SUMMARY

3.1 Number of courses in all Programmes

U.G. Courses for the A.Y. 2020-21

Year	Name of Programme	Scheme of examinations
1	B.E. CIVIL ENGINEERING	SoE 2018-19
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
	B.E. COMPUTER SCIENCE AND ENGINEERING	
2	B.E. CIVIL ENGINEERING	SoE 2018-19
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
	B.E. COMPUTER SCIENCE AND ENGINEERING	
3	B.E. CIVIL ENGINEERING	SoE 2018-19
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
	B.E. COMPUTER SCIENCE AND ENGINEERING	
4	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
	B.E. COMPUTER SCIENCE AND ENGINEERING	

Y. C. COLLEGE OF ENGINEERING AN AUTONOMOUS INSTITUTION NAGPUR SEAL

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SUMMARY

3.1 Number of courses in all Programmes

P.G. Courses for the A.Y. 2020-21

Year	Name of Programme	Scheme of examinations
1	M.Tech Environmental Engineering	SoE PG 2018
	M.Tech Structural Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Communication Engineering	
	M.Tech Computer Science and Engineering	
2	M.Tech Environmental Engineering	SoE PG 2018
	M.Tech Structural Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
	M.Tech Communication Engineering	
	M.Tech Computer Science and Engineering	

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SUMMARY

3.1 Number of courses in all Programmes

U.G. Courses for the A.Y. 2019-20

Year	Name of Programme	Scheme of examinations
1	B.E. CIVIL ENGINEERING	SoE 2018-19
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
2	B.E. CIVIL ENGINEERING	SoE 2018-19
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
3	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
4	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	

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SUMMARY

3.1 Number of courses in all Programmes

P.G. Courses for the A.Y. 2019-20

Year	Name of Programme	Scheme of examinations
1	M.Tech Environmental Engineering	SoE PG 2018
	M.Tech Structural Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
	M.Tech Communication Engineering	
	M.Tech Computer Science and Engineering	
2	M.Tech Environmental Engineering	SoE PG 2018
	M.Tech Structural Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
	M.Tech Communication Engineering	
	M.Tech Computer Science and Engineering	

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SUMMARY

3.1 Number of courses in all Programmes

U.G. Courses for the A.Y. 2018-19

Year	Name of Programme	Scheme of examinations
1	B.E. CIVIL ENGINEERING	SoE 2018-19
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
2	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
3	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
4	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	

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SUMMARY

3.1 Number of courses in all Programmes

P.G. Courses for the A.Y. 2018-19

Year	Name of Programme	Scheme of examinations
1	M.Tech Environmental Engineering	SoE PG 2018
	M.Tech Structural Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
	M.Tech Communication Engineering	
	M.Tech Computer Science and Engineering	
2	M.Tech Environmental Engineering	SoE PG 2014
	M.Tech Structural Engineering	
	M.Tech Production Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
	M.Tech Communication Engineering	
	M.Tech VLSI Design (Shift – I)	
	M.Tech VLSI Design (Shift – II)	
	M.Tech Computer Science and Engineering (Shift-I)	
	M.Tech Computer Science and Engineering (Shift -II)	
	M.Tech Information Technology	

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SUMMARY

3.1 Number of courses in all Programmes

U.G. Courses for the A.Y. 2017-18

Year	Name of Programme	Scheme of examinations
1	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
2	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
3	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
4	B.E. CIVIL ENGINEERING	SoE 2010-11
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	

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SUMMARY

3.1 Number of courses in all Programmes

P.G. Courses for the A.Y. 2017-18

Year	Name of Programme	Scheme of examinations
1	M.Tech Environmental Engineering	SoE PG 2014
	M.Tech Structural Engineering	
	M.Tech Production Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
	M.Tech Communication Engineering	
	M.Tech VLSI Design (Shift – I)	
	M.Tech VLSI Design (Shift – II)	
	M.Tech Computer Science and Engineering (Shift-I)	
	M.Tech Computer Science and Engineering (Shift -II)	
	M.Tech Information Technology	
2	M.Tech Environmental Engineering	SoE PG 2014
	M.Tech Structural Engineering	
	M.Tech Production Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
	M.Tech Communication Engineering	
	M.Tech VLSI Design (Shift – I)	
	M.Tech VLSI Design (Shift – II)	
	M.Tech Computer Science and Engineering (Shift-I)	
	M.Tech Computer Science and Engineering (Shift -II)	
	M.Tech Information Technology	

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SUMMARY

3.1 Number of courses in all Programmes

U.G. Courses for the A.Y. 2016-17

Year	Name of Programme	Scheme of examinations
1	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
2	B.E. CIVIL ENGINEERING	SoE 2014-15
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
3	B.E. CIVIL ENGINEERING	SoE 2010-11
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	
4	B.E. CIVIL ENGINEERING	SoE 2010-11
	B.E. COMPUTER TECHNOLOGY	
	B.E. ELECTRICAL ENGINEERING	
	B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING	
	B.E. ELECTRONICS ENGINEERING	
	B.E. INFORMATION TECHNOLOGY	
	B.E. MECHANICAL ENGINEERING	

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SUMMARY

3.1 Number of courses in all Programmes

P.G. Courses for the A.Y. 2016-17

Year	Name of Programme	Scheme of examinations
1	M.Tech Environmental Engineering	SoE PG 2014
	M.Tech Structural Engineering	
	M.Tech Production Engineering	
	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
	M.Tech Communication Engineering	
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	M.Tech VLSI Design (Shift – II)	
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	M.Tech Computer Science and Engineering (Shift -II)	
	M.Tech Information Technology	
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	M.Tech Structural Engineering	
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	M.Tech CAD-CAM	
	M.Tech Integrated Power Systems	
	M.Tech Electronics Engineering	
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	M.Tech Information Technology	

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UG SoE & Syllabus 2010

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

B.E. (Civil Engineering)

SCHEME OF EXAMINATION 2010

Sl. No.	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE-I	MSE-II	TA	ESE	
VII SEMESTER												
1	CV401	Water Resource Engineering	4	0	0	4	4	15	15	10	60	3
2	CV402	Structural Analysis-II	3	1	0	4	4	15	15	10	60	3
3	CV403	Structural Analysis-II	0	0	2	2	1			40	60	
4	CV404	Geotechnical Engineering II	3	1	0	4	4	15	15	10	60	3
5		Professional Elective III	4	0	0	4	4	15	15	10	60	3
6		Free Elective II	4	0	0	4	4	15	15	10	60	3
7	CV405	Steel Structures	3	1	0	4	4	15	15	10	60	4
8	CV406	Training	0	0	0	0	3			100		
9	CV407	Project- Phase I	0	0	4	4	4			40	60	
		Total	21	3	6	30	32					
	CV410	PE III : Traffic Engineering	4	0	0	4	4	15	15	10	60	
	CV411	PE III : Advanced Hydraulics	4	0	0	4	4	15	15	10	60	
	CV412	PE III : Structural Optimization	4	0	0	4	4	15	15	10	60	
	EL412	FE2:Electrical Energy Audit and Safety	4	0	0		4	15	15	10	60	
	EL413	FE2:Utilisation of Electrical Energy	4	0	0		4	15	15	10	60	
	ET411	FE2 : Soft Computing	4	0	0	4	4	15	15	10	60	3 Hrs
	ET412	FE2 : Industrial Instrumentation	4	0	0	4	4	15	15	10	60	3 Hrs
	ME429	FE 2 : Total Quality Management	4	0	0	4	4	15	15	10	60	
	ME430	FE 2 : Reliability Engineering	4	0	0	4	4	15	15	10	60	
	EE411	FE 2 :Fuzzy Logic & Neural Network	4	0	0	4	4	15	15	10	60	
	EE429	FE 2 :Basic of Analog and Digital Communication Systems	4	0	0	4	4	15	15	10	60	
	CT411	FE2:Multimedia and Animation	4	0	0	4	4	15	15	10	60	100
	CT412	FE2:Current Trends and Technologies	4	0	0	4	4	15	15	10	60	100
	IT408	FE2: Applications of Computer Networking	4	0	0	4	4	15	15	10	60	3 Hrs
VIII SEMESTER												
1	CV421	Estimating & Costing	3	1	0	4	4	15	15	10	60	4
2	CV422	Transportation Engineering -II	4	0	0	4	4	15	15	10	60	3
3		Professional Elective IV	4	0	0	4	4	15	15	10	60	3
4		Professional Elective V	4	0	0	4	4	15	15	10	60	3
5	CV424	Comprehensive Viva voce	0	0	0	0	3			40	60	
6	CV425	Project- Phase II	0	0	6	6	6			40	60	
7	CV426	Extra/Co-curricular / Competitive Examination	0	0	0	0	2			100		
		Total	15	1	6	22	27					
	CV427	PE IV : Waste Water Treatment	4	0	0	4	4	15	15	10	60	
	CV428	PE IV : Earthquake Engineering	4	0	0	4	4	15	15	10	60	
	CV429	PE IV : Matrix Analysis of Structures	4	0	0	4	4	15	15	10	60	
	CV432	PE V : Water Transmission and Distribution Systems	4	0	0	4	4	15	15	10	60	
	CV433	PE V : Advanced Steel Design	4	0	0	4	4	15	15	10	60	
	CV434	PE V : Maintenance and Rehabilitation Engineering	4	0	0	4	4	15	15	10	60	

Chairperson		**Date of Release**	May 2013	**Applicable for**
Dean (Acad. Matt.)		**Version**	**1.03**	**AY 2013-14 Onwards**

CV 401 / CV 602	WATER RESOURCES ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the importance, location, components and types of irrigation structures. 2. To learn the procedure to design the irrigation structures. 3. To get hand on experience in drawing of irrigation structures.	1. Students understood the necessity and importance of irrigation practices. 2. Students understood the analysis and design of various hydraulic structures related to irrigation engineering.
Mapped Program Outcomes: a, b, c, e,h,l	

UNIT -1:

General: Irrigation, necessity, importance, benefits and ill effects of irrigation, types, methods of water distribution to the field

Water requirement of crops : Crop seasons and major crops in India, crop rotation, suitability of soils for irrigation, standards of irrigation water, field capacity, wilting point, available moisture in soils for crops / plants, depth & frequency of irrigation, GCA, CCA, kor period, kor water depth, duty – delta relation, base period, outlet factor, PET-R method of crop water requirements.

[09 Hrs.]

UNIT -2:

Reservoir Planning: Selection of site for reservoirs, engineering surveys, geological and hydrological investigations, fixing of LWL, FTL/FRL, HFL, TBL, different storage zones in reservoirs, determination of storage capacity by mass curve method, reservoir sedimentation and its removal, life estimation of reservoir by Brunes method

[08 Hrs.]

UNIT -3:

Canal Irrigation: types of irrigation canals, canal network, irrigation canals (cross section, longitudinal section and alignment), balancing depth, losses in canals

Canals In Alluvial Soils: Kennedy's silt theory – Design procedure, silt supporting capacity, drawbacks, Lacey's silt theory – definition of initial final and permanent regime channels, Lacey's Regime equations, channel design procedure, limitations

Lined Canals: design procedure, types of lining, relative merits and demerits of canal lining, economics of canal lining.

[08 Hrs.]

UNIT -4:

Diversion Head Works: Component parts of diversion headworks – fish ladder, divide wall, silt excluder and silt ejector, causes of failure of weirs on permeable foundation, Bligh's creep theory, Khosla's theory for design of weirs on permeable foundations

[09 Hrs.]

UNIT -5:

Introduction to Dams: Classification of dams, factors governing selection of type of dams

Gravity Dam: Definition; forces acting on gravity dam, stability requirements, theoretical & practical profile of gravity dam, low &high dam, galleries.

[09 Hrs.]

UNIT -6:

Earthen Dams: Types of earthen dams, failure of earthen dams, criteria for safety and design of earthen dam, seepage analysis, seepage control through embankment and foundation, stability analysis of slopes by swedish slips circle method, Spillways: Types of spillway only.

[09 Hrs.]

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 401 / CV 602	WATER RESOURCES ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

SN	Title	Edition	Authors	Publications
1	Irrigation Engineering and Hydraulic Structures	6TH Revised Edition (1996)	S.R. Sahastrabudhe	S.K. Kataria Publications New Delhi
2	Irrigation and Water Resources Engineering	(2005)	G.L.Asawa	New Age International Publishers, New Delhi.
3	Irrigation Engineering and Hydraulic Structures	13TH Revised Edition (1998)	Santosh Kumar Garg	Khanna Publisher New Delhi.
4	Irrigation Engineering and Water power Engineering	12TH Revised Edition (1993)	B.C.Punmia	Laxmi Publications New Delhi

Reference books:

SN	Title	Edition	Authors	Publications
1	Theory and Design of Irrigation Structures Vol – II	4TH Edition (1979)	R.S. Varshney, S.C.Gupta, R.L.Gupta	Nem Chand & Bros. Publications Roorkee
2	Irrigation Engineering	(1999)	N.N. Basak	TataMcGraw-Hill Publications New Delhi
3	Principles and Practice of Irrigation Engineering	2ND Edition (1988)	S.K. Sharma	S.Chand Publications New Delhi

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 402 / CV 705	STRUCTURAL ANALYSIS - II	L=3	T=1	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study basic concept of Degree of Freedoms. 2. To analyze the structural element by Flexibility & Stiffness Method, 3. To study various approximate methods of structural analysis.	After completion of course the student will be able 1. To understand formulation of elemental / local stiffness matrix and global stiffness matrix 2. Analyze various structural element by stiffness method.
Mapped Program Outcomes: a, e, i, k, l, m	

UNIT-1

Introduction to stiffness method, basic terminology, degree of freedom, basic concept of direct stiffness method, derivation of all stiffness coefficients, formulation of compatibility equations, rotation transformation matrix

[06Hrs]

UNIT-2:

Analysis of Plane Truss by stiffness method, solution to problem with maximum three degree of freedom.

[07 Hrs]

UNIT-3:

Analysis of beam without axial deformation by stiffness method, solution to problem with maximum three degree of freedom.

[06 Hrs]

UNIT-4:

Introduction to Flexibility Method of structural analysis, influence coefficient, choice of base determinate structure and redundant forces, compatibility equations, hand solution of simple beam and truss problems

[07Hrs]

UNIT-5:

Moment distribution applied to frames with sway (up to two storey two bay)

[07Hrs]

UNIT-6

Approximate method of structural analysis for multi – storied frames with lateral loads (Portal and Cantilever method), approximate methods for vertical loads i.e. substitute frame method etc. (Maximum three bay three storey)

[06 Hrs]

Text books:

SN	Title	Edition	Authors	Publications
1	Structural Analysis (volume II)	2nd Edition (2011)	Bhavikatti S.S.	Vikas publishing House LTD, Delhi
2	Basic structural Analysis,	8th Edition	Reddy C.S;	Tata McGraw Hill Publication, New Delhi
3	Matrix Method of Structural Analysis,	1st Edition (2003)	Meghre A.S. &Deshmukh S.K. ;	Charotar publishing house, Anand
4	Matrix Method of Structural Analysis	(2004)	Gere and Weaver	CBS Publication

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 402 / CV 705	STRUCTURAL ANALYSIS - II	L=3	T=1	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:

SN	Title	Edition	Authors	Publications
1	Intermediate Structural Analysis,	2010	Wang C K,	Tata McGraw Hill Publication, New Delhi
2	Theory of Structure,	2nd	Timoshenko S.P. and D.H. Young;	Tata McGraw Hill Publication, New Delhi
3	Theory of Elasticity	3rd (1985)	Timoshenko S.P. and J.N. Goodier	Tata McGraw Hill Publication, New Delhi
4	Computational Structural Mechanics	2004	S. Rajasekaran, G. Sankarasubramanian	PHI Learning Pvt. Ltd
5	**Structural Analysis: A Matrix Approach**	2001	Pandit Gupta	Tata McGraw-Hill Education

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 403 / CE 706	STRUCTURAL ANALYSIS – II	L=0	T=0	P=2	CREDITS = 1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study basic concept of Degree of Freedoms. 2. To analyze the structural element by Flexibility & Stiffness Method, 3. To study various approximate methods of structural analysis.	After completion of course the student will be able 1. To understand formulation of elemental / local stiffness matrix and global stiffness matrix 2. Analyze various structural element by stiffness method.
Mapped Program Outcomes: a, e, i, k, l, m	

Analysis of Structures Using Standard Software Packages.

1) Analysis of a continuous beam without sinking of support by neglecting axial deformation with 3 degree of freedom.
2) Analysis of a continuous beam with sinking of support by neglecting axial deformation with 3 degree of freedom.
3) Analysis of a plane truss with 3 degree of freedom
4) Analysis of a plane truss with inclined roller support with 3 degree of freedom
5) Analysis of a plane truss with temperature effect and lack of fit with 3 degree of freedom
6) Analysis of a frame (neglecting axial deformation) by Stiffness Method (Hand Calculations)
7) Analysis of a multi storied Frame by cantilever method (Hand Calculations)
8) Analysis of a multi storied Frame by Substitute Frame Method (Hand Calculations).

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CV 410 / CV 805	PE (3) TRAFFIC ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1.To understand the calculations of spot speed, journey time & running time, methods of OD survey. 2.To understand the different statistical methods such as Binomial, Normal Poission, Chisquare to know the probabilities at various levels. 3.To study the analysis and designs of rotary intersections 4.To study different traffic signs, methods of design of traffic signal, queing Theory. 5.To study causes and remedial measures of accidents, analysis of accident data. 6.To study the methods and design of parking. To understand the concept of urban transportation problems and principles of urban transport planning.	1. Calculate the spot speed, journey and running time and can develop economical trip distribution model. 2. Understand the different statistical methods which can be used in various analysis of traffic studies. 3. He/she can design rotary intersection in field. 4. Workout the design of signals at various intersections considering practical problems. 5. Reduce the accident rate by analyzing the accident data. 6. Design the on and off street parking for different situations. Understood and used to solve urban transportation problem.
Mapped Program Outcomes: a,b,c,d,e,h,i,j	

UNIT-1:

General: Road, road user &road vehicle characteristics, traffic on Indian roads.

Traffic Surveys: speed, journey time and delay studies, methods of measurement of spot speed, headways gaps, measurements of running and journey speeds, origin and destination surveys, survey methods, sample size, data analysis &presentation, highway capacity, level of service

[9 Hrs]

UNIT-2:

Traffic Events: Statistical method for interpretation, regression, application of binomial normal and Poisson's distributions, discrete and continuous distribution of traffic flow, test of significance–Chi-square &'T' test

[8 Hrs]

UNIT-3

Road geometry: Hierarchy of urban roads and their standards, diverging, merging, crossing, weaving, maneuver's and conflict points,types of road junction, channelization of traffic flow, traffic rotary design, grade separated intersections, drive ways

[9 Hrs]

UNIT-4:

Traffic controlling devices: Traffic signs, road markings, traffic signals, design of signalized intersections & signaling systems, Queingtheory

[8 Hrs]

UNIT-5

Traffic Safety: Driver's error, vehicle & road surface laws and enforcement, traffic accident conditions in India, collection and interpretation of accident data and recording in standard Format, skidding, speed and weather effects on accidents, analysis of accidents, pedestrian, cyclist& auto vehicle driver's safety, traffic regulation, 3E's of traffic management

[9 Hrs]

UNIT-6:

Parking: Parking surveys, on and off-street parking & parking systems, parking demand, design of off-street parking lot, underground &multistoried parking,introduction to urban traffic.

[8 Hrs]

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CV 410 / CV 805	PE (3) TRAFFIC ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

SN	Title	Edition	Authors	Publications
1	Highway Engineering :	1991	Khanna S.K. and Justo C.E.G.	Nem Chand & Bros.
2	Traffic engineering and transportation planning	1987	Kadiyali	Khanna Publications

Reference books:

SN	Title	Edition	Authors	Publications
1	Highway Engineering	2011	Rangawala B.S.	Charotar Publishing Hous
2	IRC Handbook and MOST Specifications	2012	Indian Road Congress	Indian Road Congress

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CV411 / CV 806	PE (3) ADVANCED HYDRAULICS	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
The students will learn the:- 1) Concept of uniform flow and critical flow in open channels. 2) Concept of gradually varied flow profile in open channels. 3) Computation of length of gradually varied flow by various method 4) The concept of rigid water column theory and time of flow establishment. 5) The Concept of elastic water column theory and water hammer in pipe. 6) The importance of surge tanks in pipe systems.	At the end of the course, the students are able to apply the 1) Concept of uniform flow and critical flow in open channels. 2) Concept of gradually varied flow profile in open channels. 3) Computation of length of gradually varied flow by various method 4) The concept of rigid water column theory and time of flow establishment. 5) The Concept of elastic water column theory and water hammer in pipe. 6) The importance of surge tanks in pipe systems.
Mapped Program Outcomes: a, e, h, k, l	

UNIT-1:

Uniform flow, Critical flow, wide rectangular channel, conveyance of channel, section factor, Hydraulic exponent M & N, Channel transitions for subcritical and supercritical flow: hump in channel, reduction in channel width.

[08 hrs.]

UNIT-2:

Gradually varied flow, channel slope, back water curve, dropdown curve, Dynamic equation of GVF in terms of normal depth & critical depth, conveyance K & section factor Z, hydraulic exponent M & N, characteristic of GVF profiles, composite GVF profiles, Various gradually varied flow profiles in channel.

[09 hrs.]

UNIT-3

Computation of gradually varied flow length in channel, direct step method, Bresse's method, Chow's method, introduction to standard step method.

[09 hrs.]

UNIT-4:

Unsteady flow in a pipe, Bernoulli's Equation of unsteady flow in a pipeline for incompressible fluid flow, Time flow establishment, rigid water column theory of water hammer, computation of water hammer pressures

[08 hrs.]

UNIT-5

Elastic water column theory, Bernoulli's equation of motion when compressibility of fluid and elasticity of pipe is considered, continuity equation, Computation of water hammer pressure, Allievis theory for water hammer pressure.

[09 hrs.]

UNIT-6:

Surge tank and its types, location, operation, function, equations governing the flow in simple surge tank system, hydraulic stability of surge tank, Thomas criteria for stability of simple surge tank, computation of maximum upsurges in a simple surge tank by neglecting friction, study of problem of hydraulic stability in a simple surge tank system.

[09 hrs.]

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CV411 / CV 806	PE (3) ADVANCED HYDRAULICS	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

SN	Title	Edition	Authors	Publications
1	Open channel hydraulics	International Student Edition. (1959)	VenTe Chow	McGraw Hill,
2	Engineering Fluid Mechanics Vol. II	Edition (1981)	Narasimhan S.;	Orient Longman Publication.

Reference books:

SN	Title	Edition	Authors	Publications
1	Flow through open channels	1998	RangaRaju K.G.	Tata McGraw Hill,
2	Flow in open channels	3rd (1999) Vol 19 No. 2 2009	Subramanya K.	Tata McGraw Hill.
3	U.S.B.R. Earthen Dams	1998	U.S. Department of the interior Bureau of reclamation	United States Government Printing Office

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV412 / CV 717	PE (3) STRUCTURAL OPTIMIZATION	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1) To understand the need and origin of the optimization methods. 2) To understand various applications of optimization methods used in engineering. 3) To understand an optimization problem and its various components. 4) To understand formulation of optimization problems.	1) Optimization id obtaining the best result under given circumstances. 2) In design, construction and maintenance of any engineering system, engineers have to take many technological and managerial decisions at several stages. 3) Ultimate goal to minimize the effort required and to maximize the desired benefit. 4) Introduction and learning the different optimization methods for solving different types of problems. 5) Optimization problem formulation, linear programming, non linear programming along with application in Civil Engineering.
Mapped Program Outcomes: a,b,c,d,e	

UNIT-1:

Introduction and Basic Concepts

Historical development, engineering applications of optimization, art of modeling, objective function, constraints and constraint surface, mathematical formulation for optimization, classification of optimization problems based on nature of constraints, structure of the problem, deterministic nature of variables

[09 hrs]

UNIT-2:

Optimization using Calculus

Stationary points - maxima, minima and saddle points, functions of single and two variables, global optimum; convexity and concavity of functions of one and two variables, optimization of function of one variable and multiple variables, gradient vectors, optimization of function of multiple variables subject to equality constraints, Lagrangian function, optimization of function of multiple variables subject to equality constraints, Hessian matrix formulation, eigen values, Kuhn-Tucker Conditions, examples.

[08 hrs]

UNIT-3

Linear Programming I

Standard form of linear programming (LP) problem, canonical form of LP problem, assumptions in LP models, elementary operations, motivation of simplex method, simplex algorithm and construction of simplex tableau, simplex criterion, minimization versus maximization problems

[09 hrs]

UNIT-4:

Linear Programming II

Revised simplex method, duality in LP, primal-dual relations, dual simplex method, sensitivity or post optimality analysis, other algorithms for solving LP problems – Karmarkar's projective scaling method.

[08 hrs]

UNIT-5

Linear Programming Applications

Solving linear optimization problems using graphical and simplex methods, examples for transportation, water resources, structural and other optimization problems

[08 hrs]

UNIT-6:

Non-linear programming

One dimensional methods – elimination methods, unrestricted search, exhaustive search, Fibonacci method, golden section method, introduction to other methods

[08 hrs]

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CV412 / CV 717	PE (3) STRUCTURAL OPTIMIZATION	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

SN	Title	Edition	Authors	Publications
1	Engineering optimization: theory and practice	4th Edition 2009	Rao S.S	New Age International (P) Ltd., New Delhi
2	Introduction to Optimum Design	2004	Arora J S.	McGraw Hill
3	Optimization for Engineering Design of Algorithms and Examples	2nd Edition 2008	Deb, K.	Prentice-Hall of India Pvt. Ltd., New Delhi
4	Structural optimization using sequential linear programming	1st Edition 2003	Bhavikatti S.S.	Vikas publishing house, New Delhi

Reference books:

SN	Title	Edition	Authors	Publications
1	Principles of Operation Research	4th Edition 1999	Fox R. L.	Prentice Hall of India
2	Principles of Operation Research	2nd Edition 2008	Wagner H.M.,	Prentice Hall of India
3	Linear And Nonlinear Programming	2nd Edition 2011	Stephen G. And ArielaSofer Nash	McGraw Hill Book.Co.

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV418 / CV810	FE (2) ELEMENTS OF EARTHQUAKE ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1) To understand basic concepts of earthquake 2) To understand damages due to earthquake 3) To understand behavior of structures under earthquake loading 4) To understand disaster management and retrofitting	After completion of course the student will be able 1) To be understood the necessity and importance of earthquake engineering. 2) To be understood the provision of IS code used for earthquake resistance design of structure. 3) The codal provision for earthquake resistance design of structures as per Indian standard are explained. 4) The course covers study of damages caused due to past earthquake in & outside India and remedial measures.
Mapped Program Outcomes: a,c,e ,l,m	

UNIT-1:

Introduction to earthquakes:

Geology of earth, configuration of tectonic plates in a globe, behavior of plates, their motion and effects, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity, Seismic waves

[06 hrs.]

UNIT-2:

Analysis and interpretation of earthquake data, determination of magnitude, location of epicenter, focal depth

[06 hrs.]

UNIT-3

Recording earthquakes, seismicity of the world, history of earthquakes in India and abroad, case studies of effects of earthquakes, causes and sources of earthquake damage

[08 hrs.]

UNIT-4:

Non-engineered earthquake resistant structures, load bearing structures, masonry structures, seismic zoning of India (IS 1893:2002 Part I), seismic coefficients for different zones, definitions, irregularities in buildings, consequences of irregularities.

[08 hrs.]

UNIT-5:

Strengthening, rehabilitation and retrofitting of earthquake damaged structures

[06 hrs.]

UNIT-6:

Earthquake disaster management, mitigation and social aspects, lessons from past earthquake: - study of damages caused due to past earthquake in & outside India and remedial measures

[06 hrs.]

Text books:

SN	Title	Edition	Authors	Publications
1	Design of Earthquake Resistant Structures,	3rd Printing 2006	Agrawal & Shrikhande,	Ashok K. Ghosh Prentice – Hall of India Pvt. Ltd.

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Dean (Acad. Matters)		Version	1.00	

CV418 / CV810	FE (2) ELEMENTS OF EARTHQUAKE ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:

SN	Title	Edition	Authors	Publications
1	Seismic Hazard and Risk Analysis.	2004	Robin K. McGuire	Publisher
2	Earthquake Tips	2005	C.V.R. Murty	NICEE, IITK
3	NICEE Guidelines for Earthquake Resistant Non-Engineered Construction	2004	*www.**nicee**.org / iaee / E_FrontCover.pdf*	National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India
4	Geotechnical Earthquake Engineering	1996	S.L. Kramer	Prentice – Hall of India Pvt. Ltd.

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV419 / CV811	FE (2) ELECTIVE – I AIR POLLUTION AND SOLID WASTE MANAGEMENT	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1) To provide general understanding of air pollution, air pollutants, their sources & their effects 2) To provide knowledge and meteorological parameters of air pollution, air sampling & measurement of pollutants. 3) To provide knowledge of air pollution control equipments, air pollution due to automobiles & general Idea of noise pollution. 4) To provide understanding of solid waste management functional elements.	1) Student will gain an understanding of the type, sources & effect of air pollutants. 2) Will gain the knowledge of parameters affecting air pollution and able to know the various methods of measurement and estimation of pollutants. 3) Will gain knowledge of various air pollution control equipments basic of noise pollution & pollution caused due to automobile exhaust . 4) Will gain in depth understanding of solid waste management.
Mapped Program Outcomes: a,c,e,i,j	

UNIT-1:

Introduction to air pollution: Definition, air pollution episodes, atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials

[09 hrs.]

UNIT-2:

Meteorology and air pollution: Primary and secondary parameters, atmospheric stability, plume behavior**,** air sampling and measurement: ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.

[09 hrs.]

UNIT-3

air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.

[09 hrs.]

UNIT-4:

Introduction to solid waste management, sources, quantity and quality: sources of solid waste, classification and components, physical and chemical characteristics, per capita contribution, sampling and analysis**.**

[09 hrs.]

UNIT-5:

Collection and transportation of solid waste: method of collection, equipment used for collection and transportation, transfer stations, solid waste processing: methods of processing, choice of methods, merits and demerits of various methods.

[09 hrs.]

UNIT-6:

Composition of waste: method of composting, factors affecting composting, sanitary land filling: Site requirements, methods, leachate management, Incineration: Principles of incineration, types of incinerators, advantages and disadvantages.

[09 hrs.]

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CV419 / CV811	FE (2) ELECTIVE – I AIR POLLUTION AND SOLID WASTE MANAGEMENT	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

SN	Title	Edition	Authors	Publications
1	Air Pollution	01-Jun-1988	M.N. Rao & H.V.N. Rao	Tata McGraw Hill Publishing Co. Ltd
2	Environmental Pollution Control Engineering	01-Jan-2007	C.S. RAO	New Age International, Wiley Estern Ltd. New Delhi.
3	Air pollution	1973 Vol I to X	Stern A. C.	Academic Press
4	Solid Waste Management in Developing countries	1983	A.D. Bhide & Sunderesan B.B.	INSDOC, New Delhi
5	Intgrated Solid Waste Management Engineering Principle and Management Issues	1993	Tohobanoglous	McGraw-Hill
6	Air Pollution	1995	K. V. S. G. Murlikrishna	Kaushal& Company

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 405 / CV 707	STEEL STRUCTURES	L=3	T=1	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	4 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
Learn the behavior and design of 1. Structural steel components and to gain an educational and comprehensive experience in the design of steel structures. 2. The course is structured to introduce inelastic analysis of steel structures, issues of strength and stability and its application to design for cases of extreme loading, and related code provisions. 3. Advanced design topics such as torsion, flexural-torsional buckling of columns, thin webs of plate girders, bracing against LTB and frame instability	1. Understand the basic methods of design of Steel Structures. 2. Understand the structural properties and utilization of various standard steel sections. 3. Understand structural planning and design of various components of industrial buildings.
Mapped Program Outcomes: a,e, i, k, l, m	

UNIT-1:

Steel as a structural material, various grades of structural steel, properties, various rolled steel sections structural pipe (tube) sections, rectangular and square hollow sections, their properties, design of tension and compression members by working stress method

[6 Hrs]

UNIT-2:

Introduction to Limit State Method Design of tension members and compression members Behavior of bolted and welded connections: types, designations, properties, permissible stresses, failure of moment resistant bolted and welded connection, design of simple bolted and welded connections.

[7 Hrs]

UNIT-3

Design of restrained and unrestrained simple & built up beams.

[7 Hrs]

UNIT-4:

Basic industrial workshop plan, position of columns, types of trusses, load transfer mechanism, behavior of each component of industrial building. Load assessment for DL, LL and WL, for roof trusses.

[6 Hrs]

UNIT-5:

Design of axially loaded built up columns: Laced and battened.
Column bases: slab base, gusseted base, moment resistant bases.

[6 Hrs]

UNIT-6:

Design of welded plate girder, introduction to gantry girder (analysis and design are not expected)

[7 Hrs]

Text books:

SN	Title	Edition	Authors	Publications
1	Design of Steel Structures	Jul (2000)	V.N. Vazirani& M.M. Ratwani	Khanna Publishers, Delhi-6
2	Design of Steel Structures	Edition (Year of publication)	M. Raghupati	Tata McGraw Hill Publishing Company Limited
3	Design of Steel Structures	2nd Edition (1997)	L.S. Negi	Tata McGraw Hill Publishing Company Limited
4	Design of Steel Structures	Edition (Year of publication)	S. Ramamruthan, R. Narayanan	DhanpatRai and Sons

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 405 / CV 707	STEEL STRUCTURES	L=3	T=1	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	4 Hrs

5	Design of Steel Structures	Edition (Year of publication)	Subramanyam	Publisher

Reference books:				
SN	Title	Edition	Authors	Publications
1	Design of Steel Structures,	2nd reprint (2005)	B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain	Laxmi Publications Ltd
2	Design of Steel Structures,	Edition (Year of publication)	A.S. Arya, J.L.Ajmani	Nem Chand and Bros, Roorkee

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 407 / CV 804	PROJECT – PHASE I	L=0	T=0	P=4	CREDITS = 4

Evaluation Scheme	MSE – I	MSE – II	TA	ESE	TOTAL	ESE Duration
	--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To identify, formulate, analyze and solve the problem related to the project work. 2. To prepare and present the work carried out using modern tools.	1. To understand the importance of lifelong learning. 2. To be able to work in a team. 3. To be able to communicate effectively.
Mapped Program Outcomes: d,e,g,i,k	

Project will be allotted to a group of students, (preferably not more than 06) as per their choice and previous scores. The project work will be carried out by the students as directed by their guides. Evaluation will be done by continuous assessment and will be based on involvement of the student in the work.

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CV 406 / CV 80	Training	L=3	T=0	P=4	CREDITS = 3

Evaluation Scheme	MSE – I	MSE – II	TA	ESE	TOTAL	ESE Duration
	--	--	--	--	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1) To get information about latest methodologies and techniques used in the field of civil engineering. 2) To understand current practices adopted in construction management.	1) To be able to prepare detail notes and reports. 2) To be able to communicate effectively.
Mapped Program Outcomes: d,g,i,j,k	

Student would be required to undergo a practical training for two months during the summer vacation after 6th semester. They would submit a report about the same and also make the presentation for evaluation.

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Dean (Acad. Matters)		Version	1.00	

CV 422 / CV 710	TRANSPORTATION ENGINEERING – II	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To acquaint development of railway transportation in India. 2.To understand geometric design of railway tracks 3.To know zoning laws for development of air transportation in India 4. To study tunnel alignment and necessity of tunnels.	1. To update and upgrade knowledge about transportation system in India. 2. To enable to design railway tracks, crossings. 3. To avail information about development of air transportation in urban areas 4. To know how to construct tunnel and advances in tunneling.
Mapped Program Outcomes: a,b,c,e,j,k,l	

UNIT-1:

Railways: Transportation and its development, long term operative plans for Indian Railways, classification, lines and their track standards, Railway terminology, Administration & management, traction and tractive resistance, hauling capacity and tractive effort of locomotives, different types of tractions

[7 Hrs]

UNIT-2:

Permanent Way: Alignment surveys, requirement, gauges, track section, coning of wheels, stresses in railway track, high speed track, rail types and functions, selection for rails, test on rail wear & defects, corrugation and creep of rails, rail joints, short and long welded panels

Sleepers: Function, types, merits and demerits, sleeper density, ballast cushion, ballast section, rail fixtures and fasteners

Geometric design of railway track: Gauge, gradients, speed, super elevation, cant deficiency negative super elevation, curves, length of transition curves, grade compensation

Points and crossing: Left and right hand turnouts, design calculations for turnouts & crossovers, railway track functions

[7Hrs]

UNIT-3

Station and Yards: Types, functions, facilities &equipments

Railway Signaling and interlocking: Objects and principles of signaling, classification and types of signals, control and movement of trains, track circulation, necessity of interlocking, methods and mechanical devices,

railway track construction, inspection & modern techniques of maintenance, modern technology related to track & tractions, rolling stock, signaling & controlling

[7 Hrs]

UNIT-4:

History of Air Transportation in India: Comparison with other transportation modes, aircraft components and characteristics, airport site selection, modern aircrafts

Airport obstructions: Zoning laws, imaginary surfaces, approach and turning zone, clear zone, vertical clearance for highway & railway

Runway And taxiway design: Windrose diagram, cross wind component, runway orientation and configuration, basic runway length and corrections, runway geometric design standards, taxiway layout and geometric design standards, exit taxiway

[7 Hrs]

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 422 / CV 710	TRANSPORTATION ENGINEERING – II	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

UNIT-5

Airport layout and classification: Terminal area, aircraft parking and parking systems, unit terminal concept, aprons, hangers, International airports layout, phase development, helipads and heliports

Visual Aids: Airport marking and lighting for runways, taxiways and other areas

Air traffic control: Need, networks, control aids, instrumented landing systems, advances in air traffic control

[7 Hrs]

UNIT-6:

Tunnels: Alignment, surveys, cross section of highway & railway tunnels, tunneling methods in hard rock and soft grounds, tunnel lining, drainage, ventilation and lighting of tunnels, advances in tunneling techniques, tunnel boring machines, case studies

[7 Hrs]

Text books:

SN	Title	Edition	Authors	Publication
1	A Text Book of Railway Engineering	2005	S. C. Saxena and S. P. Arora	DhanpatRai Sons New Delhi
2	Airport Planning and Design	1999	S. K. Khanna	Nem Chand and Brothers, Roorkee

Reference books:

SN	Title	Edition	Authors	Publications
1	Textbook on Transportation Engineering	2001	S. P. CHANDOLA	S. Chand Publishers, New Delhi
2	Planning and Design ofAirports	Fifth Edition 2010	Robert Horonjeff, Francis Mckelvey, William Sproule, Seth Young	McGraw Hill Professionals

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CV 424 /CV 813	COMPREHENSIVE VIVA VOCE	L=0	T=0	P=0	CREDITS = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1) To understand necessity to study a topic comprehensively. 2) To know various ways and means to collect data and technical information related to a topic. 3) To understand ways to present literature collected.	1) Ability to collect information regarding only topic related in civil engineering 2) Ability to present the information collected in the expected format 3) Ability to express and communicate about the information collected.
Mapped Program Outcomes: b, c, e, i	

Every student will be allotted a specific topic related to civil engineering with the consent of the student. The student will be expected to prepare a detailed note on the topic and submit it to the guide. Evaluation will be based on the extent of information provided by the student and viva voce conducted by a panel of experts constituted by the department.

CV 425 / CV 814	PROJECT – PHASE II	L=0	T=0	P=6	CREDITS = 6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To identify, formulate, analyse and solve the problem related to the project work. 2. To prepare and present the work carried out using modern tools.	3. To understand the importance of lifelong learning. 4. To be able to work in a team. 5. To be able to communicate effectively.
Mapped Program Outcomes: d,e,g,i,k	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

CV 426 / CV 815	EXTRA / CO-CURRICULAR / COMPETITIVE EXAMINATION	L=0	T=0	P=0	CREDITS = 2

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1) Exposure to culture and tradition. 2) Opportunity for student to perform and present their hidden talent, still and art. 3) Nurture hobbies 4) Co curricular activities to make competitive spirit, co operation, leadership, diligence, punctuality, team spirits. 5) Development of creative talent, self confidence, sense of achievement. 6) Ability to design process on environmental, social, political, ethical, health and safety 7) Broad education to understand the impact of engineering solution in a global economic, environmental, socitee	1) Developed team work, leadership qualities, competitive spirit. 2) Developed thinking and analysis process for environmental, ethical society. 3) Developed solution to engineering problems related with social, environmental and ethical issues. 4) Developed and Nurture soft and communications skills.
Mapped Program Outcomes: a,b, h, j, k	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

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CV 427 / CV816	PE (4) WASTE WATER TREATMENT	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study necessity and objectives of water treatment and layout of a water treatment plant. 2. To study principles of working and design of various waste water treatment units and processes. 3. To study necessity of wastewater treatment and disposal methods for wastewater. 4. To study principle of working and design of various wastewater treatment units and processes.	1. Ability to understand necessity of water quality management. 2. Ability to design various treatment units for sewage and waste water treatment.
Mapped Program Outcomes: a,c,e,i,j	

UNIT-1:
Concept of water quality management, Indian standards and laws, wastewater characteristics and their significance, disposal methods for wastewater on land and in water and its impact, self-purification of streams

[08 Hrs.]

UNIT-2:
Preliminary and primary treatment processes and units, design of bar screens, grit chamber and primary settling tank

[09 Hrs.]

UNIT-3
Secondary treatment processes for sewage, concepts in biological treatment, bacterial growth and biological oxidation, kinetics of biological growth, activated sludge process, trickling filter, simple design problems

[09 Hrs.]

UNIT-4:
Biological treatment units such as aerated lagoons, stabilization ponds, up flow sludge blanket reactors, fixed film reactors, treatment of sludge

[08 Hrs.]

UNIT-5
Need of advanced treatment, removal of trace organics, micro filtration and control of nutrients, nitrification and de-nitrification, removal of phosphorus

[09 Hrs.]

UNIT-6:
Treatment alternatives for Industrial waste, volume reduction, strength reduction, equalization tank, neutralization tank, chemical precipitation
Specific industrial wastewater treatment for paper and pulp industry, sugar industry, distillery industry, dairy industry, textile industry

[09 Hrs.]

Text books:

SN	Title	Edition	Authors	Publications
1	Wastewater engineering	2010	B.C. Punmia	Laxmi Publications (P)Ltd.,New Delhi
2	Sewage Treatment & Disposal and Waste Water Engineering,Vol-2	2008	P. N. Modi	Standard Book House
3	Water Supply Engineering: Environmental Engineering (Volume-2)	2010	S. K. Garg	Khanna Publication

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CV 427 / CV816	PE (4) WASTE WATER TREATMENT	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

Text books:

4	Waste Water Treatment	2007	M. N.Rao	Oxford and IBH Publishing
5	Industrial Waste Water Treatment	2008	Patwardhan	PHI Learning Pvt. Ltd.
6	Waste Water Treatment: Concept and Design Approach	2006	G. L. Karia& R. A. Christian	PHI Learning Pvt. Ltd.

Reference books:

SN	Title	Edition	Authors	Publications
1	Wastewater treatment disposal and reuse	2006	Metcalf and Eddy	Tata McGraw-Hill Publishing Company Ltd., New Delhi

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CV 428 / CV 817	PE (4) EARTHQUAKE ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the basic concepts regarding earthquake and its measurements and recording. 2. To understand effect of earthquake on RCC members. 3. To understand design of earthquake resistant RCC structures.	1) The course an introduction giving fundamental concept, principle and application of earthquake engineering. 2) Concept of response spectrum analysis to determine structure response and design earthquake forces explained. 3) The codal provision for earthquake resistance design of structures as per Indian standard are explained. 4) The course covers a number of chosen problems to be solved to illustrate the design and analysis concepts clearly. 5) It will very useful to UG students.
Mapped Program Outcomes: a,b,c,d,e	

UNIT-1:
Origin of earthquakes, engineering geology, seismicity of the world, faults, earthquake waves, quantification of earthquake (magnitude, energy, intensity of earthquake), measurements of earthquake, analysis of earthquake records and its interpretation

[09 Hrs.]

UNIT-2:
Determination of magnitude, epicenter, epicenter distances, focal depth, seismic zoning, ground motion and their characteristics, factors affecting ground motions, causes or sources of earthquake damages, evaluation of seismic hazards, concept of response spectra, generation of response spectrum from available earthquake records

[08 Hrs.]

UNIT-3
Study of IS: 1893, IS: 13920 for analysis and ductile detailing of RCC structures and other related codes, concept of earthquake resistant design, design philosophy, virtues of earthquake resistant design.

[08 Hrs.]

UNIT-4
Design and detailing of RCC members, beam, column and beam-column joints for ductile behaviors, calculation of base shear distribution to various floors

[09 Hrs.]

UNIT-5
Special aspects in multi-storey buildings, effect of torsion, flexible first storey, P-delta effect, and soil-structure interaction on building response, drift limitation, soil liquefaction during earthquakes

[08 Hrs.]

UNIT-6:
Load bearing structures, masonry structures, strengthening and rehabilitation of non-engineered building for earthquake**,** earthquake disaster management, mitigation and social aspects, lessons from past earthquakes

[08 Hrs.]

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CV 428 / CV 817	PE (4) EARTHQUAKE ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

Text books:

SN	Title	Edition	Authors	Publications
1	Earthquake Resistant Design of Structures	2009	Manish Shrikhande and Pankaj Agrawal	Phi Learning Pvt. Ltd.

Reference books:

SN	Title	Edition	Authors	Publications
1	Handbook on seismic analysis and design of structures	03-2001	Farzad Neaim	Springer VerlagGmgh
2	Earthquake Tips	2005	C. V. R. Murthy	National Information Center of Earthquake Engineering, Indian Institute of Technology Kanpur 208016
3	Earthquake engineering	January/ March 1976	A.S.Arya	University of Nottingham
4	Geotechnical Earthquake Engineering	2003	S.L.Kramer	Prentice Hall, New Jersey

IS Code:

1) IS: 1893-2002 Earthquake criteria
2) IS: 13920-1993 ductile detailing
3) IS: 4326 Earthquake Resistant Design and Construction of Buildings – Code of Practice

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CV 429 /CV 818	PE (4) MATRIX ANALYSIS OF STRUCTURES	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
At the end of the course the student will be able to understand 1) Basic concepts of direct stiffness method. 2) Analysis of various structural elements by stiffness method	**After completion of course the student will be able** 1) To be understand modern topics for analyzing statically indeterminate structures. 2) To be able to analysis the structure. 3) To be understand the knowledge and methodology to compute the flexibility coefficient. 4) To compare stiffness and flexibility methods of analysis.
Mapped Program Outcomes: a,b,e,l,m	

UNIT-1:
Basic terminology, degree of freedom, basic concept of direct stiffness method, derivation of all stiffness coefficients, formulation of compatibility equations, rotation transformation matrix.
Analysis of Beam (without axial deformation): Formulation of elemental stiffness matrix for Beam, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, uniformly distributed load and moment, assembly of global load matrix, solution to problem with maximum three degree of freedom

[08 Hrs]

UNIT-2:
Analysis of Plane Truss: Formulation of elemental stiffness matrix and global stiffness matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, uniformly distributed load, assembly of global load matrix, solution to problem with maximum three degree of freedom.

[09 Hrs]

UNIT-3
Analysis of Plane Frame (Without axial deformation): Formulation of elemental stiffness matrix and, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[08 Hrs]

UNIT-4:
Analysis of Plane frame(With axial deformation): Formulation of elemental stiffness matrix and transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem

[09 Hrs]

UNIT-5
Analysis of Plane Grid: Formulation of elemental stiffness matrix, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane grid problems

[09 Hrs]

UNIT-6:
Analysis of Member for temperature loading, initial joint displacement (sinking of support), lack of fit in trusses, storing of global stiffness matrix, full storage, banded storage and band minimization.

[09 Hrs]

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CV 429 /CV 818	PE (4) MATRIX ANALYSIS OF STRUCTURES	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

Text books:

SN	Title	Edition	Authors	Publications
1	Matrix Method of Structural Analysis,	2003	Meghre A.S. &Deshmukh S.K.	Charotar publishing house, Anand
2	Matrix Method of Structural Analysis	2004	Gere and Weaver	CBS Publication

Reference books:

SN	Title	Edition	Authors	Publications
1	Matrix Method of structural Analysis	1994	Kanchi M.B.	John Wiley & Sons
2	Introduction to Matrix Method of Structural Analysis	1966	Martin H.C.	McGraw-Hill Publications
3	Computer Analysis of Structures	1996	Flemming	Prentice Hall
5	Intermediate Structural Analysis,	2010	Wang C K,	Tata McGraw Hill Publication, New Delhi
6	Theory of Structure,	2nd	Timoshenko S.P. and D.H. Young	Tata McGraw Hill Publication, New Delhi
7	Theory of Elasticity	3rd (1985)	Timoshenko S.P.and J.N. Goodier	Tata McGraw Hill Publication, New Delhi
8	Computational Structural Mechanics	2004	S. Rajasekaran, G. Sankarasubramanian	PHI Learning Pvt. Ltd.
9	Structural Analysis: A Matrix Approach	2001	Pandit Gupta	Tata McGraw-Hill Education

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CV 432 / CV 821	PE (5) WATER TRANSMISSION AND DISTRIBUTION SYSTEMS	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

COURSE OBJECTIVE	COURSE OUTCOMES
The students will learn the:- 1) Reservoir, pump, various valves in distribution system. 2) Analysis of flow in looped networks using various methods. 3) Analysis of flow in serial networks using node flow analysis. 4) Optimal and Economical diameter of pumping main 5) Design of water distribution networks 6) Optimization of water distribution network.	At the end of the course, the students are able to understand. 1) Reservoir, pump, Various valves in distribution system 2) Analysis of flow in looped networks using various methods. 3) Analysis of flow in serial networks using node flow analysis. 4) Optimal and Economical diameter of pumping main 5) Design of water distribution networks 6) Optimization of water distribution network.
Mapped Program Outcomes: a, e, h, k, l	

UNIT-1:
General Hydraulic Principles, Head loss formulae- Darcy-Weisbach formula, Hazen – Williams formula, Modified Hazen - Williams formula, minor losses, continuity equation, Series and Parallel connection of Pipes, Equivalent length of Pipes, Three Reservoirs, multy- reservoir, Pumps and Valves (check valve, flow control valve and pressure reducing valve) in Water distribution systems.

[08 Hrs.]

UNIT-2:
Types of network, Formulation of Equations for looped Water Distribution Networks, Analysis of flow in looped networks using Hardy-Cross method, Newton-Raphson and Linear Theory methods.

[09 Hrs.]

UNIT-3
Node flow analysis of water distribution networks (NFA): Necessity of node flow analysis, classification of node according to HGL, classification of node according to flow, compatibility, node head-discharge relationship, Application of NFA technique to serial networks**.**

[08Hrs.]

UNIT-4:
Optimal and Economical diameter of pumping main. Design of pumping main considering rising main diameter as continuous as well as discrete variable. Estimation of Reservoir capacity using analytical method.

[09 Hrs.]

UNIT-5:
Design of water distribution networks: Design of single source branching network using Critical path method, Determining number of branching configuration for a looped network by graph theory, Use of path concept and minimum spanning tree concept.

[09 Hrs.]

UNIT-6
Formulation of optimization model, Application of critical path method for design of looped networks. Application of Cost-head loss ratio method and linear programming technique to optimal design of branched networks.

[09 Hrs.]

Text books:

SN	Title	Edition	Authors	Publications
1	Optimal design of water distribution networks	2003-12-04	Bhave, P.R.	Alpha science International Ltd
2	Analysis of Water Distribution Networks	2006-09-18	Bhave P.R., & Gupta R.	Alpha science International Ltd

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CV 432 / CV 821	PE (5) WATER TRANSMISSION AND DISTRIBUTION SYSTEMS	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

Reference books:

SN	Title	Edition	Authors	Publications
1	Analysis of flow in pipe networks	June 1976	Jeppson, R.W.	Butterworth-Heinemann
2	Analysis of water distribution systems	November 1992	Walski, T. M.	Krieger Publishing Company
3	Manual on Water Supply and Treatment	------	CPHEEO, Ministry of Urban Development, New Delhi, 2005	CPHEEO, GOI

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CV 433 / CV 822	PE (5) ADVANCED STEEL DESIGN	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1.Understand different types of loading with respect to structural parameters. 2.Application of IS code & SP code for detailing and drafting of different structural components. 3.Analysis and design of different types of structures	1. Understand design of different types of bridges and storage vessels. 2. Understand design towers. 3.Understand fundamentals of plastic analysis of steel structures
Mapped Program Outcomes: a, e, i, k, l, m	

UNIT-1:

Bridges: Types of bridges, foot Bridge, road bridge, railway bridge, rolled beam bridges, plate girder bridges, trussed bridge, through and deck type bridges, weight of bridge truss by empirical formulae, loading on footways, IRC loading, loading on railway bridges, design of footbridge, design of components of railway and road bridges

Bearings-Types of bearings, bearing pads, introduction to rocker, roller and elastomeric bearings.

[13 Hrs.]

UNIT-2:

Storage Vessels - Design of bunkers and silos, Janssen's theory, Airy's theory, design criteria, analysis & design of Bins, design of water tanks, circular tanks with segmental bottom, rectangular pressed steel tanks, and design of staging.

[13 Hrs.]

UNIT-3

Tower: Introduction to transmission line and communication towers, various types, tower configurations, calculation of loads for design of various types of towers, analysis & design of towers.

[13Hrs.]

UNIT-4:

Plastic analysis of steel structures: Fundamentals, static and kinematic theorem, equilibrium and mechanism methods of analysis

Composite construction: General concepts, properties, steel – concrete composites design of encased beams, columns and shear connectors, advance welding techniques and approximate estimates

[13 Hrs.]

Text books:

SN	Title	Edition	Authors	Publications
1	Design of steel structures	2007	A. S. Arya and J.L. Ajmani	Nem Chand Bros, Roorkee

Reference books:

SN	Title	Edition	Authors	Publications
1	Design of steel structures, Vol II	2010	Ramachandra	Standard Book House, New Delhi
2	Design of Steel Structures	2010	S.K. Duggal	Tata McGraw Hill, Publishing Co. Ltd.
3	Design of Steel Structures	Dec 31, 2004	P. Dayaratnam	S. Chand Publications

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CV 434 / CV 823	PE (5) MAINTENANCE AND REHABILITATION ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1.To know how to plan and management maintenance of structures 2. Get knowledge of materials and techniques for maintenance. 3.To understand importance of research in maintenance	1. To understand need and necessity of maintenance management. 2. Scope and exposure of research for maintenance 3 To have industry oriented knowledge for maintenance planning.
Mapped Program Outcomes: a,b,c,h,j,k	

UNIT-1:

Introduction: Deterioration of structures, definition of maintenance, need for maintenance of different civil engineering structures, maintenance characteristics, negligence and poor maintenance of structures, quantification of maintenance.

Classification of Maintenance Work: Servicing, rectification, replacement, planned, unplanned, preventive, corrective, predictable and avoidable maintenance works, renovation and rehabilitation, routine maintenance of buildings, specifications for maintenance works

Common Maintenance Problems: Relating to various civil engineering structures and systems, techniques of maintenance, areas prone to frequent maintenance, causes that aggravate maintenance work like high-rise buildings, special construction methods, new materials, accessibility, Environment etc., construction details for prevention

[09 Hrs]

UNIT-2:

Factors Affecting Frequency and Magnitude of Maintenance Work: Over loading, movement of grounds, temperature variations, moisture, leakages and dampness, chemical actions and corrosion, growth of trees, earthquake, flood and fire, riots and vandalism, design defects, defects in construction and use of materials, choice of materials for durability and maintainability, design, exposure and other factors effecting durability, precautions to increase durability, effect of pollution on buildings.

Inspection, Identification and diagnosis of common defects and failures with possible causes in buildings, Roads, bridges, railway tracks, canals and C.D. Works, tunnels and special structures like service reservoirs, water supply, sewerage, storm water drains

[09 Hrs]

UNIT-3

Preventive Maintenance: General, site selection, choice of structural systems and materials, specifications & detailing, special attention to foundations, walls, roofs, terraces, floors, doors, windows, plinth, compound walls, expansion joints and staircases to improve maintainability, water supply and sanitary works, termite control, external finishes.

Road stabilization techniques, compaction & drainage, shoulders, slope protection, joints in C. C. Pavements, routine and service maintenance, recycling, bridges and C.D. works repairs, strengthening and rehabilitation,reliability rating of existing structures and systems, service life & expected load carrying capacity, service & stability requirements, future service requirements, loads, fatigue and creep.

[09 Hrs]

UNIT-4

Materials and Techniques for Maintenance: Materials for repairs like cement, cement grouts, epoxy grouts, mortars and coatings, polymer concrete composites, sealants, membrane overlays, fiber reinforced concrete, resin based compounds, emulsions, paints and geotextiles, techniques like

CV 434 / CV 823	PE (5) MAINTENANCE AND REHABILITATION ENGINEERING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

stiffening, linings, guniting protection systems, prestressing, post-tensioning and base isolation technology, corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, stitching, repair and strengthening of concrete buildings, foundation repair and strengthening, underpinning, leakage of roofs and methods of repair

Failure Of Buildings: Definition of building failure, functional, structural and aesthetical failures, case studies,methodology of failure investigation, diagnostic testing methods and equipments, effect of fire on buildings.

[08 Hrs]

UNIT-5

Maintenance Planning: In-depth significance of maintenance as opposed to cosmetic treatments, broad action plan, planning, budgeting and controlling the cost of maintenance work, policy formulation, standards of maintenance & controlling cost, planned maintenance, inspection cycles and condition surveys, investigation for assessing condition of structures including non-destructive evolution techniques like proof load test, photogrammetric analysis, assets and optical electric motion analysis, bovescopes, fiber optic probes, chain-dragging, acoustic emission and ultrasonic techniques, infrared thermography, high-speed non-contact sensor, sonar and sound penetrating radar techniques, reliability rating, maintenance cost records, maintenance manuals, their functions, contents and types, difficulties in planned maintenance

Conservation and Recycling – Historical buildings, conservation movement (needs), documentation, materials and methods for conservation work, recycling of old building and its advantages, case study.

[08 Hrs]

UNIT-6

Maintenance Oriented Designs: Design and its relation to maintenance, relationship between initial maintenance and running costs, cost appraisal techniques, consideration of maintenance at design stage, design needs, importance of feedback and feedback systems, information gathering, design data communication, interaction between designers and contractors, maintainability, role of design professionals

Maintenance Management: Need for data, relationship of the data base system to management process, cost of data base and management, uses of data base, problems in data collection, setting criteria from data collected, operational assessment

Research in Maintenance: Importance of research, areas of research including materials, techniques, field equipment and tools for investigation, repairs and monitoring non-destructive evaluation techniques.

[09 Hrs]

Text books:

SN	Title	Edition	Authors	Publications
1	Concrete Technology	2009	Shetty M.S.	S.Chand Publication,New Delhi
2	Concrete for Construction - Facts and Practice	1999	Raina V.K	Tata McGraw-Hill Publishing Company Limited, New Delhi
3	SP: 25 -1984 - Hand Book on Causes and Prevention of Cracks in Buildings	1999	-	Bureau of Indian Standards, New Delhi

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CV 434 / CV 823	**PE (5) MAINTENANCE AND REHABILITATION ENGINEERING**	**L=4**	**T=0**	**P=0**	**CREDITS = 4**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

Reference books:				
SN	**Title**	**Edition**	**Authors**	**Publications**
1	Concrete - Building Pathology	2003	Macdonald S.	Blackwell Science Limited, Oxford
2	The Maintenance and Adaptation of Buildings	1981	Chudley, R.	Longman Group Ltd, New York,
3	Corrosion Damaged Concrete - Assessment and Repair	1987	Strecker, P.P	Butterworths, London

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CV 435 / CV 824	PE (5) FUNDAMENTAL OF REMOTE SENSING AND GIS	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1) To study basic principle and uses of remote sensing. 2) To know the different elements and components of remote sensing. 3) To study the digitization, image processing and feature extraction. 4) To study special database management, overlay analysis and visualization of database elements. 5) To study cartography, map design and layout and topographical mapping or digital elevation modeling or digital terrain modeling. 6) To study different application of remote sensing and GIS like natural resources management, urban infrastructure management, environmental impact analysis etc.	1) Understands basic concept and uses of Remote Sensing. 2) Understands different elements of remote sensing. 3) Students will be able to process digital image and extract features of the images. 4) Able to manage different database and carry out overlay analyses. 5) Able to carry out mapping and digital elevation modeling or digital terrain mapping. 6) Able to apply the knowledge for different application like environmental mapping, water resources management, disaster mapping and management etc.
Mapped Program Outcomes: a, b, c, d, e, f, h, k	

UNIT-1:

Principles of Remote Sensing: Fundamentals of RS, electromagnetic energy and remote sensing, sensors, platforms and RS data acquisition systems, multispectral, hyper spectral and thermal sensors, radiometric aspects of remote sensing data, geometric aspects of remote sensing data, image enhancement and visualization, image interpretation techniques and classification, microwave thermal remote sensing, radar &laser altimetry.

[09 Hrs]

UNIT-2:

Elements of Remote Sensing System: Terrestrial, airborne and space borne platforms, Sun synchronous and geo-stationary satellites, advantages and disadvantages, various earth resources satellites, Indian remote sensing program, remote sensing data products and their types: analog and digital data formats, thermal and radar imageries, FCC

[09 Hrs]

UNIT-3

Digital Image Processing: Image rectification and restoration, image enhancements-contrast manipulations, spatial feature manipulation, multi – image manipulation, supervised and unsupervised classification, accuracy assessment and data merging

[09 Hrs]

UNIT-4

Principles of Geographical Information Systems: Geographic information and spatial data types, database management systems, spatial referencing, data quality, measures of location errors on maps, satellite-based positioning, spatial data input, data preparation, point data transformation, analytical GIS capabilities; retrieval and classification; overlay functions, neighborhood operations; network analysis; error propagation, data visualization.

[08 Hrs]

UNIT-5

Cartography: Introduction to cartography, classification of maps, types of data, visual variables, generalization, symbolization, map design, map layout, diagrams map projection, topographic mapping, and production of large-scale maps and photo and image maps.

[08 Hrs]

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV 435 / CV 824	PE (5) FUNDAMENTAL OF REMOTE SENSING AND GIS	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 HOURS**

UNIT-6

Applications: Integrated approach of remote sensing and GIS application: natural resource mapping, water resource management, urban infrastructure management, land information system, environmental impact analysis, GIS in utility management.

[09 Hrs]

Reference books:				
SN	**Title**	**Edition**	**Authors**	**Publications**
1	Concepts and Techniques of GIS	2005	C.P. Lo Albert	PHI Learning
2	Remote Sensing Of the Environment - An Earth Resource Perspective	2004	John R. Jensen	Pearson Education.
3	Environmental Engineering	2010	S.K.Garg	Khanna Publishers

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

CV404 / CV 603	GEOTECHNICAL ENGINEERING – II	L=3	T=1	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the studetns with basic understanding of geotechnical site investigation. 2. To understand the bearing capacity of soil & factors governing choice of foundation. 3. To understand the lateral earth pressure. 4. To study stability of sloyes. 5. To faimilirise different methods of ground improvement.	1. Understood different soil exploration techniques. 2. To workout load carrying capacity of different foundations. 3. Can estimate lateral earth pressure for different retaining structures. 4. Can calculate stability of slopes & factor of safety. 5. Understood functions & methods of various ground improvement technique.
Mapped Program Outcomes: a, b, c, e, h	

UNIT-1

GEOTECHNICAL EXPLORATION : Importance and objectives of field exploration, principal methods of subsurface exploration, open pits & shafts, types of boring, number, spacing and depth of boring for different structures, type of soil samples & samplers, collection & shipment of samples, bore logs and sampling record, One compulsory site visit for 1. Plate load test. 2. Standard Penetration Test
[06 hrs.]

UNIT-2:

SHALLOW FOUNDATIONS:
Bearing capacity of soils (IS: 6403), types of shear failure in foundation soil, Terzaghi's theory, its validity and limitations, bearing capacity factors, effect of water table on bearing capacity,effect of water table on bearing capacity, correction factors for shape and depth of footings, Standard Penetration Test, corrections to N –values & correlation for obtaining design soil parameters, bearing capacity estimation from N-values.
Settlement Analysis of footings and Rafts: Causes of settlement, computation of elastic and consolidation settlement (IS-8009: Part I), differential settlement, control of excessive settlement,proportioning the footing for equal settlement,plate load test: procedure, interpretation for bearing capacity and settlement prediction
[07 hrs.]

UNIT-3

PILE FOUNDATION: Classification and types of piles, constructional features of cast–in–situ &pre-cast concrete piles, pile driving methods, effect of pile driving on ground, load transfer mechanism of axially loaded piles. Pile capacity by Static formula & Dynamic formula, pile load test and interpretation of data, group action in piles, spacing of piles in groups, group efficiency, overlapping of stresses, settlement of pile group by simple approach, negative skin friction and its effect on pile capacity, general feature of under reamed piles, Introduction to well foundations, caissons and coffer dams
[07 hrs.]

UNIT-4:

LATERAL EARTH PRESSURE :Fundamentals of earth pressure at-rest, active & passive pressures, general & local states of plastic equilibrium in soil, Rankine's and Coulomb's theories of earth pressure, effects of soil type, surcharge, submergence, graphical solutions of Rebhan and Culmann for active case.

[06 hrs.]

UNIT-5:

STABILITY OF SLOPES : Causes and types of slope failure, stability analysis of infinite slopes and finite slopes, effect of seepage, location of critical slip circle, method of slices for cohesive and C - Ø soil slopes, pore pressure considerations, Taylor's stability numbers & stability charts, methods of improving stability of slopes

[06 hrs.]

UNIT-6

GROUND IMPROVEMENT : Method of soil stabilization – mechanical stabilization & chemical stabilization, use of admixtures (lime, cement, flyash) in stabilization, basic concepts of reinforced earth - use of geosynthetic materials-salient features, function and applications of various geosynthetic materials, deep compaction by impact, vibroflotation, pre-consolidation techniques by band drain installation, pre-loading and surcharging.

[07 hrs.]

CV404 / CV 603	GEOTECHNICAL ENGINEERING – II	L=3	T=1	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

SN	Title	Edition	Authors	Publications
1	**Geotechnical Engineering:** Principles and Practices of Soil Mechanics and Foundation Engineering	2003	VNS Murthy	CRC Press
2	Soil Mechanics & Foundation Engineering	7th Edition 2009	Arora K.R.	Standard Publisher Distributors
3	Soil Mechanics & Foundations	16th Edition 2009	Punmia B. C.	Standard Book House, New Delhi

Reference books:

SN	Title	Edition	Authors	Publications
1	Design Aids in Soil Mechanics and Foundation Engineering	1988	Kaniraj R.	McGraw Hills, New Delhi
2	Analysis and Design of Foundations and Retaining Structures	1979	Shamsher Prakash, Gopoal Ranjan and Swami Sharan	SaritaPrakashan,Meerut.
3	Theory and Practice of Foundation Design	2004	Som N.N. & Das S.C	Prentice Hall & Co., New Delhi
4	IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations	1993	------	Bureau of Indian Standards

CV 421 / CV 812	ESTIMATING AND COSTING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**4 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the importance of subject and definition involved in the estimation of various structures. 2. To understand the estimates of buildings (Load bearing and framed structure) culverts, Hydraulic structures water supply and sanitary works etc. Earthwork estimates in road, hill roads and canals. Detail estimates of steel in RCC works with bar bending schedule. 3 To understand the procedure of submitting the tenders and types of contracts. 4 To understand the writing and developing detailed specification of items and finding out quantities of various materials in different items. 5 To understand the concept of valuation, methods of valuation and rent fixation. 6 To understand the methods of accounting	1 Understood the definitions in estimates of structures. 2 Workout the estimate and costing of building, road, hydraulic structures etc. [Field problems] 3 As a contractor he can fill the tenders and can carry out the construction of civil engineering structures. 4 He can develop the specifications and find out the quantities of materials in different items to prepare the estimate. 5 He can workout the valuation and rent of civil engineering structures. 6 Accounting can be done.
Mapped Program Outcomes: a,b,c,d,e,f,j,l,n	

UNIT-1:

General: Importance of the subject, purpose of quantity estimates, mode and unit of measurement as per I.S.1200, methods and stages of estimates, items of a work and their description, Approximate estimation of Civil engineering works.

Proposal and Development of Project: Project Management Consultant & their role, various important terminologies required like work charged establishment, muster roll, contingencies, percentage charges, measurement book, overheads etc**.**

[09 Hrs.]

UNIT-2:

Specifications: Purpose and principles of specifications, types of specifications, writing and developing detailed specifications of important items.

Cost Build up: Purpose and principles, importance of Schedule of rates (CSR) in cost estimates, factors affecting analysis of rates, information from National Building Organization, task work, factors affecting task work, market rates, escalation

[08 Hrs.]

UNIT-3

Valuation: Purpose of valuation, factors affecting value of property price and cost, market value, potential value, sentimental value, scrap value etc. real estate, guide edged securities, net and gross return, tenure of land, valuation of land, free hold and leasehold, sinking fund, depreciation, capitalized value, methods of valuation, differed annuity, time cost relationship, valuation table and rent fixation

[09 Hrs.]

UNIT-4:

Cost Accounting: Various methods, classification of cost, direct and indirect charges, distribution of overheads, M.A.S. Account, issue rates and store account. earthwork estimates in road, hill roads and canals. Mass excavation and mass haul curves.

UNIT-5:

Quantity and cost estimates: Methods of detailed estimates, forms used for detailed estimates, working out the quantities of various materials required for construction of different Civil Engineering works like building, road works etc., detailed estimates of steel in RCC works, bar bending schedule

[08 Hrs.]

CV 421 / CV 812	ESTIMATING AND COSTING	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**4 hours**

UNIT-6

Arranging Works : Construction agencies, method of carrying out works, arranging contract works, pretender and contract planning, tender notice, acceptance of tender, essentials of contract, types of contracts, conditions of contract, contract documents, various schedules in the tender document, measurement and payment to contractor, arbitration

[09 Hrs.]

Text books:				
SN	**Title**	**Edition**	**Authors**	**Publications**
1	Estimating, Costing, Specification & valuation in Civil Engineering	2010	Chakraborti M.	UBS Publication, Calcutta

Reference books:				
SN	**Title**	**Edition**	**Authors**	**Publications**
1	Estimating & Costing	2010	Chandola S.P. &Vazirani V.N.	Khanna Publishers 2-B, Nath market, Naisarak, Delhi
2	Estimating & Costing in civil Engineering -	February 1999	Dutta B.N.	UBS Publishers distributors ltd., 5 Ansari road, New Delhi.
3	Estimating, Costing and valuation	2011	Rangwala S.C.	Charotar Publishing house, opposite Amul diary, court road, Anand

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
B.E. Regular (MECHANICAL ENGINEERING)
SCHEME OF EXAMINATION 2010

Sl.No.	Sub Code	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE- I	MSE- II	TA	ESE	
VII SEMESTER												
1	**GE403**	Industrial Management	3	0	0	3	3	15	15	10	60	3 Hours
2		Professional Elective - 1	4	0	0	4	4	15	15	10	60	3 Hours
3		Professional Elective - 2	4	0	0	4	4	15	15	10	60	3 Hours
4		Professional Elective - 3	4	0	0	4	4	15	15	10	60	3 Hours
5		Professional Elective - 3-Lab.	0	0	2	2	1			40	60	
6	**FE-II**	Free Elective-2	4	0	0	4	4	15	15	10	60	3 Hours
7	**ME433**	Project Phase-1	0	0	4	4	4			40	60	
8	**ME434**	Training	0	0	0	0	3			100		
		Total	**19**	**0**	**6**	**25**	**27**					
VIII SEMESTER												
1	**ME435**	Automation In Production	3	1	0	4	4	15	15	10	60	3 Hours
2	**ME436**	Automation In Production Lab.	0	0	2	2	1			40	60	
3	**ME475**	Optimisation Techniques	3	1	0	4	4	15	15	10	60	3 Hours
4		Professional Elective - 4	4	0	0	4	4	15	15	10	60	3 Hours
5		Professional Elective - 4-Lab.	0	0	2	2	1			40	60	
6		Professional Elective - 5	4	0	0	4	4	15	15	10	60	3 Hours
8	**ME472**	Comprehensive Viva Voce	0	0	0	0	3			40	60	
9	**ME 473**	Project Phase-2	0	0	6	6	6			40	60	
	ME 474	Extra Curricular / Competative Exm.	0	0	0	0	2			100		
		Total	**14**	**2**	**10**	**26**	**29**					
		Final Total	**109**	**10**	**49**	**168**	**157**					
FREE ELECTIVES-II												
EL412		FE2:Electrical Energy Audit and Safety	4	0	0		4	15	15	10	60	
EL413		FE2:Utilisation of Electrical Energy	4	0	0		4	15	15	10	60	
CV418		FE II : Elements of Earthquake Engineering	4	0	0	4	4	15	15	10	60	
CV419		FE II : Air Pollution & Solid Waste Management	4	0	0	4	4	15	15	10	60	
ET411		FE2 : Soft Computing	4	0	0	4	4	15	15	10	60	3 Hrs
ET412		FE2 : Industrial Instrumentation	4	0	0	4	4	15	15	10	60	3 Hrs
EE411		FE 2 :Fuzzy Logic & Neural Network	4	0	0	4	4	15	15	10	60	
EE429		FE 2 :Basic of Analog and Digital Communication Systems	4	0	0	4	4	15	15	10	60	
CT411		FE2:Multimedia and Animation	4	0	0	4	4	15	15	10	60	100
CT412		FE2:Current Trends and Technologies	4	0	0	4	4	15	15	10	60	100
IT408		FE2: Applications of Computer Networking	4	0	0	4	4	15	15	10	60	3 Hrs

PROFESSIONAL ELECTIVES

ME401	PE 1: Tool Design	4	0	0	4	4	15	15	10	60	
ME402	PE 1: Material Handling Systems	4	0	0	4	4	15	15	10	60	
ME403	PE 1: Refrigeration & Air Conditioning	4	0	0	4	4	15	15	10	60	
ME404	PE 1: Engineering Of Plastics	4	0	0	4	4	15	15	10	60	
ME405	PE 1: Project Evaluation & Management	4	0	0	4	4	15	15	10	60	
ME406	PE 1: Finite Element Methods	4	0	0	4	4	15	15	10	60	
ME408	PE 2 : Synthesis Of Mechanism	4	0	0	4	4	15	15	10	60	
ME409	PE 2 :Finance & Cost Management	4	0	0	4	4	15	15	10	60	
ME410	PE 2 :Renewable Energy System	4	0	0	4	4	15	15	10	60	
ME411	PE 2 :Artificial Intelligence	4	0	0	4	4	15	15	10	60	
ME412	PE 2 :Maintainance Management	4	0	0	4	4	15	15	10	60	

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Dean (Acad. Matt.)		**Version**	**1.03**	**AY 2013-14 Onwards**

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
B.E. Regular (MECHANICAL ENGINEERING)
SCHEME OF EXAMINATION

Sl.No.	Sub Code	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE- I	MSE- II	TA	ESE	
	ME415	PE 3 :Vibration	4	0	0	4	4	15	15	10	60	
	ME416	PE 3 :Vibration Lab.	0	0	2	2	1			40	60	
	ME417	PE 3 :Cim	4	0	0	4	4	15	15	10	60	
	ME418	PE 3 :Cim Lab.	0	0	2	2	1			40	60	
	ME419	PE 3 :I.C. Engines	4	0	0	4	4	15	15	10	60	
	ME420	PE 3 :I.C. Engines Lab.	0	0	2	2	1			40	60	
	ME437	PE 4 :Industrial Fluid Power	4	0	0	4	4	15	15	10	60	
	ME438	PE 4 :Industrial Fluid Power Lab.	0	0	2	2	1			40	60	
	ME439	PE 4 :Cnc & Robotics	4	0	0	4	4	15	15	10	60	
	ME440	PE 4 :Cnc & Robotics Lab.	0	0	2	2	1			40	60	
	ME441	PE 4 :Vehicle Engineering	4	0	0	4	4	15	15	10	60	
	ME442	PE 4 :Vehicle Engineering Lab.	0	0	2	2	1			40	60	
	ME443	PE 4 :Mis	4	0	0	4	4	15	15	10	60	
	ME444	PE 4 :Mis Lab.	0	0	2	2	1			40	60	
	ME445	PE 4 :Mechatronics	4	0	0	4	4	15	15	10	60	
	ME446	PE 4 :Mechatronics Lab.	0	0	2	2	1			40	60	
	ME451	PE 5 :Stress Analysis	4	0	0	4	4	15	15	10	60	
	ME452	PE 5 :Design of Experiments and Taguchi Methods	4	0	0	4	4	15	15	10	60	
	ME453	PE 5 :Value Engg.	4	0	0	4	4	15	15	10	60	
	ME454	PE 5 :Lean Sigma	4	0	0	4	4	15	15	10	60	
	ME455	PE 5 :Product Design And Development	4	0	0	4	4	15	15	10	60	
	ME456	PE 5 :Advanced Manufacturing Techniques	4	0	0	4	4	15	15	10	60	
	ME457	PE 5 :Power Plant Engineering	4	0	0	4	4	15	15	10	60	
	ME458	PE 5 :Machine Tool Design	4	0	0	4	4	15	15	10	60	
	ME459	PE 5 :Industrial Safety	4	0	0	4	4	15	15	10	60	
	ME460	PE 5 :Advance Welding Techniques	4	0	0	4	4	15	15	10	60	

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Regular: - 7th Semester Theory PTDC: -8th Semester

GE403/GE801	INDUSTRIAL MANAGEMENT			L= 4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	10	60	100		3 Hrs

Objectives: **This subject helps student to understand the Functions of management, Marketing Management, Personnel Management, Plant Management, Inventory Control and Finance Management in the organization. [a,d,f,g,i,k]**

UNIT-1: Principles of management
Concepts of management, development of scientific management, Taylor Principles Fayol, functions of management such as planning, decision making, organizing, communication, controlling, span of control. [a,d,f,g,i,k]

[8 Hours]

UNIT-2: Personnel & Human Resource Management
Concept and evolution of personnel management and HRM, Difference between PM and HRM. Functions of HRM Concept of HRD. HR Planning, Concept, Objective, Importance, and Process. Recruitment: Meaning, process, Recruitment Agencies, selection process, test, and types of test, interview and types of interview. Training and Development. [a,d,f,g,i,k]

[7 Hours]

UNIT-3: Plant Management
Definition & scope ,Plant location, plant layout, types of maintenance such as break down, predictive & preventive maintenance, stores management, industrial safety, causes & cost of accidents, safety programs, production planning & control, job, batch & process type of product [a,d,f,g,i,k,l,m]

[8 Hours]

UNIT-4: Marketing Management
Definition & scope, selling & modem concepts of marketing, market research, rural marketing, Customer Behaviors, marketing strategies, product launching, product life cycle, sales promotion, pricing, channels of distribution, Advertising, market segmentation, marketing mix, positioning, targeting [a,d,f,g,i,k]

[8 Hours]

UNIT-5: Material Management
Definition & scope, Importance of Materials Management, Classification, Codification, Forecasting, and Necessity of Inventory & it's control [a,d,f,g,i,k,l,m]

(7 Hours)

UNIT-6: Financial management
Definition & Functions of Finance department, Sources of finance ,financing organizations, types of capital, elements of costs & allocations of indirect expenses, cost control, break even analysis, budgets & budgetary control, equipment replacement policy, make or buy analysis, balance sheet, ratio analysis, profit & loss statement. [a,d,f,g,i,k,m]

[7 Hours]

Text books:				
1	Industrial Management	1st Edition 1997 ISBN:81-219-1480-9	I.K. Chopde & A.M. Sheikh	S.Chand & Company Ltd.
2	Financial management	1st Edition 2000 ISBN: 8186985158 ISBN-13: 9788186985151	S.C. Kuchhal	Chaitanya Publishing House, Allahabad
3	Principles & Practice of Management	6th Edition 2001	Dr.L.M.Prasad	S.Chand & Company Ltd.
4	Essentials of Management	1st Edition 2006 ISBN: 9780070620308	Harold Koontz, Heniz Weihrich	McGraw-Hill.

Reference books:				
1	Principles & Practice of Management	6th Edition 2000	T.N. Chabra	Dhanpat Rai & Sons, New Delhi
2	Principles of marketing management	11thEdition 2005 ISBN13: 9780131469181	Philip Kotler	Prentice Hall
3	Management & Entreprenurship	1st Edition 2009 ISBN-13:019-806190-8	Kanishla Bedi	Oxford University Press

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Regular: - 7th Semester Elective-I Theory PTDC: - 5th Semester

ME401/ME701	Tool Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To learn the mechanism of metal cutting and the design of metal cutting tools. Also to understand various press working operations along with tools to dies design.

Unit1 **[8 Hrs]**

Design of single Point Cutting Tool ,Theory of metal Cutting Introduction, Mechanics of chip formation, Cutting tool materials, Single point cutting tool, Designation of cutting tools, ASA system, Importance of Tool angles, Orthogonal rake system, Classification of cutting tools, Types of chips, determination of shear angle, velocity relationship, force relations, Merchant's Theory, Cutting power, Energy consideration in metal cutting, Tool wear, Tool life, Tool life criteria, variable affecting tool life, Machineability

[a,b, c, d, e, f, g, h, I, j ,k, l, m]

Unit2 **[8hrs]**

Form tools- Introduction, Types, design of form tools. Drills- Introduction, Types, Geometry, Design of drill. Milling cutters - Introduction, Types, Geometry, and Design of milling cutters**.**

[a, b, c, d, f, g, h, I, j, k, l, m]

Unit3 **[10hrs]**

Press tool Design

Introduction, Press operations - Blanking, piercing, Notching, Perforating, Trimming, Shaving, Slitting, Lancing, Nibbling, Bending, Drawing, Squeezing. Press working equipment - Classification, Rating of a press, Press tool Equipment, arrangement of guide posts. Press selection, press working

Terminology, Working of a cutting die, Types of dies - Simple dies, inverted die, Compound dies, combination dies, progressive dies, Transfer dies, multiple dies Principle of metal cutting, strip layout, clearance, angular clearance, clearance after considering elastic recovery, cutting forces, method of reducing cutting forces, Die block, Die block thickness, Die opening, Fastening of die block, back up plate, Punch, Methods of holding punches, Strippers. Stoppers, Stock stop, Stock guide, Knockouts, Pilots. Blanking & Piercing die design - Single & progressive dies.

[a, b, c, d, e, f, g, h, i, j ,k, l, m]

Unit4 **[10hrs]**

Bending Forming & Drawing dies Bending methods - Bending Terminology, V- Bending, Air bending, bottoming dies, spring back & its prevention. Design Principles - Bend radius, Bend allowance, Spanking, width of die opening, Bending pressure. Metal flow during drawing, Design, Design consideration - Radius of draw die, Punch radius, Draw clearance, Drawing speed, Calculating blank size, Number of draws, Drawing pressure, Blank holding pressure.

[a, b, c, d, f, g, h, I, j, k, l, m]

Unit5 **[7 Hrs]**

Forging Die Design: Introduction, Classification of forging dies, Single impression dies, Multiple Impression dies. Forging design factors - Draft, fillet & corner radius, parting line, shrinkage & die wear, mismatch, finish allowances, webs & ribs Preliminary forging operation - fullering, edging, bending, drawing, flattering, blacking finishing, cutoff. Die design for machine forging - determination of stock size in closed & open die forging. Tools for flash trimming & hole piercing, materials & manufacture of forging dies.

[a, b, c, d, f, g, h, i , j ,k, l, m]

Unit6 **[10 Hrs]**

Design of jigs & fixture: - Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures. Drilling Jigs: - Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures, Automatic clamping Devices.

[a, b, c, d, e, f, g, h, i , j, k, l, m]

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
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ME401/ME701	Tool Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.**Reference books:**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	"Tool design"	2001	Donaldson	TATA Mc-Graw Hill.
2	"Fundamentals of Tool design	1988	ASTME,	TATA Mc-Graw Hill.
3	"Fundamentals of Tool design"	1962	Pollock,	Reston Publishing Company
4	, "Fundamentals of Tool design"	1971	Kempster	Hall of India Pvt. Ltd
5	Computer aided fixture design	--	Rong , Yeming	Marcel Dekker

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Regular: - 7th Semester Elective-I Theory PTDC: - 5th Semester

ME402/ME702	Material Handling System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop the awareness about principles and practices of material handling equipments. Study the different components design and applications of material handling devices.

Unit1 **[8 Hrs]**

Types of intraplant transporting facility, principles of material handling and classification of material handling equipments, selection of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments. **[a, b, c, d, e, g, h, k]**

Unit 2 **[10 Hrs]**

Component selection and design Flexible hoisting appliances like ropes and chains, welded load chains, roller chains, selection of chains, hemp rope and steel wire rope, selection of ropes, rope reeving arrangement and pulley blocks fastening of chains and ropes, different types of load suspension appliances, fixed and movable pulleys, different types of pulley systems, multiple pulley systems. Chain and ropes heaves and sprockets.
[a, b, c, d, e, f, g]

Unit 3 **[7 Hrs]**

Load handling attachments, standard forged hook, hook weights, hook bearings, cross piece and casing of hook, crane grab for unit and piece loads, carrier beams and clamps, load platforms and side dump buckets, Electromagnetic lifting system, grabbing attachments for loose materials, crane attachments for handling liquid materials. [**a, b, c, d, e, f, i, j]**

Unit 4 **[10 Hrs]**

Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thrusters operated, controlled brakes, shoe brakes, Electro-Hydraulic thrusters safety handles, load operated constant force and variable force brakes, Rope drum design and assembly, design of guides and column, [a, **b, c, d, e, i, j,k]**

Unit 5 **[8 Hrs]**

Different drives of hoisting gears like individual and common motor drive for several mechanisms, travelling gear, travelling mechanisms for moving trolleys and cranes on runway rails, mechanisms for trackless, rubber-tyre and crawler cranes, motor propelled trolley hoists and trolleys, rails and travelling wheels, slewing, jib and lifting gears. Operation of hoisting gear during transient motion, selecting the motor rating and determining braking torque for hoisting mechanisms, selecting the motor rating and determining braking torque for travelling mechanisms, slewing mechanisms, jib and lifting mechanisms. (Elementary treatment is expected)
[a, b, c, d, e, fj, k]

Unit 6 **[7 Hrs]**

Cranes with rotary pillar, cranes with a fixed post, jib cranes with trolley, portal cranes with luffmg boom, cantilever cranes, cage elevators, safety devices of elevators, belt and chain conveyors and their power calculations, vibrating and oscillating conveyors, pneumatic and hydraulic conveyors, screw conveyors, hoppers, gates and feeders. Introduction to AGV's as new material handling device, use of robot for material handling. **[a, b, c, d, e j, k]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Materials Handling Equipment-	1964	N. Rudenko ,	Envee Publishers, New Dehli
2	Materials Handling Equipment-	1968	M.P. Alexandrov.	Mir publications

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Regular: - 7th Semester Elective-I Theory PTDC: - 5th Semester

ME403/ME703	Refrigeration and Air Conditioning	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To familiarize with terminologies associated with refrigeration and Air conditioning. To understand principle of Refrigeration and Air conditioning systems. To understand basic and applied psychrometry. To understand air conditioning load calculations and duct design. To understand energy conservations and management

[a, b, c, e, i ,k, l, m]

Unit 1 **[7 Hrs]**

PSYCHROMETRY: Introduction, psychometric properties of air, psychometric chart, psychometric processes bypass factor, apparatus dew point temperature.

HUMAN COMFORT: **Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart**

[a, b, c, e, i ,k, l, m]

Unit 2 **[8 Hrs]**

ADVANCED PSYCHROMETRY: Application of psychrometry to various air-conditioning systems. RSHF, GSHF, ESHF, air washers, air coolers.

HEAT LOAD CALCULATIONS: **Data collection for load calculation. Various components of heat load estimate. Methods of cooling load calculation. Demonstration of air conditioning systems to students.**

[a, b, c, e, i ,k, l, m]

Unit 3

[7 Hrs]

AIR TRANSMISSION & DISTRIBUTION:

Principle of air distribution, types of grills & diffusers & their selection criteria, air alteration, types of air filters, distribution of air through ducts, pressure losses in ducts, methods of duct design, duct friction chart, air conditioning controls.

[a, b, c, e, i ,k, l, m]

Unit 4 [8 Hrs.]

REFRIGERATION: Introduction, Definition, Applications.

Study of simple vapour compression refrigeration system.

Analysis of simple vapour compression refrigeration system, effect of sub cooling, superheating, polytropic compression & pressure drops on the performance of the system. Demonstration of performance of VCRS to students.

[a, b, c, e, i ,k, l, m]

Unit 5 **[8 Hrs]**

MULTISTAGE VAPOUR COMPRESSION REFRIGERATION SYSTEMS:

Multiple compressor & multiple evaporator systems, cascade refrigeration systems. Study of equipments such as compressors, evaporators, expansion devices & controls defrosting methods (types & principle only). Testing & charging of refrigeration systems. Demonstration of above equipments to students.

REFEGERANTS:

Nomenclature of refrigerants, refrigerant properties, mixture refrigerants, global warming potential & Ozone depletion potential, Montreal & Kyoto protocol, alternate refrigerants.

[a, b, c, e, i ,k, l, m]

Unit 6.

[7 Hrs]

STUDY OF VAPOUR ABSORPTION REFRIGERATION SYSTEM:

Introduction Ammonia-Water, Lithium bromide-water systems, three fluid refrigerators.

OTHER REFRIGERATION TECHNIQUES:

Air cycle refrigeration, Applications in air refrigeration systems, Vortex tube, and thermoelectric refrigeration.

CRYOGENICS:

Introduction, Application of cryogenics, Joule- Thomson coefficient, inversion curve, methods of liquefaction of air

[a, b, c, e, i ,k, l, m]

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ME403/ME703	Refrigeration and Air Conditioning	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Refrigeration & Air-conditioning	2005	R.S. Khurmi & J.K. Gupta	Eurasia Publishing House
2	Refrigeration & Air-conditioning	2005	Dr. P.L. Ballany	Khanna
3	Refrigeration & Air-conditioning	2000	Dr.C.P. Arora	Tata McGraw-Hill Education
4	Refrigeration & Air-conditioning	2007	Dr. Manohar	New Age International
5	Refrigeration & Air-conditioning	2007	S.V. Domkundwar	Dhanpat Rai Company (P) Ltd
REFERENCE BOOKS:				
1	Refrigeration & Air-conditioning	1986	Stocker & Jones	McGraw-Hill
2	Principle of Refrigeration & Air-conditioning	1997	Roy J.Dossat	Prentice Hall
3	ASHRAE hand books	2003		ASHRAE
4	Air conditioning Principles & System. Energy approach	1989	E.G. Pita	Wiley
6	Basic Refrigeration& Air-conditioning	2005	P.N. Ananthnarayanan	Tata McGraw-Hill Education

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Regular: - 7th Semester Elective-I Theory PTDC: - 5th Semester

ME404/ME704	Engineering of Plastics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.(a,b,d,e,j,k.l.m)

Unit 1 **[7 Hrs]**

Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages.[**a,k,l,m]**

Unit 2 **[7 Hrs]**

Extrusion - Blow Molding – Casting – Thermo Forming – Rotomolding Study of molds **[a,b,j,k,l,m]**

Unit 3 **[8 Hrs]**

Compression and Transfer Molding - Injection Molding- study of compression and injection molding moulds **[a,b,k,l]**

Unit 4 **[8 Hrs]**

General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics - Mechanical Fasteners - Thermal bonding - Press Fitting. Testing of plastic **[a,b,k,l]**

Unit 5 **[8 Hrs]**

Fibers - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics. Open Mould Processes, Bag Molding, Compression Molding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Molding - Application of PMC's. **[a,b,d,e,k,l]**

Unit 6 **[7 Hrs]**

Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques - Plasma Spray,Chemical and Physical Vapor Deposition of Matrix on Fibers - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting - Compocasting - Application of MMCS. **[a,b,d,e,k,l]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Product Design and Process Engineering	1995.	Harold Belofsky,	Hanser Publishers,
2	High Performance Polymers	**1991**	Bera, E and Moet	Hanser Publishers,
3	Plastics Extrusion technology	**1988**	F.Hensen,	
4	Injection Moulding Machines	**1983**	F.ohannaber	Hanser Publishers,
5	Polymer extrusion	**1990**	C.Rauwendaal,	Hanser Publishers,
6	Blow Moulding Handbook	**1989**	D.V.Rosatao,	Hanser Publishers,
7	Modern Plastics Moulding		E.B Seamour,	John Wiley.
8	Plastics Moulding	**1952**	John Dalmonte,	John Wiley.
9	Machining of Plastics	**1981**	Akira Kobyashi,	Mc-Graw Hill.
10	Composite Materials science and Engineering	**1998**	Krishan K.Chawla	Springer-Verlag, 1987.

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Regular: - 7th Semester Elective-I Theory PTDC: - 5th Semester

ME405/ME705	Project Evaluation & Management	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economical feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.

Unit1 **[7 hrs]**

Project Identification considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty.[**a,b,c,d,e,h,I,j,k]**

Unit 2 **[7 hrs]**

Technical feasibility : Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation: [**a,b,c,d, ,h,I,j,k,l,m]**

Unit 3 **[9 hrs]**

Economic feasibility: Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Break even point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes. **[a,b,d,e,h,I,j,k]**

Unit 4 **[7 hrs]**

Project Planning and Control: Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating [**a,b,c,d,,h,I,j,k,l,m]**

Unit 5 **[7 hrs]**

Project report: Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital **[a,b,c,d,e, f, h,I,j,k,l,m]**

Unit 6 **[8 hrs]**

Initial review, performance analysis , ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environmental & social aspects**. [a,b,c,d,e, f, h,I,j,k,l,m]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Projects	Seventh edition 2007	Prasanna chandra	Tata mc graw Hill publishing company Ltd.
2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	Fifth edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	Sixth edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	Fourth edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	Eighth edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

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Regular: - 7th Semester Elective-I Theory PTDC: - 5th Semester

ME406/ME706	FINITE ELEMENT METHOD	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

Unit 1 **[7 hrs]**

Fundamentals of stress & strain, stress & strain components, stress strain relationship, Elastic constants, plane stress, plane strain., differential equation of equilibrium, compatibility equations, boundary conditions, Saint Venant's principle.

[a,b,c,d,j,k]

Unit 2 **[7 hrs]**

Fundamental concepts of FEM -' Historical background, Scope of FEM in Engg. Applications, Principle of minimum potential energy. Concept of Virtual work. Raleigh-Ritz method. FEM analysis procedure. Mathematical understanding required for FEM, Matrix algebra & operations, Eigen values & Eigen vectors. Methods for solution of simultaneous equations. like Gauss elimination. Matrix decomposition method.

Concept of discritization of body into elements. degrees of freedom, bandwidth, Basic types of 2-D & 3-D elements, displacement models, convergence requirements, shape function. Programming for above matrices.

[a,b,c,d,e,j,k]

Unit 3 **[8 hrs]**

Finite element modeling and analysis of one dimensional problems:

Finite element modeling & analysis using Bar & Beam element -stiffness matrix, assembly, boundary conditions, load vector, temperature effects.

Two dimensional plane trusses-Local & Global coordinate system, element stiffness matrix, assembly, boundary conditions, load vector, force & stress calculations. Programming for simple bar and beam elements**.**

[a, b, c, d, e, i, j, k]

Unit 4 **[8 hrs]**

Two dimensional problems using CST & LST -formulation of CST & LST elements, elemental stiffness matrix, assembly, boundary conditions, load vector. stress calculation. Temperature effect .

Axi-symmetric solids subjected to axi-symmetric loading -axi-symmetric formulation using CST ring, element, stiffness matrix, boundary conditions, load vector, calculation of stresses. Programming for simple 2-D problems using CST and LST elements.

[a, b, c, d, e, h, k]

Unit 5 **[7 hrs]**

Introduction to Isoperimetric & Higher order elements. Introduction to Numerical Integration.

Introduction to dynamic analysis, formulation of mass matrix for one-dimensional bar element, free vibration analysis using one-dimensional bar element.

Torsion of prismatic bars using triangular elements. Programming for these elements.

[e, g, h i, j, k]

Unit 6 **[8 hrs]**

Application of commercial software for simple machine elements and interpretation of results..

[h i, j, k]

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ME406/ME706	FINITE ELEMENT METHOD	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Introduction to Finite Elements in Engineering	4th edition 2011	Chandrupatla T.R; Belegundu AD	Pearson Education
2	Theory of Elasticity	2nd edition 1951	Timoshenko S.P	Tata McGraw-Hill Education
3	Concept and applications of Finite element Analysis	2nd edition revised, 2010	Cook RD	I. K. International Pvt Ltd
4	The Finite Element Method -A basic introduction for engineers	2nd edition	Griffiths D. W; Nethercot D.A	BSP Professional, 1983
5	Finite element methods	6th edition, 2005	O. C. Zienkiewicz, Richard Lawrence Taylor, Perumal Nithiarasu, J. Z. Zhu	Butterworth-Heinemann
6	Applied elasicity	--	Chi The Wang	Amazon
7	Finite to Infinite	--	--	Infinite seris

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Regular: - 7th Semester Elective–II Theory PTDC: - 7th Semester

ME408/ME801	Synthesis Of Mechanism	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To make the students understand various types of mechanisms and criterion used in their selection. To give detailed knowledge of type, number and dimensional synthesis of mechanisms. To introduce various graphical and analytical methods so as to enable students to design the mechanisms to meet kinematic needs. Introducing various optimization techniques for synthesis.

Unit 1 **[7 hrs]**

Introduction to kinematics, types of mechanism, kinematics synthesis, science of relative motion, tasks of kinematic synthesis with practical applications, Degree of freedom, class-I, class-II chain, Harding's notation, Grashof criterion, Grubler's criterion. [a,b,c,e,l]

Unit 2 **[8 hrs]**

Introduction to position generation problem, concept of pole, two &three position generation synthesis, pole triangle, Relationship between moving & fixed pivots, Four position generation, opposite pole quadrilateral, center point &circle point curve, Burmester's point. Matrix method for position generation problem, rotation matrix, displacement matrix. **[a, b, c,e,l]**

Unit 3 **[7 hrs]**

Introduction to function generation problem, co-ordination of input-output link motion, relative pole technique, inversion technique, overlay technique, graphical synthesis of quick return mechanisms for optimum transmission angle. Types of errors, accuracy points, cheby sher's spacing, frudenstein's equation with problems**.[a,b,c,e,l]**

Unit 4 **[8 hrs]**

Introduction to path generation problem, synthesis for path generation with and without prescribed timing using graphical method. Coupler curves, cognate linkages, Robert's law of cognate linkages.
Complex number method for path generation problem 3 precision points. **.[a,b,c,e,l]**

Unit 5 **[7 hrs]**

Synthesis for infinitesimally separated position, concept of polode and centrod, Euler's savery equation, inflection circle, Bobbilier and Hartman's construction**.[a,b,c,e,l]**

Unit 6 **[8 hrs]**

Optimal synthesis of planer mechanisms, powell's search method, least square method, penalty function. Introduction to spatial mechanisms, D-H notations, introduction to kinematic analysis of robot arm.
.[a,b,c,e,l]

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Applied linkage synthesis	Fifth edition	Tao D.C.	New York, NY,
2	Advanced mechanism design	1984	Erdman A.G.; Sandor G.N	Prentice-Hall, 1984
3	Kinematics and mechanism design	Third edition 2010	Sue C.H; Radchiffe C.W	

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Regular: - 7th Semester Elective-II Theory PTDC: - 7th Semester

ME409/ME802	Financial & Cost Management	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

Unit 1 **[7 Hrs]**

Business Finance:

Need for finance, sources of finance (fixed and working capital), equity and preference shares, deposits from public, debentures, bonds, term loans, financial institutions in India, Financial statements and their analysis. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 2 **[7 Hrs]**

Concept of Cost:

Concept of cost, classification of cost, direct and indirect , fixed and variable , semi variable, product and period, controllable and uncontrollable costs, opportunity costs , sunk cost, joint cost, prime cost, factory cost, cost of production, selling and distribution cost, administrative cost, cost of sales. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 3 **[7 Hrs]**

Cost ascertainment and cost reduction:

Concept of overhead, collection of overheads, allocation and appointment, absorption of overheads, absorption rates, under – over absorption , cost centers, cost units, cost statement sheet.
Areas of cost reduction, techniques, productivity**[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 4 **[8 Hrs]**

Costing System:

Job costing, contract costing, cost plus contracts, batch costing, process costing, simple process costing, normal abnormal losses and gains, waste, scrap & spoilage, joint & byproducts, operating costing. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 5 **[8 Hrs]**

Cost Planning and Control:

Concept of budgeting, advantages and limitations, budgetary control, key factors, fixed and flexible budget. Standard costing, selling of standards, variance analysis. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 6 **[8 Hrs]**

Decision Making:

Marginal costing, break even analysis, cost volume, profit analysis, application of costing to various decisions like make or buy, add or drop products, cost or process further, operate or shut down, replace or retain. **[a, c, d, e, f, g, h, i ,j ,l,]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Principles and Practice of Cost Accounting	Fifth edition	N.K.Prasad	Pearson Education
2	Cost Accounting		Jawahar Lal	
3	Management Accountancy	Third edition2010	J. Batty	Tata Mc Graw Hill
4	Financial Management		Khan and Jain	
5	Financial Management	2007	Prasanna Chandra	Tata Mc Graw Hill
6	Engineering Economy	1973	Paul Degarmo	Macmillan, 1973
7	Cost Accounting	2008	B.K.Bhar	Academic publishers
8	Costing and finance managment	2012	Mrunalini Naik	Thakur publications

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Regular: - 7th Semester Elective-II Theory PTDC: - 7th Semester

ME410/ME803	Renewable Energy System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To realize understand the importance of various renewable energy sources in this era of energy crisis. To study the theory of conversation of various renewable energy such thermal, electrical, etc. Apply thermodynamics cycles to above systems. To study Magneto Hydrodynamic systems. **[a, b, c, e, i ,l, m]**

Unit 1 **[8 hrs]**

Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & diffuse radiation, measurement of solar radiation and measuring instruments. Solar radiation geometry, solar angles, estimation of average solar radiation, radiation as tilted surface, tilt factors **[a, b, c, e, i ,l, m]**

Unit 2 **[7 hrs]**

Solar flat plate collectors: Types of collectors, liquid flat plate collectors, solar air heaters, transmissivity of glass cove(system, collector efficiency, analysis of flat plate collector, fin efficiency, collector efficiency factor and heat removal factor, selective surfaces, evacuated collectors, novel designs of collector.
[a, b, c, e, i , l, m]

Unit 3 **[8 hrs]**

Concentrating collectors: line focusing, point focusing and non focusing type, central receiver concept of power generations compound parabolic collector, comparison of flat & concentrating collectors. Applications of solar energy to water heating, space heating, space cooling, drying refrigeration, distillation, pumping. Solar furnaces, solar cookers, solar thermal electric conversion, solar photo- voltaics Solar energy storage, sensible, latent and thermochemical storage, solar pond **[a, b, c, e, i , l, m]**

Unit 4 **[7 hrs]**

Biogas: - Introduction, bio gas generation, fixed dome & floating drum biogas plants their constructional details, raw material for biogas production, factors affecting generation of biogas and methods of maintaining biogas, production, digester design considerations, fuel properties of biogas and utilisation of biogas biomass :- Introduction, methods of obtaining energy from biomass, Incineration, thermal gasification, classification of gasifiers & constructional details chemistry of gasification fuel properties, applications of gasifiers.
[a, b, c, e, i ,l, m]

Unit 5 **[8 hrs]**

Wind and Ocean energy: -Power in wind, forces on blades, wind energy: Basic principle of wind energy conversion site selection consideration wind data and energy estimation, basic components of WECS Classification of WEC systems, savonius and darrieus rotars applications of wind energy.
Ocean energy: Introduction: - ocean thermal electric conversion open and closed cycle of OTEC, hybrid cycle, energy from tides basic principles of tidal power & components of tidal power plants, single & double basin arrangement estimation of tidal power and energy. Energy from ocean waves -energy availability, wave energy conversion devices. **[a, b, c, e, i , l, m]**

UNIT 6 **[7 hrs]**

Geothermal and MHD power generation :
Geothermal energy: Introduction, classification of geothermal systems vapour dominated, liquid dominated system, total flow concept, petrothermal systems, magma resources, applications of geothermal operational & environmental problems. Magneto Hydro Dynamic power generation: Introduction principles of MHD power generation, MHD open and closed systems, power output from MHD generators, design problems of MHD generation, gas conductivity, seeding **[a, b, c, e, i , l, m]**

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ME410/ME803	Renewable Energy System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Energy Technology	3rd edition	Parulekar & Rao	Khanna Publishers
2	Non Conventional Energy Sources		G D Rai	Standard Publishers Distributors
Reference book				
1	Solar Energy	3rd edition	S.P. Sukhatme	Tata McGraw-Hill Education,
2	Solar Energy	3rd edition, 2006	John A. Duffie, William A. Beckman	Wiley
3	Solar energy engineering	2007	Jui Sheng Hsieh	Prentice-Hall,

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Regular: - 7th Semester **Elective-II** **Theory** **PTDC: - 7th Semester**

ME411/ME804	Artificial Intelligence	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To learn about the automation of machines tools making the system intelligent. Understanding the different techniques used for implementation of artificial intelligence.

Unit 1 **[7 hrs]**

Human and machine intelligence, Artificial Intelligence (AI), Programming in AI environment,. Natural Language processing (NLP) Architecture of an Expert system, Knowledge base, inference engine forward and backward chaining, Selection of inference mechanism. **[a, b, c, d]**

Unit 2 **[7 hrs]**

Introduction, to Rule Based System, Conflict Resolution, Advantages and Drawbacks of Rule Based Systems Clausal Form Logic; Rule Base Verification, Refinement and Validation **[a, b, c, d, j]**

Unit 3 **[9 hrs]**

Creating Knowledge Base, Knowledge Engineer and Domain Expert, Phases of Knowledge Engineering, Tools for Knowledge Engineering **[a, b, c, d, e, j, k]**

Unit 4 **[7 hrs]**

Neural network applications, artificial neural network models, NN applications in Cellular manufacturing and other areas of mechanical Engg. **[a, b c, i, j, k]**

Unit 5 **[7 hrs]**

Fundamentals of OOP (Object oriented programming), creating structures and objects, object operations, invoking procedures, programming applications, Object oriented expert systems. **[a, b, i , j, k]**

Unit 6 **[8 hrs]**

Semantic nets, ruled systems for semantic nets, certainty factors, automated learning; **[a, b, e, i, j, k]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Designing Knowledge Based System	1985	Addis, T.R	Prentice Hall
2	Principles of Artificial Intelligence and Expert Systems Development	1988.	Rolston, D.W	McGraw Hill
3	Handbook of Expert Systems in Manufacturing	1991	Maus, R. and Keyes	McGraw Hill
4	A comprehensive guide to artificial intelligence and expert systems	1990	Robert Levine	McGraw-Hill, 1990
5	Artificial Intelligence	1991	Elain Rich	McGraw-Hill, 1991
6	Rule based expert systems	1990	Sasikumar, Ramani	
7	Design for Knowledge Based Systems	1978	Graham Winstanley	Galgotia Publications
8	Artificial Neural Networks	1992	Zurada	West, 1992
9	Neural Networks and Fuzzy Logic		V.B. Rao and H.V. Rao, "C^{++} :	BPB Publications

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Regular: - 7th Semester Elective-II Theory PTDC: - 7th Semester

ME412/ME805	Maintenance Management	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The student will be able to (1) understand the maintenance function, its importance and types.(2) organize the maintenance department.,(3) analyze the failure of a machine ,(4) estimate repair and maintenance cost,(5) plan the condition monitoring program for a machine and to understand the maintenance needs of basic electrical and mechanical devices.

Unit I **[8 Hrs]**

Objectives, scope, structure of maintenance organization and operating policies to guide management, policies with respect to work allocation, work force, intra and inter plant relation, material, finance and control.
Concept of life cycle maintenance ,optimization of total maintenance, analysis of productivity ,Reliability ,Maintainability, and Availability, **[a, b, d, h, j ,l ,m]**

Unit II **[7 Hrs]**

Maintenance policies, Preventive maintenance program, corrective maintenance guidelines, replacement policies-cyclic replacement, group replacement, standbys, economics of machine replacement, TPM,RCM and CMMS. **[a, d, m]**

Unit III **[7 Hrs]**

Failure analysis:
General practice, failure classification , data collection, failure pattern recognition ,determination of replacement period, time between preventive maintenance checks. Use of various modern techniques to monitor the condition of machine to facilitate maintenance **[a, b, d, e, k ,m]**

Unit IV **[8 Hrs]**

Work measurement for maintenance:
Need for Work measurement ,various techniques for work measurement of direct and indirect labour. Work force requirement, location and size. **[b, d, m]**

Unit V **[8 Hrs]**

Control and estimation of maintenance cost:
Job classification, various estimating techniques and its use.
Maintenance manual, plant performance improvement, Maintenance training program, Maintenance control indices and factor affecting them .Lubrication system-need ,design and implementation. **[a, d, m]**

Unit VI **[7 Hrs]**

Maintenance of various mechanical and electrical equipments. **[d, i, m]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Maintenance engineering handbooks	2008	Mobley and Higgins	Mc-graw Hill
2	Guide to Complete Maintenance	1988.	Rolston, D.W	Heintzelment
3	Maintainability and maintenance management	1991	J. Patton	Maus, R. and Keyes
4	Operation research in Maintenance	--	Jarding	--
5	Introduction to reliability and maintainability Engineering.	--	Thomos Ebelling	Mc-graw Hill
6	Advanced operations management		R.P.Mohanty and S.G.Deshmukh	Pearson Education
7	Maintenance engineering and management		R.C.Mishra and K.Pathak	PHI Publications
8	Industrial Maintenance management		S.K.Shrivastava	S.Chand

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.**Regular: - 7th Semester Elective–III Theory PTDC: - 7th Semester**

ME415/ME808	Vibrations	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in students fundamentals knowledge of vibrations. To familiarize with energy methods for multi degree freedom systems. To impart, knowledge of vibration of continuous systems and applications of factor in vibration analysis. To impart knowledge of use of FFT in vibration analysis for condition monitoring purpose.

Unit 1 **[7 hrs]**

Free body diagram, free & forced vibration, un damped and damped single degree of freedom systems subjected to harmonic and other periodic excitations. Impulse response, convolution integral and response to arbitrary excitation. Vibration isolation and transmissibility. Solution using laplace transform, Runga kutta method, structural damping.**[a, b, l]**

Unit 2 **[7 hrs]**

Energy method applied to multi degree freedom system. Lagranges equation. Generalized mass formulation of mass , damping and stiffness matrix and its numerical solutions . Vibration absorber, conservative and non conservative systems. Geared rotor system, Influence Coefficients and flexibility matrix of bending vibration of beam and multi-disc rotor. Mode shapes and orthogonality principle.

.**[a, b, l]**

Unit 3 **[8 hrs]**

Numerical techniques for M.d.o.f. systems. Matrix iteration method. Holzer's method for torsional vibration. Dunkeleys method for critical speed determination of multi disc rotor. Rayleigh quotient sweeping matrix method for determination of all the natural frequencies and mode shapes. Rayleigh Rit method. Modal matrix and expansion theorem. Free and forced response by modal analysis. .**[a, b, l]**

Unit 4 **[8 hrs]**

Vibration of continuous system. Axial vibration of rod, bending vibration of beam and torsional vibration of shaft. Hamiltons principle and derivation of equation of motion, Rayleigh quotient. Modal co-ordinates and modal forces. Free and forced response through modal analysis.**[a, b, l]**

Unit 5 **[8 hrs]**

Vibration pickup, seismometers, accelerometer, proximity probe spectrum analyzer, FET & DFT (DiscreteFT), torsional, Vibration measurement, Digital vibration measurement, philosophy of vibration. condition monitoring. .**[a, b, m]**

Unit 6 **[7 hrs]**

Introduction to Finite element method in vibration of continuous system. Natural frequencies and mode shape computation for simple rod and beam problem. **[a, b, m]**

.**Reference books:**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Theory of vibration	2001	Thomson W.T	Prentice hall
2	Elements of vibration analysis	1986	Meirovitch L	McGraw-Hill Science/Engineering/Math; 2 Sub edition (January 1, 1986)
3	Mechanical vibration	1984	Rao J.S.;Gupta K	Wiley Eastern, c1984
4	Theory of vibrations	1983	Morse TSE; Hinkle	New Delhi: CBS Publishers, 1983.
5	Advanced theory of vibration	1992	Rao J.S	Wiley, 1992
6	Vibration condition Monitoring of Machines	2000	Rao J.S	Alpha Science International Limited, 2000
7	Random vibration		Gandall & Mark	

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Regular: - 7th Semester Elective–III Practical PTDC: - 7th Semester

ME416/ME809	Vibration Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

List of Practical

1. To determine transmissibility of single degree freedom system using load cells and exciter.
   [a, b, l]
2. To Study the Transverse Vibrations of Cantilever Beam and to determine the frequency or period of Vibration (oscillation) theoretically and actually by experiment.
   [a, b, l]
3. To determine natural frequency of Torsional vibration of geared system.
   [a, b, l]
4. To Study the forced vibration of equivalent spring mass System.
   [a, b, l]
5. Study and determination of modes shapes for two degree and three degree freedom systems.

   [a, b, l]
6. To Study the Free Vibration of two rotor and three rotor System and to determine the natural frequency of vibration theoretically & experimentally.
   [a, b, l]
7. To verify the Dunkerley's Rule.
   [a, b, l]
8. Determination of Whirling of shaft.
   [a, b, l]
9. To study the effect of damping on natural frequency and plot frequency response curves at various damping coefficient.
   [a, b, l]
10. To determine vibration parameters (Amplitude Velocity acceleration for machines using FFT)
    [a, b, m]
11. To diagnose faults in simple machines like pumps motor gearbox using FFT.
    [a, b, m]
12. To remove dynamic unbalance using FFT.
    [a, b, m]

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Regular: - 7th Semester Elective-III Theory PTDC: - 7th Semester

ME417/ME810	Computer Integrated Manufacturing	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

Unit 1 **[7 hrs]**

Concept and scope of CIM, components of CIM, benefits, limitations.Basics of computer graphics NC basics, NC words, Manual part programming (NC part programming) Punch Tape, Tape Format CNC , DNC, APT programming Adaptive control, application. Tooling for CNC machine. **[a, b, d]**

Unit 2 **[7 hrs]**

Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT. Part families , classification and coding , Production flow analysis , Machine cell design , Benefits **[a, k ,l]**

Unit 3 **[8 hrs]**

Introduction & Components of FMS , Application work stations , Computer control and functions , Planning, scheduling and control of FMS , Scheduling , Knowledge based scheduling , Hierarchy of computer control , Supervisory computer Manufacturing data systems , data flow , CAD/CAM considerations , Planning FMS database **[b, d, k]**

Unit 4 **[8 hrs]**

Industrial robotics Robot anatomy, Robot control, accuracy, repeatability, End Effectors Sensor, Introduction to robot programming, Robot application (Material handling processing assembly and inspection) introduction to robot Kinematics. **[d, h,l]**

Unit 5 **[10 hrs]**

Process Planning in the Manufacturing cycle , Process Planning and Production Planning Process Planning and Concurrent Engineering, CAPP, Variant process planning , Generative approach , Forward and Backward planning, Input format, Logical Design of a Process Planning , Implementation considerations ,manufacturing system components, Automated material handling systems, AS/RS, general considerations , selection, evaluation and control . Inspection and Quality control, CAQC, CMM types, working, applications Expert process planning **[a, b, d]**

Unit 6 **[5 hrs]**

Totally integrated process planning systems, Integration of CNC robotics for CIM, Agile manufacturing, Nano Manufacturing. Simulation **[a, h, k]**

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ME417/ME810	Computer Integrated Manufacturing	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.**Reference books:**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Systems Approach to Computer Integrated Design and Manufacturing	1996	Nanua Singh	John Wiley & Sons, 1996.
2	Automation, Production Systems and Computer Integrated Manufacturing	2002	Groover M.P	Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
3	Handbook of Flexible Manufacturing Systems	1991	Jha, N.K	Academic Press Inc., 1991
4	Group Technology in Engineering Industry	1979	Burbidge, J.L	Mechanical Engineering pub. London, 1979.
5	G.T Planning and Operation, in The automated factory-HandBook: Technology and Management	1991	Askin, R.G. and Vakharia, A.J	Cleland, D.I. and Bidananda, B (Eds), TAB Books, NY, 1991.
6	Cellular Manufacturing Systems		Irani, S.A	Hand Book
7	Planning, design and analysis of cellular manufacturing systems	1995	Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds)	Elsevier
8	Principles of Process Planning	1995	Gideon Halevi and Roland D. Weill	A logical approach, Chapman & Hall,

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ME418/ME811	Computer Integrated Manufacturing Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

List of Practical

1. Study of CIM. **[a, e, k]**
2. Study of CAD systems **[a, b, c]**
3. Numerical control – Fundamental & Application **[a, b, k]**
4. CNC- Lathe – Features, Specification, & Part Program. **[a, b, ,l]**
5. CNC- Milling – Features, Specification, & Part Program. **[a, b, ,l]**
6. Group Technology. **[a, b, e]**
7. FMS & CIM. **[a, b, e]**
8. Computer Aided Process Planning. **[a, b, d]**
9. Manual Part Programming. **[a, b, ,l]**
10. APT Part Programming. **[a, e ,l]**
11. Robots Fundamental and Applications **[a, b, ,l]**
12. AGVS- Fundamental and applications **[a, b, l]**
13. CNC Lathe – Programming , Simulation & Actual Machining of Part.
(Thread Cutting , Facing , Turning , Grooving etc.) **[a, b, ,l]**
14. CNC Milling – Programming , Simulation & Actual Machining of Part.
(Profile Cutting , Various Interpolation , Pocketing , Mirroring etc.) **[a, b, l]**
15. Programming , Simulation of Robot. **[a, b, e]**

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Regular: - 7th Semester Elective-III Theory PTDC: - 7th Semester

ME419/ME812	I.C.Engines	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To understand basic working cycles, types and development of I.C. Engines. To study the various systems related to I.C. Engines. To understand testing and performance of Engines. To study fuels, combustion, pollution and its control of engines. **[a, b, c, e, i ,l, m]**

UNIT 1 **[7 HRS]**

Historical Perspective, Engines classification, Working cycles and operation, P-V, Valve Timing diagrams, Engine components and their material .Engine cycle Energy Balance, various losses in the engine like Frictional losses, blow by losses, pumping loss etc. Engine system: Air supply, Fuel supply, lubrication systems, cooling systems and their importance. **[a, b, c, e, i , l, m]**

UNIT 2 **[8 HRS]**

I.C.Engines fuel and its desirable properties. Requirements of S.I and C.I. Engine fuel
Rating of I.C. engine fuels, Other fuel like CNG, LPG, Alcohols,
Air pollution from I.C.Engines and their control using EGR, Catalytic converters, particulate traps. **[a, b, d, e, i , l, m]**

Unit 3 **[8 HRS]**

Fuel supply systems for S. I. Engine: A-F mixture requirements, Basic principle, Simple Carburetor and systems like main metering, choke, idle, acceleration pump. Operating difficulties for carburetors. Petrol Injection SPFI., MPFI, Direct Gasoline Injection, Ignition system & components for S.I.Engine - Battery, Magneto & Electronic. **[a, b, c, e, i , l, m]**

Unit 4 **[7 hrs]**

Combustion in S. I. Engine: Stages of combustion with p-θ diagram. Factors affecting various stages of combustion. Abnormal combustion Pre ignition, Detonation and Knocking. HUCR, S.I.Engine combustion chamber. **[a, b, c, e, i , l, m]**

Unit 5 **[7 HRS]**

Fuel supply systems for C.I.Engine: Requirements of an ideal FI system, Types of Injection, Fuel injection pumps, fuel injectors and nozzles.
Combustion in C. I. Engines. Stages of combustion with p-θ diagram, Factors affecting various stages of combustion. Abnormal combustion Diesel Knock,
Supercharging and turbo charging in engine. **[a, b, c, e, i , l, m]**

Unit 6 **[8hrs]**

Engine performance Parameters. MEP, Torque ,speed, power, Specific fuel consumption and various efficiencies., Air measurement, Excess air and Volumetric efficiency, Measurement and Testing of friction power ,indicated power, Brake power, Fuel consumption, Air consumption, etc. Heat balance sheet calculation. **[a, b, c, e, i , l, m]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Internal Combustion Engine Fundamentals	1988	John B. Heywood	McGraw-Hill
2	Internal Combustion Engines and Air pollution	1973	Edward F. Obert	
3	Internal Combustion Engines	2007	M. C. Mathur, R.D. Sharma.	McGraw-Hill
4	Internal Combustion Engines	2007	V. Ganesan	McGraw-Hill
5	Internal Combustion Engines	2010	V. M. Domkundwar	Dhanpat Rai & Co
6	Internal Combustion Engines	2012	R.K.Rajput	Laxmi publications (P) Ltd.

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ME420/ME813	I.C.Engines Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

List of Practical

1. Study and demonstration of working of 2-S & 4-S Engines. **[a, b, c, e, i ,k, l, m]**
2. Study and demonstration of Lubrication & Cooling systems. **[a, b, c, e, i ,k, l, m]**
3. Study of fuel systems for S.I. engines.**[a, b, c, e, i , k, l, m]**
4. Study of fuel systems for C.I. engines. **[a, b, c, e, i , k, l, m]**
5. Determination of Air: Fuel ratio for Petrol Engine. **[a, b, c, e, i , k, l, m]**
6. Determination of Air: Fuel ratio for Diesel Engine.**[a, b, c, e, i , k, l, m]**
7. Determination of BP/FP/IP of Engine. **[a, b, c, e, i , k, l, m]**
8. Heat balance sheet calculation. **[a, b, c, e, i , k, l, m]**
9. Visit to Automobile Industry/ workshop. **[a, b, c, e, i , k, l, m]**

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Regular: - 7th Semester Practical PTDC: - 7th Semester

ME433ME828	Project Phase-I	L=0	T=0	P=4	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	
	0	0	100	0	100	Internal Evaluation

OBJECTIVES

The objective is to prepare the student to examine any design or process or phenomenon fron all angles.This will encourage and develop the process of independent thinking and team working in them and expose them to the needs of industry and society

The group of students (not more than 4) will work under the guidance of the faculty member on the project work .It is expected to carry out literature survey for their project work and finalized the methodology and schedule of project.

Each student from the project batch shall present [(1st Preliminary and 2nd Progress) using audio visuals, aids] the seminar of about 10 to 15 minute duration on their project methodology. Seminar delivery will be followed by question – answer session. The batch of the students shall also require to submit a progress report of minimum 3 pages before 2nd seminar .The seminar committee (minimum 3 members) shall be constituted for the purpose of evaluating seminar.

[a,b,c,d,e,f,g,h,I,j,k,l,m]

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Regular: - 7th Semester Practical PTDC: - 7th Semester

ME434/ME829	Training	L=0	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	
	0	0	100	0	100	Internal evaluation

OBJECTIVES

To work in an industry for understanding-

1. Nature of work **[a, b, d, f ,g, h, j, k l]**
2. Different machines used **[a, b, d, f ,g, h, j, k l]**
3. Different technologies used**[a, b, d, f ,g, h, j, k l]**
4. Work culture**[a, b, d, f ,g, h, j, k l]**
5. Various problems exists in Industry. **[a, b, d, f ,g, h, j, k l]**

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TRAINING: The student shall undergo training in an industry for minimum period of one month duration during summer vacation after completion of 6th Semester. They will be required to prepare and submit a comprehensive report on the training undergone by them. They will have to submit a certification of completion of training from the industry at the time of joining 7th Semester. They will have to face or undergo a viva-voce by a committee of teachers during 7th semester.

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Regular: - 7th Semester Free Elective-II Theory PTDC: - 7th Semester

ME429/ME824	Total Quality Management	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course aims to build an overall capability to understand Quality and its relevance in today's dynamic market. Various Quality Improvement tools and technique shall be introduced and practiced so as to develop skills and knowledge to function as a good quality professional in the Engineering Profession.

Unit 1 **[7 hrs]**

Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering **[d, f, g, h, l, j, m]**

Unit 2 **[7 hrs]**

Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards. **[c, f, g, h, j, l]**

Unit 3 **[8 hrs]**

Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA -YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design **[d, e, l]**

Unit 4 **[8 hrs]**

Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes **[a, e, m]**

Unit 5 **[8 hrs]**

Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling, **[b, c, m]**

Unit 6 **[7 hrs]**

Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing **[b, h, k , l]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Total Quality Management for Engineers	1991	Mohamed Zairi	Woodhead Publishing Limited 1991
2	Production and Operations mangament - Total Quality and Responsiveness	1995	Harvid Noori and Russel	McGraw-Hill Inc, 1995
3	Managing for Total Quality	1998	N.Logothetis	Prentice Hall of India Pvt .Ltd,1998
4	The Essence of Total Quality Management	1995	John Bank	Prentice Hall of India Pvt.Ltd., 1995.
5	Introduction to Statistical Quality Control	1991	Douglus C. Montgomery	2nd Edition, John Wiley and Sons, 1991.
6	Statistical Quality Control	1984	Grant E.L and Leavensworth	McGraw-Hill, 1984.

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Regular: - 7th Semester Free Elective-II Theory PTDC: - 7th Semester

ME430/ME825	Reliability Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution.

Unit 1 **[7hrs]**

Fundamental concepts:-

Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability, **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 2 **[8hrs]**

Probability theory:-

Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 3 **[7hrs]**

System reliability and modeling:

Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 4 **[8hrs]**

Maintainability and Availability:

Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 5 **[7hrs]**

System reliability Analysis:

Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 6 **[8hrs]**

Strength based reliability:

Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads. **[a, c, d, e, f, g, h, i ,j ,l,]**

. .Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Concepts of Reliability Engg	1985	L.S. Srinath	Affiliated East-Wast Press (P) Ltd
2	Reliability Engineering	1983	A.K. Govil	Tata McGraw-Hill Publishing Co. Ltd
3	Reliability Engineering	1984	E. Balagurusmy	Tata McGraw-Hill Publishing Co. Ltd
4	Engineering Reliability	1980	B.S. Dhillion, C. Singh	John Wiley & Sons
5	Probabilistic, Reliability	1968	M.L. Shooman	McGraw-Hill Book Co.,
6	Practical Reliability Engg	1985	Patric D.T.O'connor	Heyden and sons ltd.
7	Reliability in Engineering Design	1977	K.C. Kapur, L.R. Lamberson	John-Wiley and sons.
8	Reliability Engineering, Theory and Practice	Third Edition, 1999	A.Birolini	Springer,

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Regular: - 8th Semester **Theory** **PTDC: - 7th Semester**

ME435/ME830	Automation In Production systems	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

Unit 1 **[7 hrs]**

Automation- Definition, types, reasons for automating, arguments for and against automation. Types of production, functions in manufacturing, Organization and information processing in manufacturing.

Automated Flow 'Lines- Methods of workpart transport, Transfer mechanisms, Buffer storage. Analysis of flow lines- General terminology and analysis, analysis of transfer lines without storage, partial automation, automated flow lines with storage buffers, manual assembly lines. Line Balancing Problem, Methods of line balancing. Automated Assembly Systems- Types, parts delivery system

[a, b, h]

Unit 2 **[8 hrs]**

Numerical Control Production Systems- Basic concepts, coordinate system and machine motion- Types of NC systems- Point to point, straight cut and continuous path. Machine control unit and other components, Tape and tape readers.

NC part programming- Punched tape and tape formats, NC words, methods of part programming, manual part programming: APT programming, Direct numerical control. Computer numerical control. Adaptive control. Applications and economics of NC. **[a, b, k]**

Unit 3 **[8 hrs]**

Industrial Robotics- Introduction, robot anatomy, robot control systems, accuracy and repeatability and other specifications, end effectors, sensors, introduction to robot programming, safety monitoring.

Robot applications- Characteristics of robot applications, work cell layout, robot applications in material handling, processing, assembly and inspection. **[a, h, l]**

Unit 4 **[7 hrs]**

Automated material handling & storage-Conveyor systems : Roller conveyer , Skate wheel conveyer, Belt conveyers, Chain conveyers, Slat conveyers , Overhead trolley conveyers , Infloor towline conveyers, Cart on track conveyers . Automated Guided Vehicle Systems -

Types: - Driverless trains, AGVS pallet trucks, AGVS unit-load carriers. Vehicle guidance & Routing, Traffic control & safety, System management, Analysis of AGVS systems, AGVS applications.

Automated Storage & Retrieval System -

Types :- Unit load AS/RS , mini load AS/RS , man on board AS/RS , automated item retrieval system, deep lane AS/RS -Basic components & special features of AS/RS , Carousel storage systems , Work in process storage, quantitative analysis. **[a, c, l]**

Unit 5 **[7 hrs]**

Automated inspection & Group technology:- Automated inspection principles & methods -100% automated inspection, off -line & on -line inspection, distributed inspection & final inspection; Sensor technologies for automated inspection , coordinate measuring machines contruction , operation & benefits; Machine vision - image aquisition & digitization, image processing & analysis, interpretation,

machine vision applications; Other optical inspection methods -Scanning laser systems , linear allay devices, optical tringulation techniques. Introduction to Group Technology. **[a, d, k]**

Unit 6 **[7 hrs]**

Computer aided manufacturing -Manufacturing planning, manufacturing control ; Computer integrated manufacturing ;

Flexible manufacturing systems -Components, Types of systems, FMS layout configuration computer functions, data files, system reports, FMS benefits.

Computer aided process planning: Retrieval CAPP systems, generative CAPP systems, benefits of CAPP . Shop floor control. Computer Process Control. **[a, c, d]**

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ME435/ME830	Automation In Production systems	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Automation, production System & CIMS	Third edition (2007)	M P, Groover PHI	Prentice Hall
2	CAD/CAM	Fifth edition (2008)	Zimmers & Groover PIII	Pearson Education India
Reference Books:				
1	Numerical Control And Computer Aided Manufacturing	13th edition (2007)	Rao, N K Tiwari, T K Kundra	Tata McGraw-Hill Education
2	Computer Control of Manufacturing Systems	2005	Koren	Mcgraw Hill

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Regular: - 8th Semester Practical PTDC: - 7th Semester

ME436/ME831	Automation In Production Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Practicals:

1) Performance, Simulation on CNC lathe (atleast two Complex Geometric) **[b, k ,m]**
2) Performance, Simulation on CNC milling (atleast two Complex Geometries) **[a, d, m]**
3) Practice Programming on Manual Part Program **[a, b, m]**
4) Practice Programming on APT **[a, b, m]**
5) Case Study on Automated System of any Industry. **[a, b, k]**
6) Performance/ Practical on Robot. **[a, b, k]**
7) Part Coding and Group Technology **[a, d, h]**
8) Study of FMS**[a, b, c]**
9) Study of Automated material handling **[a, b, e]**
10) Study of Automated inspection **[a, d, h]**

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Regular: - 8th Semester	Theory	PTDC: - 5th Semester			
ME475 / ME720	**Optimization Techniques**	**L=3**	**T=1**	**P=0**	**Credits=4**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course

Unit 1 **[7 hrs]**

Introduction of operation research. LP Formulations, Graphical method for solving LP's with 2 variables, Simplex method, Duality theory in linear programming and applications, Integer linear programming, dual simplex method.

[a, b, c, d, e, f, g, h, i, k, l, m]

Unit 2 **[7 hrs]**

Transportation model, Assignment model.

/FCFS, M/M/S : N/FCFS.∞ /FCFS,M/M/1 : N/FCFS, M/M/S : ∞Queuing Models : Essential features of queuing systems, operating characteristics of queuing system, probability distribution in queuing systems, classification of queuing models, solution of queuing M/M/1 **[a, b, d, e, f, g, h, i, k, l, m]**

Unit 3 **[8 hrs]**

Dynamic Programming: Basic Concepts, Bellman's optimality principles, Dynamics programming approach in decision making problems, optimal subdivision problem.

Sequencing Models: Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines. **[a, b, c, d, e, f, g, h, i, j, k, l, m]**

Unit 4 **[8 hrs]**

Project Management: PERT and CPM : Project management origin and use of PERT, origin and use of CPM, Applications of PERT and CPM, Project Network, Diagram representation, Critical path calculation by network analysis and critical path method (CPM), Determination of floats, Construction of time chart and resource labeling, Project cost curve and crashing in project management, Project Evaluation and review Technique

[a, b, c, d, e, f, g, h, i, k, l, m]

Unit 5 **[7 hrs]**

Replacement Models and Economic Equivalence: Concept of equivalence interest rate, present worth, economic evaluation of alternatives, group replacement models. Simulation model.

[a, b, c, d, e, f, g, h, i, k, l, m]

Unit 6

[8 hrs]

Inventory Models: Introduction to the inventory problem, Deterministic Models, The classical EOQ (Economic Order Quantity) model, Inventory models with deterministic demand (no shortage & shortage allowed), Inventory models with probabilistic demand, multi item deterministic models. **[a, b, c, d, e, f, g, h, i, j, k, l, m]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Introduction to Operation Research, Computer Oriented Algorithmic approach	2007	Gillet B.E	Tata McGraw Hill Publising Co. Ltd. New Delhi.
2	Operations Research	Third edition 2008	P.K. Gupta & D.S. Hira	S.Chand & Co.
3	Operations Research: Theory and Applications	Second edition 2002	J.K. Sharma	Mac Millan
4	Operations Research	2006	S.C. Sharma	Discovery Publishing House
5	Optimization Theory and Application	Second edition 2010	S.S. Rao	Halsted Press
6	Operations Research - An Introduction	Ninth Edition 2010	Tata Hamdy	Prentice Hall of India Pvt. Ltd., New Delhi.

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Regular: - 8th Semester Elective-IV Theory PTDC: - 8th Semester

ME437/ME832	INDUSTRIAL FLUID POWER	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To realize and understand the importance of industrial fluid power systems in the world of automation and power transmission. To introduce simple fluid power systems and apply fluid principles to it. To study various basic components of fluid systems. Understanding the language and graphic symbols associated with fluid power systems. To study various fluids for hydraulic systems and various accessories such as filters, accumulators, etc. to design and analyze practical fluid power systems.

Unit 1 **[8 hrs]**

Fluid power systems: Components, advantages, applications in the field of M/c tools, material handling, hydraulic presses, mobile & stationary machines, clamping & indexing devices etc. **Transmission of power at static & dynamic states**. Pascal's Law, continuity equations,

Types of Hydraulic fluid petroleum based, synthetic & water based. Properties of fluids. Selection of fluids, additives, effect of temperature & pressure on hydraulic fluids.

Seals, sealing materials, selection of seals.

Filters, strainers, sources of contamination of fluid & its control.

JIC symbols/ISO Symbols for hydraulic & pneumatic circuits. **[a, e, k, l, m]**

Unit 2 **[7 hrs]**

Pumps: Types, classification, principle of working & constructional details of vane pump, gear pumps, radial & axial plunger pumps, power and efficiency calculations, characteristic Curves, selection of pumps for hydraulic power transmission.

Accumulators & Intensifiers: Types & functions of accumulators & intensifiers, applications, selection & design procedure. **[e, k, l, m]**

Unit 3 **[8 hrs]**

Control Of Fluid Power: Necessity of pressure control directional control, flow control valves,

Pressure Control Valves: Principle of pressure control valves, direct operated, pilot operated, relief valves, pressure reducing valve, sequence valve & methods of actuation of valves.

Flow Control Valves: Principle of operation, pressure compensated, temperature Compensated flow control valves, meter in & meter out flow control circuits, bleed off circuits.

Direction Control Valves: Check valves, types of D.C. valves:- Two way two position, four way three position, four way two position valves, open center, close center, tandem center valves, method of actuation of valves, manually operated, solenoid operated, pilot operated etc **[a, e, k, l]**

Unit 4 **[7 hrs]**

Actuators: Linear & Rotary actuators.

Hydraulic motors: Types, vane, gear piston, radial piston.

Theoretical torque, power & flow rate hydraulic motor performance.

Hydraulic Cylinders: Types of cylinder & mountings, calculations of piston velocity, thrust under static & dynamic applications. Design consideration for cylinders. **[a, e, k, l]**

Unit 5 **[7 hrs]**

Design Of Hydraulic Circuits:

Meter in meter out circuits. Pressure control for cylinders, Flow divider circuits, etc. Introduction to **Fluidics**. Circuit illustrating use of pressure reducing valves, sequencing valve, counter balance valves, unloading valves with the use of electrical controls, accumulators etc. Hydraulic circuit analysis.

Maintenance, trouble shooting & safety precautions of Hydraulic Circuits.

Hoses & Pipes: Types, materials, pressure drop in hoses/pipes, valves and fittings.

Hydraulic piping connections. **[a, b, c, e, l, m]**

Unit 6 **[8 hrs]**

Pneumatics: **Introduction** to pneumatic power sources, e.g. reciprocating & rotary compressors, roots-blower etc. **Comparison** of pneumatics with Hydraulic power transmission. **Air preparation units**, filters, regulators & lubricators. **Actuators**, linear, single & double acting, rotary actuators, air motors, **Pressure Regulating Valves**, **Directional Control Valves** two way, three way & four way valves, solenoid operated, push button; & lever control valves. **Flow Control Valves**. Check valves methods of actuation, mechanical, pneumatic & electrical etc.

Pneumatic circuits for industrial applications & automation. **[a, b, c, e, l, m]**

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ME437/ME832	INDUSTRIAL FLUID POWER	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:			
Title of the book	**Edition (Year of publication)**	**Author(s)**	**Publisher**
Introduction to Fluid Power	2002	James L Johnson	**Delmar Thomson Learning**
Fluid Power With Applications	6th	Anthony Esposito	PEARSON Prentice Hall
Industrial Hydraulics	3rd or above	J.J. Pipenger & T. G. Hicks	McGraw Hill Co.
Pneumatic Systems: Principles and Maintenance	16th (2006)	S. R. Majumdar	Tata McGraw-Hill Education
Reference Books:			
Power pneumatics	(2007)	Michael J. Pinches	Prentice Hall
Vickers manuals on Industrial Hydraulics	3rd edition or above	Vickers	Vickers, 1996
Hydraulics & Pneumatics	4th edition	Harry L. Stewart	Industrial Press
Fluid Power Design Handbook	3rd edition	Franklin D. Yeaple	Marcel Dekker, 1996

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Regular: - 8th Semester Elective-IV Practical PTDC: - 8th Semester

ME438/ME833	INDUSTRIAL FLUID POWER Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Practical: - Minimum eight practical to be conducted /studied

Note: Demonstrations shall be carried out on Hydraulic and Pneumatic Kit

1) Study of JIC/ISO symbols for Hydraulics and Pneumatics
2) Demonstration of hydraulic pumps used in hydraulic systems
3) Demonstration of Actuators used in Fluid Power systems
4) Demonstration of various valves used in Fluid Power systems
5) Demonstration of accumulators and Intensifiers used in Fluid Power systems
6) Demonstration of different flow control methods used in Fluid Power systems
7) Demonstration of various hydraulic circuits (three to four applications)
8) Demonstration of various industrial hydraulic circuits (another three to four applications)
9) Demonstration of FRL unit used in pneumatic systems.
10) Demonstration of valves used in pneumatic systems.
11) Demonstration of industrial pneumatic circuits (three to four app.)
12) Study of hydraulic fluids used in hydraulic systems
13) Study of hydraulic seals used in Fluid Power systems
14) Study of Contamination Control of Hydraulic Fluids.
15) Design report of a hydraulic or pneumatic system using manufacturer's catalogue

All the above project will satisfy [a, c, l, m]

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Regular: - 8th Semester Elective–IV Theory PTDC: - 8th Semester

ME439/ME834	**CNC and Robotics**	**L=4**	**T=0**	**P=0**	**Credits=4**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines and Robots, their components, functions, functions, programming and applications.

Unit 1 **[7 hrs]**

Concepts of NC, CNC, DNC. Classification of CNC machines, MCU architecture and functionality, Machine configurations, Types of control, CNC controller's characteristics, Interpolators**. [a, d, h, I, j]**

Unit 2 **[8 hrs]**

Qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, of CNC Machines.

Programming CNC machines, Part print analysis and Process planning, Advanced Programming features , Canned cycles. APT part programming CAD/CAM, Parametric Programming**.[a, b, c, d, e, h, I, j, k ,l ,m**]

Unit 3 **[8 hrs]**

Manual part programming for CNC turning, milling and machining center. Wire EDM machines. Computer assisted part programming techniques, Conversational and Graphics based software, Solid based part programming. Freeform surface machining. Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM. **.[a, b, c, d, e, h, I, j, k ,l ,m**]

Unit 4 **[7 hrs]**

Robotics, Basic concepts , Robot configurations , Basic robot motions , Types of drives , Applications

Transformations and kinematics, Vector operations, Translational transformations and Rotational transformations , Properties of transformation matrices,

Homogeneous transformations and Manipulator, Forward solution, Inverse solution, Introduction to robot dynamics.

Controls, Control system concepts, Analysis, control of joints, Adaptive and optimal control. **[a, b, c, d, e, h, I, j, k ,l ,m]**

Unit 5 **[8 hrs]**

End effectors, Classification, Mechanical, Magnetic, Vacuum, and Adhesive, Drive systems, Force analysis and Gripper design**.**

Robot programming, Methods, Languages ,Computer control and Robot Software – Programming Languages, Robot application (Assembly, inspection, material handling, processing) **[a, b, c, d, e, h, I, j, k ,l ,m**]

Unit 6 **[7 hrs]**

Sensory devices, Non optical and optical position sensors, Velocity and Acceleration, Range, Proximity, touch, Slip, Force, Torque. Machine vision, Image components , Representation , Hardware , Picture coding , Object recognition and categorisation Integration of Robots with CNC machines for CIM. **[a, b, c, d, e, h, I, j, k ,l ,m**]

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ME439/ME834	CNC and Robotics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Robot Engineering An Intergrated approach	2004	Klafter R.D., Chmielewski T.A. and Negin M	Springer
Reference :				
1	CNC Technology and Programming	2003	Krar, S., and Gill	Industrial Press Inc
2	An Introduction to CNC Machining	1991	Gibbs, D.	Industrial Press
3	Computer Numerical Control Concepts and Programming	1991	Seames, W.S.	Thomson Learning EMEA, Limited
4	Computer Numerical Control for Machining	1993	Lynch, M	McGraw-Hill
5	Computer Control of Manufacturing Systems	2005	Koren Y	Tata McGraw-Hill Education
6	Robotics control, sensing, vision, and intelligence	2004	Fu K.S., Gonzalez R.C., and Lee C.S.G.	Tata McGraw-Hill Education
7	Robotics Technology and Flexible Automation	2001	Deb S.R	Tata McGraw-Hill Education
8	Introduction to Robotics Mechanics and Control	2008	Craig J.J	Pearson Education India

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Regular: - 8th Semester Elective–IV Practical PTDC: - 8th Semester

ME440/ME835	CNC and Robotics Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

List of Practical

1) Demonstration on Automation through development in NC machines. **[a, b ,e ,i, j, k]**
2) Numerical control – Fundamental & Application. **[a, b , d, e ,i, j, k]**
3) Manual Part Programming. **[a, b ,e ,i, j, k, l, m]**
4) APT Part Programming. **[a, b ,e ,i, j, k, l, m]**
5) CNC- Lathe – Features, Specification, & Part Program. **[a, b ,e ,i, j, k, l, m]**
6) CNC Lathe – Programming, Simulation & Actual Machining of Part. **[a, b ,e ,i, j, k, l, m]** (Thread Cutting, Facing, Turning, Grooving etc.) **[a, b ,e ,i, j, k, l, m]**
7) CNC- Milling – Features, Specification, & Part Program. **[a, b ,e ,i, j, k, l, m]**
8) CNC Milling – Programming, Simulation & Actual Machining of Part. **[a, b ,e ,i, j, k, l, m]** (Profile Cutting, Various Interpolation, Pocketing, Mirroring etc.)
9) Robots Fundamental and configurations. **[a, b , d, e ,i, j, k]**
10) Robots Applications **[a, b ,e ,i, j, k, l, m]**
11) Programming, Simulation of Robot. **[a, b ,e ,i, j, k, l, m]**
12) Problems on Robot kinematics **[a, b ,e ,i, j, k, l, m]**

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Regular: - 8th Semester Elective-IV Theory PTDC: - 8th Semester

ME441/ME836	Vehicle Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The main objective of the syllabus to understand basic knowledge about Automobile systems which are used in the regular vehicle. The modernization in automobile is also included to understand recent trend in the field.

UNIT-1: **[8 hrs]**

Introduction, Automobile history and development and classification. Vehicles layout.
Engine construction and working of 2 stroke and 4-stroke cycle.
Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic)
Engine cooling and lubrication systems., **[a ,b , i , l, m]**

UNIT-2: **[8 hrs]**

Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch.
Gear box: Necessity of gear box, working principle, Classification: Sliding mesh, constant mesh, synchromesh, synchromesh and Transfer case gear box, Gear Selector mechanism, lubrication and control.
Introduction to Automatic Transmission **[a ,b , k, l, m]**

UNIT-3: **[8 hrs]**

Transmission system: Propeller shaft, Universal joint, constant velocity joint, Hotchkiss drive, torque tube drive.
Differential - Need and working. Differential lock.
Rear Axles and Front Axles
Wheel and Tyres : tyres specification, factors affecting tyre performance. **[a ,b , k, l, m]**

UNIT-4: **[8 hrs]**

Steering systems, principle of steering, Steering linkages, steering geometry and wheel alignment, steering gear box and its types, Drum and Disc brakes, Comparison
Brakes - Need, types : Mechanical, hydraulic (Master and wheel cylinder), Air brakes.
Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber.
[a ,b , k, l, m]

UNIT-5: **[8 hrs]**

Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries.
Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator, wiper.
Automobile air-conditioning,
Panel board instruments
Overhauling, Engine tune up **[a ,b , d, l, m]**

UNIT-6: **[8 hrs]**

Resistance to vehicle motion: Air, Road and gradient resistance and power calculation.
Recent Advances in automobiles such as ABS, Power Steering, Collision avoidance, Navigational aids etc **[a ,b , d, ,l, m]**

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1	Automotive Technology		H.M.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automotive Mechanics		Joseph Heitner	
4	Motor Vehicle Technology		J.A. Dolan	
5	Automotive Engines		W.H. Crouse	

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Regular: - 8th Semester Elective-IV Practical PTDC: - 8th Semester

ME442/ME837	Vehicle Engineering Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

List of Practical: Minimum eight practical to be conducted

1. Study and demonstration of four wheeler chassis layout. Two-wheel & four-wheel drive layouts.
2. Study and demonstration of 2S & 4S Engine Working
3. Study and demonstration of working of single plate/Multiplayer/Diaphragm automobile clutch.
4. Study and demonstration of synchromesh gearbox.
5. Study and demonstration of final drive and differential.
6. Study and demonstration of working Hydraulic braking system.
7. Study and demonstration of front wheel steering geometry and steering mechanism.
8. Study and demonstration of suspension system of a four-wheeler.
9. Study and demonstration of battery, electrical charging system.
10. Study and demonstration of electrical starting system
11. Study and demonstration of Electric horn, Brake light and side indicator
12. Visit to workshop to study and demonstration of wheel balancing.
13. Visit to servicing station for study of vehicle maintenance, repairs and report

For all the above practical's **[a ,c, d, e, i k, l, m]**

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Regular: - 8th Semester Elective-IV Theory PTDC: - 8th Semester

ME443/ME838	Management Information Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To focus on the integration of computer systems with the overall goals set by an organization. To learn the development and management of information technology tools for assisting executives and the general workforce in performing any tasks related to the processing of information MIS and business systems are especially useful in the collation of business data and the production of reports to be used as tools for decision making.

Unit 1 **[7 hrs]**
Introduction to MIS;
System & Its components, System Concepts, system control, Types of systems, Date & Information, Nature and scope, Character Function & Applications, system life cycle design. **[a, b, c, e]**

UNIT 2
[7 hrs]
System Analysis: System planning, Information Gathering, Structure Analysis tools, Feasibility Study, cost/benefit analysis. **[a ,b, c, e, h, i, j, k]**

UNIT 3 **[7 hrs]**
System Design: Stages of system Design, Input/output & form design, Database Design, Design Documentation.
[a, b, h, i, j, k]

UNIT 4 **[7 hrs]**
SYSTEM IMPLEMENTATION & EVALUATION :
System testing, Implementation Detailed evaluation, System maintenance. **[a, b, i, j, k]**

UNIT 5 **[7 hrs]**
DECISION SUPPORT SYSTEM :
Concepts & Philosophy of DSS, Deterministic System, Artificial Intelligence(AI), knowledge Based Expert system(KBES). **[a, b, i, j, k]**

UNIT 6 **[7 hrs]**
MIS TOOLS & PACKAGES/AREAS OF MIS
ERP(Enterprise Resource Planning)
SCM(Supply Chain arrangement)
CRM(Customer Relation ship Management.)
Concept of data ware housing and data mining. **[a, e, f, g, h]**

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	MIS	2002	WS Jawadekar	Tata McGraw-Hill
2	MIS	2006	D. P. Goyal	Macmillan
3	System Analysis and Design	1985	Elias M. Awad	R.D. Irwin
4	System Analysis and Design	2004	Donald Yeales.	Financial Times Prentice Hall

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Regular: - 8th Semester Elective-IV Practical PTDC: - 8th Semester

ME444/ME839	Management Information Systems Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

PRACTICALS :

1. Inventory control, **[a ,b, c, e, h, i, j, k]**
2. MRP, **[a ,b, c, e, h, i, j, k]**
3. Office Automation by using: MS-Access **[a ,b, c, e, h, i, j, k]**
4. Visual Basic, **[a ,b, c, e, h, i, j, k]**
5. Oracle or any other database Languages. **[a ,b, c, e, h, i, j, k]**

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Regular: - 8th Semester Elective-IV Theory PTDC: - 8th Semester

ME445/ME840	Mechatronics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

Develop the ability to understand the working of various electronically and computer control devices. This will help to bridge the existing gap between machines, Automation and Computer control system

Unit 1 **[7 hrs]**

Introduction, sensors, actuators, modeling of systems. Recent trend of designing machine units along with electronic circuits for operation and supervision of mechanisms. Techniques of interfacing mechanical devices with computer hardware. **[a, b, c, d, e, i, l]**

Unit 2 **[8 hrs]**

Basic principles ,working and specific applications of armature and field controlled D.C. Motors, Variable voltage and variable frequency control of 3 phase and single phase Induction motors, speed control of synchronous motors, Different types of stepper motors-Constriction ,working and application. Position control of stepper motors.
[a, b, d, e, i, l]

Unit 3 **[8 hrs]**

Common and commercial I.Cs used for amplification, timing and digital indication.
Different types of actuators, working of synchro-transmitter and receiver set, Pressure to current (P/I) and I/P conversion. Electrical and hydraulic servomotors.
Design of solenoid plungers and pressure and force amplification devices. **[a, b, d, e, i, l]**

Unit 4 **[7 hrs]**

Add-on cards for sampling and actuation, 4-20 mA ports, AD-DA conversion, Peripheral interface organization, general layout of data bus and data transfer through serial and parallel modes of communication, schemes of computer networking and hierarchy in supervisory control. **[a, b, d, e, i, l]**

Unit 5 **[8 hrs]**

Study of various integrated systems by using block diagrams. Study of systems used in Ink Jet Printers, Photo copying, Washing Machines, IC Engine fuel injection system etc **[a, b, c, d, e, i, l , m]**

Unit 6 **[7 hrs]**

General philosophy of Artificial Neural Network simulations, Fuzzy logic for operation and control of mechatronic systems. **[a, b, d, e, i, l , m]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Introduction to Mechatronics and Measurement Systems	2007	Michael B.Histand and David G. Alciatore	Tata McGraw-Hill Education
2	Mechatronics	2007	Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ.,	Chapman and Hall, 1991
3	Microprocessor Architecture, Programming and Applications	2002	Ramesh.S, Gaonkar	Prentice Hall
4	Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics	1996	Lawrence J.Kamm	John Wiley and Sons
5	Introduction to Microprocessors for Engineers and Scientists	2004,	Ghosh, P.K. and Sridhar	PHI Learning Pvt. Ltd.

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Regular: - 8th Semester Elective-IV Practical PTDC: - 8th Semester

ME446/ME841	Mechatronics laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

List of Practical (Minimum 10 Experiments)

1. Verification of P, P+I, P+D, P+I+D control actions.
2. Demonstration on XY position control systems.
3. Demonstration on linear conveyor control system.
4. Demonstration on rotary table positioning systems.
5. Demonstration on different switches and relays.
6. Analysis of control system using software like MATLAB/SIMULINK or equivalent.
7. Development of ladder diagram/programming PLC for level control, position control or any other mechanical engineering application.
8. Demonstration on A/D and D/A converters.
9. Demonstration on Flip Flops and Timers.
10. Demonstration on Application of Op – Amp circuits.
11. Demonstration on Data acquisition system.
12. Demonstration on Microcontrollers.

For all the above practical's [a, b, d, e, i, l , m]

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Regular: - 8th Semester Elective–V Theory PTDC: - 8th Semester

ME451/ME846	STRESS ANALYSIS	L=3	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles of stress analysis.

Unit 1 **[7 hrs]**

Two Dimensional Problems in. Cartesian Coordinate system -Fundamentals of stress & strain, stress-strain relationship, Elastic constant, plane stress, plane strain., differential equation of equilibrium Boundary conditions, Saint Venant's principle, compatibility equation. **[a ,b , e, l]**

Unit 2 **[7 hrs]**

Airys stress function. Stress analysis of cantilever subjected to concentrated load at its end and simply supported beam subjected to uniformly distributed load.

Two dimensional problems in polar coordinate systems -General equations of equilibrium in polar coordinate compatibility equation. **[a ,b , e, l]**

Unit 3 **[7 hrs]**

Stress distribution about symmetric. axis, stress analysis of cylinder subjected to internal & external pressure, Pure bending of curved beams, effect of hole on the stress distribution in plates, Stress analysis of rotating circular disk. **[a ,b , e, l]**

Unit 4 **[8 hrs]**

Introduction to various methods of stress analysis like grid techniques, brittle coating method, Moire fringe method etc.

Two Dimensional Photo elasticity - Introduction to basic optics related to photo elasticity, stress optic law, plane & circular polariscope arrangements, diffusion and lens type polariscope .Effect of stressed model in plane & circular polariscope, Isoclinic & Isochromatics, stress trajectories, calibration of photo elastic material (determination of fringe constant). Various photoelastic materials and their properties, Casting of photo elastic models, Tardy's and other compensation technique. Separation techniques like, shear difference, oblique incidence & electrical analogy. **[a ,b , e, l]**

Unit 5 **[8 hrs]**

Strain gage technique for stress & strain analysis -Introduction to electrical resistance strain gages, gage . factor, bridge circuit, bridge balance, output voltage of Wheatstone bridge, balancing of bridge, temperature compensation, various bridge configurations, bonding of strain gages to the specimen, determination of principle strains & stresses using strain rosettes. Environmental effects on performance of strain gages, Strain gages response to dynamic strains, Effect of lead wires. Introduction to Strain measurement on rotating components, Static & Dynamic Strain Measurement introduction to semiconductor gages, high temperature strain gages & self-temperature compensated gages. Introduction to Commercial strain indicators. **[a ,b , e, l]**

Unit 6 **[7 hrs]**

Introduction to fatigue and fracture mechanics. **[a ,b , e, l]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Theory of Elasticity	2nd edition	Timoshenko S.P;	Tata McGraw-Hill Education, 1951
2	Experimental Stress Analysis	3rd edition	Dally ;Riley	McGraw-Hill, 1991
3	Experimental Stress Analysis	1982	Ray T.K.	S. Chand,
4	Experimental Stress Analysis	1984	Srinath L.S	Tata McGraw-Hill Publishing Company Limited, 1984
5	Vol - I and Vol – II.“Theory of photoelasticity	2009	Max Mark Frocht	Pergamon Press, 1969
6	Applied elasicity	--	Chi The Wang	Amazon

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Regular: - 8th Semester Elective-V Theory PTDC: - 8th Semester

ME452/ME847	Design of Experiments and Taguchi methods	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.

Unit 1 **[7 Hrs]**
Frequency Distribution & Histograms, Probability & its Distribution, Measures of Central Tendency & Distribution, Presentation of Statistical Data. Importance and significance of statistics in an engineering industry.
[**a,f,h,i,l**]

Unit 2 **[8 Hrs]**
Confidence intervals, Hypothesis Testing, Correlation, Liner & Multiple Repression Analysis, Signification Testing, Introduction to minitab.**[b, e, m]**

Unit 3 **[7 Hrs]**
Full & fractional factorial experiments, analysis of variance, Latin squares, response surface methology,
[c, k , l]

Unit 4 **[7 Hrs]**
Group Method of Data Handling, shainin variable search technique, Regression equation in matrix form.
[j, m]

Unit 5 **[8 Hrs]**
Taguchi techniques, concept of six sigma, DoE and six sigma, Six sigma implementation. **[b, d, g,j, l]**

Unit 6 **[8 Hrs]**
Industrial application of Taguchi technique, orthogonal arrays, OA selection, DoE with Taguchi and comparison with conventional DoE. **[b, l]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Experimental Design	1950	Cochran & Cox	Wiley,
2	Taguchi Techniques in Quality Engineering	2nd edition	Phillip J. Ross	McGraw-Hill, 1996
3	Statistical Analysis for Engineers and Scientist	2010	Barnes	McGraw-Hill, 1994
4	Introduction to Probability and Statistics	4th edition 2003	Milton	McGraw-Hill,
5	Engineering Statistics	2nd edition	Bowker & Liberman	Prentice-Hall, 1972

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Regular: - 8th Semester Elective-V Theory PTDC: - 8th Semester

ME453/ME848	Value Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To learn about the philosophy of VA/VE, its importance to present day industrial and consumer product design. ,Study the various steps involved in systematic implementation of VA/VE.

Unit 1 **[7 hrs]**

Introduction to Value Engineering (V.E.) and Value Analysis, Quantitative definition of Value, Use Value and Prestige Value, Estimation of product quality/performance, Types of Functions. **[e, g, l]**

Unit 2 **[7 hrs]**

Life Cycle of a Product, Product life cycle Management, Methodology of V.E., **[f, h, m]**

Unit 3 **[8 hrs]**

Relationship between Use Functions and Esteem Functions in product design, Functional Cost and Functional Worth, Effect of value improvement on profitability, Aims of VE systematic Approach [**c, i, l]**

Unit 4 **[8 hrs]**

Introduction to V.E. Job plan / Functional Approach to Value Improvement, Various phases and techniques of the job plan **[a, j, m]**

Unit 5 **[8 hrs]**

Factors governing project selection, Life Cycle Costing for managing the Total Value, Concepts in LCC, Present Value concept, Annuity concept, Net Present Value, Pay Back period, Internal rate of return on investment (IRR), Examples and illustrations. **[b, k, l]**

Unit 6 **[7 hrs]**

Creative thinking and creative judgment, False material, labor and overhead saving, System Reliability, Reliability
elements in series and parallel, Decision matrix, Estimation of weights and efficiencies, Sensitivity analysis, Utility functions, Fast diagramming, Critical path of functions, DARSIRI method of value analysis, Purchase price analysis.
[a, c, d, m]

Reference Books

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Value Engineering	1962	L.D.Miles	Materials Management International,
2	Getting more at less cost	1995	Jagannathan	Tata McGraw-Hill Publishing Company Limited,
3	Value Engineering		Tufly	
4	Value Engineering	3rd edition	Donald Parker	
5	Value Engineering	4th edition 1984	Zimmerman	City of Tulsa, 1984

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Regular: - 8th Semester Elective-V Theory PTDC: - 8th Semester

ME454/ME849	Lean Sigma	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course aims to develop a broad understanding of Lean/Six Sigma principles. It focuses on build capability to implement Lean/Six Sigma initiatives in manufacturing as well as service operations will also help the capability to operate with awareness of Lean/Six Sigma at the enterprise level.

UNIT 1 **[8 hrs]**
Business process, Quality management, Need and significance of LS, COQ, COPQ, LS implementation, LS culture, Team roles and function, benefits. **[c, d, f, i, j, l]**

UNIT 2 **[8 hrs]**
Six sigma essentials, SS tools, DMAIC methodology, case studies and applications**.[a, b, e, k, m]**

UNIT 3 **[8 hrs]**
Statistical applications and methods using Minitab Software, cases and problems**.[a, b, k, l]**

UNIT 4 **[7 hrs]**
Process capability, Gage R & R,MSA, ANOVA,HYPOTHESIS testing, DOE, process characterization.
[b, g, k, l]

UNIT 5 **[7 hrs]**
Lean manufacturing concepts, Lean means speed, efficiency, waste time and cost reduction.
Lean Tools and Techniques-VSM,7 waste,5S,Kanban,Poka-yoke,Kaizen,TPM,SMED,Pull vs Push, JIT, single piece flow. **[a, c, h, k, m]**

UNIT 6
Design for Six Sigma, (DFSS)- need and significance, DMADV methodology, DFSS tools, Product and process optimization, innovations, TRIZ, case studies and applications**.[a, b, e, k, m]**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
Test Books :				
1	Getting started in Six-sigma		Michel C Thomset	John Wiley and Sons
2	Six Sigma for every one		George Eclees	John Wiley and Sons
3	Transactinal Six sigma nad Lean servicing		Betsi Harris Ehrlich	St.Lucie Press
4	Six sigma for small business		Greg Brue	Ep- Entrepreneur press
5	Six sigma for Quality and productivity promotion	2003	Sung H.	Park Asian Productivity organization
Reference Books				
1	Six sigma and Beyond- Vol I to VII		D. S Stamalatis	St. lucie Press
2	Demystifying Six Sigma	2003	Alan Lasson	AMCON(American management Association)
3	The Six sigma Way	2003	P.Pande R Nenman & R.Cavanagh	Mc GraHill
4	Lean Production Simplified: A plain- Language Guide to the World's Most powerful Production System	2002	Dennis, Pascal	New York: Productivity Press, ISBN: 1563272628
5	Lean Six sima		Michel L George	Mc GraHill
6	Design for Six Sigma		Kai Yang,Basen El-Haik	Mc GraHill
7	Design for Lean Six sigma			

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Regular: - 8th Semester Elective –V Theory PTDC: - 8th Semester

ME455/ME850	PRODUCT DESIGN AND DEVELOPMENT	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To understand the Product Life Cycle. Study different design techniques, product development phases, process selection, material selection and costs associated with PDD.**[a,b,c,d,k,l]**

Unit 1 **[7 hrs]**
Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods. **[a, c, d, k]**

Unit 2 **[7 hrs]**
Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart, other constrain effect. **[a, e, k]**

Unit 3 **[8 hrs]**
Process selection – Impotence types of manufacturing processes and their classification, sources of information, selection criteria, Material and Process selection Methods- Expert systems, Computer Database Approach, Performance indices, decision matrix, AHP and fuzzy approach, introduction to material and process selection software **[a, c, d, l]**

Unit 4 **[8 hrs]**
Benchmarking, integrated product design and development, DFM, DFA, DFX, Early supplier involvement, robust design, QFD and concurrent engineering. Introduction to green design.
[a, c, d, l]

Unit 5 **[8 hrs]**
Mathematics of Time Value of Money, Cost Comparison, Depreciation, Taxes, Inflation, Profitability of Investment and Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates. Industrial Engineering Approach, Parametric Approach, Introduction to Assembly Modelling, Top-Down and Bottom-Up Approaches of AM, Mating Conditions, Representation Schemes, Generations of Assembly Sequences
[a, b, c, d, k]

Unit 6 **[7 hrs]**
Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereolithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations
[a, c, k]

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Fourth Eye (Excellence through Creativity	1992.	KHANDWALLA P.N.;	Wheeler Publishing, Allahabad,
2	Product Design and Manufacturing	4th edition, 2007	A. K. Chitale and R. C. Gupta	PHI Pvt. Ltd., 2002 ,
3	Engineering Design	4th edition 2008	Dieter George E	McGraw Hill Pub. Company

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ME455/ME850	PRODUCT DESIGN AND DEVELOPMENT	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference Books:				
1	Product Design and Development	2003	Ulirich Karl T. and Eppinger Steven D	McGraw Hill Pub. Company
2	Handbook of Product Design for Manufacturing	1986	Bralla, James G.	McGraw Hill Pub. Company
3	I.P.R. Bulletins			TIFAC, New Delhi,
4	Creativity and innovation	2008	Harry Nystrom	John Wiley & Sons, 1979.
5	Managing technological innovation	4th edition	Brain Twiss	Pitman Publishing Ltd
6	New Product Planning		Harry B.Watton	Prentice Hall Inc.
7	Techniques in Reverse engineering and new product development.		Kevin Otto and Kristin wood.	Pearson Education

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Regular: - 8th Semester Elective-V Theory PTDC: - 8th Semester

ME456/ME851	Advanced Manufacturing Techniques	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

Unit 1 **[7 hrs]**
Non-traditional machines process: Need, classification & historical development. Abrasive machine and finishing operations, high speed grinding, creep feed grinding, belt grinding, hot and cold machining. **[a, b, c, d, f, g, h, I, j, k, l, m]**

Unit 2 **[8 hrs]**
Abrasive Jet Machine: Mechanics of AJM. Process parameter and characteristics ultrasonic machining mechanics, process parameter & control, effect of USM on materials, water jet machining. **[a, b, c, d, e, f, g, h, i, j, k, l, m]**

Unit 3 **[9 hrs]**
Electro – chemical machining: Electrochemistry of ECM, tool design, effect of variable on performance chemical milling, Chemical Engraving, Photo chemical machining, EC grinding, Electric discharge machining, machine surface finish & machining accuracy, electron beam. Laser beam and plasma arc machining **[a, b, d, e, h, I, k, l, m]**

Unit 4 **[6hrs]**
High energy rate forming process. Burnishing, dallising and other miscellaneous forming and finishing processes, electroforming. Thermoform High velocity forming, Vacuum forming, **[a, b, d, e, f, g, h, I, j, k, l, m]**

Unit 5 **[8 hrs]**
Unconventional welding techniques, laser, electron beam, plasma arc, atomic hydrogen, submerged arc, explosive welding techniques, electro slag welding and casting. **[a, b, d, e, f, g, h, I, j, k, l, m]**

Unit 6 **[7 hrs]**
Adhesive bonding, solid phase welding, technique such as ultrasonic welding, friction welding, recent development in welding, comparative analysis, economics and applications of nontraditional processes for machining, welding and forming. **[a, b, c, d, e, f, g, h, I, j, k, l, m]**

Reference Books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Manufacturing Science	2007	A. Ghosh & A. Mallik.	Ellis Horwood, 1986
2	Non Traditional Machining	2005	P.C. Paonoey & H. S. Shan.	Tata McGraw-Hill Education, 1980
3	New Technology		A Bhattacharya	
4	Advance machining process		V.K.Jain	Allied publisher

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Regular: - 8th Semester Elective-V PTDC: - 8th Semester

ME457/ME852	Power Plant Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To understand the conventional processes of power generations. To study the basic systems of the various conventional power plant. To understand the analysis of load calculations and measuring systems of power plant.

Unit 1 **[7 Hrs]**

THERMAL POWER PLANT- I

Introduction to thermal power plants and power plant layouts.
Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling.
Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers, water treatment, Waste Disposal-Present practices, environmental hazards and other social aspects**.[a, c, i, k, l, m]**

Unit 2 **[8 Hrs]**

THERMAL POWER PLANT- II

Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations
Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout.
Comparison with other power plant. Introduction to captive power plant.(To study the practical aspect ot power plant,the visit to nearby power plant shall be arrange for the students) **.[a, c, i, k, l, m]**

Unit 3 **[7 Hrs]**

HYDROELECTRIC POWER PLANT.

Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve.
Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection, models & model testing, governing.
Comparison with other power plant. **.[a, c, i, k, l, m]**

Unit 4 **[8 Hrs]**

POWER PLANT ECONOMICS

Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load.
Economic Analysis: - Cost of electric energy, load division, and. Tariff methods for Electrical Energy. **.**
[a, c, d, k, l, m]

Unit 5 [8 Hrs]

NUCLEAR POWER PLANT

Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India.
Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor. Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal-Present practices, environmental hazards and other social aspects.
Comparison with other power plant. **.[a, c, i, k, l, m]**

Unit 6 **[7 Hrs]**

COMBINED OPERATION OF DIFFERENT POWER PLANTS
Combined operation: - Need division, combination of different plant & their coordination, advantages.
NON CONVENTIONAL POWER GENERATION SYSTEMS
Introduction to Non Conventional power Generation Systems
Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant
Global scenario, prominent installations worldwide present & proposed plant locations. **.**
[a, c, i, k, l, m]

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ME457/ME852	Power Plant Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Power Plant Engineering	**2002**	Domkundwar.	Dhanpat Rai & Co.
.Reference books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Power Plant Engineering	**2007**	Vopal & Slortzki	
2	Power Plant Engineering	**1984**	M.M. Wakil	TATA Mc-Graw Hill.
3	Power Plant Engineering	**2008**	P. K. Nag	TATA Mc-Graw Hill.
4	Power Plant Engineering	**2005**	R. K. Rajput	TATA Mc-Graw Hill.

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Regular: - 8th Semester Elective-V Theory PTDC: - 8th Semester

ME458/ME853	Machine Tool Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

UNIT 1 **[7Hrs]**

Introduction to Machine tool drives & Mechanisms, Working & auxiliary motions in machine tools, Parameters defining the working motions of a machine tool; Machine tool drives, Hydraulic Transmission & its elements, Mecll.'U1ical Transmission & its elements, General requirements of machine tool design, layout of machine tool. **[a, c, l, m]**

UNIT 2 **[8 Hrs]**

Regulation of speed & feed rates - Aim of speed & feed regulation, Stepped regulation of speed -Various laws of stepped regulation, Selection of range ratio, Standard values of Geometric progression Ratio & guidelines for selecting proper value, break up of speed steps; Structure diagrams & their analysis, Speed classification. Design of feed box, machine tool drives using multiple speed motors, Special cases of gear box design -speed box with overlapping speed steps, speed box with a combined structure, speed box Wit11 broken geometric progression, General recommendation for developing the Gearing diagram, determining the Number of teethes of gears, Classification of speed & feed boxes. Electromechanical system of Regulation, Friction, Pressure and Ball Variation, Epicyclic Drive **[a, c, e, k, l, m]**

UNIT 3 [7Hrs]

Machine Tool Structure - Functions of machine tool structures & their requirements, Design criteria for machine tool structures, Materials of machine tool structures, Static &Dynamic stiffness, Profiles of machine tool structures, Factors affecting stiffness of machine tool structures & methods of improving it; Basic design procedure of machine tool structures -design for strength, design for stiffness. Design of Beds, Column, housings, Bases & Tables, Cross Rails, Arms, Saddles, Carriages, Rams. **[a, c, e, k, l, m]**

UNIT 4 **[8Hrs]**

Design of Guide ways & Power Screws - Functions & types of guide ways, Design of Sideways - Shapes, materials, methods of adjusting clearances. Design Criteria & Calculations for sideways, Design for wear resistance, Design for stiffness. Guide ways operating under liquid friction conditions -Hydrodynamic & Hydrostatic sideways, Design of Aerostatic sideways, Design of Antifriction Guide ways, Combination guide ways, protecting devices for sideways.

Design of Power Screws -Sliding friction power screws, Rolling friction Power Screws. **[a, c, e, k, l, m]**

UNIT 5 **[7Hrs]**

Design of Spindles & Spindle Supports Functions of spindle unit & requirements, Materials of spindles, design calculations of spindles – Deflection of spindle axis due to bending, deflection of spindle axis due to compliance of spindle supports, optimum spacing between spindle supports deflection due to compliance of the Tapered Joint permissible deflection & design for stiffness. Antifriction bearings -Preloading of antifriction bearing. Sliding bearings - Sleeve bearings, hydrodynamic journal bearing, and air -lubricated bearings**.**

[a, c, e, k, l, m]

UNIT 6 **[8Hrs]**

Testing & Control of Machine Tools

a) Testing: Objects and procedure for Acceptance Test, Instrumentation for acceptance, Accuracy of machine tools, and accuracy of work pieces.

b) Control systems: Electrical control, push button control, directional control relays, electrical brakes, automation in feed mechanism

c) Hydraulic control: positional control, power pack for lubrication system in hydraulic drive.

d) Control system for gear sliding and feed mechanism (open loop or close loop) for NC/CNC machine using stepper motor or DC motor. **[a, c, d, e, k, l, m]**

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

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ME458/ME853	Machine Tool Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Machine Tool Design	2007	N. K. Mehata	Tata McGraw-Hill, 1984
2	Principles of Machine Tools	2011	Gopal Chandra Sen, Amitabha Bhattacharyya	New central book agency
3	Design Of Machine Tools	5th edition 2008	Basu, Pal	Oxford and IBH Publishing, 2008
4	Principles of Machine tools		Sen and Bhattacharya	New central book agency

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Regular: - 8th Semester Elective-V Theory PTDC: - 8th Semester

ME459/ME854	INDUSTRIAL SAFETY	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To understand the need and importance of safety. Study different types of accidents and its preventions. Also study the various safety equipments and their applications.

Unit 1 **[7Hrs]**

Introduction

Introduction to occupational safety & health, need for occupational safety, Safety Organization, Safety Policy, Safety Committee, Safety Officer, Medical Officer, Labour welfare Officer, Safety manual, Disaster management plan, Government & other autonomous occupational safety & health organizations. Introduction to OHSAS 18000.**[a, b, c, e, f, h, d]**

Unit 2 **[8Hrs]**

Occupational Accidents

Accident, causes of accident, cost of accident, unsafe conditions, unsafe actions, unsafe personal factors, Accident causations models, accident reporting, accident investigation & analysis, Application of remedial measures, result monitoring, Personal Protective Equipments(ppe), Types of ppe, legal provisions of accident reporting, safety performance measurement, Frequency Rate, Severity Rate, Incidence Rate, Introduction to IS:3786.**[a,b,c,d,e,f,g]**

Unit 3 **[7Hrs]**

Risk Identification & Risk management

Plant safety inspection, Job safety analysis, Hazards identification & Risk analysis **(HIRA)**, Fault tree analysis **(FTA)**, Hazards & operability Study **(HAZOP)**, Failure mode & Effect analysis**(FMEA)**, Failure mode, criticality & effect analysis **(FMCEA)**, Safety audits, Safety Integrity Level **(SIL)**, Level of Protection Analysis **(LOPA)**.**[a,b,d,g,h,I,j,k]**

Unit 4 **[7Hrs]**

Safety & The Law

Introduction to various Laws & Rules pertaining to Safety, Health & Welfare of Indian work-force. Provisions of Factories Acts' 1948 pertaining to Safety only, **[b, c, d, e, g, h]**

Unit 5 **[8Hrs]**

Safety with Machines

Safety in design, Plant layout & housekeeping, Machine maintenance, Machine guarding, types of machine guards, special tools for enhancing safety, safety in use of compressed gas cylinder, safety around grinding wheel, safety in drill machines, safety in use of hand tools, safety in press machines, handling and disposal of hazardous chemicals, electrical safety, fire safety.**[a, b, c, d, i, j, k,]**

Unit 6 **[7Hrs]**

Safety Training & Awareness

Safety training and safety education, safety awareness methods viz safety competitions, safety posters and hording, safety magazine, safety pamphlets, safety campaign, Tool-Box talk, Employees participation in promoting safety.**[a, b, c, d, i, j, k]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Industrial Safety	3rd editiion	Roland Patton Blake	Prentice-Hall, 1963
2	Industrial Safety	1977	Jack W. Boley	Gulf Publishing Company, Book Division,

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
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Regular: - 8th Semester Elective-V Theory PTDC: - 8th Semester

ME460/ME855	Advance Welding Techniques	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To study and analyze various welding methods with advanced techniques to pin engineering materials.

Unit 1 **[8 hrs]**

Resistance Welding Methods, Variations in the process, Effect of current, Pressure and resistance on nugget quality, Expulsion of metal, Mushrooming of electrodes, Temperature variations in set up. Weld cycle, metal contact during cycle, Materials, Direct spot welding, two sides spot welding, multiple spot welding, Shunt current, Electrode material, Approximate values for steel, seam welding, Projection welding, Butt welding Flash butt welding, applications.**[a, b, c, e, g, h, l, k, m]**

Unit 2 **[7 hrs]**

High energy Density Welding processes, Electron Beam Welding, Principle Bead geometry, Mediums of beam, Vacuum range, Laser Beam welding, Principle, Keyhole technique, applications, Laser materials, Gaseous Lasers. **[a, b, d, f, g, h, k, l, m]**

Unit 3 **[8 hrs]**

Solid state welding Processes, Friction, Welding, Principle, Variables affecting weld quality, Heat generated, Machines used, Ultrasonic welding, Principle, Comparison with Resistance Spot Welding, Diffusion Bonding, Principles of inter atomic diffusion, equation, diffusion length, Rate of inter atomic Diffusion, Use of Inert Gas, Application, Explosive Welding. **[a, b, h, k, l, m]**

Unit 4 **[7 hrs]**

Brazing, Soldering, ,Capillary action, wetting action, joint designs for sheet metal brazements, methods of prep.lacing brazing filler wire, Butt Joint design for sheet metal brazements, brazing methods, filler materials in brazing, Soldering, materials solder combinations, soldering fluxes,
Hardfacing, cladding metal sprying , hard facing materials, selection of thermal spray coatings.
[a, b, e, f, h, j, k, l, m]

Unit 5 **[8 hrs]**

Cutting, Arc cutting, Flame cutting, Plasma cutting, Gouging, Plasma cutting with different gases, Comparision with Oxyacetylene cutting, Oxyacetylene cutting, colour codes for cylinder. Welding of ceramics, plastic and composite**[a, b, e, h, l, k, l, m]**

Unit 6 **[7 hrs]**

Welding defects, Weldment testing, Destructive and non destructive testing, Coupon, Determination of yield strengths, ultimate strength, visual Inspection, Dye Penetrant test, penetrants and developers, Eddy current testing, Ultrasonic testing, Magnetic particle Inspection , advantages and application of each method.
Welding Procedure specifications, Weldor qualification. **[a, b, f, h, k, l, m]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Welding and Welding Technology	2008	Richard Little	McGraw-Hill, 1973
2	Welding	10th edition	A. C. Davies, Davies	Cambridge University Press, 2002
3	Laser Machining and Welding	2007	Rykalin, Uglov, kokora	Pergamon Press, 1978
4	Welding Engineering and Technology	1997	R. S. Parmar	Khanna, 1997
5	Welding Metallurgy	2nd edition 2003	Sindo Kau	John Wiley & Sons, 2003
6	Manufacturing Science		Ghosh and Mallik	Ellis Horwood
7	Manufacturing Technology Vol-I 3E	3rd edition 2009	P.N.Rao	Tata McGraw-Hill Education,
8	Welding of ceramics, plastic and composite		David A.Grewelland Avrahm Benatar	Hanser

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Regular: - 8th Semester Practical PTDC: - 8th Semester

ME472/ME867	Comprehension Viva Voce	L=0	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	0	50	50	External Evaluation

OBJECTIVES

To equip the students with the thorough knowledge of the Mechanical Engineering branch. Through knowledge of each and every subject learnt till date. This will be helpful for preparations of competitive examinations and campus interviews.

COMP. VIVA VOCE

The viva voce will be on complete syllabus learnt during the period of 4 years for completion of studies to obtain the degree of Mechanical Engineering.

[a, b, c, d, e, f, g, h, I, j, k, l, m]

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Regular: - 8th Semester Practical PTDC: - 8th Semester

ME473/ME868	PROJECT – Phase-II	L=0	T=0	P=6	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	External Evaluation

OBJECTIVES

The project topic for the batch is decided in the 1st semester of final year, the student shall carry out the project work further 2nd semester of final year.
The project work consists of :

1. A comprehend since and update survey of literature.
2. Demonstration on processes /phenomenon related to project.
3. Design of any equipment its fabrication and testing.
4. Critical analysis of design or process for optimization
5. Verification by experimentation.
6. In case of industrial project the necessary modifications with the proper drawing / design suggested to the industry should be explained. The letter from the industry should be attached in the report related to the performance of the batch.

Evaluation

The term work will be assessed by the project guide. The students will be examined by the external examiner and the project guide. Marks will be allotted on the basis of work done and performance in the examination.

[a, b, c, d, e, f, g, h, I, j, k, l, m]

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Regular: - 8th Semester Practical PTDC: - 8th Semester

ME474/ME869	EXTRA CURRICULUR ACTIVITIES	L=0	T=0	P=0	Credits=2

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	50	0	50	Internal Evaluation

OBJECTIVES

EXTRA CURRICULUR ACTIVITIES

Every student has to participate in at least two extra-curricular activities from Second year. The certificate of these activities to be submitted to the related Coordinator/head of the department.
The credit for these activities shall be given in 8th semester.
[a, b, c, d, e, f, g, h, I, j, k, l, m]

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YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
B.E. (Electrical Engineering)
SCHEME OF EXAMINATION 2010

Sl.No.	Sub. Code	Subject	L	T	P	Total Contact Hours	Credits	% Weightage				ESE Duration
								MSE - I	MSE - II	TA	ESE	
VII Semester												
1	EL401	High Voltage Engineering	3	0	0		3	15	15	10	60	3 Hrs
5	EL402	High Voltage Engineering Lab	0	0	2		1			40	60	
	EL403	Computer Applications in Electrical Engg	3	1	0		4	15	15	10	60	3 Hrs
	EL404	Computer Applications in Electrical Engg Lab.	0	0	2		1			40	60	
2		**Prof. Elective 2**	4	0	0		4	15	15	10	60	3 Hrs
4		Free Elective 2	4	0	0		4	15	15	10	60	3 Hrs
6	EL405	Simulations in Power System	0	0	2		1			40	60	
8	EL406	Training	0	0	0		3			100		
9	EL407	Project Phase 1	0	0	4		4			40	60	
10	EL408	Seminar 2	0	0	2		1			100		
Total			**14**	**1**	**12**	**27**	**26**					
	EL409	PE2:Optimisation Technique	4	0	0		4	15	15	10	60	
	EL410	PE2: FACTS Devices	4	0	0		4	15	15	10	60	
	EL411	PE2:Electrical Drives - II	4	0	0		4	15	15	10	60	
	CV418	FE 2 : Elements of Earthquake Engineering	4	0	0	4	4	15	15	10	60	
	CV419	FE2 : Air Pollution & Solid Waste Management	4	0	0	4	4	15	15	10	60	
	ET411	FE2 : Soft Computing	4	0	0	4	4	15	15	10	60	3 Hrs
	ET412	FE2 : Industrial Instrumentation	4	0	0	4	4	15	15	10	60	3 Hrs
	ME429	FE 2 : Total Quality Management	4	0	0	4	4	15	15	10	60	
	ME430	FE 2 : Reliability Engineering	4	0	0	4	4	15	15	10	60	
	EE411	FE 2 :Fuzzy Logic & Neural Network	4	0	0	4	4	15	15	10	60	
	EE429	FE 2 :Basic of Analog and Digital Communication Systems	4	0	0	4	4	15	15	10	60	
	CT411	FE2:Multimedia and Animation	4	0	0	4	4	15	15	10	60	100
	CT412	FE2:Current Trends and Technologies	4	0	0	4	4	15	15	10	60	100
	IT408	FE2: Applications of Computer Networking	4	0	0	4	4	15	15	10	60	3 Hrs
VIII Semester												
1	EL416	Switchgear and Protection	3	0	0		3	15	15	10	60	3 Hrs
		Prof. Elective 3	3	0	0		3	15	15	10	60	3 Hrs
3		**Prof. Elective 4**	3	0	0		3	15	15	10	60	3 Hrs
4		**Prof. Elective 5**	3	0	0		3	15	15	10	60	3 Hrs
5	EL417	Switchgear and Protection	0	0	2		1			40	60	
6	EL418	Substation Design	0	0	4		4			40	60	
7	EL419	Comprehensive Viva-voce	0	0	0		3			40	60	
8		Extra Curricular Activies / Competative Exam.	0	0	0		2			100		
9	EL420	Project Phase 2	0	0	6		6			40	60	
Total			**12**	**0**	**12**	**24**	**28**					
	EL421	PE3:Power Quality Conditioning and Monitoring	3	0	0		3	15	15	10	60	
	EL422	PE3:Power System Operation and Control	3	0	0		3	15	15	10	60	
	EL423	PE3:Transients in Power System	3	0	0		3	15	15	10	60	
	EL424	PE4: EHVAC-HVDC Transmission	3	0	0		3	15	15	10	60	
	EL425	PE4: Electrical Power Utilization	3	0	0		3	15	15	10	60	
	EL426	PE4: Digital Signal Processing	3	0	0		3	15	15	10	60	
	EL427	PE5: Artificial Intelligence based Systems	3	0	0		3	15	15	10	60	
	EL428	PE5: Power Plant Instrumentation	3	0	0		3	15	15	10	60	
	EL429	PE5: Electrical Distribution System	3	0	0		3	15	15	10	60	

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Dean (Acad. Matt.)		**Version**	**1.03**	**AY2013-14 Onword**

EL401/EL703	High Voltage Engineering	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: The demand for the generation and transmission of large amounts of electric power today necessitates in transmission at extra high voltages. It provides all the latest information on insulating material , breakdown phenomenon, overvoltage and testing techniques, It is also useful for self study by engineers in the field of electricity utilities and in the design, development and testing of electrical apparatus, transmission line hardware, particle acceleration etc.

UNIT-1: **Breakdown mechanism in Dielectrics**

Ionisation process : Townsend's criterion for B.D, Break-down In electro-negative gases, Time -lag for Breakdown, Streamer theory for Breakdown in gases, Paschen's law, Breakdown in non-uniform fields, corona discharges and Introduction of corona Post Breakdown phenomenon and applications, practical considerations in using gases for insulation purposes, vacuum insulation, liquid as insulators, conduction and B.D. in Pure and commercial liquids. Intrinsic electromechanical and thermal Breakdown. Breakdown of solid dielectric in practice, B.D. in composite dielectric.

UNIT-2: **Lighting and switching over voltages**

Mechanism of lighting types of strokes, parameter and characteristics of lighting strokes, characteristics of switching surges; power frequency over voltages, control of overvoltage due to switching. Protection of lines by ground wire, protection by lightning Arrester, gap type and gapless L.A. selection of L.A. ratings, Surges absorbers.

UNIT-3 :Travelling waves and insulation co-ordination

Travelling waves on transmission lines, classifications of lines, attenuation and distortion of travelling wave, reflection and transmission of waves, behaviour of rectangular waves at transition points. Introduction to insulation co-ordination associated terms, impulse wave-form, introduction to Basic insulation level (BIL), Reduced BIL and switching impulse level (SIL).

UNIT-4: Generation of high voltage and currents

Generation of High D.C. voltages by rectifiers, voltage doubler and multiplier circuits (Derivations of expression not required) electrostatic machines. Generation of high AC voltage by Cascade transformers, Resonant transformers. Generation of high impulse voltages : Standard impulse wave shapes , analyses of model and commercial impulse generation circuits, waveshape control, Marx Circuit , tripping and control of impulse generation, generation of switching surges, generation of impulse current.

UNIT-5 : Measurement of high voltage and current

Measurement of high AC and DC voltages by micro ammeter, generating voltmeters, resistance and capacitance potential devices, series impedance voltmeter, Capacitive Voltage Transformer (CVT) , Magnetic type potential transformers, electrostatic voltmeter ,peak reading AC voltmeters , sphere gap arrangement Measurement of impulse voltage by potential devices and peak reading voltmeters. Measurement of High AC/DC currents: Measurement of high frequency and impulse current by resistive shunts (Bifilar strip shunt only).

UNIT-6: Non destructive and high voltage testing of electrical apparatus

Non destructive testing : Measurement of DC Resistivity, measurement of dielectric constant and loss-factor (low and power frequency only) ,Schering bridge for high charging circuits, for high dissipation factor for three terminal measurements, transformer ratio arm bridges, partial discharge measurements by straight detector by balance detectors, calibration of detectors, discharge detection in power cables.

High voltage testing : Testing of insulators, bushings, isolators, circuit breakers, cables, transformers lightning arresters and power capacitors.

EL401/EL703	High Voltage Engineering	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	High Voltage Engineering		**K. R. Padiyar**	
2	High Voltage Engineering	**3rd -2006**	M. S. Naidu and V. Kamaraju	Mc GrawHill Publisher
3	High Voltage Engineering	**1st -1994**	C.L. Wadhwa	New Age international Publisher
	EHV AC Transmission	**2nd**	Begamudre	New Age international Publisher

Reference books:				
1	Advances In high Voltage Engineering		M. Haddad and Warne	

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EL402/EL704	High Voltage Engineering	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

Following practical based on above syllabus can be performed.

1) Study of high voltage Laboratory equipments.
2) Calibration of panel voltmeter by sphere gap.
3) Study of corona.
4) Study of movement of arc in horn gap.
5) Flash over voltage test : 11 KV pin type insulator.
6) Determination of string efficiency of suspension insulator.
7) Determination of breakdown voltage for transformer oil sample.
8) Determination of breakdown voltage for solid insulator.
9) Study of cable fault locator.
10) Measurement of resistivity of transformer oil.
11) Measurement of dielectric constant (ε_r)of transformer oil.
12) Measurement of loss of angle of transformer oil (tan δ).

Department of Electrical Engineering
Semester VII

EL401/EL703	High Voltage Engineering	L= 3	T=0	P=0	Credits=3
PO/PSPO – a, b, c, e, h, i, k, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Students will understand • breakdown mechanism in solid liquid and gaseous medium • lightening and switching over voltages and insulation coordination. • different methods of generation and measurement of high voltage and currents in laboratory • different methods of non destructive and High Voltage testing of apparatus.	Students has understood • breakdown mechanism in solid liquid and gaseous medium • lightening and switching overvoltage and insulation coordination • different methods of generation and measurement of high voltage and currents in laboratory • different methods of non destructive and High Voltage testing of apparatus.

UNIT-1:
Breakdown Mechanism in Dielectrics
Ionisation process : Townsend's criterion for breakdown, Break-down in electro-negative gases, Time -lag for breakdown, Streamer theory for breakdown in gases, Paschen's law, Breakdown in non-uniform fields, corona discharges and introduction of corona, post breakdown phenomenon and applications, practical considerations in using gases for insulation purposes, vacuum insulation, liquid as insulators, conduction and breakdown in pure and commercial liquids. Intrinsic electromechanical and thermal breakdown. Breakdown of solid dielectric in practice, breakdown in composite dielectric.

UNIT-2:
Lightning and switching over voltages
Mechanism of lightning types of strokes, parameter and characteristics of lightning strokes, characteristics of switching surges; power frequency over voltages, control of over voltages due to switching. Protection of lines by ground wire, protection by Lightning Arrester (LA), gap type and gapless LA, selection of LA ratings, Surge absorbers.

UNIT-3
Travelling Waves and Insulation Co-ordination
Travelling waves on transmission lines, classifications of lines, attenuation and distortion of travelling waves, reflection and transmission of waves, behaviour of rectangular waves at transition points. Introduction to insulation co-ordination and associated terms, impulse wave-form, introduction to Basic Insulation Level (BIL), Reduced BIL and Switching Impulse Level (SIL).

UNIT-4:
Generation of High Voltage and Currents
Generation of High D.C. voltages by rectifiers, voltage doubler and multiplier circuits (Derivation not required) electrostatic machines. Generation of high ac voltage by cascade transformers, resonant transformers. Generation of high impulse voltages: Standard impulse wave shapes, analyses of model and commercial impulse generation circuits, waveshape control, Marx Circuit, tripping and control of impulse generation, generation of switching surges, generation of impulse current.

UNIT-5
Measurement of High Voltage and Current
Measurement of high AC and DC voltages by micro ammeter, generating voltmeters, resistance and capacitance potential dividers, series impedance voltmeter, Capacitive Voltage Transformer (CVT), Magnetic type potential transformers, electrostatic voltmeter, peak reading AC voltmeters, sphere gap arrangement, measurement of impulse voltage by potential dividers and peak reading voltmeters. Measurement of High AC/DC currents: Measurement of high frequency and impulse current by resistive shunts (Bifiliar strip shunt only).

EL401/EL703	High Voltage Engineering	L= 3	T=0	P=0	Credits=3
PO/PSPO – a, b, c, e, h, i, k, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6:

Non Destructive and High Voltage Testing of Electrical Apparatus

Non destructive testing : Measurement of DC Resistivity, measurement of dielectric constant and loss-factor (low and power frequency only), Schering bridge for high voltage circuits, for high dissipation factor for three terminal measurements, transformer ratio arm bridges, partial discharge measurements by straight detector, balance detectors, calibration of detectors, discharge detection in power cables. High voltage testing: Testing of insulators, bushings, isolators, circuit breakers, cables, transformers, lightning arresters and power capacitors.

Text books:				
	Name	Edition	Author	Publisher
1	EHV AC Transmission	2nd	Begamudre	New Age international Publisher
2	High Voltage Engineering	3rd -2006	M. S. Naidu and V. Kamaraju	Mc GrawHill Publisher
3	High Voltage Engineering	1st -1994	C.L. Wadhwa	New Age international Publisher

Reference books:				
1	Advances In high Voltage Engineering		M.Haddat and Warne	

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EL402	High Voltage Engineering Lab.	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	02 Hours

Following practical based on above syllabus can be performed.

1) Study of high voltage Laboratory equipments.
2) Calibration of panel voltmeter by sphere gap.
3) Study of corona.
4) Study of movement of arc in horn gap.
5) Flash over voltage test: 11 kV pin type insulator.
6) Determination of string efficiency of suspension insulator.
7) Determination of breakdown voltage for transformer oil sample.
8) Determination of breakdown voltage for solid insulator.
9) Study of cable fault locator.
10) Measurement of resistivity of transformer oil.
11) Measurement of dielectric constant of transformer oil.
12) Measurement of loss angle of transformer oil.
13) Study of 100 kV AC/ 140 kV DC test set and calibration of panel voltmeter by sphere gap.
14) Study of 150 kV, 225 Joules impulse generator and test on pin type insulator.

EL403/EL801	Computer Applications in Electrical Engineering	L=3	T=1	P=0	Credits=4
PO/PSPO – a, b, c, e, h, i, k, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
This subject exposes students to the mathematical foundational concepts that are necessary in the field of electrical engineering such as a) Load flow. b) Short Circuit studies. c) Transient Stability Studies.	• Determine Bus Impedance & Admittance matrix (required for Load flow & Short circuit Studies) by graphically, Inspection & building algorithm. • Load flow study of a power system by Newton-Raphson & Gauss-Seidal Iterative Method. • Short circuit studies. • Transient stability by using Eulersodified Eulers & RK-4 order differential method.

UNIT-1: **Incidence and network matrices**
Incidence and network matrices: - Graph incidence Matrices, Primitive network, formation of network matrices by singular transformations.

UNIT-2: **Algorithm for single phase network**
Algorithm for formation of Bus Impedance and Bus Admittance matrix for system without mutual coupling.

UNIT-3 Three Phase Networks
Three Phase Networks:- Three phase balance network elements with balanced and unbalanced excitation incidence and network matrices for three phase element Algorithm for formation of three phase bus impedance matrices without mutual coupling.

UNIT-4:
Short circuit studies
Short circuit studies : Three phase network short circuit calculations using bus impendence matrix for balanced and unbalanced faults. Computer programme for short circuit studies on simple system.

UNIT-5
Transient stability studies
Transient stability studies :- Modelling of synchronous machine, power system network for transient stability studies. Numerical solution of swing equation by modified Euler and Runge Kutta 4th order method. Elementary computer programme for the transient stability study.

UNIT-6:
Load Flow Studies
Load Flow Studies :- Power system load flow equation , solution technique : Gauss Seidal , Newton Raphson and fast decoupled technique with and without (voltage) control buses. Representation of tap changing and phase shifting transformers. Elementary load flow programmes.

Text books:				
1	Computer Methods in Power Systems	**1st 1968**	Stag and El – abiad	Mc Graw Hill
2	Elements of Power System analysis	**1982**	Willim D. Stevenson	Mc Graw Hill
3	Computer analysis of power system	**1982**	R. N. Dhar	Mc Graw Hill
	Modern power system analysis	**3rd-2006**	D.P. Kothari and I.J.Nagrath	TMH

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EL404/EL802	Computer Applications in Electrical Engineering	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

1. Write a program to plot the transient response of 2nd order RLC network
2. Write a program to find bus incidence matrix
3. Write a program to find B C K matrix
4. Write a program for Z_{bus} by building algorithm method.
5. Find Y_{bus} by i) Inspection.
   ii) Building algorithm.
   iii) Singular transformation
   for a given system.
6. Write flow chart & program in C to plot swing curve (t v/s δ) using step by step method.
7. Write flow chart & program in C to plot swing curve (t v/s δ) using step by Euler's method.
8. To calculate the change in power handling capacity of transmission line with change in parameters or change in distance.
9. To find I_f and V_f and other bus voltages for LG fault.
10. To find I_f and V_f and other bus voltages for LLG fault.

EL405/EL803	Simulations in Power System	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	02 Hours

Text books:				
1	Power System Analysis	2nd Edition, 2002	Hadi Saddat	Mc GrawHill
2	MATLAB Programming for Engineers	2nd Edition, 2002	S. J. Chapman	Bookware Companion Series, Thomson Brooks/Cole, Thomson Asia Pte. Ltd., Singapore
3	MATLAB and Simulink for Engineers	1st Edition, 2012	Agam Kumar Tyagi	Oxford University Press
4	MATLAB and its applications in Engineering	2009	R. K. Bansal, A. K. Goel and M. K. Sharma	Pearson Education

Reference books:		
1	Matlab Simulink manual	Mathwork
2	Sim Power system toolbox manual	Mathwork

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EL409/EL711	Optimization Technique	L=4	T=0	P=0	Credits=4
PO/PSPO – a, b, d, e, h, i, j, k					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Students will learn the concept of optimization, classical optimization techniques and linear and nonlinear method of optimization.	The student on completion will be able to understand • Concept of optimization • Classical Optimization Techniques • Linear Programming • Storage classes • Nonlinear programming

UNIT-1:- **Introduction**
Concept of optimization, Statement of optimization problem, classification of optimization problems, optimization techniques.

UNIT-2: **Classical Optimization Techniques**
Single variable optimizations, multivariable optimization with no constraints and equality & inequality constraints, solution using Lagrangian multipliers, Kunh – Tucker Conditions.

UNIT-3:- Linear Programming (Simplex method)
Application of linear programming. Standard form & geometry of linear programming problems, definitions & theorems, solution of system of linear simultaneous equations, pivotal reduction of a general system of equations, simplex algorithm.

UNIT-4:- Nonlinear programming I
One dimensional minimization methods: Introduction, unimodal functions, elimination methods, direct root methods.

UNIT-5:- Nonlinear programming II
Unconstrained optimizations techniques : Introduction, Direct search methods, Random & grid search methods, Powell's method, Indirect search method, Cauchy's method, Fletcher – Reaves method, Newton's method.

UNIT-6:- Nonlinear programming III
Constrained optimizations techniques: Introduction, characteristics of constrained problem, sequential linear programming, Zoutendijk's method of feasible directions, Rosen's gradient projection method. Introduction to software for optimization techniques, (TORA), Introduction to GA)

Text Books :-

S.N.	Name	Edition	Author	Publisher
1	Engineering Optimization: Theory & practice	Fourth Edition	S.S. Rao	John Willey Publication
2	Operations Research: An Introduction	Eighth Edition	Taha, H.A	Prentice Hall of India

Reference Books

S.N.	Name	Edition	Author	Publisher
1	Engineering Optimization : Methods and Applications	Second Edition (Wiley India Edition)	A.Ravindran, K. M. Ragsdell, G. V. Reklaitis	John Wiley Publication

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EL410/EL712	Flexible AC Transmission Systems (FACTS)	L= 4	T=0	P=0	Credits=4
PO/PSPO – a, c, e, h, i, j, k, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
To understand the problems and constraints related with stability of large interconnected systems and to study their solutions using different FACTS controllers, shunt (SVC, STATCOM), series (TCSC, GCSC, SSSC), series-shunt (UPFC), series-series (IPFC) .	A student who successfully fulfills the course requirements will be able to demonstrate the • Ability to understand and identify the problems and constraints with stability of large interconnected system. • Ability to understand different types of converters, regulators and compensators

UNIT-1: **Flexible AC Transmission Systems (FACTS)**
FACTS concept and General System Consideration, Transmission interconnections, Flow of power in an AC System, factors affecting the Loading Capability, power flow and Dynamic Stability Consideration of Interconnected Transmission. Importance of controllable Parameters, FACTS Controller.

UNIT-2: **Static shunt compensators**
SVC and STATCOM, Objectives of shunt Compensation, Methods of Controllable var Generation, Static var Compensators SVC and STATCOM, Comparison between STATCOM and Static var System (SVS).

UNIT-3 : Static Series Compensators
GCSC, TSSC, TCSC and SSSC Objectives of series Compensation, Variable Impedance Type Series compensators, Switching Converter Type Series Compensators, External (System) Control for Series Reactive Compensators.

UNIT-4: Static Voltage and Phase Angle Regulators
TCVR and TCPAR, Objectives of Voltage and phase angle regulators, Approaches to Thyristor Controlled Voltage Regulators (TCVR) and Thyristor Controlled Phase Angle Regulators (TCPAR), Switching Converter-Based Voltage and Phase Angle regulators, Hybrid Phase Angle Regulators.

UNIT-5 : Combined Compensators
Combined Compensators(UPFC,IPFC) Operating modes of UPFC, Multifunctional and Generalized FACTS controllers, Sub-synchronous resonance, NGH-SSR damping scheme

UNIT-6: Harmonic effects and Solutions
Harmonic: Causes, effects, Passive filters. Introduction to active filters (Shunt , series and hybrid)
Introduction to power quality conditioner. (DSTATCOM, DVR, UPQC).

Text books:				
1	Understanding FACTS	2001	Naryan G Hingorani and Laszlo Gyigyi	Standard Publishers
2	FACTS : Controllers in Power Transmission & Distribution	1st Edition, 2007	K. R. Padiyar	New Age International
3	Thyristor based FACTS controller for electrical transmission systems	1st Edition 2002	R. Mohan Mathur, Rajiv K Verma	Wiley

Reference books:				
1	Flexible AC Transmission System [FACTS]		Edited by Yong Hua Song and Johns	IEEE Press

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EL411/EL713	Electrical Drives-II	L=4	T=0	P=0	Credits=4
PO/PSPO – a, e, m					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
1) To study the converter and Chopper control of DC drives. 2) To study the semiconductor based control of Induction and Synchronous motors. 3) To learn the basics of Switched reluctance motor and Brushless DC motor. **4)** To Study the non conventional and renewable energy based drives.	1) The student will be able to work with confidence on the drives used in the Industry. 2) The students can carry research on the newer Switched Reluctance motor and Brushless DC motor.

UNIT-1: **Introduction to Electric Drives**
Dynamics of electric drives and control of electric drives. Energy conservations in electric drives.

UNIT-2: **D.C. Drives**
Controlled rectifier fed D.C. drives, single phase and three phase rectifier control of Separately excited D.C. motor; Dual Converter control of separately excited D.C. motor; Power factor, supply harmonics and ripples in motor current; Chopper controlled of separately excited dc motor; chopper control of series motor; source current harmonics.

UNIT-3 : Induction Motor Drives
Stator voltage control, v/f control, static rotor resistance control, slip power recovery schemes , variable frequency control using voltage source inverter. Current sources inverter and cyclo converter, Introduction to vector control of Induction motor.

UNIT-4: Synchronous Motor Drives
Starting and Braking of Synchronous motor; variable frequency control; self controlled synchronous motor drive employing load commutated thyristor inverter , Introduction of Cyclo-converter control of Synchronous motor; starting of large synchronous motors.

UNIT-5 : Special Motors Drives
Brush less dc motor, stepper motor switched reluctance motor drives and eddy current drives. Introduction to solar and battery powered drives.

UNIT-6: Traction Drives
DC and AC traction drives, semiconductor converter controlled Drives; 25 KV AC traction using semi conductor converter controlled dc motor; DC traction using semiconductor chopper controlled dc motors; polyphase AC motors for traction drives.

Text books:				
1	Fudamenta1s of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
2	Modern Electric Traction	2003	H.Pratap	Dhanpatrai & Company
3	Electric drives concepts and applications	2005	V.Subramaniam	Tata McGraw Hill
4	Electric Motor Drives	2001	R. Krishnan	Prentice Hall India

Reference books:				
1	Electrical Machines Drives and Power Systems	6th edition 2008	Theodore Wildi	Pearson Education

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EL412/EL810	Electrical Energy Audit and Safety	L= 4	T=0	P=0	Credits=4
PO/PSPO – a, b, d, f, h, l, m					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Students will understand the various aspects of energy management audit monitoring and safety.	The student on completion will be able to Understand • Energy Scenario • Basics of Energy and its various forms • Energy Management & Audit • Energy Monitoring and Targeting • Global environmental concerns • Electrical Safety

UNIT-1: **Energy Scenario**
Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.

UNIT-2: **Basics of Energy and its various forms**
Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT-3 : **Energy Management & Audit**
Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

UNIT-4: Energy Monitoring and Targeting
Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).

UNIT-5 : Global environmental concerns
United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

UNIT-6: Electrical Safety
Primary hazards associated with electricity. control measures and safety-related work practices to minimize the risk associated with electrical hazards. response procedures in the event of electrical shock or fire.

Text books:				
1	Principles of Energy Conservation	1991	Archie, W Culp	McGraw Hill
2	Energy management handbook	8th Edition	Wayne C. Turner	John Wiley and Sons
3	Bureau of Energy Efficiency Study material for Energy Managers & Auditors Examination	--	---	Bureau of Energy Efficiency www.beeindia.in
Reference books:				
1	Handbook on Energy Audits and Management		Amit Kumar Tyagi	TERI

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Department of Electrical Engineering
Semester VII

EL413/EL811	Utilisation of Electrical Energy	L= 4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
To understand the basic principle of electrical heating, welding, illumination, refrigeration and air conditioning, fans, pumps, compressors and digi sets.	The student on completion will be able to Understand the application of electrical energy in • Electric Heating • Electric Welding • Illumination • Refrigeration & Air conditioning • Fans & Pumps • Compressors and DG Sets

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UNIT-1: **Electric Heating**

i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat, type
ii) s & application of electric heating equipments, transfer of heat.
iii) Resistance Ovens : General constructions, design of heating elements, efficiency & losses, radiant heating.
iv) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating.
v) Dielectric heating: Principle and application.
vi) Arc furnace : Direct & indirect arc furnace, power supply, characteristics & control.

UNIT-2: **Electric Welding:**

i) Importance, Advantages & Disadvantages of welding, classification of welding processes.
ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding.
iii) Electric arc welding: carbon arc welding, metal arc welding, submerged arc welding, Stainless Steel welding
iv) Ultrasonic welding, electron beam welding, laser beam welding.

UNIT-3 : **Illumination :**

Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.

UNIT-4: Refrigeration & Air conditioning:

Terminology, refrigeration cycle, refrigeration systems (Vapor compression, vapor absorption), domestic refrigerator, water cooler, desert cooler.
Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.

UNIT-5 : Fans & Pumps:

Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportunities.
Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system.

UNIT-6: Compressors and DG Sets:

Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets.

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EL413/EL811	Utilisation of Electrical Energy	L= 4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Utilization of Electric Energy	1st Edition, 2006	E. Openshaw Taylor	Orient Longman
2	Utilization of Electric Power & Electric Traction	Edition, 2009	J.B. Gupta	Kataria & Sons
3	Art and Science of Utilization of Electrical Energy		H Partap	Dhanpat Rai & Sons, Delhi
4	Utilisation of Electrical power	1st Edition, 2006	R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:				
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International

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Dean (Acad. Matters)		Version	1.01	

Department of Electrical Engineering
Semester VIII

EL416/EL816	Switchgear and Protection	L= 3	T=0	P=0	Credits=3
PO/PSPO – a, b, c, e, i, j , m					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Students will understand • the theory and applications of the main components used in power system protection. • the protection systems used for electric machines, transformers, bus bars, transmission lines. • the theory, construction, and applications of main types of circuit breakers. • to design the feasible protection systems needed for each main part of a power system	At the completion of the subject, students will be able to perform the following tasks: • Theory & application of main components used in power system protection. • Protection systems used for electric machines, transformers, bus bars, transmission lines. • Theory, construction, and applications of main types of circuit breakers. • Design the protection systems needed for each main part of a power system

UNIT-1: **Introduction**
General Philosophy of Protective Relaying:- Protective Zones. Primary Protection, Back up protection. Primary and Local Back Up. Selectivity, Fuse (wire and HRC).

UNIT-2: **Overcurrent Protection**
Medium voltage Line Protection: Overcurrent relaying, directional overcurrent relays.

UNIT-3 : Distance protection
High voltage line Protection :- Distance relays, carrier distance schemes, Unit carrier schemes.

UNIT-4: Static relays :
Introduction to static relays: Comparison of static and electro-mechanical relays, two input amplitude and phase comparators and their duality, Generation of various distance relay characteristics using above comparators.
Circuit breakers
Switchgear :- Circuit breakers Arc interruption theory, recovery and Restriking voltage ,RRRV, breaking of inductive & capacitive currents, C. B. rating, different media of arc interruption, overview of oil circuit breakers, Air blast, SF6 and vacuum breakers.

UNIT-5 : Equipment Protection
Equipment Protection: Principles of differential relaying, protection, transformers and busbars by differential relaying and other relays. Miniature circuit breakers, moulded case circuit breaker, release, earth leakage circuit breaker.

UNIT-6: Equipment Protection
Protection of Generators & Induction Motors.

Text books:				
1	Switchgear and Protection	**1990**	S. S. Rao	Khanna
2	Switchgear and Protection	**2006**	Bhide and Paithankar	PHI
3	Power System Protection and Swithgear	**1st 1999**	Badri Ram	TMH.

Reference books:				
1	The Art and science of protective relaying	**1992**	Russel, Mason	Wiley Eastern
2	Computer relaying for power system	**2009**	Arun G. Phadke and James S. Thorpe	John Wiley

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EL417/EL817	Switchgear and Protection	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	02 Hours

1) To plot the characteristic of IDMT relay ICM 21N.
2) To plot the characteristic of directional relay with calculation of maximum torque angle.
3) To plot the characteristic of reactance relay.
4) To plot the characteristic of impedance relay.
5) To plot the characteristic of fuse wire.
6) To study the differential protection of single phase transformer.
7) To plot characteristics of numerical relay MC61C.
8) To study the undercurrent & overcurrent relay.
9) To study the harmonic restraint effect on differential relay.
10) To plot the characteristic of earth fault relay.
11) To study undervoltage relay.
12) To study air circuit breaker.
13) Study of MICOM P430
14) To plot characteristics of MCB
15) To study operation of BMR
16) To study operation of ELCB
17) Study of (quasar) intelligent panel meter
18) Study of relay test set

EL418/EL818	Substation Design	L=0	T=0	P=4	Credits=4

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

Learning Objectives	Learning Outcomes
The student will understand different aspects of substation design that is layout drawing, earthing drawing, lighting drawing and cable wiring.	Practical based on following topics may be performed. 1) One Line diagram 2) Switchyard and control panel layout for 132 and 11 kV substation. 3) Lighting layout of substation and switchyard. 4) Substation earthing.

Practical based on following topics may be performed.

1) One Line diagram
2) Switchyard and control panel layout for 132 and 11 kV substation.
3) Lighting layout of substation and switchyard.
4) Substation earthing.

Text books:				
1	Handbook of Electrical power Distribution	2nd Edition	Gorti Ramamurthy	University Press
2	Electric Power Distribution	4th edition, 1997	A.S. Pabla	Tata Mc Graw-Hill Publishing Company

EL421/EL807	Power Quality Conditioning and Monitoring	L= 3	T=0	P=0	Credits=3
PO/PSPO – a, e, h, i, j, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Students will understand the various power quality issues, harmonics, filter designs and power quality improvements using custom power devices.	The student on completion will be able to Understand • Overview and definition of power quality • Voltage sag analysis • Harmonics • Filter Design • Analysis and Conventional Mitigation Methods • Power Quality Improvement using custom power devices

UNIT-1: **Overview and definition of power quality**
Overview and definition of power quality (PQ): Sources of pollution and regulations, Power quality problems: rapid voltage fluctuations voltage unbalance, Voltage dips and voltage swells, Short duration outages, long duration variations, power acceptability curves.

UNIT-2: **Voltage sag analysis**
Definitions Voltage sag analysis: Sag caused by motor starting, Sag caused by utility fault clearing, Sag magnitude and duration calculations, RMS voltage, calculation in single phase systems, Computers, AC and DC drives etc. performance in presence of sag.

UNIT-3: Harmonics
Harmonic Distortion: Power system harmonics: Harmonic analysis, Harmonic sources and their effects, the static converters, Transformer magnetization and non – linearities, Arc furnaces, Fluorescent lighting. Introduction to power converters, Fourier analysis, Total harmonic distortion, rms & average value calculation, Effects of harmonic distortion and Flickers.

UNIT-4: Filter Design
Filters: passive filters, active filters, hybrid filter design and working principles.
UNIT-5 : Analysis and Conventional Mitigation Methods
Analysis: Extraction of fundamental sequence components, reference theories, voltage sag reduction, harmonic reduction, introduction to network configuring devices.

UNIT-6: Power Quality Improvement using custom power devices
Custom Power Devices: Introduction to custom power devices, Dynamic Voltage Restorer (DVR) , Distribution Static Compensator (DSTATCOM) and Unified Power Quality Conditioner (UPQC), Control strategies, status of application of custom power devices.

Text books:				
1	Electrical Power Systems Quality	2nd edition.	R. C. Dugan, M.. F. Mcgranaghan	McGraw-Hill
2	Power Quality		C. Sankaran	CRC Press
3	Understanding Power Quality Problems: Voltage sag and interruptions	2002	M. H. Bollen	John Willey

Reference books:				
1	Power System Harmonics	2nd edition, 2003	J. S. Arillaga	Wiley
2	Power Quality Enhancement using custom power devices	2002	Arindam Ghosh	Kluwer Academic Publishers

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EL422/EL808	Power System Operation and Control	L= 3	T=0	P=0	Credits=3
PO/PSPO – a, b, e, i, j, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
The student will understand the economic aspects of power system operation, methods of power frequency control, economic dispatch control, reactive power control and voltage control.	The student on completion will be able to Understand • Economic Aspects • Pre requisite of Load Dispatching • Load Frequency Control (LFC) • Economic Dispatch Control • Reactive Power Control • Voltage Control

UNIT-1: **Economic Aspects**
Introduction, system load characteristics curves-chronological load curves-load duration curves-energy time curves load factor utilization factor-diversity factor- coincidence factor- demand factor- reserve requirements installed reserve- spinning reserve- cold reserve- hot reserve – operational restrictions, load dispatching.

UNIT-2: **Pre requisite of Load Dispatching**
Load forecasting- components of system load- classification of base load- forecasting of the base load by method of least square fit introduction to unit commitments unit commitment using priority ordering.

UNIT-3 : Load Frequency Control (LFC)
Introduction, necessity of maintaining frequency constant, LFC (P-f control & Q-V control). LFC control of a single area static & dynamic analysis of uncontrolled system proportional plus integral control of a single area LFC control of two area system uncontrolled case static & dynamic response Tie line with frequency bias control of two area.

UNIT-4: Economic Dispatch Control
Incremental cost curve- co-ordination equations with loss included (No derivation of B_{mn} coefficient) solution of co-ordination equations using B_{mn} co-efficient by iteration method Base point & participation factors- Economic dispatch controller added to LFC.

UNIT-5 : Reactive Power Control
Introduction, objective of load compensation, theory of load compensation, uncompensated transmission line, compensated transmission line, shunt compensator, series compensator, basic relationship for power flow control, Sub synchronous resonance, comparison of different types of compensating equipment for transmission systems,

UNIT-6 : Voltage Control
Introduction, necessity of voltage control, generation and absorption of reactive power, location of voltage control equipment, methods of voltage control, rating of synchronous phase modifier.

Text Book :				
1	Power System Operation and control		S. Sivanagarjuand G. Srinivasan	Pearson Publisher
2	Power System Stability and control		P. Kundur	TMH Publisher
3	Elecric Power system		C. L. Wadhwa	
4	Economic Operation of power system studies		L. K. Kirchmayer	Wiley Eastern India, New Delhi
5	Power System Analysis Operation and Control	3rd Edition, 2010	Abhijit Chakrabarti, Sunita Halder	PHI Learning Pvt. Ltd.

Reference books:				
1	Power Generation, Operation and control	2nd Edition	A. J. Wood and B.F. Woolenberg	John Wiley & Sons

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EL423/EL809	Transients in Power System	L= 3	T=0	P=0	Credits=3
PO/PSPO – a, e, i, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Student will learn the causes of transients in power system, switching transients, overvoltage due to lightening and travelling waves.	The student on completion will be able to Understand • Causes of Transients in Power systems • Abnormal Switching Transients • Three Phase Circuit transients • Traveling waves • Lightning • Protection

UNIT-1: **Introduction**
Transients in Power systems: Simple switching transients, Circuit closing and recovery transients, Arcing grounds, double frequency transients, Damping, resistance switching.

UNIT-2: **Abnormal Switching Transients**
Abnormal Switching Transients:, Current chopping, Capacitance switching, Ferro-resonance, Transformer magnetizing inrush currents, re-striking phenomenon and its effects on recovery voltage.

UNIT-3 : **Three Phase Circuit transients**
Transient in three phase circuits: Switching of three phase transformers, effect of types of neutral connection, three phase capacitance switching, Symmetrical component method of analysis of three phase switching transients, effect of open conductors.

UNIT-4: Traveling waves
Traveling Waves: Traveling waves in transmission lines, reflection and refraction of waves, Typical cases of effects of line terminators, Equivalent circuit for traveling wave studies, Forked line, Reactive termination, Bewley lattice diagram, multi conductor systems.

UNIT-5 : Lightning
Lightning: Lightning phenomenon, over voltage due to lightning, lightning arrestors.

UNIT-6: Protection
Protection against transients: Protection of power systems against transient over-voltage due to switching and lightning, surge diverters, surge capacitors, and reactors, Overhead ground wires, Insulation Coordination, Computer aids to calculate transient (EMTP).

Text books:				
1	Electrical Power System	5th Edition 2009	C. L. Wadhawa	New Age International
2	Power System analysis	2008	I. J. Nagrath & D. P. Kothari	PHI, India

Reference books:				
1	Electrical Transients in Power Systems	2 edition 1994	Allan Greenwood	Wiley Interscience
2	Power System Transients: Statistical Approach	**2002**	C. S. Indulakar and D. P.Kothari	PHI publisher

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Dean (Acad. Matters)		Version	1.00	

EL424/EL822	EHVAC – HVDC Transmission	L=3	T=0	P=0	Credits=3
PO/PSPO – a, c, e, h, i, j, k, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Students will understand various aspects of Transmission systems, controlling systems for power flow controls, design parameters of filters and Layout of HVDC power plant	On Successful Completion of the course the Student will be able to demonstrate the following task: • Power handling capacity of different Transmission systems • Electrostatic and electromagnetic fields and corona • The differences between AC and DC Transmission systems. • Different controlling systems for power flow controls.(Voltage control, current control.) • The knowledge of design parameters of AC filters as well as DC filters and Reactive power compensation • Overall knowledge about the layout of HVDC power plant.

UNIT-1: P**ower handling and voltage gradient**
1)Power handling capacities of EHV AC transmission lines.
2)Voltages gradients : Electric field of point charge, sphere gap line-charge. Single and three phase lines, and bundled conductors. Maxwell's potentials coefficients, Mangoldt Formula.

UNIT-2: **Electrostatic and electromagnetic fields of EHV lines & corona**
1) Electrostatic and electromagnetic fields of EHV lines, electric shock and Threshold current , calculation of electrostatic field of A.C. lines (3 phase single and double circuit lines only). Effect of high electrostatic field.
2) Corona: Types, critical disruptive voltages, Factors affecting corona, Methods for reducing corona power loss (empirical formula), corona current waveform, audible noise and radio interference.

UNIT-3 : **HVDC Power transmission**
DC Power transmission technology:- Introduction, comparison of AC and DC Transmission, application of DC transmission, Description of DC transmission system, configuration, planning for HVDC transmission, types of DC link. Introduction to HVDC light, Earth electrode and earth returns.: Introduction, objectives, location and configuration, resistance of electrodes, means of reducing earth electrode resistance, troubles caused by earth current and remedies.

UNIT-4: Analysis of HVDC converters
Analysis of HVDC converters:- Pulse number, choice of converter configuration, simplified Graetz circuit, converter bridge characteristics, characteristics of twelve pulse converter Power flow control in HVDC system :- Constant current. Constant voltage, constant ignition and excitation angle control, control characteristics.

UNIT-5 : Harmonic Filters &Reactive power compensation
Harmonic Filters :- Introduction, Filters, surge capacitors and damping circuits, shunt filters, series filters, AC filters, design of AC filters and tuned filters, double frequency and damped filters, cost considerations and ratings. Harmonics on D.C side of converters. DC Harmonics filters.
1) Reactive power compensation: - Reactive power requirement of HVDC converters, substations.

UNIT-6: HVDC circuit breakers
1) HVDC circuit breakers :- Introduction, construction and principle of operation. Interruption of DC current, application of MRTB, Type of HVDC circuit breaker, capability and characteristics of HVDC circuit breakers .
2) HVDC Substation protection against short-circuits : Introduction , fault clearing, protective zones, HVDC line pole protections (fault clearing and re-energizing).

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EL424/EL822	EHVAC – HVDC Transmission	L=3	T=0	P=0	Credits=3
PO/PSPO – a, c, e, h, i, j, k, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	EHV AC & HVDC Transmission & Distribution	**3rd-2006**	S. Rao	Khanna
	EHV AC Transmission	2nd	Begamudre	New Age international Publisher
2	Power system Stability and Control	**2nd - 2006**	P. Kundur	Publisher
3	HVDC Transmission Systems		J. Arrilaga	**Publisher**

Reference books:				
1	HVDC Power Transmission System	**1st-2002**	K.R. Padiyar	Publisher

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EL425/EL823	Electrical Power Utilisation	L=3	T=0	P=0	Credits=3
PO/PSPO – c, e, h, i, k, l, m					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Student will understand The knowledge about energy utilization The application of electrical energy such as lighting, heating, welding, fans and pumps.	The student on completion will be able to understand the basics of electrical power utilization in various applications.

UNIT-1: **Electric Heating**
Introduction, Advantages of electric heating, modes of heat transfer, methods of electric heating, resistance heating, arc heating, arc furnaces, induction heating, dielectric heating, infrared and radiant heating.

UNIT-2: **Electric Welding:**
Definition, welding process, resistance electric welding, electric arc welding, submerged arc welding, MIG welding, Ultrasonic welding, laser beam welding, welding of various metals, underwater welding, defects in welding, testing of welding joints.

UNIT-3 : **Illumination :**
Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.

UNIT-4: Refrigeration & Air conditioning:
Terminology, refrigeration cycle, refrigeration systems (Vapor compression, vapor absorption), domestic refrigerator, water cooler, desert cooler.
Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.

UNIT-5 : Fans & Pumps:
Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportunities.
Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system.

UNIT-6: Compressors and DG Sets:
Compressors: Compressor types, Compressor efficiency, Compressed air system components.
Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets.

Text books:				
1	Utilization of Electric Energy		E. Openshaw Taylor	Orient Longman
2	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
3	Art and Science of Utilization of Electrical Energy		H Partap	Dhanpat Rai & Sons, Delhi
4	Utilisation of Electrical power	1st Edition, 2006	R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:				
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International

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EL426/EL824	Digital Signal Processing	L=3	T=0	P=0	Credits=3
PO/PSPO – a, b, c, e, i, k					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Student will understand the various transform methods and design of signles in discrete time and frequency domain.	The student on completion will be able to understand • Discrete Time Signals and systems • Frequency Domain Representation • Z-transform • Discrete Design technique • Design Fourier transform

UNIT-1: **Discrete Time Signals and systems**
Discrete Time Signals, Discrete Time Systems, Linearity, causality, stability, static/dynamic. Time invariance/Time variance, classification of Discrete Time Systems, Linear convolution, circular convolution, Auto correlation. Linear constant coefficient difference equations, sampling theorem and sampling process, reconstruction of sampling data, convolution.

UNIT-2: **Frequency Domain Representation**
Frequency Domain Representation of discrete time signals and systems. Fourier Transform of discrete time signals. Properties of discrete time Fourier transform.

UNIT-3 Z-transform
The Z-transform definition, Z-transform properties, Inverse Z-transform using contour Integration, complex convolution theorem, Parseval's unilateral Z-transform, stability interpretation using Jury's array.

UNIT-4:LTI systems
Transform Analysis of LTI systems and structures for discrete time systems, Frequency response of LTI systems, relationship between magnitude and phase, all pass systems, minimum phase system, linear system with generalized linear phase.
Block diagram representation and signal flow graph representation of linear constant. Coefficient difference equation, basic structure for IIR systems, transposed forms, and basic network structures for FIR systems lattice structures.

UNIT-5 Discrete Design technique
Design of discrete time IIR filters from continuous time filters, frequency transformation of low pass IIR filters, Design of FIR filter by windowing FIR filter design by Kaiser window method, frequency sampling method.

UNIT-6:Design Fourier transform
Design Fourier transform-discrete Fourier series, properties of discrete Fourier series, discrete Fourier transform, properties of DFT, circular convolution using discrete Fourier transform, decimation in time FFT algorithm, decimation in frequency FFT, FFT of long sequence using overlap add and overlap save method.

Text books:				
1	Discrete Time Signal Processing	2nd-2004	Etalon V.Oppenheim, Ronald W.Schafer & Buch	Pearson.
2	Digital Signal Processing : A computer based approach	2008	Sanjit Kumar Mitra	TMH
	Digital Signal Processing: A Practical Approach	2002	Emmanuel C. Ifeachor, Barrie W. Jervis	Prentice Hall of India Ltd.

Reference books:				
1	Digital Signal Processing : Theory and Application	3rd edition	Proakis and Manolakis	PHI Ltd.

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EL427/EL825	Artificial Intelligence Based Systems	L=3	T=0	P=0	Credits=3
PO/PSPO – b, e, i, k, l, m					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Student will understand The concept of fuzzy logic and neural network The basic concepts and mathematical models of fuzzy and neural network are covered	On completion of the subject, student will able to perform the following task • Fundamental concept of fuzzy systems • Non-linear fuzzy control • Artificial neural network • Recurrent network • Associative Memories & self organizing network

UNIT-1: **Introduction :-**
Fundamental concepts of fuzzy systems
1. Fuzzy sets, Approximate reasoning Representing set of rules.
2. Fuzzy knowledge based (FKBC) parameters. Introduction rule and data base inference engine, choice of fuzzification and defuzzification processes.

UNIT-2: **Nonlinear fuzzy control**
Introduction, Control problem, FKBC as nonlinear transfer element, types of FKBC.

UNIT-3 : **Adaptive Fuzzy control**
Introduction, design and performance evaluation, main approach to design.

UNIT-4: Artificial Neural Network
1. Fundamental concept of ANN.
2. Model of artificial Neural network (ANN), Learning & adaptation learning rules.

Feed forward networks:
Classification Model, features & decision, regions, Minimum distance classification, perceptron, delta learning rules for multi perceptron layer, Generalized learning rules, back propagation algorithm, back propagation training, learning factors.

UNIT-5 Recurrent networks
Mathematical foundation of discrete time & gradient type Hopfield networks, transient response & relaxation modeling.

UNIT-6: Associative memories & self organizing networks
Basic concept & performance analysis of recurrent associative memory, Bi-directional associative memory, Hamming net & MAXNET Unsupervised learning of clusters, counter propagation network, feature mapping, self organizing feature maps, cluster discovery network.

Text books:				
1	Introduction of Artificial Neural Networks	1992	Jacek Zurada	JPH
2	Neural Network & Fuzzy Systems	1992	Bart Kosko	Prentice Hall of India
3	Neural Networks	2009	Simon Haykin	(Maxwell) Macmillan Canada Inc.) Comprehensive Foundation
4	An Introduction to Fuzzy Control	2010	D. Drianko	Springer
5	Fuzzy sets: Uncertainty & information	1988	Klir & Folger	Prentice Hall of India
6	Digital Image Processing (AWPC)		Gonzalez.	

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EL 428/EL826	Power Plant Instrumentation	L=3	T=0	P=0	Credits=3
PO/PSPO – b, e, i, k, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Student will understand the overview of different techniques of instrumentation used in power generation	On completion of the subject, student will able to perform the following task Instrumentation for Power Generation Transducers Signal Conditioning Measurements in Power Plants Power System Instrumentation-I Power System Instrumentation-II (Advance Instrumentation)

UNIT-1: **Instrumentation for Power Generation**
Instrumentation requirements for Hydro, thermal, nuclear, solar and wind power generators, Thermal power plants, Block diagram, Details of boiler processes, UP&I diagram of boiler, Cogeneration.

UNIT-2: **Transducers**
Construction & Operating Characteristics of active and digital transducers, Measurement of temperature, pressure, displacement, acceleration, noise level, Instrumentation for strain, displacement, velocity, acceleration, force, torque and temperature.

UNIT-3 Signal Conditioning
Instrumentation amplifiers, isolation amplifiers, analog multipliers, analog dividers, function generators, timers, sample and hold, optical and magnetic isolators, frequency to voltage converters, temperature sensors. Shielding and grounding.

UNIT-4: Measurements in Power Plants
Non electrical parameters – Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum level measurement – Radiation detector – Smoke density measurement – Dust monitor.

UNIT-5 Power System Instrumentation-I
Measurement of voltage, current, phase angle, frequency, active power and reactive power in power plants. Energy meters and multipart tariff meters.

UNIT-6: Power System Instrumentation-II (Advance Instrumentation)
Performance of Instruments Advanced instrumentation in power systems – Digital CT's, optical CT's etc. and their transient response. Capacitive voltage transformers and their transient behavior, Current Transformers for measurement and protection, composite errors and transient response

Text books:				
1	The control of Boilers	1991	Sam G. Dukelow	Instrument Society of India
2	Power Plant Engineering	2001	P. K. Nag	Tata Mcgraw Hill
3	Modern Power Station Practice: Instrumentation, controls and testing			Central Electricity Generation Board, Great Britan
4	Standard Boiler Operations	1994	S.M. Elonka and A.L. Kohal	Tata McGraw Hill, New Delhi
5	Mechanical and Industrial Measurements	1995	R. K. Jain	Khanna Publishers, New Delhi
6	Power Plant Engineering	1998	E. Al. Wakil	Tata McGraw Hill

EL 429/EL827	Electrical Distribution Systems	L=3	T=0	P=0	Credits=3
PO/PSPO – b, c, e, h, i, l					

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Student will be able to understand the various aspects	On completion of the subject, student will able to perform the following task • Load Forecasting • Distribution Feeders • Overhead lines and Cables • Reactive power compensation and applications of capacitors • Substation & Metering, instrumentation & Tariffs • Distribution automation (DA) & SCADA

UNIT-1: **Load Forecasting**
Introduction, Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor, load & load characteristics, load and load duration curve, relation between load and loss factor, load curve and diversified demand, load modeling,load growth and forecasting.

UNIT-2: **Distribution Feeders :**
Introduction, Primary and secondary distribution, Radial and loop types, Distribution substation location and planning, Feeder loading and voltage drop considerations, Voltage drop in feeder with different loading, Engineering considerations for voltage levels and loading, causes of unbalance and unequal drops, common faults in feeders, fault location, fault isolation, restoration.

UNIT-3 : Overhead lines and Cables
Introduction, Line parameters, Overhead lines, insulators and supports, cables, Insulation resistance, Voltage drop and power loss in conductors, voltage drop in ac single phase distribution system, voltage drop computation based on load density, voltage drop in underground cable distribution.

UNIT-4: Reactive power compensation and applications of capacitors
Introduction, advantages and benefits of power factor improvement, power factor improvement using capacitors :mathematical calculations, location of capacitors, application of capacitor banks for power factor improvement, sub harmonic oscillations and ferro resonance due to capacitor banks, optimum power factor for distribution system.

UNIT-5 : Substation & Metering, instrumentation & Tariffs
Introduction, substation types, substation components, equipment and layouts, substation location and size, Grounding, earth connection and earthing system, measurement of power, measurement of energy, maximum demand and trivector meter, automatic meter reading (AMR), AMR systems, substation instrumentation, tariffs and billing.

UNIT-6: Distribution automation (DA) & SCADA
Problems with existing distribution systems, need for distribution automation, distribution automation, feeder automation, communication requirements for DA. Remote terminal unit (RTU), Block diagram of SCADA, Components of SCADA, Functions of SCADA, SCADA applied to distribution automation, Advantages of DA through SCADA,DA integration mechanisms, Functions of substations automation systems, state and trends of substation automation.

Text books:				
1	Electrical power Distribuion Systems	2009	V. Kamaraju	Tata Mcgraw Hill Education Private Ltd., New Delhi
2	A Text Book of Electric Power Distribution Automation	1st Edition, 2010	Dr. M. K. Khedkar and Dr. G. M. Dhole,.	University Science Press

Reference books:				
1	Electric Power Distribution	4th edition, 1997	A.S.Pabla	Tata Mc Graw-Hill Publishing Company

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YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

B.E. (Electronics Engineering)

SCHEME OF EXAMINATION 2010

Sl.No.		Subject	L	T	P	Total Contact Hours	Credits	% Weightage				ESE Duration
								MSE - I	MSE - II	TA	ESE	
SEMESTER VII												
1	GE404	Engineering Economics	3	0	0	3	3	15	15	10	60	3 Hrs
2		Prof. Elective 2	4	0	0	4	4	15	15	10	60	3 Hrs
3		Prof. Elective 2 Laboratory	0	0	2	2	1			40	60	
4	EE407	Electronics Circuit Design	3	1	0	4	4	15	15	10	60	3 Hrs
5	EE408	Electronics Circuit & Design Laboratory	0	0	2	2	1			40	60	
6	EE409	Digital Communication	4	0	0	4	4	15	15	10	60	3 Hrs
7	EE410	Digital Communication Laboratory	0	0	2	2	1			40	60	
8		Free Elective 2	4	0	0	4	4	15	15	10	60	3 Hrs
9	EE412	Project Phase 1	0	0	4	4	4			40	60	
10	EE413	Industrial Training	0	0	0	0	2			100		
		Total	**18**	**1**	**10**	**29**	**28**					
	EE401	PE 2 : Embedded System	4	0	0	4	4	15	15	10	60	
	EE402	PE 2 :Embedded System Laboratory	0	0	2	2	1			40	60	
	EE403	PE 2 :Digital CMOS Circuits	4	0	0	4	4	15	15	10	60	
	EE404	PE 2 :Digital CMOS Circuits Laboratory	0	0	2	2	1			40	60	
	EE405	PE 2 :Algorithm & Data Structure	4	0	0	4	4	15	15	10	60	
	EE406	PE 2 :Algorithm & Data Structure Laboratory	0	0	2	2	1			40	60	
	EL412	FE2 : Electrical Energy Audit and Safety	4	0	0		4	15	15	10	60	
	EL413	FE2 : Utilisation of Electrical Energy	4	0	0		4	15	15	10	60	
	CV418	FE 2 : Elements of Earthquake Engineering	4	0	0	4	4	15	15	10	60	
	CV419	FE 2 : Air Pollution & Solid Waste Management	4	0	0	4	4	15	15	10	60	
	ME429	FE 2 : Total Quality Management	4	0	0	4	4	15	15	10	60	
	ME430	FE 2 : Reliability Engineering	4	0	0	4	4	15	15	10	60	
	CT411	FE2 : Multimedia and Animation	4	0	0	4	4	15	15	10	60	100
	CT412	FE2 : Current Trends and Technologies	4	0	0	4	4	15	15	10	60	100
	IT408	FE2 : Applications of Computer Networking	4	0	0	4	4	15	15	10	60	3 Hrs
SEMESTER VIII												
1	GE405	Engineering Management	3	0	0	3	3	15	15	10	60	3 Hrs
2		Prof. Elective 3	4	0	0	4	4	15	15	10	60	3 Hrs
3		Prof. Elective 4	3	1	0	4	4	15	15	10	60	3 Hrs
4		Prof. Elective 4 Laboratory	0	0	2	2	1			40	60	
5		Prof. Elective 5	4	0	0	4	4	15	15	10	60	3 Hrs
6		Prof. Elective 5 Laboratory	0	0	2	2	1			40	60	
7	EE433	(EDA)Electronics Design Automation Laboratory	0	0	2	2	1			40	60	
8	EE430	Comprehensive Viva-voce	0	0	0	0	2			40	60	
9	EE431	Extra Curricular / Competitive Exam	0	0	0	0	2			100		
10	EE432	Project Phase 2	0	0	6	6	6			40	60	
		Total	**14**	**1**	**12**	**27**	**28**					
	EE414	PE 3 : Computer Communication Network	4	0	0	4	4	15	15	10	60	
	EE415	PE 3 :Operating System Concepts	4	0	0	4	4	15	15	10	60	
	EE416	PE 3 :Biomedical Instrumentation	4	0	0	4	4	15	15	10	60	
	EE417	PE 4 :Soft Computing	3	1	0	4	4	15	15	10	60	
	EE418	PE 4 :Soft Computing Laboratory	0	0	2	2	1			40	60	
	EE419	PE 4 :Analog VLSI Design	3	1	0	4	4	15	15	10	60	
	EE420	PE 4 :Analog VLSI Design Laboratory	0	0	2	2	1			40	60	
	EE421	PE 4 :Optical Communication	3	1	0	4	4	15	15	10	60	
	EE422	PE 4 :Optical Communication Laboratory	0	0	2	2	1			40	60	
	EE423	PE 5 :Object Oriented Programming	4	0	0	4	4	15	15	10	60	
	EE424	PE 5 :Object Oriented Programming Laboratory	0	0	2	2	1			40	60	
	EE425	PE 5 :Wireless Communication	4	0	0	4	4	15	15	10	60	
	EE426	PE 5 :Wireless Communication Laboratory	0	0	2	2	1			40	60	
	EE427	PE 5 :Digital Image Processing	4	0	0	4	4	15	15	10	60	
	EE428	PE 5 :Digital Image Processing Laboratory	0	0	2	2	1			40	60	

Chairperson		**Date of Release**	May 2013	**Applicable for**
Dean (Acad. Matt.)		**Version**	**1.03**	**AY 2013-14 Onwards**

GE404/ GE607	Engineering Economics			L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Objective	Outcome
➢ The major learning objectives are to understand of the Economics of Engineering, which includes the Time Value of money and the Mathematics of Finance.	➢ It helps in analyzing the various types of demand which enable the students to arrive at reasonable estimates of demand for product of his company. ➢ As a studying marketing & finance often helps us become more savvy consumers. ➢ It is more concerned with decision making to make the best under a given situations & to be ethically and socially responsive to the needs of society . ➢ It helps to formulating strategies to exploit rewarding opportunities thereby maximizing its return on investment. ➢ Students are expected to understand & demonstrate the effect of time value of money, depreciation & foreign currency, trade.
Mapped Program Outcomes :c,h,i,j	

UNIT-1: Importance of Economics, concept of macro & micro economics, Demand Utility and Indifference curves, Approaches to analysis of demand, Elasticity of demand, Measures of demand elasticity Factors of production. Advertising elasticity, Marginalism.
UNIT-2: Factors of Production, Laws of returns and costs, Price and output determination under perfect competition, Monopoly, Monopolistic competition, oligopoly, Depreciation and methods for its determination.

UNIT-3 Value of money, index numbers, inflation, deflation stagflation, nature and meaning of economic development and growth, role of capital accumulation in economic development.

UNIT-4: Functions of central and commercial banks Inflation, Deflation, Stagflation, Direct and Indirect taxes. . Monetary and cycles, new economic policy, Liberalisation, Globalisation, privatization, market friendly state, fiscal policy of the government, Meaning and phases of business.

UNIT-5 Sources of public revenue, classification of taxes, direct taxes, indirect taxes, income of wealth and expenditure , corporation tax, tax on business , taxation and functions of money market, bills of exchange, hundis
UNIT-6: Pattern and composition of India's foreign trade, Free Trade, Trade Vs Protection , Export Promotion, Foreign Exchange Market, Methods and objectives of exchanges control, IMF, IBRD, GATT

Text books:				
1	Modem Economics	13th EditionDate: 2009.	by H.L. Ahuja	S. Chand Publisher
2	Modem Economic Theory	3rd edition Date: 2007	by K.K. Dewett.	S. Chand Publisher
3	Monetary Economics	Edition1990	by M.L. Seth	Lakshmi NarainAgrawal
4	Industrial Management		by I.K. Chopde, A.M. Sheikh.	

Reference books:				
1	Business Organization and Management	2002	S.A. Sherlekar	
2	Managerial Economics	Sixth Edition, 1968	Joel Dean.	New Delhi : Prentice Hall of India Private Ltd.
3	Managerial Economics	2010. Edition, Third	Pylee.	Government Publications
4	Economics		Samuelson.	

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EE401 / EE711	Embedded System	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To understand the concept of Embedded System, ARM Architecture & RTOS. ➢ To understand different functional blocks like ADC, DAC, RTC,I2C etc. ➢ To understand device programming concepts.	➢ Students will be familiar with ARM7 architecture. ➢ Student will be able to program ADC, DAC, etc. Also able to interface & program different peripheral devices like LCD, Keys, seven segment etc. ➢ Student will be able to design a system, components or process as per the needs & specifications.
Mapped Program Outcomes: b,d,e,i,l,m	

UNIT-1:
Introduction to ARM, Advantages of architectural features of ARM Processor, Processor modes, Register organization, Exceptions and its handling, 3/5- stage pipeline ARM organization.
UNIT-2:
Memory and memory-mapped I/Os, ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs.
UNIT-3
ARM floating point architecture, Memory buses: AMBA, ASB, & APB. Architectural support for system development.
UNIT-4:
DMA Architecture, Memory Hierarchy, memory size and speed, on-chip memory, caches, cache design, memory management.
UNIT-5
Architectural support for operating system, RTOS issues, µCOS-II and embedded Linux features, the shared Data Problem, Software Architectures (Round Robin, Round Robin with Interrupts, Function Queue Scheduling,),Selecting a software Architecture, Introduction to RTOS :tasks and task states, tasks and data, semaphores and shared data, message queues, mailboxes and pipes, events, RT Linux.
UNIT-6:
Case for Real Time Operating System, Embedded ARM applications such as USB interface, Bluetooth, Ethernet.

Text books:				
1	ARM System–on-chip Architecture	2nd edition, 2000	Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2002.	Craig Hallabaugh	Addison-Wesley Professional
3	ARM System Developer's Guide: Designing and Optimizing	2005	Sloss Andrew N, Symes Dominic & Wright Chris	Morgan Kaufman Publication

Reference books:

1	Technical references on www.arm.com.
2	Web base resources for RTOS and µCOS.

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EE402 / EE712	Embedded system Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcome
➢ To familiar with RARM7 software & KITS. ➢ To enhance the ability of logical thinking so that student will be design an algorithm and program for a specific task .	➢ Student will be able to understand different instruction used in programming. ➢ Student will be able to design Effective algorithm design for specific experiment. ➢ Student will be perfume experiments on different peripheral devices like LCD, Seven segment, GSM, etc.
Mapped Program Outcomes: b,d,e,i,l,m	

Expt. No.	Name of Experiment (Any Ten)
1	To swap data byte
2	To perform addition, subtraction of 16 bit number
3	To find larger of a two numbers.
4	To perform factorial of a given number
5	To perform ON/OFF LED and show status of LED on LCD
6	To display number from 0 to 9 on seven segment display.
7	To ON/OFF LED using Switch.
8	To rotate a stepper motor in clockwise & anti-clock wise direction with equal delay.
9	To Perform experiment on DAC of LPC2103
10	To read ADC and display value on LCD.
11	To find 1's complements of a given number.
12	Study of RTOS
13	Write device driver for UART.
14	Modify scheduler in such a way that it will assign highest priority to keypad.
15	To read values from RTC and display on LCD.
16	To send SMS to any mobile number.
17	Interface pen drive for writing predefined file.

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE403 / EE713	Digital CMOS circuits	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES	OUTCOMES
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To learn the modeling of circuits, circuit characterization and performance extraction. ➢ To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	➢ To learn the basics of MOS Circuits. ➢ To learn the various MOS Process Technologies. ➢ Students are expected to design circuits using different CMOS styles and also to do analysis on CMOS structures. ➢ To learn the physical layout of standard and compound Gates. ➢ Understanding electrical Properties and modeling of Very Large Scale Integrated Circuits in order to design the large systems. ➢ Graduates will demonstrate the ability to design a system, component or process as per needs and specifications.
Mapped Program Outcomes: b,c,k,l,m	

UNIT-1:
Introduction of MOSFETs:MOS Physics, NMOS Enhancement Transistor, MOS Transistor Operations, PMOS Enhancement Transistor, Regions of Operations, Threshold Voltage, MOS Device Equations, Small Signal Modeling of MOSFETs.

UNIT-2:
Physical Structure and Fabrication of CMOS IC : Integrated Circuit Layers, MOSFETs, CMOS Layers, Overview of Silicon Processing, N-Well Process, P-Well Process, Basic Physical Design of Simple Logic Gates, Stick Diagram, Euler's Path, Twin Tub Process, Silicon on Insulator (SOI) Process, Latch-up Effect.

UNIT-3:
Logic Design With MOSFETs: Ideal Switches and Boolean Operations, MOSFETs as Switches, Basic Logic Gates in CMOS, Compound Gates in CMOS, Transmission Gate Circuits (TG), Pass Transistor, Multiplexers.

UNIT-4:
MOS inverter Characteristics: Resistive load inverter, Inverters with n type MOSFET load, CMOS inverter, Principle of operation, DC characteristics, Tristate Inverter, Noise Margin, Introduction to Bi-CMOS Inverter.

UNIT-5 :
Analysis of CMOS Logic Gates: MOS Device Capacitance, Switching Characteristics, Rise Time, Fall Time, Propagation Delay, Power Dissipation in CMOS, Charge Sharing, Fan-in, Fan-out, Combinational circuit design, static CMOS, Ratioed Logic circuits, sequential circuit, Latches and Flip Flops.

UNIT-6:
Advanced Techniques in CMOS Logic Circuits: Complex Logic Structures, Complementary Static CMOS, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, CMOS Pass Transistor Logic and Flip-Flops.

Text books:				
1	Introduction to VLSI Circuits and Systems	First Edition	John P. Uyemura	Wiley Publication
2	Principle of CMOS VLSI Design	2nd Edition, 1994	Neil H. E. Weste, K. Eshraghian	Addison Wesley VLSI Series
Reference books:				
1	CMOS VLSI Design	3rd Edition, 2005	Pucknell , K. Eshraghian	Prentice Hall
2	CMOS Digital Integrated circuits Analysis and Design	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici	TataMcGraw Hill

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE404 / EE714	Digital CMOS Circuits Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

OBJECTIVES	OUTCOMES
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	➢ To learn the basics of MOS Circuits. ➢ To learn the various MOS Process Technologies. ➢ Students are expected to design circuits using different CMOS styles and also to do analysis on CMOS structures. ➢ To learn the physical layout of standard and compound Gates. ➢ Understanding electrical Properties and modeling of Very Large Scale Integrated Circuits in order to design the large systems. ➢ Graduates will demonstrate the ability to design a system, component or process as per needs and specifications.
Mapped Program Outcomes: b,c,k,l,m	

Expt. No.	Name of Experiment
1	Introduction to EDA Tool.
1	Plot the transfer characteristics of NMOS using EDA Tools.
2	Plot the transfer characteristics of PMOS transistor using EDA Tools.
3	Plot the transfer characteristics of CMOS Inverter using EDA Tools.
4	Gate Level Analysis of NAND Gate.
5	Gate Level Analysis of NOR Gate.
6	Gate Level Analysis of Transmission Gate.
7	Designing of low power D Flip-flop.
8	Designing of low power S-R Flip-flop.
9	Study of Combinational Circuit Design.
10	Study of Advanced Logic Families.

EE405 / EE715	Algorithm & Data Structures	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To verify the fundamental data structures and algorithms, to have good command of algorithmic techniques, their applications and complexity.	➢ Graduates will learn the basic concepts of Algorithms. ➢ Graduates will learn formation Data Structures. ➢ Graduates will learn Searching and Sorting Algorithms.
Mapped Program Outcomes: a,b,d,e,k	

UNIT-1:
Introduction to Algorithms, Basics of Algorithm, Sub Algorithms, Procedures and Functions, Analysis of Algorithms, Time and Space Complexity, Programming aspects with respect to structured programming, Top down and bottom Up Approach.

UNIT-2:
Arrays, Operations, Types, Representation of 1D, 2D arrays in memory, Sparse Matrices, Sorting, Quick Sort, Merge Sort, Insertion, Radix, Selection and Bubble Sort, Searching , Linear, Binary Search, Hashing and collision Handling mechanism.

UNIT-3 :
Stack , Fundamentals, Operations, Push , Pop , Applications of Stacks, Evaluation of Expressions, Recursion, Stack Machines and Multiple Stacks, Queues , Operations, Add , Delete, Types of Queues , Priority Queues, Circular Queue, Dequeue.

UNIT-4:
Fundamentals of singly, Doubly, Circular, Linked Stacks and Queues, Examples of Linked List, Circular Linked List, Doubly Linked List and Dynamic Storage Management, Garbage Collection, Compaction and Applications of Linked List, Operations of Polynomials, Generalized Linked List.

UNIT-5 :
Basic Terminology , Binary Tree Traversals, Threaded Storage Representation, Binary Search Tree, Applications of Tree, Preliminary Treatment of AVL Trees, B-Trees, B+ Trees, Heap Sort.

UNIT-6:
Basic Terminology, Graph Representation, Matrix, List, Multi-List, Graph Traversals, Breath First Search, Depth First Search, Minimum Cost Spanning Trees, Shortest Path Algorithm, Topological Sort, Critical Path.

Text books:				
1	Data Structures and Program Design in C	Second Edition	Kruse, Leung and Tondo	PHI
2	Fundamentals of Data Structures	Fifth Edition	Ellis Horowtiz and SartajSahani	Galgotia Publications,
Reference books:				
1	An Introduction to Data Structures with Applications	Second Edition	Tremblay & Sorenson	TMH
2	Data Structures, Schuam Series	Fifth Edition	Seymour Lipschutz, G.A. V. Pai	TMH

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE406 / EE716	Algorithm & Data Structure Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ To verify the fundamental data structures and algorithms, to have good command of algorithmic techniques, their applications and complexity.	➢ Student will understand Algorithm and their Applications. ➢ Student will understand the use of Data Structures in Computer Programming. ➢ Student will get exposure to Practical Computer Programming Concept.
Mapped Program Outcomes: a,b,d,e,k	

Expt. No.	Name of Experiment
1	Write a program on control Structure & Statements
2	Write a program on If –else structure
3	Write a program on Case Statement
4	Write a program on Functions
5	Write a program on Macros
6	Write a program on Pointers
7	Write a program on Structures
8	Write a program on Linked List
9	Write a program on Doubly linked list
10	Write a program on graphs
11	Write a program on Trees
12	Write a program on Search Algorithms
13	Write a program on Stacks

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE407 / EE706	Electronics Circuit Design	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
➢ This course deals with the various types of active filters, Amplifiers and their analysis. ➢ It also gives better understanding of the functions of operations and limitations of different Circuits.	➢ Students will acquire knowledge of Practical Circuit Design. ➢ Students will have a fair knowledge of Analysis of circuit Design. ➢ Students will understand the Power supplies and their design.
Mapped Program Outcomes: b,c,e,k,l,m	

UNIT-1:
Design of Filters: Filter Transmission Types and Specifications, The Filter Transfer Function, Butterworth and Chebyshev Filters, First Order and Second Order Filter Functions, The second Order LCR Resonator, Second order Active Filters Based on Inductor Replacement.

UNIT-2:
Design of Differential and Multistage Amplifiers: The BJT Differential Pair, Small Signal Operation of the BJT Differential Amplifier, Other Non-ideal characteristics of the differential amplifier, Biasing in BJT Integrated Circuits, The BJT Differential Amplifier with Active Load, MOS Differential Amplifiers, BiCMOS Amplifiers, Multistage Amplifier.

UNIT-3 :
Design of Tuned & Untuned Amplifiers: Tuned Amplifier Circuits, Inductor Losses, Use of Transformers, Amplifiers with Multiple Tuned Circuits , Synchronous Tuning, Classification of Amplifier, Distortion in Amplifiers, Frequency Response of Amplifier, RC Coupled Amplifiers, Low-Frequency Response of an RC-Coupled Stage, Cascaded Transistor CE Stage, Step Response of an Amplifier, Bandpass of Cascaded States, Effect of an Emitter bypass capacitor on low frequency response

UNIT-4:
Design of Power Amplifiers: Classification of Output Stage, Class A Output Stage, Class-B Output Stage, Class AB Output Stage, Biasing the Class AB Circuit, Class C Output Stage, Power BJTs, Variations on the Class AB Configuration, IC Power Amplifiers, Design of Heat Sinks for Power Amplifiers

UNIT-5 :
Design of Signal Generators and Wave Shaping Circuits: Basic Principle of Sinusoidal Oscillators, Op-Amp RC Oscillator Circuits, LC and Crystal Oscillators, Bistable Multivibrators, Generation of Square and Triangular Waveform using Astable Multivibrators, Generation of Standardized Pulse, The Monostable Multivibrator, Integrated Timer Circuits, Precision Rectifier Circuits

UNIT-6:
Design of Switch Mode Power Supplies: Introduction to switch mode power supplies ,comparison linear and switch mode power supplies, Analytical techniques, Buck converter, Boost Converter, Buck-Boost Converter

Text books:				
1	Microelectronics Circuits : Theory and Applications	Fifth Edition, 2010.	Adel S. Sedra and Kenneth C. Smith	Oxford University Press
2	Millman's Electronics Devices and Circuits	Second Edition,2008	Jacob Millman, Christos C. Halkias, SatyabrataJit	Tata McGraw Hill
3	Schaum's Outline of Electronics Devices and Circuits	2002	Jimmie Kathey	McGraw Hill
Reference books:				
1	Design with Operational Amplifiers and Analog Integrated Circuits	Third Edition, 2002	Sergio Franco	McGraw Hill
2	Electronics Devices and Circuits Theory	1999	NasheskyBoylestead	PHI

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE408 / EE707	Electronics Circuit Design Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ This course deals with the various types of active filters, such as LP, HP, BP, BR, and notch filters, which is very useful in communications. It also gives better understanding of the functions of operations and limitations of different ICs and their remedies.	➢ Students will acquire knowledge of Practical Circuit Design. ➢ Students will have a fair knowledge of Analysis of circuit Design. ➢ Students will understand the Power supplies and their design.
Mapped Program Outcomes: b,c,e,k,l,m	

Expt. No.	Name of Experiment
1	Design of LPF (Butterworth Filter) First Order
2	Design of HPF (Butterworth Filter) Second Order
3	Design of Non-Ideal Differential Amplifier / Multistage
4	Design of Multistage RC Coupled Amplifiers
5	Design of Class B Amplifier(Symmetry)
6	Design of Triangular Wave Generator
7	Design of Precision Rectifier
8	Design of Step Down SMPS
9	Design of Step Up SMPS
10	Mini-project

EE409 / EE717	Digital Communication	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
➢ This course provides compressive coverage of digital communication systems and understanding of the operation of digital modulation schemes/	➢ Graduates will learn pulse modulation & discuss the process of sampling, quantization & coding that is fundamental to the digital transmission of analog signals. ➢ It will provide fundamental concepts & limits in information theory in the context of digital communication theory/ ➢ Will able to analyze mathematical model of digital communication systems. ➢ Will able to apply error control coding techniques at the receiver.
Mapped Program Outcomes: b,c,e,l	

UNIT-1:
PCM, DM, ADM, DPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding.

UNIT-2:
Introduction to information theory, entropy, Huffman, Prefix code, and L-Z encoding algorithm, Rate distortion theory for optimum quantization.

UNIT-3 :
Gram-Schmitt procedure, Signal space representation of baseband and modulated signals, line coding and baseband digital transmission, Error probability and optimum receivers for AWGN channels, Matched filters.

UNIT-4:
Digital Modulation techniques, Transmitter, Receiver and signal space representation of BPSK, BFSK,QPSK, Introduction toTDM,FDM,OFDM.

UNIT-5 :
Channel capacity Review of channel coding, Linear block codes, cyclic codes, convolution, encoding and decoding, distance properties, Viterbi algorithm and Fano algorithm. Trellis coded modulation methods.

UNIT-6:
Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, performance analysis, synchronization methods for spread spectrum. Application of spread spectrum, CDMA.

Text books:				
1	Digital communication	3rd Edition, 2004	John G Prokis	Springer publication
2	Digital communication	2nd Ed, 2002.	Simon Haykin	John Wiley & sons

Reference books:

1	Modern Communication systems (Principles and application)	6th Edition, 2002	Leon W. Couch	Pearson
2	Digital Communication	5th Edition, 2003.	ShanmughamK.Sam	John Wiely
3	Modern Digital & Analog Communication Systems	3rd Edition, 1999.	B.P.Lathi	Oxford university Press
4	Principles of Communication Systems	3rd Edition, 2007.	Taub Schilling	Tata McGraw Hill publication

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Dean (Acad. Matters)		Version	1.00	

EE410 / EE718	Digital Communication Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcome
➢ To analyze digital modulation techniques. ➢ To analyze keying techniques.	➢ Students will be able to demonstrate different modulation techniques and observe the behavior for the same.
Mapped Program Outcomes: b,c,e,l	

Expt. No.Name of Experiment

1.	To perform Pulse Code Modulation
2.	To perform Delta modulation.
3.	To perform Adaptive Delta modulation.
4.	To observe and perform u law and A low companding.
5.	To perform DPCM
6.	To observe and perform ASK,FSK,PSK modulation.
7.	To simulate BPSK transmitter and receiver
8.	To simulate QPSK transmitter and receiver
9.	To implement design for PN sequence generator.

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EE411 / EE803	Fuzzy Logic & Neural Network	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
➢ To make the students well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. ➢ To make the students able to identify the complex problems in conventional structures, obtain intelligent acceptable solutions for these problems using soft computing techniques and take the necessary corrective action in the light of ongoing events.	➢ Students are well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. ➢ Students are able to identify the complex problems in conventional structures especially in fields pattern recognition, communication engineering, and several control operations, obtain intelligent acceptable solutions for these problems using soft computing techniques. ➢ Students are able to handle uncertainty, unpredictability and vagueness in some of the concepts which are not covered by traditional science and technology by applying concepts of fuzzy logic. ➢ Students are able to introduce intelligence in conventional structure using neural networks. ➢ Students are able to search fast and arrive at some optimized solutions for some problems using concepts of Genetic algorithm. ➢ Students can take the necessary corrective action in the light of ongoing events.
Mapped outcomes: b,c,d,k	

UNIT-1:
Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets
UNIT-2:
Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations
UNIT-3 :
Fuzzy controllers: an overview with applications, applications of fuzzy logic
UNIT-4:
Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning
UNIT-5
Brief introduction to single layer and multi layer perceptions, ADALINE and MADALINE, Feed forward networks, Back propagation networks and applications.:
UNIT-6:
Radial basis function network, Self organizing feature map and applications

Text books:				
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications
Reference books:				
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI
2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Neural Network and Fuzzy Systems	1991	Bart Kosko	PHI
4	Neural network design	2004	Martin Hagan, Howard Demukh, Mark Beale	Thomson learning and Vikas publishing house

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE429/ EE825	Basics of Analog and Digital Communication Systems	L= 4	T = 0	P = 0	Credits =4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To Study of amplitude, frequency & phase modulation. ➢ To learn the concept of PPM, PAM, PWM & PCM & delta modulation. ➢ To understand the operation of digital modulation techniques.	➢ Recognize and utilize latest analogue and digital communication technologies. ➢ It will provide fundamental concepts & limits in information theory in the context of digital communication theory. ➢ Graduates will demonstrate different modulation techniques. ➢ Graduate will be able to explain digital modulation techniques for transmitting digital data. ➢ Graduates will be able to describe various types of transmitters & receivers in communication system.
Mapped outcomes: b,c,d,k	

UNIT-1:Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.

UNIT-2:Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.

UNIT-3Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing.

UNIT-4Basic digital Modulation System, Channel capacity, PCM, ADPCM, Delta Modulation, ADM.

UNIT-5Digital Modulation techniques: ASK, FSK, PSK, BPSK,QPSK, MSK, DPSK, BFSK,

UNIT-6 Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.

Text books:				
1	Electronic Communication System	Fourth Edition, 1999	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications		Symon Hykin	Wiley, 1988
Reference books:				
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
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EE412 / EE810	Project phase 1	L = 0	T = 0	P = 4	Credits = 4

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	
Mapped outcomes: d,i,l,m,g,f,e				

EE413 / EE821	Industrial Training	L = 0	T = 0	P = 0	Credits = 2

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	100		100	
Mapped outcomes: f,g,d				

GE405/GE702	Engineering Management			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Objective	Outcome
➢ This subject helps student to understand the Functions of management, Marketing Management, Personnel Management, Plant Management, Inventory Control and Finance Management in the organization.	➢ As a studying HR, it helps us to know administration of organization. ➢ It is more concerned with decision making to make the best under a given situations & to be ethically and socially responsive to the needs of society. ➢ It helps to formulating strategies to exploit rewarding opportunities thereby maximizing its return on investment. ➢ Students are expected to understand & demonstrate the effect of time value of money, depreciation & foreign currency, trade.
Mapped Program Outcomes: d,f,g,h,j	

UNIT-1: Principles of management
Concepts of management, development of scientific management, Taylor Principles Fayol, functions of management such as planning, decision making, organizing, communication, controlling, span of control.
[8Hours]

UNIT-2: Personnel & Human Resource Management
Concept and evolution of personnel management and HRM, Difference between PM and HRM. Functions of HRM Concept of HRD. HR Planning, Concept, Objective, Importance, and Process. Recruitment: Meaning, process, Recruitment Agencies, selection process, test, and types of test, interview and types of interview. Training and Development.
[7Hours]

UNIT-3 Project management
Types of projects, various phases of project, Project Proposal, Components of planning, Objectives of planning, Factors affecting planning, Organizational setup, Network techniques Introduction and Use of CPM &PERT for planning. Estimation of critical path and project duration. Resource planning, Resource Allocation, Resource leveling, Optimization of project cost, Cost slope concept.
[7Hours]

UNIT IV Marketing Management:-
Definition & scope, selling & modem concepts of marketing, market research, rural marketing, Customer Behaviors, marketing strategies, product launching, product life cycle, sales promotion, pricing, channels of distribution, Advertising, market segmentation, marketing mix, positioning, targeting
[8 Hours]

UNIT V Inventory Management :-
Principles of Inventory Management , Importance & objectives of Effective Inventory Management , Types of Inventory Control Systems, Inventory Control Procedures, Concept of ABC Analysis Benefits of ABC Analysis.
[7 Hours]

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GE405/GE702	Engineering Management			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

UNIT VI Financial Management:-
Definition & Functions of Finance department, Sources of finance ,financing organizations, types of capital, elements of costs & allocations of indirect expenses, cost control, break even analysis, budgets & budgetary control, equipment replacement policy, make or buy analysis, balance sheet, ratio analysis, profit & loss statement. [8Hours]

TEXT BOOKS:
I) Principles of Management: Koontz & O Denial
2) Industrial Organization & Engineering Economics: T. R. Banga & S. C. Sharma
3) Financial Management – Kuchal
REFERENCES:
1) Principles of marketing management; Philip Kotler & William Stauton
2) Customer Behavior : Leon G. Schiffman, & Leslie Lazar Kanuk

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE414 / EE812	Computer Communication Network	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:	Outcomes:
➢ To learn basics of data communication, wireless transmission, spread spectrum, medium access control- FDMA, TDMA & CDMA. ➢ To study TCP/IP, ARP, RARP, UDP protocols & addressing. ➢ To study network security & it applications.	➢ Will have understanding of reference mode for data communication & functions of all layers of OSI reference model. ➢ Will able to differentiate between various protocols of different layers & standards on data communication. ➢ Will acquire knowledge of the network layer routing protocols.
Mapped Program Outcomes: a,c,e	

UNIT-1:
Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model.

UNIT-2 :
LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN
UNIT-3 :
Physical layer and data link layer: transmission media, PSTN.
Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.

UNIT-4:
Network layer and transport layer: network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways

UNIT-5:
Application layer: network security cryptography, secrete key, public key, digital signature, domain name system, electronic mail system

UNIT-6: Multimedia, real time transport protocol, e-mail security, web security, communication security, electronic mail, world wide web.

Text books:				
1	Computer Networks	3rd Edition,1996	Tanenbaum	Prentice Hall
2	Data Communications and Networking	4th edition, 2007	Behrouz a Forouzan	Tata Mc. Graw Hill
eference books:				
1	Data and Computer Communication	8th Edition,2006	W. Stallings	Prentice Hall
2	Telecommunication switching systems and networks	2004.	T. Vishwanathan	Prentice Hall

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE415 / EE813	Operating Systems Concepts	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To have an overview of different types of operating systems. ➢ To know the components of an operating system. ➢ To have a thorough knowledge of process management. ➢ To have a thorough knowledge of storage management.	➢ Graduates will learn the basic concepts Operating System. ➢ Graduates will learn Processes , Threads, Memory Management. ➢ Graduates will also learn Security Issues in Operating System.
Mapped Program Outcomes: a, e, i, l	

UNIT-1:
Computer System organization ,Architecture, Structure, Operations, Process Management, Memory Management, OS Services, User Operating System Interface, System Calls, System Programs

UNIT-2:
Process Concept, Scheduling, Operations, Scheduling Criteria, Scheduling Algorithms, Tread Scheduling, Multiple Processor Scheduling

UNIT-3 :
Synchronization, Critical Section Problem, Semaphores, Deadlocks, System Models, Characterization, Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance

UNIT-4:
Memory Management Strategies, Swapping, Continuous Memory Allocation, Paging, Segmentation , Virtual Memory Management, Demand Paging, Page Replacement, Trashing,

UNIT-5 :
File System Concept, Access Methods, Directory and Disk Structure, Mounting, Sharing, Mass Storage Structure, Disk Attachment, Scheduling, RAID Structure

UNIT-6:
Protection and Security , Domain of Protection, Access Matrix, Access Control, Language based Protection, Security Problem, System and Network Threats, Cryptography as Security Tool

Text books:				
1	Operating System Concepts	Eigth Edition, 2012	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	John Wiley & Sons (ASIA) Pvt. Ltd
2	Modern Operating Systems	2003.	Andrew S. Tanenbaum	Prentice Hall of India Pvt. Ltd
Reference books:				
1	Operating Systems	2002	Harvey M. Deitel	Pearson Education Pvt. Ltd
2	Operating System	4th Edition, 2003	William Stallings	Prentice Hall of India
3	An Introduction to Operating Systems, Concepts and Practice	2003	Pramod Chandra P. Bhatt	PHI,

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE416 / EE814	Biomedical Instrumentation	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ This course is intended for exposing the students to basics of biomedical instrumentation. ➢ It also includes sections on microprocessors and signal acquisition systems as applied to medical instrumentation.	➢ Graduates will learn the basic concepts of biomedical instrumentation. ➢ Graduates will learn measurement techniques for involved in processes such cardiovascular measurements. ➢ Graduates will also learn techniques in x-rays, EMG, etc.
Mapped Program Outcomes: a, c, d, e, k	

UNIT-1:
Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.

UNIT-2:
Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers.

UNIT-3 :
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers.

UNIT-4:
Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG.

UNIT-5 :
Patient care and monitoring, the elements of intensive care monitoring , diagnosis, calibration, reparability of patient monitoring equipment, instrumentation for monitoring patient, pacemakers, defibrillators.

UNIT-6:
Computers in biomedical instrumentation, digital computer, microprocessor, interfacing the computer with medical instrumentation and other equipments, electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments, Methods of accident prevention.

Text books:				
1	Biomedical Instrumentation & Measurement	2nd Edition	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	PHI
Reference books:				
1	Handbook of Biomedical Instrumentation	2nd Edition	R.S.Khandpur	TMH
2	Bioelectronic Measurement	Jan 1983 edition	Dean A Dmane, David Michaels	PHI
3	Medicine and Clinical Engineering	2nd Edition	Jacobson and Webster	PHI
4	Introduction to Biomedical Equipment Design	4th Edition	Carr and Brown	John Wiley
5	Biomedical Digital Signal Processing	1993 Edition	Tompkins	PHI

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EE417 / EE804	Soft Computing	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
➢ To make the students well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. ➢ To make the students able to identify the complex problems in conventional structures, obtain intelligent acceptable solutions for these problems using soft computing techniques and take the necessary corrective action in the light of ongoing events.	➢ Students are well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. ➢ Students are able to identify the complex problems in conventional structures especially in fields pattern recognition, communication engineering, and several control operations, obtain intelligent acceptable solutions for these problems using soft computing techniques. ➢ Students are able to handle uncertainty, unpredictability and vagueness in some of the concepts which are not covered by traditional science and technology by applying concepts of fuzzy logic. ➢ Students are able to introduce intelligence in conventional structure using neural networks. ➢ Students are able to search fast and arrive at some optimized solutions for some problems using concepts of Genetic algorithm. ➢ Students can take the necessary corrective action in the light of ongoing events.
Mapped outcomes: b,d,e,k	

UNIT-1:
Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conorms.

UNIT-2:
Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations

UNIT-3 :
Fuzzy controllers, Defuzzification Methods, applications of fuzzy logic in pattern recognition and image processing,

UNIT-4:
Introduction of neural networks, learning methods, perceptrons, perceptron training algorithm, single layer perceptron, multiplayer perceptron, neural network architectures, ADALINE, MADALINE

UNIT-5 :
LMS algorithm, Back propagation algorithm, RBF networks, self-organizing feature maps, Applications of ANN

UNIT-6:
Introduction of Soft Computing Methods, Fundamentals of Genetic Algorithms, Encoding, Fitness function, Genetic modeling, Applications of GA.

Text books:				
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications		S. Rajsekharan, VijayalaxmiPai,	Prentice Hall
3	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

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EE417 / EE804	Soft Computing	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	Prentice Hall
2	Introduction of Artificial Neural Networks	1999.	Jacek Zurada	Pws Pub Co
3	Principles of soft computing		S.N.Sivanandam, S.N.Deepa	Wiley India Ed.
4	Neural Network and Fuzzy Systems	1991	Bart Kosko	Prentice Hall
5	Neural network design	2004	Martin Hagan, Howard Demukh, Mark Beale	Thomson learning and Vikas publishing house

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Dean (Acad. Matters)		Version	1.00	

EE418 / EE805	Soft Computing Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
➢ To make the students well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. ➢ To make the students able to identify the complex problems in conventional structures, obtain intelligent acceptable solutions for these problems using soft computing techniques and take the necessary corrective action in the light of ongoing events.	➢ Students are well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. ➢ Students are able to identify the complex problems in conventional structures especially in fields pattern recognition, communication engineering, and several control operations, obtain intelligent acceptable solutions for these problems using soft computing techniques. ➢ Students are able to handle uncertainty, unpredictability and vagueness in some of the concepts which are not covered by traditional science and technology by applying concepts of fuzzy logic. ➢ Students are able to introduce intelligence in conventional structure using neural networks. ➢ Students are able to search fast and arrive at some optimized solutions for some problems using concepts of Genetic algorithm. ➢ Students can take the necessary corrective action in the light of ongoing events.
Mapped outcomes: b,d,e,k	

Expt. No	Name Of Experiment
1	Design of Water level controller for a tank using Fuzzy logic.
2	Using Fuzzy Concepts, design temperature control in a shower
3	Use fuzzy concepts for adaptive noise cancellation.
4	Design of fuzzy inference engine
5	Design neural network for adaptive linear predictor
6	Design neural network for amplitude detector
7	Design neural network for cancer detector
8	Design neural network for crab classifier
9	GA based experiment to be added.
10	Self organizing Neural detector.
11	LVQ equalizer

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE419 / EE806	Analog VLSI Design		L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES	OUTCOMES
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To learn the modeling of circuits, circuit characterization and performance extraction. ➢ To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of various analysis of differential amplifiers. ➢ To give basic understanding of non linear circuits such as comparator design.	➢ To learn the basics of MOS Circuits. ➢ To learn the various MOS Proces Technologies. ➢ Ability to design an electrical component system to meet desired needs. ➢ This course helps students in design ar analysis of analog circuits. ➢ To design and analysis of basic analc functional module designs such as curre mirrors, active load, biasing circuits. ➢ Understanding electrical Properties ar modeling of Very Large Scale Integrated Circui in order to design the large systems. ➢ Graduates will demonstrate the ability to desic a system, component or process as per neec and specifications. ➢ Ability to simulate MOS devices and CMC circuits with SPICE: AC, DC, Transients.
Mapped Program Outcomes: b,c,l,m	

UNIT-1: SPICE Modeling of the MOSFET:
Depletion regions of a PN Junction, Basic principle of MOSFETs, Depletion and enhancement MOS Transistors, Review of MOS Transistor Theory, Introduction to large signal MOS models, Small Signal MOS Modeling, Square Law Equations, MOS Device Equations, MOSFET Noise Modeling.

UNIT-2:CMOS Technologies and Layouts:
CMOS technology, Analog MOS Process, N-Well Process, Twin Tub Process, CMOS Layout and Design Rules, Physical layout of Standard Gates, Latch-up considerations.

UNIT-3:Current Mirrors:
Current Source, Current Mirrors: Simple Bipolar current mirror, Simple MOS current mirror, I-V Characteristics of MOS Current Mirror, Cascode current mirrors, Widlar current mirror, Wilson Current mirror, Applications of Current Mirrors, Matching Currents.

UNIT-4 : MOS Transistor Amplifier:
Two Port Modeling, Single transistor Amplifiers stages: Common Drain, Common Gate & Common Source Amplifiers.
UNIT-5:Differential amplifiers:
Source Coupled Pair Differential Amplifiers, DC Transfer Characteristics, AC Operations, Transconductance, wide swing differential amplifiers, matching considerations.

UNIT-6: Nonlinear analog circuits:
Basic CMOS Comparator Design, Pre-amplification, Decision Circuit, Output Buffer, Characteristics: DC Characteristics, Transient Response, Propagation Delay, Minimum Input Slew Rate, Clocked Comparators.

Text books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

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EE419 / EE806	Analog VLSI Design		L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	VLSI Design Techniques for Analog & Digital Circuits	1990	L Geiger, P E Allen and N R Strader	McGraw Hill
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analog Integrated Circuit Design	1997	D. A. Johns and Martin	John Wiley,

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Dean (Acad. Matters)		Version	1.00	

EE420 / EE807	Analog VLSI Design Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

OBJECTIVES	OUTCOMES
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To learn the modeling of circuits, circuit characterization and performance extraction. ➢ To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of various analyses of differential amplifiers. ➢ 5. To give basic understanding of non linear circuits such as comparator design.	➢ To learn the basics of MOS Circuits. ➢ Ability to simulate MOS devices and CMOS circuits with SPICE: AC, DC,Transients. ➢ To learn the various MOS Process Technologies. ➢ Ability to design an electrical component or system to meet desired needs. ➢ This course helps students in design and analysis of analog circuits. ➢ To design and analysis of basic analog functional module designs such as current mirrors, active load, biasing circuits. ➢ Graduates will demonstrate the ability to design a system, component or process as per needs and specifications.
Mapped Program Outcomes: b,c,l,m	

Expt. No.	Name of Experiment
1	NMOS characteristic :- VdsVs ID for various values of Vgs.
2	PMOS characteristic :- VdsVs ID for various values of Vgs.
3	Current source using current mirror :- DC analysis
4	Common Source amplifier:- AC analysisTransientanalysis
5	Common Drain amplifier:- AC analysisTransientanalysis
6	Differential Amplifier :- AC analysis Transfer curve (Vin VsVout, DC condition)
7	Op-Amp Design: AC analysis Transient analysis DC analysis
8	SPICE simulation of basic analog circuits, Analog Circuit simulation Verification of layouts.
9	Basic CMOS Comparator Design
10	Source Coupled Pair Differential Amplifier

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EE421 / EE808	Optical communication	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ This course will provide understanding for applying optical fiber technology to sophisticated modern telecommunication systems. ➢ To understand the fundamental behavior of the individual optical components, describes their interactions with other devices in an optical fiber. ➢ To measure & analyze different measurements, parameters & properties of optical fiber.	➢ Student will learn the basic elements of optical fiber. ➢ Student will understand the different kinds of losses, signal distortion in optical wave guides & other signal degradation factors. ➢ Student will able to classify various optical source materials, LED structures, LASER diodes. ➢ Student will learn the fiber optic receivers such as PIN, APD diodes, receiver operation & performance. ➢ Student will understand the operational principal of WDM, SONET, measurement of attenuation, dispersion, refractive index profile in optical fibers.
Mapped Program Outcomes: a, b, e, l	

UNIT-1: INTRODUCTION TO OPTICAL FIBERS
Evolution of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi mode fibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure.

UNIT-2:SIGNAL DEGRADATION IN OPTICAL FIBERS
Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers, Mode Coupling, Design Optimization of SM fibers, RI profile and cut-off wavelength.

UNIT-3 : FIBER OPTICAL SOURCES
Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency and LED power, Modulation of a LED, Laser Diodes , Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes structures and radiation patterns, Single Mode lasers, Modulation of Laser Diodes, Temperature effects, Fabry Perot cavity Quantum laser
UNIT-4: FIBER OPTICAL RECEIVERS
PIN and APD diodes , Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise ,Comparison of Photo detectors, Fundamental Receiver Operation, Error Sources, Receiver Configuration, Probability of Error, The Quantum Limit, Noise Effects on System Performance, Eye diagram.

UNIT-5 : DIGITAL TRANMISSION SYSTEM
Introduction of fibers cables, Fiber Splicing and connectors, Operational Principals of WDM, SONET, LAN 1000 baseSX, LX and Passive Components, Optical TDM.

UNIT-6:MEASUREMENT IN OPTICAL FIBERS
Attenuation, Time domain dispersion and Frequency domain dispersion, OTDR, NA measurement Refractive index profile and optical source characteristic measurements.

Text books:				
1	Optical Fiber Communication	3rd edition, 1999.	Gerd Keiser	McGraw-Hill Science/Engineering /Math
2	Optical Communication, Principles and Practice	2nd Edition,1994	J.Senior	Prentice Hall of India

Reference books:				
1	Optical Communication System	2001	J.Gower	Prentice Hall of India
2	Fiber-Optic Communication System	Third Edition, 2009.	GovindAgrawal	John Willy & Sons

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EE422 / EE809	Optical Communication Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

OBJECTIVES

Objective	Outcome
➢ This course will provide understanding for applying optical fiber technology to sophisticated modern telecommunication systems. ➢ To understand the fundamental behavior of the individual optical components, describes their interactions with other devices in an optical fiber. ➢ To measure & analyze different measurements, parameters & properties of optical fiber.	➢ Student will learn the basic elements of optical fiber. ➢ Student will understand the different kinds of losses, signal distortion in optical wave guides & other signal degradation factors. ➢ Student will able to classify various optical source materials, LED structures, LASER diodes. ➢ Student will learn the fiber optic receivers such as PIN, APD diodes, receiver operation & performance. ➢ Student will understand the operational principal of WDM, SONET, measurement of attenuation, dispersion, refractive index profile in optical fibers.
Mapped Program Outcomes: a, b, e, l	

Expt. No.	Name of Experiment
1	Measurement of Numerical Aperture.
2	Analysis of losses in optical fiber.
3	Measurement of propagation loss & bending loss.
4	Analysis of characteristics of fiber optic LED's and Detectors.
5	Analysis of Frequency Division Multiplexing & De-multiplexing.
6	To verify and measure different parameters of LED & Laser source using optical spectrum analyzer.
7	To measure attenuation of a fiber of 1 km length using optical spectrum analyzer.
8	To verify optical spectrum analyzer & using it find the location of fault.
9	To plot frequency response of detector for different values of load resistance.
10	To measure numerical apertures of plastic fiber.

EE423 / EE815	Object Oriented Programming	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ The course aims is to introduce the students to Object Oriented Programming Concepts. ➢ Demonstrate mastery of object oriented programming concepts: inheritance, polymorphism, and operator overloading. ➢ Demonstrate mastery of pointers, iterators, memory management including object creation and destruction.	➢ Graduates will learn the basic concepts of Object Oriented Programming. ➢ Graduates will learn Inheritance, Polymorphism, Overloading. ➢ Graduate will also learn to Files and Stream Operations.
Mapped Program Outcomes: a,b,d,e,k	

UNIT-1:
Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP.

UNIT-2:
Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators, Expressions and Control Structures, Pointers, Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Friend and Virtual Functions.

UNIT-3 :
Classes and Objects, Constructors and Destructors, Operator overloading, Type of Constructors, Function Overloading, Inheritance, Types of Inheritance Virtual Functions and Polymorphism.

UNIT-4:
Definition of a data structure, Primitive and Composite data types, Asympotic notations, Arrays, Operations of Arrays, Order lists, Stacks, Applications of Stack, Infix to Postfix Conversion, Recursion, Queues, Operations of Queues.

UNIT-5 :
Singly linked list, Operations, Doubly linked list, Operations, Trees and Graphs: Binary tree, Tree traversal; Graph, Definition, Types of Graphs, Traversal (BFS & DFS), Dijkstra`s algorithm

UNIT-6:
Files, classes for file stream operations, Opening, Closing and Processing files, End of file detection , File pointes, Updating a file , Error Handling during file operations, Command line arguments, Templates, Exception Handling.

Text books:				
1	Object Oriented programming with C++	4th Edition,2008	E. Balagurusamy	TMH
Reference books:				
1	Object Oriented Programming in Microsoft C++	Third Edition, 2003	Robert Lafore	Galgotia publication
2	Fundamental of data structure in C++	2002.	E. Horowitz and S.Shani	Galgotia Pub
3	Computer algorithms	1998.	Horowitz, S.Shani and S.Rajasekaran	Galgotia Pub Pvt Ltd

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EE424 / EE816	Object oriented programming Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ The course aims is to introduce the students to Object Oriented Programming Concepts memory management including object creation and destruction, and parameter passing in C++ .	➢ Student will understand Algorithm and their Applications. ➢ Student will understand the use of Data Structures in Computer Programming. ➢ Student will get exposure to Practical Computer Programming Concept.
Mapped Program Outcomes: a,b,d,e,k	

Expt. No.	Name of Experiment
1	Write a function using variables as arguments to swap the values of a pair of integers.
2	Write a program to read the ballot & count the votes cast for each candidate using an array, variable count. In case, a number read is outside the range 1 to 5, the ballot should be considered as a ' spoilt ballot' and the program should also count the number of spoilt ballot.
3	Write a program to read a matrix of size m*n from the keyboard and display the same on the screen.
4	Write a macro that obtains the largest of three numbers.
5	As the practical 4, using inline function. Test the function using the main program.
6	Define a class to represent a bank account including the following members:- Data Members, Member function to display the name and balance.
7	Modify the class and the program of practical 6 for handling 10 customers.
8	Create 2 classes OM and DB which store the value of distance. DM store distances in meters and cm and DB in feet and inches. Write a program that can read values for the class objects and add 1 object OM with another object of DB. Use a friend function to carry out the addition operation the object that stores the results may be a DM object or a DB object, depending upon the units in which the results are require. The display should be in the format of feet and inches or meters and cms depending on the object on display.
9	Write a program for maintaining the inventory of books that are being sold at the shop the Design a system using a class called books with suitable member functions and constructors. Use new operator in constructor to allocate memory space require.
10	Define a class string that could work as a user defined string type include constructors that will enable us to create an .un-initialized string String s1; :/ string with length 0 And also to initialize an object with string constant at the time of creation like String s2("well done"); . Include a function that adds two strings to make a third string.
11	Create a class float that contains 2 float data member. Over load all the 4 arithmetic operators so that do operate on the objects of float.
12	Define 2 classes POLAR and RECTANGLE to represent points in the POLAR and RECTANGLE systems. Use conversion routines to convert from one system to the other.
13	Exercise on file handling

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EE425 / EE817	Wireless Communication	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To develop a strong theoretical background involving the evolution and future of wireless communication systems. ➢ To develop a detailed technical knowledge of current practice in wireless systems and networks.	➢ The students undergoing this course will be able to know the evolution of mobile communication. ➢ Will be able to understand the need and different methods for enhancing the quality of communication. ➢ Will also develop a detailed technical knowledge of current practice in wireless systems and networks.
Mapped Program Outcomes: b, c, e, k	

UNIT-1:
Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications Mobile Radio Systems around the world. Examples of Wireless Communication Systems, Comparison of common wireless communication systems, trends of cellular radio and personal communications, Second generation (2G) cellular Networks, Third generation (3G) cellular Networks, wireless local loops and LMDS.
UNIT-2:
The Cellular Concept: Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system.
UNIT-3 :
Mobile Radio Propagation- Large & Small Scale Path Loss & Fading: Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling. Small Scale Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types Of Small Scale Fading, Rayleigh &Rician Distribution.
UNIT-4:
Equalization & Diversity: Fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver.
UNIT-5 :
Wireless Systems and Standards: GSM- global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard (IS-95).
UNIT-6:
Wireless Networking: Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signaling, Signaling System No. 7.An Example of SS7,SIP-Global Cellular Network Interoperability.

Text books:				
1	Wireless Communication – Principles and practice	2nd edition, 2002	T S. Rappaport	Prentice Hall PTR, upper saddle river, New Jersey
2	Mobile Communications – Design fundamentals	2nd edition, 1997	William C. Y. Lee	John Willey

Reference books:				
1	Wireless digital communication : modulation & spread spectrum applications	1995.	Kamilo Feher	Prentice Hall PTR; Har/Dis edition
2	Wireless and Cellular Communication	3rd Edition,2005	W .C .Y. Lee	McGraw Hill
3	The Mobile Radio Propagation channel	2nd Edition, 2000	J.D. Parson	John Willey

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EE426 / EE818	Wireless Communication Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcome
➢ To develop an ability to implement different system and study their outcome. ➢ To develop a detailed technical knowledge of current practice in wireless systems and networks.	➢ The students undergoing this course will be able study the working of cellular system. ➢ Will be able to understand different methods for enhancing the quality of communication. ➢ Will be able to design a communication system.
Mapped Program Outcomes: b, c, e, k	

Expt. No	Name Of Experiment
1	To study the Block diagram and working principal of cellular phone.
2	To study the cellular system and to compute the reuse ratio for different cluster size and plot it against different values of N.
3	Plot Path loss curve with respect to distance for different values of path loss exponent between 2 to 6.
4	To study effects of Rayleigh fading.
5	Using above example compute the bit error rate of the system for different values of the signal-to-noise ratio.
6	To filter a signal using a fading channel.
7	To determine errors that occurs in trying to recover the modulated message with and without the equalizer.
8	To identify the time and frequency spreads of a channel.
9	Study of CDMA Architecture.
10	Study of GSM Architecture.

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EE427 / EE819	Digital Image Processing	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ The principal objective is to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field.	➢ Graduates will learn the basic concepts of image processing. ➢ Graduates will learn formation of digital image and concepts of digital geometry that help in understanding the image processing operations. ➢ Graduates will learn image enhancement techniques. ➢ Graduates will also learn image restoration, compression and storage techniques.
Mapped Program Outcomes: b,e,l,m	

UNIT-1:
Digital image fundamentals : Digital Image through scanner, digital camera, Concept of gray levels, Gray level to binary image conversion, Sampling and quantization, Relationship between pixel, Imaging Geometry.

UNIT-2:
Image Transforms: 2-D FFT, Properties, Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform.

UNIT-3 :
Image enhancement : Point processing, Histogram processing, Two dimensional fourier transform, Spatial filtering and its frequency domain interpretation. Enhancement in frequency domain, Image smoothing, Image sharpening.

UNIT-4:
Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.

UNIT-5 :
Image Restoration: Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT-6:
Image compression: Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.

Text books:				
1	Digital Image processing	2nd Edition, 2002	R.C. Gonzalez & R.E. Woods	Wesley/ Pearson education
2	Fundamentals of Digital Image processing	1989.	A.K.Jain	PHI
Reference books:				
1	Digital Image processing using MAT LAB	2004	Rafael C. Gonzalez, Richard E Woods and Steven L.	PEA,
2	Digital Image Processing	3rd Edition,2004.	William K. Pratt	John Wilely
3	Fundamentals of Electronic Image Processing	SPIC/IEEE Series,1996	Arthur R. Weeks	PHI

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE428 / EE820	Digital Image Processing Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcome
➢ The principal objective is to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field.	➢ Graduates will learn formation of digital image and concepts of digital geometry that help in understanding the image processing operations. ➢ Graduates will learn image enhancement techniques. ➢ Graduates will also learn image restoration, compression and storage techniques.
Mapped Program Outcomes: b,e,l,m	

Expt. No	Name Of Experiment
1	To Explore statistical properties of Image & displaying histogram & profile.
2	Histogram modification
3	Image smoothing operations
4	Pseudo coloring of gay level images
5	Edge detection
6	Segmentation using threshold
7	Region based segmentation
8	Image Transforms
9	Image Compression
10	Image Segmentation

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE433 / EE811	Electronic Design Automation Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	
Mapped Program Outcomes: c, d, e, f, j,l,m				

Expt. No.	Name of Experiment
1	Study of Device model using SPICE.
2	DC circuit analysis.
3	Transient analysis.
4	AC circuit analysis.
5	Analysis of Diode circuits.
6	Bipolar junction transistors.
7	Field effect transistors.
8	Op-Amp Circuits.
9	SMPS/SWITCHING CIRCUIT.

Text books:				
1	Introduction to PSpice using OrCAD for circuits and Electronics	Third edition, 2003.	Muhammad H.Rashid	Prentice Hall

Reference Website:	
1	http://bwrc.eecs.berkeley.edu/classes/icbook/spice/

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

EE430 / EE822	Comprehensive Viva-voce	L = 0	T = 0	P = 0	Credits =2

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	
Mapped outcomes: d,i,l,m,g,f,e				

EE431 / EE823	Extra Curricular / Competitive Exam	L = 0	T = 0	P = 0	Credits = 2

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	100		100	
Mapped outcomes: i,f,g				

EE432 / EE824	Project Phase 2	L = 0	T = 0	P = 6	Credits = 6

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	
Mapped outcomes: d,i,l,m,g,f,e				

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

B.E. (Electronics and Telecommunication Engineering)

SCHEME OF EXAMINATION 2010

Sl. No.	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE I	MSE II	TA	ESE	
SEMESTER VII												
1	GE409	Engg. Management	3	0	0	3	3	15	15	10	60	3 Hrs
2	ET401	RF & Microwave	4	0	0	4	4	15	15	10	60	3 Hrs
3	ET402	RF & Microwave Lab	0	0	2	2	1			40	60	
4	ET403	Principles of Image Processing	4	0	0	4	4	15	15	10	60	3 Hrs
5	ET404	Principles of Image Processing Lab	0	0	2	2	1			40	60	3 Hrs
6		Prof. Elective 3	3	0	0	3	3	15	15	10	60	3 Hrs
7		Prof. Elective 3 Lab	0	0	2	2	1			40	60	
8		Free Elective 2	4	0	0	4	4	15	15	10	60	3 Hrs
9	ET413	Industrial Training	0	0	**0**	**0**	**2**			100		
10	ET414	Project phase -I	0	0	4	4	4			40	60	
		Total	**18**	**0**	**10**	**28**	**27**					
	ET405	PE3 : Optical Communication	3	0	0	3	3	15	15	10	60	3 Hrs
	ET406	PE3 : Optical Communication Lab	0	0	2	2	1			40	60	
	ET407	PE3 : Microwave Integrated circuit	3	0	0	3	3	15	15	10	60	3 Hrs
	ET408	PE3 : Microwave Integrated circuit Lab	0	0	2	2	1			40	60	
	ET409	PE3 : Communication Networks	3	0	0	3	3	15	15	10	60	3 Hrs
	ET410	PE3 : Communication Networks Lab	0	0	2	2	1			40	60	
	EL412	FE2 : Electrical Energy Audit and Safety	4	0	0		4	15	15	10	60	
	EL413	FE2 : Utilisation of Electrical Energy	4	0	0		4	15	15	10	60	
	CV418	FE 2 : Elements of Earthquake Engineering	4	0	0	4	4	15	15	10	60	
	CV419	FE 2 : Air Pollution & Solid Waste Management	4	0	0	4	4	15	15	10	60	
	ME429	FE 2 : Total Quality Management	4	0	0	4	4	15	15	10	60	
	ME430	FE 2 : Reliability Engineering	4	0	0	4	4	15	15	10	60	
	CT411	FE2 : Multimedia and Animation	4	0	0	4	4	15	15	10	60	100
	CT412	FE2 : Current Trends and Technologies	4	0	0	4	4	15	15	10	60	100
	IT408	FE2 : Applications of Computer Networking	4	0	0	4	4	15	15	10	60	3 Hrs
SEMESTER VIII												
1	ET415	Antenna Theory & Design	4	0	0	4	4	15	15	10	60	3 Hrs
2	ET416	Antenna Theory & Design Lab	0	0	2	2	1			40	60	
3	ET417	CMOS VLSI Design	4	0	0	4	4	15	15	10	60	3 Hrs
4	ET418	CMOS VLSI Design Lab	0	0	2	2	1			40	60	
5		Prof. Elective 4	3	0	0	3	3	15	15	10	60	3 Hrs
6		Prof. Elective 5	3	0	0	3	3	15	15	10	60	3 Hrs
7		Prof. Elective 5 Lab	0	0	2	2	1			40	60	
8	ET428	Project Phase-II	0	0	6	6	6			40	60	
9	ET429	Comprehensive viva voce	0	0	0	0	3			40	60	
10	ET430	Extra Curricular /Competitive Exam	0	0	0	0	2			100		
		Total	**14**	**0**	**12**	**26**	**28**					
	ET419	PE4 : Power Electronics	3	0	0	3	3	15	15	10	60	3 Hrs
	ET420	PE4 : Wireless & Mobile Communication	3	0	0	3	3	15	15	10	60	3 Hrs
	ET421	PE4 : Satelite Communication	3	0	0	3	3	15	15	10	60	4 Hrs
	ET422	PE5 : Fuzzy Logic & Neural Networks	3	0	0	3	3	15	15	10	60	3 Hrs
	ET423	PE5 : Fuzzy Logic & Neural Networks Lab	0	0	2	2	1			40	60	
	ET424	PE5 : RF Circuit Design	3	0	0	3	3	15	15	10	60	3 Hrs
	ET425	PE5 : RF Circuit Design Lab	0	0	2	2	1			40	60	
	ET426	PE5 : Multimedia Commuincations	3	0	0	3	3	15	15	10	60	3 Hrs
	ET427	PE5 : Multimedia Commuincations. Lab	0	0	2	2	1			40	60	

Chairperson		**Date of Release**	May 2013	**Applicable for**
Dean (Acad. Matt.)		**Version**	**1.03**	**AY 2013-14 On wards**

GE409	Engineering Management	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:
This subject helps student to understand the Functions of management, Marketing Management, Personnel Management, Plant Management, Inventory Control and Finance Management in the organization

UNIT-1: Principles of management
Concepts of management, development of scientific management, Taylor Principles Fayol, functions of management
such as planning, decision making, organizing, communication, controlling, span of control .

06 Hrs

UNIT-2: Personnel & Human Resource Management
Concept and evolution of personnel management and HRM, Difference between PM and HRM. Functions of HRM Concept of HRD. HR Planning, Concept, Objective, Importance, and Process. Recruitment: Meaning, process, Recruitment Agencies, selection process, test, and types of test, interview, and types of interview. Recruitment Agencies, Training and Development.

06 Hrs

UNIT-3: Project management
Types of projects, various phases of project, Project Proposal, Components of planning, Objectives of planning, Factors affecting planning, Organizational setup, Network techniques Introduction and Use of CPM &PERT for planning. Estimation of critical path and project duration. Resource planning, Resource Allocation, Resource leveling, Optimization of project cost, Cost slope concept

06 Hrs

UNIT-4: Marketing Management:-
Definition & scope, selling & modem concepts of marketing, market research, rural marketing, Customer Behaviors, marketing strategies, product launching, product life cycle, sales promotion, pricing, channels of distribution, Advertising, market segmentation, marketing mix, positioning, targeting

06 Hrs

UNIT-5: Inventory Management :-
Principles of Inventory Management , Importance & objectives of Effective Inventory Management , Types of Inventory Control Systems, Inventory Control Procedures, Concept of ABC Analysis Benefits of ABC Analysis.

06 Hrs

UNIT -6: Financial Management:-
Definition & Functions of Finance department Sources of finance ,financing organizations, types of capital, elements of costs & allocations of indirect expenses, cost control, break even analysis, budgets & budgetary control, equipment replacement policy, make or buy analysis, balance sheet, ratio analysis, profit & loss statement.

06 Hrs

Text books:

1	Industrial Management	2nd Edition 1999	by I.K. Chopde, A.M. Sheikh.	S Chand & Company
2	Operations Research	2002	by L.C. Jhamb	Everest Publishing house

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

GE409	Engineering Management	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	Business Organisation and Management	Second Edition 2002	by S.A. Sherlekar	BRAND NEW FROM PUBLISHER
2	Management Information Systems	Date: 2009 11th International Edition	by Laudon and Laudon	Publisher: Prentice Hall.

Course Outcomes:

After completion of the course, the students will be able to:

1. Develop leadership qualities and managerial skills.
2. Apply their managerial skills in the areas such as Personnel & Human Resource Management, Project management, rketing Management, Inventory Management & Financial Management

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I						√	√	√					
	II													
	III								√					
	IV						√	√	√					
	V								√					

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET401	RF & Microwave	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives:

1. To understand the basic concepts of klystron amplifier & oscillator
2. To study RF energy sources.
3. To learn microwave passive components like couplers, tees, attenuators, circulators, etc
4. To study concepts of s-matrix.
5. To study microwave filters and different microwave measurement techniques
6. To introduce different microwave solid state devices

UNIT-1:

Microwave linear beam tubes (O type)

High frequency limitations of conventional microwave devices,Two cavity Klystron Amplifier – Mechanism and mode of Operation, Power output and Efficiency, Applegate diagram, applications, Reflex Klystron Oscillator – Mechanism and mode of Operation Power output, efficiency, mode curve, Electronic Admittance, Modulation of Reflex Klystron; Applications, Helix TWT, BWO. Slow wave structures.

08Hrs

UNIT-2:

Microwave cross-field tubes (M Type):

Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Power output and Efficiency,

Cylindrical magnetron, parallel plate magnetron, split anode magnetron, Types of strapping, Tuning of magnetron. Applications, Numerical Problems

08Hrs

UNIT-3:

Microwave passive Devices (Reciprocal and Non reciprocal):

Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, , Directional couplers, Wave guide Corners, Bends and Twists ,Attenuators, Isolators, Gyrators, Circulators, Phase shifter, Rectangular cavity resonator, Transmission line resonators

08Hrs

UNIT-4:

Microwave Network Analysis

Introduction, Symmetrical Z and Y matrices for reciprocal network, Scattering matrix representation of multi port networks, comparison between [S], [Z] and [Y] matrices. Inter relationship between impedance matrix, admittance matrix and Scattering matrix, properties of scattering matrix. Scattering matrix of transmission lines, ABCD parameters with S parameters, Scattering matrix derivation for all components, Numerical Problems

08Hrs

UNIT-5:

Microwave measurement:

Introduction, Tunable detector, Slotted line Carriage, VSWR meter, Power measurements sensor, Bolo meter sensor, power sensor, Low and High power measurement, Insertion loss and Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement. Frequency measurement, Measurement of cavity Q, Dielectric measurement, Antenna Measurement – radiation pattern, Phase and gain. Types of Microwave filters: Image parameter method, Insertion loss method

07Hrs

ET401	RF & Microwave	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6:

Microwave solid state devices and circuits:

Microwave diodes – Gunn diode – Mode of operation, Crystal diode, PIN diode –, IMPATT diodes, Application as Oscillator and Amplifiers, Varactor diode, parametric amplifier, Microwave transistors, MASER, Strip lines: Micro strip lines, parallel strip lines. Coplanar, shielded

07Hrs

Text books:				
1	Microwave device and circuits	Third Edition	Samuel Y.Lio	Pearson Education
2	Foundations of microwave engineering	Second Edition 1992	R.E. Collins	Tata Mc-Graw Hill
3	Microwave engineering	Second Edition 1992	R Chatterjee.	
4	Microwave Engineering	Third Ed. 2007	David Pozar	Wiley Ind. Pub.
Reference books:				
1	Microwave communication	1989	Hund	
2	Microwave theory and measurement		G. Lance	
3	Microwave Engineering	2nd Edition Reprint 2001	Annapurna Das, Sisir. K.Das	Tata McGraw-Hill Co., Ltd.
4	Microwave	1978	Reich J.H.et al	East West Press,

Course Outcome:

After completion of the course, the students will be able to:

1. Explore behavior of active devices like klystron, magnetron, TWT & BWO
2. Analyze behavior of different passive components using s-matrix
3. Measure various parameters like power, VSWR, attenuation, Q factor & impedance
4. Design microwave filters
5. To explore different microwave solid state devices

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√				√			√			√	√	√
	II	√	√			√				√		√	√	√
	III		√			√			√			√		
	IV								√					
	V								√	√			√	√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET402	RF & Microwave Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs
OBJECTIVES:					
Analysis of various active and passive RF microwave devices.					

Sr. No.	TEN EXPERIMENTS BASED ON
1	Active RF Devices
2	Passive RF Devices
3	Microwave Measurement
4	MIC Components

ET403	Principles of Image Processing	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

1. To introduce the concept of sampling theory and quantization in image processing.
2. To interpret the digital images in frequency domain by using various transform techniques.
3. To understand basic algorithms for the enhancement of digital images.
4. To learn the various processes of image compression.
5. To learn segmentation of digital images through various algorithms.

UNIT-1:

Digital image fundamentals-Digital Image through scanner, digital camera, Concept of gray levels, Gray level to binary image conversion, Sampling and quantization, Relationship between pixels, Imaging Geometry

08Hrs

UNIT-2:

Image enhancement, Point processing, Histogram processing, Two dimensional fourier transform, Spatial filtering and its frequency domain interpretation, Enhancement in frequency domain, Image smoothing, Image sharpening

08Hrs

UNIT-3

Image segmentation, Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation

08Hrs

UNIT-4:

Image Restoration Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration

08Hrs

UNIT-5

Image Transforms 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hoteling transform

07Hrs

UNIT-6:

Image compression, Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression

07Hrs

Text books:				
1	Digital Image processing	2nd Education, 2002.	R.C. Gonzalez & R.E. Woods	Addison Wesley/ Pearson education
2	Fundamentals of Digital Image processing	1989	A.K.Jain	PHI

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ET403	Principles of Image Processing	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	Digital Image processing using MAT LAB	Edition, PEA, 2004	Rafael C. Gonzalez, Richard E Woods and Steven L	Pearson
2	Digital Image Processing	3rd Edition, 2004	William K. Pratt, John Wiley	

Course Outcome:

Upon successfully completing the course, the student will be able to:

1. Process digital images using image enhancement technique.
2. Demonstrate the application of image processing algorithms to real life problems
3. To represent & describe of digital images using different techniques.
4. Implement image processing algorithms in CAD Tools.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√		√			√				√	√
	II	√		√		√				√			√	√
	III			√		√			√					
	IV								√					
	V								√	√			√	√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET404	Principles of Image Processing Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objectives

1. Cover the basic theory and algorithms that are widely used in digital image processing
2. Expose students to current technologies and issues that are specific to image processing systems
3. Develop hands-on experience using software and hardware to process images
4. Familiarize with MATLAB Image Processing Toolbox

Sr. No.	Ten Experiments Based on
1.	Statistical properties of image and displaying histogram and profile
2.	Histogram modification.
3.	Image smoothing operations.
4.	Edge detection.
5.	Segmentation using threshold.
6.	Region based segmentation.
7.	Image transforms.
8.	MATLAB Interface with hardware

ET405	Optical communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

1. To study the behavior of optical systems
2. To Learn concept of operation of active and passive optical communication components, the principles of designing optical communication systems
3. To understand operation of light sources in optical systems.
4. To study the principles of single and multi mode optical fiber.
5. To learn transmitter, receiver sections of optical system.

UNIT-1:

INTRODUCTION TO OPTICAL FIBERS

Evolution of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi mode fibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure. Electromagnetic wave equation in step index and graded index fibers Modes and Power flow in fibers

06 Hrs

UNIT-2:

SIGNAL DEGRADATION IN OPTICAL FIBERS

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides – Information Capacity determination – Group Delay – Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers – Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers – Mode Coupling – Design Optimization of SM fibers – RI profile and cut-off wavelength

06 Hrs

UNIT-3

FIBER OPTICAL SOURCES

Direct and indirect Band gap materials – LED structures – Light source materials – Quantum efficiency and LED power, Modulation of a LED, Laser Diodes – Modes and Threshold condition – Rate equations – External Quantum efficiency – Resonant frequencies – Laser Diodes structures and radiation patterns – Single Mode lasers – Modulation of Laser Diodes, Temperature effects, Source launching and coupling. Fabry Perot cavity Quantum laser

06 Hrs

UNIT-4:

FIBER OPTICAL RECEIVERS

PIN and APD diodes – Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise – Comparison of Photo detectors – Fundamental Receiver Operation – pre-amplifiers - Error Sources – Receiver Configuration – Probability of Error – The Quantum Limit

06 Hrs

UNIT-5

DIGITAL TRANMISSION SYSTEM

– Fiber Splicing and connectors – Noise Effects on System Performance – Operational Principals of WDM,SONET,LAN 1000 baseSX, LX and Passive Components

06 Hrs

ET405	Optical communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6:

MEASUREMENT IN OPTICAL FIBERS

Attenuation, Time domain dispersion and Frequency domain dispersion, NA measurement Refractive index profile and optical source characteristic measurements, OTDR

06 Hrs

Text books:				
1	Optical Fiber Communication	2008	Gerd Keiser	McGraw-Hill International, Singapore
2	Optical Communication, Principles and Practice.	1992	J.Senior	
Reference books:				
1	Optical Communication System		J. Gower	Prentice Hall of India
2	Fiber-Optic Communication System	Third Edition	Govind Agrawal	John Willy & Sons

Course Outcome:

The student will be able to:

1. Explore fiber optics and electro-optical components.
2. Design of optical communication links.
3. Apply the geometrical optics technique to analyze ray propagation in optical systems
4. Analyze an Optical Communication System.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√				√			√					
	II	√				√				√				
	III					√			√					
	IV								√					
	V								√	√				

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET406	Optical communication Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objectives

1.To observe and analyze various fiber optic data links when used for both digital and analog data transmission.
2. To learn proper fiber splicing techniques and to become familiar with the use of optical time domain reflectometry in characterizing optical fibers.

Sr. No.	Ten Experiments Based on
1.	Optical Sources Characteristics
2.	Numerical Aperture
3.	Fiber Attenuation
4.	Optical detector Characteristics
5.	Fiber Bandwidth/ Data Rate

ET407	Microwave Integrated Circuits	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives
Students will achieve a broad understanding of the current trends in Micro strip technologies. They will learn Micro strip line, Micro strip line devices, Micro strip Antennas, Design of micro strip circuits and Hybrid MICs, which will clear their fundamentals & vision up to final IC fabrication

UNIT-1:
Micro strip line:
Analysis using conformal transformation and Hybrid mode method. Characteristic impedance, Guide wavelength and loss, Slot line – Wave-guide analysis, coupling coaxial and micro strip lines Coplanar line: analysis using conformal transformation and Hybrid mode method

06 Hrs

UNIT-2:
Micro strip line devices:
Directional couplers, Micro strip coupler and branch-line couplers, even and odd mode analysis, coupling coefficient and bandwidth. Impedance transformers and filters, Lumped elements for MIC design and fabrication of inductors, resistors and capacitors, Non-reciprocal components, micro strip circulators, isolators, phase shifters

06 Hrs

UNIT-3:
Micro strip Antennas:
Radiation mechanism, radiation fields, patch antennas, traveling wave antennas, slot antennas, excitation techniques, surface waves

06 Hrs

UNIT-4:
Design of micro strip circuits:
High power circuits – Transistor Oscillator, step recovery diode frequency multiplier, avalanche diode oscillator, PIN diode switch, low power circuits Schottky diode, Balanced mixer, parametric amplifier, PIN diode limiter, Diode phase shifter

06 Hrs

UNIT-5:
Hybrid MICs:
Dielectric Substrates, thick film technology, thin film technology, methods of testing, encapsulation of devices, mounting

06 Hrs

UNIT-6:
Monolithic MICs fabrication:
Epitaxial growth, Diffusion, Ion implantation, Electron Beam technology for pattern delineation

06 Hrs

ET407	Microwave Integrated Circuits	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Antennas and Radio Wave Propagation	1985	R.E.Collin	McGraw Hill Publishers
2	Microwave Devices and Circuits	Third Edition	Samuel Liao	Prentice-Hall of India Ltd
3	Microwave Engineering	Third Edition	David Pozar	Wiley Ind. Pub.

Reference books:				
1	Microwave Integrated Circuits	1974	K. C. Gupta and Amarjit Singh	Wiley East. Ltd
2	Micro strip Antennas	1980	I.J. Bahl and P. Bhartia	Artech House
3	Strip line Transmission Line for MIC		Bharti Bhat, S. K. Koul	New Age International

Course Outcome:

The student will be able to:
1.Analyze and synthesis different antennas starting from microstrip antennas, Hybrid MICs and antenna arrays.
2.Fabricate using the different technologies available as well as testing and mounting it.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√		√						√	√	√
	II	√	√	√		√						√	√	√
	III		√	√		√						√		
	IV													
	V												√	√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET408	Microwave Integrated Circuits Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objectives

1. To understand the concept of various microwave Integrated circuites..
2. Develop hands-on experience on EM simulation Software.
3. To analyze and Design various Filters and Microstrip antennas.

Sr. No.	Ten Experiments Based on
1.	Directional coupler
2.	Power Divider
3.	Measurement of antenna pattern : parabolic antenna, slot antenna, Horn antenna
4.	A micro strip antenna
5.	Ferrite Devices / Components
6.	Micro strip Filters.

ET409	Communication Networks	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

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Course Objectives:

1. To understand the concept of computer communications and functions of OSI and TCP/IP layers.
2. To study how communication works in data networks and the Internet.
3. To study internetworking devices and their functions.
4. To understand the role of protocols in networking
5. To study the features and operations of various application layer protocols.

UNIT-1:

Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model,

05 Hrs

UNIT-2 :

LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN

05 Hrs

UNIT-3 :

Physical layer and data link layer: transmission media, PSTN.

Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.

06 Hrs

UNIT-4:

Network layer and transport layer: network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways

06 Hrs

UNIT-5: Network Applications

Application layer: domain name system, electronic mail system, multimedia, real time transport protocol, electronic mail, world wide web.

07 Hrs

UNIT-6: Network Security:

network security cryptography, secrete key, public key, digital signature, e-mail security, web security, communication security,

07 Hrs

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET409	Communication Networks			L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

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Text books:				
1	Computer networks	3rd Edition	Tanenbaum	*Amazon*
2	Computer communication	2003	by W. Stanlling	Prentice Hall
3	Data Communication and Networking	4th Edition	Forouzan	McGrawHill

Reference books:				
1	Telecommunication switching systems and networks	Paperback	by vishwanathan	PHI
2	Computer Networks	Third Edition 2003	Larry Peterson, Bruce Davie	MKP
3	Top down approach		Galo & Hancock	Pearson

Course Outcome:

The students will be able to

1. Compare communication topologies and network architectures.
2. Utilize interfacing standards and communication protocols in computer communication network.
3. Design computer communication network systems.
4. Apply the knowledge of network securities in computer networks.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√							√					
	II	√								√				
	III								√					
	IV								√					
	V								√	√				

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET410	Communication Networks Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objectives

1. To understand the concept of various networking protocols.
2. To analyze the need of security in the computer network.

Sr. No.	Ten Experiments Based on
1.	Network design LAN, MAN ,WAN
2.	PC to PC communication using RS-232 port
3.	Sliding window protocol
4.	Wireless TCP and UDP protocols
5.	Bluetooth
6.	Network security cryptography
7.	Communication networks like Wi-Fi, Wimax
8.	Routing protocols

ET411	Soft computing	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

1. To familiarize with soft computing concepts.
2. To describe the basics of Soft computing and its application areas particularly to intelligent systems
3. To introduce the ideas of Neural networks.
4. To introduce the concepts of Fuzzy Logic.
5. To introduce the concepts of Genetic algorithm

UNIT-1:

Introduction of Soft Computing Methods, Fundamentals of Genetic Algorithms, Encoding, Fitness function, Genetic modeling, Applications of GA

06 Hrs

UNIT-2:

Introduction of neural networks, learning methods, perceptrons, perceptron training algorithm, single layer perceptron, multiplayer perceptron, neural network architectures, ADALINE, MADALINE

07 Hrs

UNIT-3

Adaptive filtering, LMS algorithm, Back propagation algorithm, RBF networks,ART Networks, self-organizing feature maps, Applications of ANN

08 Hrs

UNIT-4:

Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conforms

07 Hrs

UNIT-5

Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations, fuzzy relations, projections and cylendric extensions, binary fuzzy relations, fuzzy equivalence, compatibility and ordering relations, fuzzy morphism

08 Hrs

UNIT-6:

Fuzzy controllers, Defuzzification Methods , Fuzzy Inference Techniques, applications of fuzzy logic in pattern recognition and image processing

08 Hrs

Text books:				
1	Fuzzy sets and Fuzzy logic	1995	by George Klir, Bo Yuan	PHI
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, Vijayalaxmi Pai	PHI
3	Elements of Artificial Neural Network	1997	K. Mehrotra	MIT Cognet

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET411	Soft computing	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1.	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2.	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3.	Fuzzy Logic & Applications	2003	J. Ross, TMH/Mc	Mc Graw Hill

Course Outcome

1. Identify and describe soft computing techniques and their roles in building intelligent machines
2. Recognize the feasibility of applying a soft computing methodology for a particular problem
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
4. Apply genetic algorithms to combinatorial optimization problems
5. Apply neural networks to pattern classification and regression problems
6. Evaluate and compare solutions by various soft computing approaches for a given problem.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√			√							√		√
	II	√										√		√
	III				√							√		
	IV				√									
	V													√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET412	INDUSTRIAL INSTRUMENTATION			L= 4	T = 0	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	10	60	100		3 Hrs

Course Objectives

To learn various techniques used for the measurement of industrial parameters. To learn pressure transducers, temperature standards, calibration and signal conditioning used in RTD's, thermocouples and pyrometry techniques, load cells, torque meter and various velocity pick-ups.

UNIT-1:

INTRODUCTION

Block diagram of instrumentation system, static and dynamic characteristics of instruments, functions of instruments, Definition of Transducers- Role of transducers in instrumentation- Advantages of electrical transducers - Classification of transducers- Analog and Digital, Active and passive, Primary and Secondary transducers- Inverse transducer- Sensitivity and specification for transducers - Characteristics and Choice of transducer-Factors influencing choice of transducer. Need of transducers, Classification, selection criteria,

07 Hrs

UNIT-2:

PRESSURE MEASUREMENT

Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.

08 Hrs

UNIT-3 :

TEMPARATURE MEASUREMENT:1

Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.

07 Hrs

UNIT-4:

TEMPARATURE MEASUREMENT:2

THERMOCOUPLES AND PYROMETERS

Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation – Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.

08 Hrs

UNIT-5

FLOWMETERS

Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube.

Area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flow meters, flow measurements for gases

08 Hrs

UNIT-6:

MISCELLANEOUS MEASUREMENT

Electrical level gauge: – Resistive - capacitive – Nuclear radiation - Ultrasonic type, Radar type ,Speed measurement D.C and A.C tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive. Soil & water pH measurements.

07 Hrs

ET412	INDUSTRIAL INSTRUMENTATION			L= 4	T = 0	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Text books:				
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi

Reference books:				
1	Principles of Industrial Instrumentation		D. Patranabis	Tata McGraw Hill Publishing Company Ltd, 1996.
2	Instrumentation Measurement & Analysis	2004.	B.C. Nakra & K.K.Chaudary	Tata McGraw Hill Publishing Ltd
3	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
4	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

Course Outcome

1. The students will be equipped with the basic knowledge of Pressure, Temperature, flow, level, density and viscosity measurements.
2. The students will be able to calibrate various instruments.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√			√							√		√
	II	√										√		√
	III				√							√		
	IV				√									
	V													√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
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ET413	Industrial Training	L = 0	T = 0	P = 0	Credits = 2

Evaluation Scheme	Continuous Evaluation	ESE*	Total	ESE Duration
		100	100	

* **Evaluation Based on Seminar / Report.**

Course Objectives
To provide students with industry exposure, so that they can work efficiently in industry.

Course Outcome
Students will be able to apply the knowledge gained in industry, so that they could effectively use this knowledge while doing their projects.

Mapping of POs & PSOs with PEOs

		Program Outcome and Program Specific Program Outcome												
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**
Program Educational Objectives	**I**	√		√	√	√	√	√	√			√	√	√
	II	√	√	√		√						√	√	√
	III		√	√	√	√						√		
	IV				√		√	√	√		√			
	V								√	√	√		√	√

ET414	Project Phase -I	L = 0	T = 0	P = 4	Credits = 4

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	2 Hrs

Course Objectives

1. To identify the project problem statement by doing the literature survey
2. To define and prepare road map to get a desired output.
3. To gain knowledge and implement it to get a desired output for project problem statement.

Course Outcome

Students will be able to complete their framework of project and start working for project phase-II, where the focus will be about implementation of project.

Mapping of POs & PSOs with PEOs

		Program Outcome and Program Specific Program Outcome												
		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√	√	√	√	√	√			√	√	√
	II	√	√	√		√						√	√	√
	III		√	√	√	√						√		
	IV				√		√	√	√		√			
	V								√	√	√		√	√

ET415	Antenna Theory and Design	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

1. Ability to calculate antenna parameters (radiation pattern, beam width, lobes, directivity, gain,
2. impedance, efficiency, polarization)
3. Ability to analyze wire antennas (monopoles, dipoles, and loops).
4. Ability to analyze and design antenna arrays.
5. 4 Understand the operation of broadband and traveling wave antennas.
6. 5 Understand the operation of aperture and reflector antennas.
7. Ability to analyze and design microstrip antennas.

UNIT-1:

BASIC ANTENNA CONCEPTS:

Types of antennas, Radiation mechanism, Beam solid angle, radiation intensity, Directivity, effective aperture, beam efficiency, Antenna field zones, Polarization, impedance, bandwidth, impedance, effective length, antenna temperature

07Hrs

UNIT-2:

DIPOLE ANTENNA RADIATION:

Scalar and vector potentials, retarded potentials, field due to a current elements, power radiated and radiation resistance for field due to a dipole, power radiated and radiation resistance, Earth curvature, Half wave dipole antenna radiated fields of short dipole, small loop and helical Antenna, Radiation resistance, Directivity and Design Feature. Half wave dipole: radiated fields and other feature

07Hrs

UNIT-3

LOOP ANTENNAS AND ARRAYS:

circular loop ,polygonal loop and ferrite loop antenna**,** circular loop antenna with constant current, Two element array, linear array, N- element array ,uniform ,broad side, end fire ,Non uniform Amplitude antenna array**,** planar and circular array

08Hrs

UNIT-4:

TRAVELING WAVE AND BROAD BAND DIPOLE

Introduction, traveling wave antenna, long wire, V antenna, rhombic antenna, Broadband antennas, Helical antenna, Electric-Magnetic Dipole, Yagi-Uda array of linear Elements, Yagi array of loops

08Hrs

UNIT-5

SPECIAL ANTENNAS:

Aperture Antennas: Rectangular aperture, Circular aperture, Babinet's principle, Horn antenna: conical horn, corrugated Horn, Multimode horn reflector antenna: plane reflector, corner reflector, corner, parabolic, spherical, Patch Antenna

08Hrs

UNIT-6:

ANTENNA MEASUREMENTS:

Antenna Range, Radiation Pattern, Gain Measurement, Directivity Measurement, Radiation Efficiency, Impedance Measurement, Current Measurement, Polarization Measurement

07Hrs

ET415	Antenna Theory and Design	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Antenna Theory Analysis and Design Technology	1982 Third edition	Balanis E.S.	Wiley India
2	Antennas	II edition 1988	John D.Krauss	McGraw-Hill International edition
Reference books:				
1	Electromagnetic waves and Radiating systems	1993	Edward C.Jordan, Keith G.Balmain	Prentice Hall of India 1Td
2	Antennas and Radio Propagation	1985	R.E. Collins	McGraw-Hill

Course Outcome

1. Ability to calculate antenna parameters (radiation pattern, beam width, lobes, directivity, gain, impedance, efficiency, polarization)
2. Ability to analyze wire antennas (monopoles, dipoles, and loops).
3. Ability to analyze and design antenna arrays.
4. Understand the operation of broadband and traveling wave antennas.
5. Understand the operation of aperture and reflector antennas. Lectures,
6. Ability to analyze and design microstrip antennas

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√		√						√	√	√
	II	√	√	√		√				√		√	√	√
	III		√	√		√						√		
	IV													
	V									√			√	√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET416	Antenna Theory and Design Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs
Course Objective					
To plot and analyze the characteristics of the following antennas					

Expt. No	Ten Experiments Based on
1	Dipole
2	Half Wave Dipole
3	Monopole
4	Yagi Antenna
5	Boardside array
6	Endfire array
7	Loop Antenna
8	Crossed Dipole
9	Lock Periodic Antenna
10	Slot Antenna
11	Helix Antenna
12	Microstrip Antenna

ET 417	CMOS VLSI Design	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

The objective of this subject is to study detailed treatment of the MOS transistor with all its relevant aspects; to the static and dynamic operation principles, analysis, and design of basic inverter circuit; and to the structure and operation of combinational and sequential logic gates.

UNIT-1: Introduction of MOSFETs

MOS Physics, NMOS Enhancement Transistor, MOS Transistor Operations, PMOS Enhancement Transistor, Regions of Operations, Threshold Voltage, MOS Device Equations, Small Signal Modeling of MOSFETs.

08 Hrs

UNIT-2: Physical Structure and Fabrication of CMOS IC

Integrated Circuit Layers, MOSFETs, CMOS Layers, Overview of Silicon Processing, N-Well Process, P-Well Process, Basic Physical Design of Simple Logic Gates, Stick Diagram, Euler's Path, Twin Tub Process, Silicon on Insulator (SOI) Process, Latch-up Effect.

07 Hrs

UNIT-3: Logic Design With MOSFETs

Ideal Switches and Boolean Operations, MOSFETs as Switches, Basic Logic Gates in CMOS , Compound Gates in CMOS , Transmission Gate Circuits(TG),Pass Transistor, Multiplexers.

07 Hrs

UNIT-4: MOS inverter Characteristics:

Resistive load inverter, Inverters with n type MOSFET load, CMOS inverter, Principle of operation, DC characteristics, Tristate Inverter, Noise Margin, Introduction to Bi-CMOS Inverter.

07 Hrs

UNIT-5 : Analysis of CMOS Logic Gates

MOS Device Capacitance, Switching Characteristics, Rise Time, Fall Time, Propagation Delay, Power Dissipation in CMOS, Charge Sharing, Fan-in , Fan-out, Combinational circuit design, static CMOS, Ratioed Logic circuits, sequential circuit, Latches and Flip Flops

07 Hrs

UNIT-6: Advanced Techniques in CMOS Logic Circuits

Complex Logic Structures, Complementary Static CMOS, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, CMOS Pass Transistor Logic and Flip-Flops.

08 Hrs

Text books:				
1	Introduction to VLSI Circuits and Systems	First Edition	John P. Uyemura	Wiley Publication
2	Principle of CMOS VLSI Design	2nd Edition, 1994	Neil H. E. Weste, K. Eshraghian	Addison Wesley VLSI Series

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET 417	CMOS VLSI Design	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	CMOS VLSI Design	3rd Edition, 2005	Pucknell , K. Eshraghian	Prentice Hall
2	CMOS Digital Integrated circuits Analysis and Design	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici	TataMc Graw Hill

Course Outcome

1. Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnect.
2. Be able to create models of moderately sized CMOS circuits that realize specified digital functions.
3. Be able to apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√								√	√	√
	II	√	√	√								√	√	√
	III		√	√								√		
	IV													
	V												√	√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET418	CMOS VLSI Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objectives
1. To introduce the fundamental principles of VLSI circuit design & layout 2. To provide hands-on design experience using tanner tool.

Sr. No.	Ten Experiments Based on
1	Introduction to EDA Tool.
2	Plot the transfer characteristics of NMOS using EDA Tools
3	Plot the transfer characteristics of PMOS transistor using EDA Tools
4	Plot the transfer characteristics of CMOS Inverter using EDA Tools
5	Gate Level Analysis of NAND Gate
6	Gate Level Analysis of NOR Gate
7	Gate Level Analysis of Transmission Gate
8	Designing of low power D Flip-flop

ET419	Power Electronics	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

To make familiar with the SCR & other power devices, power controller, various techniques of improving power factor, different methods of commutation

UNIT-1:

Power Semiconductor Diodes and Circuits, control Characteristics of power devices, power modules, power diodes, reverse recovery, series, shunt connected diodes, Diode Rectifiers—single phase, three phase rectifiers, bride rectifiers, design of rectifiers

05 Hrs

UNIT-2:

Power Transistors, Switching characteristics of BJT, Power MOSFETs, IGBTs, limitations, Power Thyristors

06 Hrs

UNIT-3:

Pulse-width Modulated Inverters: Principle, single phase, multiple phase, PWM Forced commuted inverters, current source inverters, design of inverter, DC-DC Converters, Step up, stepdown, SMPS, thyrister Choppers, design of choppers

06 Hrs

UNIT-4:

Resonant Pulse Inverters—Series, parallel, resonant inverters, Class E resonant inverter, Zero voltage/current Switching resonant inverter Multilevel Inverters

06 Hrs

UNIT-5:

Controlled Rectifiers: phase control converter, single phase, three phase converters, power factor improvement. AC Voltage Controllers. Principle of ON-OFF control, Phase control, Single phase controllers, three phase controllers, cyclo-converters

06 Hrs

UNIT-6:

Power Supplies, SMPS, SM ac power supplies, power factor conditioning Gate Drive Circuits- Protection of Devices and Circuits Snubber, reverse recovery transients, protection devices varisters, Introduction to AC and DC drives.

06 Hrs

Text books:

1	Power Electronics:Circuits,Devices and Applications	Second Edition 1993	M. Rashid	PHI

Reference books:

1	Power Electronics and its application	Second Edition, 2004	Alok Jain	Penram International Publishing Pvt Ltd

Course Outcome

1. Learn the principles of operation of power electronic converters
2. Understand how to design inverter, dc-dc power converters
3. Introduce the concept of switching losses
4. Understand the principles of operation of Controlled Rectifiers

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET420	Wireless Mobile Communication Systems	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives:

1. To study cellular concept and techniques to improve capacity in cellular system.
2. To study mobile radio environment and its different parameters.
3. To learn different modulation techniques for mobile communication.
4. To study fundamentals of equalization, diversity & its techniques.
5. To study multiple access techniques.

UNIT-1: Introduction to Wireless Communication Systems:

Evolution of Mobile Radio Communications Mobile Radio Systems around the world. Examples of Wireless Communication Systems, Comparison of common wireless communication systems, trends of cellular radio and personal communications, Second generation (2G) cellular Networks, Third generation (3G) cellular Networks, wireless local loops and LMDS

05 Hrs

UNIT-2: The Cellular Concept :

Evolution of mobile radio communication, Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system

06 Hrs

UNIT-3: Mobile Radio Propagation- Large & Small Scale Path Loss & Fading:

Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling. Small Scale Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types Of Small Scale Fading, Rayleigh & Rician Distribution

06 Hrs

UNIT-4: Equalization & Diversity:

Fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver

06 Hrs

UNIT-5: Wireless Systems and Standards:

GSM- global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard(IS-95)

06 Hrs

UNIT-6: Wireless Networking:

Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signaling, Signaling System No 7.An Example of SS7, SIP -Global Cellular Network Interoperability

06 Hrs

ET420	Wireless Mobile Communication Systems	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Wireless Communication – Principles and practice	Second edition	by T S. Rappaport	(Prentice Hall PTR, upper saddle river, New Jersey.)
2	Digital Communication		Proakis	
Reference books:				
1	Wireless digital communication	1995	by Kamilo Feher	PHI
2	Mobile Communications Design fundamentals	1993	by William C. Y. Lee	John Willey
3	Mobile Cellular Communication	2005	by W .C .Y. Lee	Mc Graw Hill

Course Outcome:

After learning this subject the students will be able to:

1. Design a model of cellular system communication and analyze their operation and performance.
2. Quantify the causes and effects of path loss and signal fading on received signal characteristics.
3. The students will construct and analyze the GSM system

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√				√			√					
	II	√				√				√				
	III					√			√					
	IV								√					
	V								√	√				

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET421	Satellite Communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

Students will achieve a broad understanding of the current trends in satellite communications systems and technologies as well as the future directions of the subject area. They will be able to plan satellite systems for quality of service and understand how new technology will enhance and open up new markets

UNIT-1:

ORBIT DYNAMICS

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, Orbit Dynamics, station keeping, geo stationary and non Geo-stationary orbits, frequency allocation, frequency co-ordination and regulatory services, sun transit outrages, limits of visibility, launching vehicles and propulsion

06 Hrs

UNIT-2:

SPACE SEGMENT

Space craft configuration, communication Payload and supporting subsystems, satellite up link, down link, link power budget, c/no. G/T, Noise temperature, System noise, propagation factors, rain and ice effects, polarization

06 Hrs

UNIT-3

SATELLITE ACCESS:

Modulation and Multiplexing , Multiple Access Techniques : Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption

06 Hrs

UNIT-4:

EARTH SEGMENT

Transmitters, receivers, Antennas, Terrestrial Interface, TVRO, MATV, CATV, Test Equipments Measurements on G/T, C/No, EIRP, Antenna Gain

06 Hrs

UNIT-5

SATELLITE APPLICATIONS :

INTELSAT Series, INSAT, VSAT, Facsimile system, Weather service, Remote sensing, mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System

06 Hrs

UNIT-6:

DIRECT BROADCAST

Direct Broadcast satellites (DBS), Direct to home Broadcast (DTH), Digital audio broadcast (DAB), Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, internet

06 Hrs

ET421	Satellite Communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Satellite Communication	1989	Dennis Rody	Regents/Prentice Hall, Englewood cliffs, New Jersey
2	Satellite Communication Systems Engineering	1993	Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson	Prentice Hall, II Edition
Reference books:				
1	Design of Geosynchronous Space Craft	1986	N. Agarwal	Prentice Hall
2	The Satellite Communication Applications	1997	Bruce R. Elbert	Hand Book, Artech House Bostan London
3	Digital Satellite Communication'	II edition, 1990	Tri T. Ha	
4	Manual of Satellite Communications'	1984	E manuel Fthenakis	McGraw Hill Book Co
			Pratt	

Course Outcome:

1. Identify the fundamentals of orbital mechanics, the characteristics of common orbits used by communications and other satellites, and be able to discuss launch methods and technologies.
2. Understand and apply the knowledge of satellite communication to various broadcast techniques like DTH,DA,BTV.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√				√			√					
	II	√				√				√				
	III					√			√					
	IV								√					
	V								√	√				

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET422	Fuzzy Logic & Neural Network	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

Soft computing refers to principle components like fuzzy logic, neural networks, which have their roots in Artificial Intelligence. Healthy integration of all these techniques has resulted in extending the capabilities of the technologies to more effective and efficient problem solving methodologies

UNIT-1:

Introduction of neural networks, NN Architecture Neural learning and laws, Applications of ANN Evaluation of network,

Supervised Learning :

Single layer network : MP neuron, Perceptron, Perceptron training algorithm, LMS algorithm , ADALINE

06 Hrs

UNIT-2:

Supervised Learning :

Multiplayer network: Multilevel Discrimination, Backpropogation Algorithm, Setting the parameter values, Accelerating the learning Process, MADALINE, Adaptive Multilayer Networks, Recurrent Network, RBF networks

06 Hrs

UNIT-3:

Unsupervised Learning : Winner Take Network, Learning Vector Quantizer, ART Networks, self-organizing feature maps, Associate Models

06 Hrs

UNIT-4:

Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conforms

06 Hrs

UNIT-5:

Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations, fuzzy relations, projections and cylendric extensions, binary fuzzy relations, fuzzy equivalence, compatibility and ordering relations, fuzzy morphism

06 Hrs

UNIT-6:

Fuzzy controllers, Defuzzification Methods , Fuzzy Inference Techniques, applications of fuzzy logic in pattern recognition and image processing

06 Hrs

Text books:				
1.	Fuzzy sets and Fuzzy logic	1995	by George Klir, Bo Yuan	PHI
2.	Elements of Artificial Neural Network	1997	K. Mehrotra	MIT Cognet

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET422	Fuzzy Logic & Neural Network	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1.	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2.	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3.	Fuzzy Logic & Applications	2003	J. Ross, TMH/Mc	Mc Graw Hill
4.	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, Vijayalaxmi Pai	PHI
			Timothy Ross	

Course Outcome:

After learning this subject the students will be able to:

1. To learn the various architectures of building an ANN and its applications
2. Fundamentals of Crisp sets, Fuzzy sets and Fuzzy Relations
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√			√							√		√
	II	√										√		√
	III				√							√		
	IV				√									
	V													√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET423	Fuzzy Logic & Neural Network Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objectives

Develop and implement a basic trainable neural network or a fuzzy logic system for a typical control, computing application or biomedical application.

Sr. No.	Ten Experiments Based on
1.	Perceptron , LMS and Adaline
2.	Backpropogation Algorithm
3.	Unsupervised Learning:
4.	Fuzzy sets and representation of fuzzy sets
5.	Fuzzy numbers
6.	Arithmetic operation on fuzzy sets
7.	Fuzzy Controller

ET424	R.F. Circuit Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

Students will achieve a broad understanding of the current trends in RF circuit design. Student will learn the fundamentals of RF circuit design along with broad understanding of design of CMOS Radio-Frequency Integrated Circuits. Thus they will be finally able to design application based RF circuit

UNIT-1:

Introduction, History of wireless Communication, Noncellular wireless Applications, Shannon , Modulations, Propagation, Parallel RLC Tank Circuit, Series RLC Circuit , RLC Network as Impedance Transformer ,Skin Effect, Resistor,Capactor, Inductor, Transformer

06 Hrs

UNIT-2:

MOSFET Physics, MOS Device Physics in Short Channel Regime , Other Effects, Link Between Lumped and Distributed Regime ,Driving Point impedance at iterated structures , Transmission line , Behavior of finite length Transmission line, Artificial lines

06 Hrs

UNIT-3:

Review of Smith Chart and S- Parameter, Bandwidth Estimation Techniques , Rise time , Delay , Open Circuit Time Constant , Short Circuit Time constant

06 Hrs

UNIT-4:

Introduction to High Frequency Amplifier Design, Zeros as Bandwidth Enhancer , The shunt series Amplifier, Tuned Amplifiers, Neutralization and Unilateralization Cascaded Amplifiers, AM-PM Conversion

06 Hrs

UNIT-5:

Introduction to Voltage references and Biasing, Review of Diode Behavior, Diodes and Bipolar transistors in CMOS Technology Supply independent bias circuits, Band gap Voltage References, Amplifier linearity, Noise and Noise Figure analysis, Introduction to Mixers

06 Hrs

UNIT-6:

Introduction to RF Power Amplifiers, Classification of Power Amplifiers, Modulation of Power Amplifiers, Introduction to Phase lock loops , Linear zed PLL Model, Phase Detector, Sequential Phase Detector, Loop Filters and Charge Pumps

06 Hrs

Text books:				
1	The Design of CMOS Radio-Frequency Integrated Circuits	Second Edition	by Thomas H. Lee	
2	RF Circuit Design Theory and Applications		R. Ludwig & P. Bretchko	

ET424	R.F. Circuit Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	Analysis and Design of Analog Integrated Circuits		By Paul R. Gray	
			Razavi	

Course Outcome:
Students will be equipped with the knowledge of basic circuit theory and/or an exposure to microelectronics and will be able to cover the entire spectrum from the basic principles of transmission and microstrip lines to the various high-frequency circuit design procedures.

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√		√				√		√	√	√
	II	√	√	√		√						√	√	√
	III		√	√		√						√		
	IV													
	V									√			√	√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET425	R.F. Circuit Design Lab	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs
Course Objectives					
Design and Testing of RF Circuits					

Sr. No.	Ten Experiments Based on
1	RF Tuned Amplifier
2	RF Oscillator
3	RF Crystal Oscillator
4	IF Amplifier
5	RF Mixer
6	RF Filters (LP, HP, BP, Notch Filter)
7	RLC circuits
8	S parameters

ET426	Multimedia Communications	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives

1. To learn the basics of analog and digital video: video representation and transmission
2. To analyze analog and digital video signals and systems
3. To acquire the basic skill of designing video compression
4. To familiarize with video compression standards

UNIT-1:

Fundamental concepts in Text and Image: Multimedia and hypermedia, world wide web,overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video

06 Hrs

UNIT-2:

Fundamental concepts in video and digital audio: Types of video signals, analog video,digital video, digitization of sound, MIDI, quantization and transmission of audio

06 Hrs

UNIT-3:

Multimedia data compression: Lossless compression algorithm: DCT, Wavelet- Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT), Basic Audio Compression Techniques

06 Hrs

UNIT-4:

Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, MPEG2, MPEG4

06 Hrs

UNIT-5:

Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications : Quality of Multimedia Data Transmission, Multimedia over IP, RTCP,RTP,SIP-Transport of MPEG-4, Media-on-Demand(MOD) **,**

06 Hrs

UNIT-6:

Content-Based Retrieval in Digital Libraries C-BIRD— A Case Study ,C-BIRD GUI Color Histogram Color Density Color Layout Texture Layout Search by Illumination Invariance Search by Object Model

06 Hrs

Text books:				
1	Fundamentals of Multimedia	2004	Ze-Nian Li , Mark S Drew	PHI/Pearson Education
2	Multimedia Applications	2004	Steinmetz, Nahrst	Springer

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET426	Multimedia Communications	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	Multimedia Communications: Applications, Networks, Protocols and Standars	2001	Fred Halsall	Addison-Wesley

Course Outcome:
Students will be able to do 1.Graphics/image/video/audio data representations, including color models, HDTV, MIDI, and audio coding 2.Compression formats and standards for data, images, audio, and video, including both lossless and lossy formats 3.Multimedia networks, considering QoS, VoIP, media-on-demand, and multimedia over wireless networks 4.Content-based retrieval in digital libraries

Mapping of POs & PSOs with PEOs

		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√		√				√		√	√	√
	II	√	√	√		√						√	√	√
	III		√	√		√						√		
	IV													
	V									√			√	√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET427	Multimedia Communications Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Course Objectives
Develop hands-on experience using software on multimedia communication techniques.

Sr. No.	Ten Experiments Based on
1.	Sampling and Reconstruction
2.	Compression Techniques
3.	Image and video formats
4.	Content based image retrieval
5.	Network Simulations (NS2)

ET428	Project Phase-II	L = 0	T = 0	P = 6	Credits = 6

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Course Objectives
1. Implementation of project problem statement. 2. Testing, verification and validation of results.

Course Outcome
At the end of Project phase II , the student will be able to demonstrate the knowledge gained and Apply the same in practice .

Mapping of POs & PSOs with PEOs

		Program Outcome and Program Specific Program Outcome												
		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√	√	√	√	√	√			√	√	√
	II	√	√	√		√						√	√	√
	III		√	√	√	√						√		
	IV				√		√	√	√		√			
	V								√	√	√		√	√

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET429	Comprehensive Viva-Voce	L = 0	T = 0	P = 0	Credits = 3

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
		100	100	

Course Objectives
To prepare the students for various competitive exams and personal interviews

Course Outcome
The students will be able to demonstrate their technical knowledge which they have learnt throughout the program.

		Program Outcome and Program Specific Program Outcome												
		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I						√	√	√					
	II													
	III													
	IV						√	√	√		√			
	V								√		√			

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

ET430	Competitive Exam/Extra Curricular	L = 0	T = 0	P = 0	Credits = 2

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
		100	100	

Course Objectives
To develop the students personality to face the challenges in life.

Course Outcome
The students will be able to demonstrate their technical knowledge which they have learnt throughout the program.

		Program Outcome and Program Specific Program Outcome												
		a	b	c	d	e	f	g	h	i	j	k	l	m
Program Educational Objectives	I	√		√		√	√	√	√					
	II	√		√		√								
	III			√		√								
	IV						√	√	√		√			
	V								√	√	√			

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version	1.00	

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

B.E. (Computer Technology)

SCHEME OF EXAMINATION 2010

S. No.	Code	Subject	L	T	P	Total Contact Hours	Credits	Evaluation Scheme					
								MSE-I	MSE-II	TA	ESE	Total	ESE Hrs
SEMESTER VII													
1	CT401	Software Engineering	4	0	0	4	4	15	15	10	60	100	3
2	CT402	Software Engineering Laboratory	0	0	2	2	1			40	60	100	
3	CT450	Object Oriented Modeling	3	1	0	4	4	15	15	10	60	100	3
4		Professional Elective 2	4	0	0	4	4	15	15	10	60	100	3
5		Professional Elective 3	4	0	0	4	4	15	15	10	60	100	3
6		Free Elective 2	4	0	0	4	4	15	15	10	60	100	3
7	CT413	STR (TRAINING)	0	0	0	0	3			100		100	
8	CT440	Seminar 2	0	0	2	2	1			100		100	
9	CT414	Project Phase 1 (Analysis & Design)	0	0	6	6	4			40	60	100	
Total			19	1	10	30	29						
	CT405	PE2: Embedded Systems	4	0	0	4	4	15	15	10	60	100	3
	CT406	PE2: Neural Network & Fuzzy Logic	4	0	0	4	4	15	15	10	60	100	3
	CT407	PE2: Ad-hoc Wireless Networks	4	0	0	4	4	15	15	10	60	100	3
	CT408	PE3:Cloud Computing	4	0	0	4	4	15	15	10	60	100	3
	CT409	PE3:Operations Research	4	0	0	4	4	15	15	10	60	100	3
	CT410	PE3: Artificial Intellegience	4	0	0	4	4	15	15	10	60	100	3
	EL412	FE 2 : Electrical Energy Audit and Safety	4	0	0		4	15	15	10	60	100	
	EL413	FE 2: Utilisation of Electrical Energy	4	0	0		4	15	15	10	60	100	
	CV418	FE 2 : Elements of Earthquake Engineering	4	0	0	4	4	15	15	10	60	100	
	CV419	FE 2 : Air Pollution & Solid Waste Management	4	0	0	4	4	15	15	10	60	100	
	ET411	FE2 : Soft Computing	4	0	0	4	4	15	15	10	60	100	
	ET412	FE2 : Industrial Instrumentation	4	0	0	4	4	15	15	10	60	100	
	ME429	FE 2 : Total Quality Management	4	0	0	4	4	15	15	10	60	100	
	ME430	FE 2 : Reliability Engineering	4	0	0	4	4	15	15	10	60	100	
	EE411	FE 2 :Fuzzy Logic & Neural Network	4	0	0	4	4	15	15	10	60	100	
	EE429	FE 2 :Basic of Analog and Digital Communication Systems	4	0	0	4	4	15	15	10	60	100	
SEMESTER VIII													
1	GE408	Cyber laws	4	0	0	4	4	15	15	10	60	100	3
2	CT415	Network Security	4	0	0	4	4	15	15	10	60	100	3
3		Professional Elective 4	4	0	0	4	4	15	15	10	60	100	3
4		Professional Elective 4 Laboratory	0	0	2	2	1			40	60	100	
5		Professional Elective 5	4	0	0	4	4	15	15	10	60	100	3
6		Professional Elective 5 Laboratory	0	0	2	2	1			40	60	100	
7	CT425	Comprehensive viva	0	0	0	0	3			40	60	100	
8	CT426	Project Phase 2 (Implementation)	0	0	6	6	6			40	60	100	
9	CT427	Extra/Co-curricular / Competitive Examination	0	0	0	0	2			100			
Total			16	0	10	26	29						
	CT418	PE4: Digital Image Processing	4	0	0	4	4	15	15	10	60	100	3
	CT419	PE4: Digital Image Processing Laboratory	0	0	2	2	1			40	60	100	
	CT420	PE4: Pattern Recognition	4	0	0	4	4	15	15	10	60	100	3
	CT421	PE4: Pattern Recognition Laboratory	0	0	2	2	1			40	60	100	
	CT422	PE4: Mobile Operating Systems	4	0	0	4	4	15	15	10	60	100	3
	CT423	PE4: Mobile Operating Systems Laboratory	0	0	2	2	1			40	60	100	
	CT 430	PE 5: Business Intelligence and its Applications	4	0	0	4	4	15	15	10	60	100	3
	CT431	PE 5: Business Intelligence and its Applications Laboratory	0	0	2	2	1			40	60	100	
	CT432	PE5: Software Project Management	4	0	0	4	4	15	15	10	60	100	3
	CT433	PE5: Software Project Management Lab.	0	0	2	2	1			40	60	100	
	CT434	PE5: Speech Processing	4	0	0	4	4	15	15	10	60	100	3
	CT435	PE5: Speech Processing Lab.	0	0	2	2	1			40	60	100	

Chairperson	Govind	**Date of Release**	May 2013	**Applicable for**

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
B.E. (Computer Technology)
SCHEME OF EXAMINATION

S. No.	Code	Subject	L	T	P	Total Contact Hours	Credits	Evaluation Scheme					
								MSE-I	MSE-II	TA	ESE	Total	ESE Hrs
Dean (Acad. Matt.)			Version				1.03			AY2013-14 Onwards			

SEMESTERVII								
CT401	SOFTWARE ENGINEERING				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3 Hrs		

OBJECTIVES	OUTCOMES
1. To introduce basic software engineering methods /models/ practices and their appropriate application. 2. To understand concepts , principles , and strategies applicable to the analysis of software requirements and design activity. 3. To understand various testing strategies and types of testing. 4. To understand configuration management , version control and change control process. 5. To understand project management , planning, scheduling , risk management , project and process metrics. 6. To get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re-engineering.	1. Choose appropriate Software Process Model for given Project depending on requirements and resources at hand. 2. Perform requirements analysis and create design for a given case study. 3. Choose appropriate testing strategy and apply testing principles for testing a given application. 4. To understand basics of software configuration management , version control and change control. 5. To calculate effort and cost estimate for given requirements and assess risks. 6. To perform basic operations on Sub-version.

PO, PSO MAPPING:a,b,c,d,e,f,g,h,I,j,k,l,m

SYLLABUS

UNIT I Introduction to Software Engineering. A Generic View of process, Process models: Water fall Mode l, RAD Model, Prototyping Model, Component Development Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation

UNIT II Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.

UNIT III Testing Strategies : Strategic Approach, Strategic issues, Strategies for conventional Software, Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White-Box Testing, Basis Path testing: Flow Graph Notation, Independent Program Paths, Control Structure Testing, Black Box Testing, Introduction to object oriented testing.

UNIT IV Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration ,Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards.

UNIT V Project Management, Metrics for Process and Projects, Project Estimation , Risk Management: Reactive vs. Proactive Risk Strategies , Software Risks, Risk Identification, Risk Projection.

UNIT VI Advanced Topic sin Software Engineering : Reengineering Computer Aide software engineering, Open source SE tools introduction, Example-Subversion : Overview, Typical subversion usage and workflow.

TEXT BOOKS:

1. Software Engineering – A Practitioner's Approach (Sixth Edition) by Roger S. Pressman– Mc Graw Hill.
2. Object Oriented Software Engineering by Leth bridge , Pearson Edu.

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CT402	SOFTWARE ENGINEERING LABORATORY	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Practical List:

Sr.No.	PracticalName
1	Introduction to Software Engineering fundamentals.
2	Introduction to RATIONAL ROSE Interface.
3	Overview and Case study of UML.
4	To study and draw Use Case diagram for the given case study.
5	To create use case documents for the given case study.
6	To study and create Software Requirement Specification document.
7	To study and draw UML Class diagram.
8	To study and draw UML Activity diagram.
9	To create SRS for Mini Project including appropriate UML diagrams.
10	To study basic operations on a Subversion Repository under Windows.
Beyond Syllabus Practical List:	
1.	To study Manual /Automated testing.
2.	To study Microsoft Project Plan.

SEMESTER: VII								
CT403	OBJECT ORIENTED MODELING				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To distinguish between procedure oriented and Object Oriented Methodology. 2. To understand the features of Object Oriented Programming. 3. To Understand the basic building blocks of C++ language. 4. To Understand the Utility and difference of various Data Structure. 5. To Understand the need of Exception. 6. Exception Handling Mechanisms of OOP Methodology using C++. 7. To study the concept of Templates . 8. To Understand the OOP methodology and relate to it day to day applications. 9. To relate various practical examples with the OOP Methodology.	1. Compare different types of Programming Languages 2. Describe Real World object, Structure and Class. 3. Implement the Programming Examples. 4. Implement the Concept of abstract class, Concept of Interface. 5. Define and classify Data Structure. 6. Implement the Mechanisms and Concept of Exception , Types of Exception 7. Define stream, the Concept of File, Opening and Closing of File
PO, PSO MAPPING:a,c,e,g,i,j,k,l,m	

SYLLABUS

UNIT I Introduction : object orientation, Object Oriented development, modeling as a design technique, Class modeling:- the three models, object, classes, links and associations, navigation of class models, aggregation, abstract classes, metadata, packages.

UNIT II State Modeling: events & states, transitions and conditions, state diagrams behavior, concurrency advanced state modeling concepts, nested state diagrams, concurrency, relation of class & state models. Interaction modeling : Use case. Sequence and activity models, relationships among the models.

UNIT III System Analysis :
Development life cycle and development style, system conception, domain analys is application analysis

UNIT IV System Design : Overview, estimating performance, making are use plan, breaking into sub systems, identifying concurrency, allocation of sub systems, management of data storage, handling global resources, choosing software control strategy, handling boundary conditions, setting trade off priorities, common architectur all styles.

UNIT V Class Design, implementation modeling, object oriented languages.

UNIT VI Databases : implementing structures basic and advanced, implementing functionality, object oriented databases. Object oriented programming style, reusability, extensibility, robustness.

TEXT BOOKS:

1. Object oriented modeling and design with UML by James Rumbaugh, Michal Blaha , Pearson Prentice Hall Second Edition.

REFERENCE BOOKS:

1. Practical Object Oriented Design with UML by Mark Priestley TMH 2nd Edition.
2. The Unified Modeling Language user guide by Booch , Rumbaugh, Jacobson Addison Wesley 2nd Edition.

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Professional Elective 2								
CT405	PE2: EMBEDDED SYSTEM				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To make the students aware of the Embedded Systems surrounding them. 2. Students should know about the types of processors & architectures used, design & codesign concepts usedin ES. 3. To learn the concept of Real Time Operating System, Mobile Operating System. The working of micro controller to be used in ES.	1. Using the Basics of ES, decide the components of a particular ES. 2. Design & implement the hardware & software and integrate them to develop the final device. 3. Choose appropriate processors and Real Time operating system for ES design. 4. Use assembly or high level languages for S/W development & decide which development & debugging tool will be suitable for ES development. 5. Choose proper microcontroller / microprocessor for a particular ES design . 6. Develop the program for core functionality & communication of ES with other devices.
PO, PSO MAPPING : - a,c,d,e,h,i,k,l,m	

SYLLABUS

UNIT I — Embedded Systems concepts and definition , Embedded System design : Requirement analysis, Hardware and Software Design, co-design, I/O interface co-design for distributed embedded system, Applications of Embedded system.

UNIT II — Embedded Computing platform Software Development tools and debugging technologies Host and Target machines, Cross Assemble & Cross Compiler, Linker/Loader for embedded software, study and use of simulator, EPROM emulator, In Circuit Emulator, concept of tool chain.

UNIT III — Concept of Real Time Operating System, Real Time IO, R/T Multitasking & multithreading processes, RTOS Task Scheduling models Inter-task Communication, memory management.

UNIT IV — Overview of Embedded Operating Systems, Real Time operating System, Handheld operating system, Some Representative Embedded Systems.

UNIT V — ARM Architecture Block Diagram, Pin Description Memory Organization, Register Description, I/O Ports, Interrupts.

UNIT VI — Thumb Instruction Set and Programming Timers, Serial communication, Interfacing with analog and digital circuits.

TEXT BOOKS:

1. An Embedded software primer by David E. Simon, Pearson Edu. Asia.
2. Embedded System by Raj Kamal.
3. ARM System on Chip Architecture by Steve Furber, Pearson Edu. Asia.

REFERENCE BOOKS:

1. Real–time system : design principles for distributed embedded application by H. Kopetz .
2. Embedded system design by Krishna & Shinn .
3. Embedded Real -Time Systems : Concepts , Design & Programming by Dr. K. V. K. K. Prasad.

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SEMESTER: VII								
CT406	PE2: NEURAL NETWORKS & FUZZY LOGIC				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. This course provides introduction various aspect so fneuralnet works, with emphasison element of design no ftrainable systems. The course introduces students to the fundamental theory, mathematics and modeling tools necessary to analyze and simulate natural and engineered systems.	1. Apply training and classification using the discrete perceptron and single layer continues perceptron networks for linearly separable classification . 2. Summarize Operations on fuzzy sets by solving the problem. 3. Compute fuzzy numbers. 4. Construct arithmetic operations on intervals and arithmetic operations on fuzzy numbers. 5. Apply lattice fuzzy numbers and Fuzzy equations to solve fuzzy controller problem.
PO, PSO MAPPING :- a,b,c,e,h,i,j,l	

SYLLABUS

UNIT I Fundamentals concepts and model so fartificial neural systems: Biological neurons and their artificial models, models of artificial neural networks, learning and adaptation, neural network learning rules, overview of neural networks, Simple Programming exercisein 'C'.

UNIT II Single-layer perceptron classifiers: Discriminant functions, linear machine and minimum distance classification, training and classification sing the discrete perceptron : algorithm and example, single layer continuous perceptron networks forlinearly separable classification.

UNIT III Multi layer feedback networks: linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors, Hopfield networks, Applications of Neural Networks.

UNIT IV From classical (CRISP) sets to fuzzy sets: introduction crispsets: an overview, fuzzy sets: basic types, fuzzy sets: basic concepts, characteristics and significant of the paradigms hift. Fuzzy set sversuscrisp sets, representation of fuzzy sets, alpha cuts,cardinality, Operations on fuzzy sets : types of operations, fuzzy complements, fuzzy intersection : t-norms, fuzzy unions: t-Conorms, Distinction between Probability, Fuzzy and Random System.

UNIT V Linguistics variables, linguistic edges, Fuzzy relations, Binary Operation on as ingle set, projection and cylindrical extension, Extension principles for fuzzy sets, Fuzzy Arithmetic: fuzzy numbers, arithmetic operations on fuzzy numbers, Fuzzy Equations.

UNIT VI Defuzzification methods, design fuzzy rule base, Fuzzy Inference Systems: Mamdani Vs Sugeno, Steps indesign of a fuzzy controller, applications of fuzzy logic, Use of MATLAB for Design and Arguments

TEXT BOOKS:

1. Introduction to Artificial Neural System by J. M. Zurada, Jaico Publishing House, India.
2. Fuzzy logic & Neural Network b y T. J. Ross, TMH.

SEMESTER: VII								
CT407	PE2: ADHOC WIRELESS NETWORK				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. Understand the design issues and application areas of Ad hoc network. 2. Understand the design goals of MAC protocols, classification of MAC protocols. 3. Introduce design issues and various types of routing protocols. 4. Understand design issues, operation and classification of multicast routing protocol. 5. Understand issues and challenges in the design of transport protocol and security aspect of communication in ad hoc network. 6. Introduce Quality of Service and energy management techniques in Ad-hoc network.	1. Identify the need of Ad hoc network. Compare infrastructure base and infrastructure less wireless network 2. Identify the design issues involved in the design of MAC protocol and classify the different MAC protocols. 3. Compare proactive and reactive routing protocols, Classify routing protocols. 4. Compare tree based and mesh based multicast routing protocols, identify advantage and drawback involved in each protocol. 5. Identify the various types of attack in ad hoc network and classify various types of transport layer protocol. 6. Classify QoS approaches and Identify the need of energy management in ad hoc network.

PO, PSO MAPPING :- a,c,d,f,h,k,l

SYLLABUS

UNIT I Ad hoc Wireless Networks: Introduction, Issues in Ad hoc wireless Networks, Ad hoc Wireless Internet.

UNIT II MAC Protocols for Ad hoc Wireless Networks: Introduction, issues in designing MAC protocol, Design goals of MAC protocols, classification, Contention based protocols: MACAW. Floor acquisition multiple access Protocols. Contention based protocols with reservation mechanism: Distributed Packet reservation multiple access protocol, Collision avoidance Time allocation protocol. Contention based MAC protocols with scheduling mechanism: Distributed priority scheduling and medium access in ad hoc networks.

UNIT III Routing Protocols for Ad hoc Wireless Networks: Introduction, Issues in designing routing protocol, classification, table driven routing protocols: DSDV, cluster head gateway switch routing protocol. On demand routing protocols: DSR, AODV. Hybrid routing protocols: core extraction distributed routing protocol, Zone routing protocol. Routing protocols with efficient flooding mechanisms, hierarchical routing protocols, Power aware routing protocols.

UNITIV Multicast routing in ad hoc wireless networks: Introduction, Issues in designing multicast routing protocol, operation of multicast routing protocols, An architecture reference model, classification, Tree based multicast routing protocol: Bandwidth efficient multicast routing protocol, Multicast routing protocol based on zone routing, Multicast core extraction distributed Ad hoc routing, MAODV. Mesh based multicast routing protocols: on demand multicast routing protocol, Dynamic core based multicast routing protocol. Energy efficient Multicasting: Energy efficient reliable broadcast and multicast protocols, A distributed power aware multicast routing protocol. Multicasting with Quality of Service guarantees, Application dependent multicast routing.

CT407	PE2: ADHOC WIRELESS NETWORK				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

UNIT V

Transport layer and security protocols: Introduction, Issues in designing transport layer protocol, design goals of transport layer protocol, Classification of transport layer solutions, TCP over ad hoc wireless networks, Other transport layer protocols for ad hoc wireless network, security in ad hoc wireless network, network security requirements, Issues and challenges in security provisioning, Network security attacks, Key management, Secure routing in AD hoc Wireless networks: Requirements of secure routing protocol, security aware ad hoc routing protocol.

UNIT VI

Quality of service and energy management in Ad hoc Wireless networks: Introduction, Issues and challenges in providing Quality of service, classification of Quality of service solutions. Introduction to energy management, Need for energy management, classification, Battery management schemes, transmission power management schemes, system power management schemes.

TEXT BOOKS:

1. Ad Hoc Wireless Networks Architecture and protocols by C. Siva Ram Murthy, B. S. Manoj. Pearson Publication.

REFERENCE BOOKS:

1. Ad hoc Networking by Charles E. Perkins Addison ,Wesley.
2. The hand book of ad hoc wireless networks by Mohammad Ilyas, CRC press.

SEMESTER: VII								
CT408	CLOUD COMPUTING				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. Main objective is to create, promote and exploit an open-source Cloud API and platform targeted for designing and developing multi-Cloud-oriented applications.	1. Explain software and hardware support for enterprise and cloud computing. 2. Perform data modeling for enterprise and cloud knowledge bases. 3. Design enterprise and cloud software applications. 4. Implement and run distributed and cloud applications. 5. Ensure security and privacy in enterprise and cloud applications.
PO, PSO MAPPING :- a,b,c,d,e,f,g,h,i,k,l,m	

SYLLABUS

UNIT I Introduction to Cloud Computing: Defining Cloud Computing; Cloud Types and different models-The NIST model, The Cloud Cube Model, Deployment models, Service models; Examining the Characteristics of Cloud Computing; Benefits of cloud computing; Disadvantages of cloud computing; Assessing the Role of Open Standards.

UNIT II Cloud Architecture, Services and Applications: Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frame works, Software as a Service, Identity as a Service, Compliance as a Service .

UNIT III Abstraction and Virtualization: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT IV Exploring Cloud Infrastructures: Managing the Cloud-Administrating the Clouds, Management responsibilities, Lifecycle management Cloud Management Products, Emerging Cloud Management Standards, Understanding Service Oriented Architecture-Introducing Service Oriented Architecture.

UNIT V Managing & Securing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, The security boundary, Security service boundary, Security mapping, Brokered cloud storage access, Establishing Identity and Presence.

TEXT BOOKS:

1. Cloud Computing Bible, by Sosinsky B. Wiley India.
2. Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online by Miller Michael, Pearson Education India .

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigm by Buyya R. Broberg, J. Goscinski, A. John Wiley & Sons.
2. Cloud Computing – A practical Approach by T. Velte , A. Elsenpeter, R. Tata McGraw Hill.
3. Cloud Computing and SOA Convergence in Enterprise by Linthicium D. Pearson Education India.
4. Enterprise Cloud Computing by Shroff G, Cambridge University Press
5. Private Cloud Computing by Smooth S. Tan, N. Morgan Kauffman.
6. Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online by Miller Michael, Pearson Education India .

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SEMESTER: VII							
CT409	PE3: OPERATIONSRESEARCH				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

OBJECTIVES	OUTCOMES
1. To provide knowledge about basic deterministic methods of operations research (linear programming, network flows, integer programming and nonlinear programming) and their applications to resource allocation problems in business and industrial organizations. 2. To develop an ability to analyze any engineering problem in a simple and logical manner and to apply appropriate basic principles to its solution.	1. Describe at an intuitive level the process of operations research: a real-time cycle of problem understanding, formulation, solution and implementation . 2. Identify and develop operational research models from the description of the real system. 3. Formulate simple reasoning, learning and optimization problems, in terms of the representations and methods presented . 4. Manipulate the basic mathematical structures underlying these methods, such as system state, search trees, plan spaces, model theory, constraint systems, linear programs and integer programs. 5. Demonstrate the hand execution of basic reasoning and optimization algorithms on simple problems . 6. Use the mathematical tools that are needed to solve optimization problems. 7. Use mathematical software to solve the proposed models.
PO, PSO MAPPING :- a,b,c,d,e,h,i,k,l,m	

SYLLABUS

UNIT I Definitions, characteristics and limitations of O. R. phases of O. R. modelinging O. R. tools and techniques of O.R. .

UNIT II Linear programming , formulation, solution of L.P.P., graphical method, simplex method.

UNIT III Duality in L.P.P. and Integer Programming.

UNIT IV Allocation models – Assignment models multiple optima, prohibited assignment, transport model.

UNIT V Prohibited and preferred routes, and degeneracy ,Sequencing & Scheduling.

UNIT VI Karush-Kuhn-Tucker (KKT) Conditions for Constrained Optimization , exposure to tools e.g. Mathematica.

TEXT BOOKS:

1. Optimization technique by Radrin pearson ,Ed. Publication.
2. Problems in Operation Research by P.K.Gupta & Man Mohan ,Khanna Pub.
3. Mathematical Model sin Operation Research by J. K. Sharma, Mac millan Pub.

REFERENCE BOOKS:

1. Introduction to Operation research by Hiller & Liberman (Holden Day Inc. San Francisco).
2. Operation Research by Kantiswaroop & Gupta, S.Chand Pub.
3. Principles of Operation Research by Wagner ,PHI Pub.
4. Operation Research by Dr. B. S. Goel & S. K. Mittal , Pragati Prakashan.
5. Optimization Technique by S. S. Rao.

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SEMESTER: VII							
CT410	PE3: ARTIFICIAL INTELLIGENCE			L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

OBJECTIVES	OUTCOMES
1. The study of Artificial Intelligence course will equip the students with the sound understanding of AI concepts, perspectives to apply the AI themes to the challenging research are asrelated to AI. 2. To introduce the fundamental concepts in Artificial Intelligence, applications of AI, techniques in AI. 3. To concentrate on the basic algorithms for searching the goal, concepts of representation and control . 4. Provide the ability to assess the applicability, strengths, and weaknesses of the basic knowledge representation, various approaches. 5. To compare various Knowledge Representation methods and to understand Prolog fundamentals for Knowledge Representation. 6. To understand the reasoning process is carried out in Machines. 7. To understand how human thinking be emulated by a machine and Provide the ability to assess the applicability, strengths, and weaknesses of various learning methods.	1. Apply fundamentals of Artificial Intelligence for given problem statements. 2. Use basic algorithms for searching the goal, represent various knowledge structures in various applications of AI and related fields. 3. Assess the applicability, strengths , and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems. 4. Compare various knowledge representation approaches, solve problems based on knowledge representation methods. 5. Assess Monotonic and Non-monotonic reasoning methods. 6. Assess various learning methods, compare them.

PO, PSO MAPPING :- a,c,e,h,i,k,l

SYLLABUS

UNIT I Introduction to AI : Definition of AI, early work in AI, the importance of AI,AI and related fields, distributed AI, task domain of AI, Problems, problem spaces and searches: defining the problem on a state space search, Introduction to intelligent agents, generic architecture of intelligent agents.

UNIT II Production systems and control strategies: depth first and breadth first search, back tracking, problem characteristics , issues in the design of search programs.
Heuristic search techniques: generate and test, hill climbing, best-first search, problem reduction, constraint satisfaction, means-ends analysis.

UNIT III Knowledge representation: issues, representation and mapping approaches, procedural Vsdeclarative knowledge, introduction to proposition logic, knowledge representation using predicate logic, unification and resolution algorithms.

UNIT IV Representation of knowledge using rules, logic programming, forward backward reasoning, matching, control knowledge. Knowledge representation using semanticnets, Prolog: Representation of Predicates, rules, and facts, recursion unification.

UNIT V Introduction to non-monotonic reasoning, logics for non-montonic reasoning Statistical reasoning: probability and Bay's theorem, certainty factors and rule based system.

UNIT VI Learning: general learning model, overview of different forms of learning, learning decision trees, Artificial Neural Networks (Introduction).

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CT410	PE3: ARTIFICIAL INTELLIGENCE				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

TEXT BOOKS:

1. Artificial Intelligence by E. Richand K. Knight and Nair .

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence and Expert System by D. W. Patterson , PHI.
2. Principles of Artificial Intelligence by N. J. Nilsson, Narosa.
3. Artificial Intelligence by George F. Lugar, 4th Edition , Pearson Education.

SEMESTER: VII								
CT411	FE 2: MULTIMEDIA AND ANIMATION				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To learn basics of multimedia, applications of multimedia, requirements to make good multimedia. 2. To study Multimedia hardware, Macintosh and windows production platforms, multimedia authoring tools. 3. Multimedia building blocks. 4. The basics of animation, techniques of animation. 5. Animation in Flash. 6. To study 3D Animation, Types of 3D Animation Applications & Software of 3D Animation.	1. To understand the Basics of multimedia. 2. To understand multimedia hardware and multimedia authoring tools. 3. To develop skills in design, illustration, image manipulation, graphic designing, video editing, visual effects and game designing. 4. To apply the fundamental broad-based skills in traditional Animation techniques and emphasize to apply in practice. 5. To develop the skills in Flash Animation and apply it on some script. 6. To develop the 3D Animation skills.
PO, PSO MAPPING :- a,b,c,d,e,g,h,i,j,k,l	

SYLLABUS

UNIT I Multimedia – definitions, CD-ROM and the multimedia highway. Applications of multimedia, introduction to making multimedia, the stages of project, requirements to make good multimedia, multimedia skills and training, the multimedia tech.

UNIT II Multimedia hardware, Macintosh and windows production platforms, hardware peripherals, connections, memory and storage devices, input devices output hardware, communication devices, media software, basic tools, making instant multimedia authoring tools.

UNIT III Multimedia building blocks – text- using text in multimedia, computers and text, font editing and design tools, Sound-the power of sound , multimedia system sound, Digital audio, preparing digital audio files, Audio file format, images- Making still Images, Color, Image file format, video- Broadcast video standard, Analog video, Digital video, optimizing video files for CDROM .

UNIT IV What is meant by Animation, Why we need Animation, History of Animation, Uses of Animation. Types of Animation, Principles of Animation, Some Techniques of Animation, and Animation on the WEB, Special Effects, and Creating Animation.

UNIT V Creating Animation in Flash: Introduction to Flash Animation – Introduction to Flash – Working with the Timeline and Frame-based Animation - Working with the Timeline and Tween-based Animation – Understanding Layers – Action script.

UNIT VI 3D Animation & its Concepts, Types of 3D Animation, Skeleton & Kinetic, 3D Animation Texturing & Lighting of 3D Animation, 3D Camera Tracking, Applications & Software of 3D Animation.

TEXT BOOKS:

1. Multimedia Making Work by Tay Vaughan (TMH), 3rd Ed.
2. Principles of Multimedia by Ranjan Parekh, 2007, TMH.
3. Multimedia Technologies by Ashok Banerji, Ananda Mohan Ghosh, McGraw Hill Publication.

REFERENCE BOOKS:

1. Multimedia systems design by K. Andleigh, K. Thakkrar, Phi Pub.
2. Multimedia: Computing, Communications & Applications by Raif Stein Metz and Kiara Nahrstedt.
3. Advanced Multimedia Programming by Steve Rimmer, McGraw Hill Pub.

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SEMESTER: VII							
CT412	FE 2: CURRENT TRENDS AND TECHNOLOGIES				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

OBJECTIVES	OUTCOMES
1. The objective of this course is to make the students aware of the basic fundamentals of communication. 2. Growth of technologies in Internet, E-Technologies & E-Learning. 3. Students should know about the Green Computing and its implementation .	1. Using the Basics of Internet for deployment of various servers and recourses. 2. Designing and implementation of E-technologies 3. Design E-Learning Resources. 4. Choose appropriate processors and Real Time System for Green Computing. 5. Develop the Social Networking for next generation.

PO,PSO MAPPING :- a,b,c,d,e,f,g,h,i,j,k,l,m

SYLLABUS

UNIT I Fundamentals of Communications: Types of communication- Wired, wireless, mobile, Modes of transmission: Simplex, Half Duplex, Full Duplex, Multiplexing techniques, History and evolution of wireless and mobile systems, Transition and characteristics of 1G, 2G, 3G, 4G, Spectrum, regulations, and frequency allocation.

UNIT II Fundamental of INTERNET: History, Internet working, Connections, Internet services, The World Wide Web, Tools for the WWW, Web servers, Web browsers, Web page makers and editors, Plug-ins and delivery vehicles.

UNIT III E-Technologies : Electronic Commerce: Framework, Media Convergence of Applications, Consumer, Applications, Organization Applications, Electronic Payment Systems: Digital Token, Smart Cards, Credit Cards, Risks in Electronic, Payment System, Designing Electronic Payment Systems, Electronic Data Interchange (EDI): Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software, Implementation, EDI Envelope for Message Transport, Internet-Based EDI.

UNIT IV E-Learning: Definition, Introduction, Types of e-Learning: Learner-led e-Learning , Facilitated e-Learning , Instructor-led e-Learning , Embedded e-Learning, Tele monitoring And e-Coaching E-Learning Models: WBT, CBT, LMS, LCMS , Virtual School Systems, E-Learning Tools And Technologies: e-mail, Online Discussion, Chat and Instant Messaging, Voting, Whiteboard, Application Sharing, Conferencing, Online Meeting Tools ,Case study.

UNIT V Green Computing: Introduction, Why....Green Computing? Approaches to Green Computing- Virtualization, Power Management, Power supply, Storage, Video Card, Display, IT Equipment, Recycling, Remote Conferencing & Telecommuting Strategies, Product longevity, Resource allocation, Terminal servers, Operating system support, How to Implement? Industrial implementations of Green Computing- Blackle, Fit-PC, Zonbu computer, Sunray thin client.

UNIT VI Social Networking: Definition, Overview of Social Networking Sites, Types of Social Networking Sites: General purpose, Niche. Advantages of Social Networking Sites, Drawbacks of Social Networking Sites, Features and Need of Social Networking, Security Issues with Social Networking Sites, Case Studies.

TEXT BOOKS:

1. Impact of E-Business Technologies on Public and Private Organizations by OzlemBak, Nola Stair.
2. Mobile Computing by Tomasz Imielinski , Henry F. Korth .
3. Broadband telecommunications technology by Byeong Gi Lee, Minho Kang, Jonghee Lee.

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CT412	FE 2: CURRENT TRENDS AND TECHNOLOGIES				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

REFERENCE BOOKS:

1. Introduction to broadband communication systems by Cajetan M. Akujuobi, Matthew, N. O. Sadiku.
2. E-Learning Tools and Technologies William Hortan, Katherine Hortan,Wiley Pub
3. Internet (Use of Search Engines Google & Yahoo etc).

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
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SEMESTER: VIII Syllabus								
GE408	CYBER LAWS				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3 Hrs		

OBJECTIVES	OUTCOMES
1. This course will give an overview of the legal prospective of network security and in the process shall provide a detailed study of the law of e-commerce e-governance, e-documentation electronic and digital signature, hacking etc. The student shall be acquiring knowledge of the national and international regime of cyber issues and technology law along with issues of intellectual property law. Finally an understanding of the regulation and punishment related to cyber contravention shall be developed through a study of the relevant penal provisions.	
PO, PSO MAPPING :- a,d,f,h,i,j	

SYLLABUS

UNIT I Evolution of the Law relating to information Technology –Legal environment in Information Age-Technology and law-The international regime, The National regime and initiatives in internet legislation-Issues of jurisdiction in cyber space – International Convention on cyber space 2001 OECD model treaty and E-commerce, WIPO copyright treaty (WCT) 1996,WIPO performance and phonograms treaty (WPPT) 1996.

UNIT II The basics of IT Act - Objectives, Scope and application of the Act of 2000, Application of the IP Code as a measure of penal statute to regulate cyber activities and cyber contracts.
Basic foundations in the Information Technology Act for the protection of E commerce, E Contracts and E documents, Digital signatures and identity-Access requirements, contract formation related nomenclature as defined in Section 2 of the IT Act.
Basic Contract Law – Formation of contracts, performance and discharge of contractual obligations under the Indian Contract Act, 1872.

UNIT III Legal aspect of Digital signature and Electronic signature:
Authentication of electronic record by electronic signature (5.3 and 3A),Legal recognition of e-contracts and e-documents of the governments-ss.4, 5, 6 ,7A and 10A, Securing e-records and e-signatures, Duties of subscriber ss.40-42 ss. 14 and 15, Certification of e-signature (s.35,36,37,38,39), Regulation of certifying authorities through licensing application for license ,renewal of license, procedure for grant or rejection of license, suspension or revolution of license.

UNIT IV Adjudication of cyber crime and contraventions under the I.T Act, 2000:
Power to adjudicate-5.46, Factors considered by adjudicating offers s.47, Composition of cyber appellate tributes S.49, Power of superintendence –S.52A, Appeal to CAT-S.57, Procedure and power of Cat S.58, S.59, S.60, S.62, S.63, S.64

UNIT V Treatment of cyber crimes under the IT Act 2000
Offence and penalties prescribed in I.T Act 2000, Controller's powers with respect to offences And their regulation. Law relating to Cyber crime Under Indian Penal Code (IPC) 1860
Making false electronic record (S.464 IPC) Punishment for forgery (S.465 IPC); forgery of public record etc. (S.466 IPC) and Forgery for purpose of cheating (S.468) Forged document or electronic record (S.470); Using as genuine a forged document or electronic record (S.471);
Counterfeiting device or mark used for authenticating documents or electronic record or possessing counterfeit marked material, Falsifying accounts. (S.474 and S.477A).

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GE408	CYBER LAWS				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3 Hrs		

UNIT VI Implication of cyber law on intellectual property related issues and commercial transaction:
Copyright Act-definition of computer and computer program (S.2ffb), Subsistence of copyright in computer programs, Copyright and Internet, Copyright in digital medium, Copyright in computer databases
Trade mark Act –Search engine and meta tags-
Domain Names: digital marks in the online medium, Resolving domain name disputes, Cyber Squatting /TYPO squatting Domain name in Indian law-
Cyber issues related Case study on Landmark and well known cases like -

1. Satyam infoway Ltd. Vs Sifynet solution Pvt. Ltd (2004) 6SCC145
2. Cadilla health care Ltd Vs. Cedilla pharmaceuticals Ltd AIR 2001 SC 1952(sc)
3. The Napster's story
4. NEC corporation Vs Inter corporation
5. Any other important and current case

TEXT BOOKS:

1. Vakul Sharna, Information Technology Law and Practice, Universal Law Publishing Company, New Delhi, Third ed. 2012.
2. S. V. JogaRao, Law of Cyber Crime and Information Technology Law, Wadhwa and Company, Nagpur, 2007.
3. S. V. JogaRao, Computer Contract and Capital IT Law (in 2 vol.),2005 Prolific Law Publication, New Delhi.
4. Kamlesh N and Murali, D. Tiwari (Ed), I.T and Indian Legal System, Macmillan India Ltd., New Delhi.
5. The information Technology Act (21 of 2000) Bare Act.
6. Cyber Laws, Justice Yatinder Singh, Universal Publishers.

REFERENCE BOOKS

National Legislations:

1. The Information Technology Act, 2000 .
2. The Indian Penal Code, 1860 .
3. The Indian Evidence Act, 1872 .
4. The Indian Contract Act, 1872 .

SEMESTER: VIII								
CT415	NETWORKSECURITY				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. Understanding of basic issues, concepts , principles and mechanisms in n/w security, mathematics of cryptography, determine appropniate mechanisms for protecting networks.	1. To indentify n/w security threats and determine efforts to counter them. 2. To apply basic Principles, Theorems, Algorithms to solve the problem. 3. To use diffiesent encryption Algorithms. 4. To apply approtunate function and protocols for masseage authentication. 5. To desing solution for securied n/w application. 6. To analyze given system with respect to security.

PO, PSO MAPPING :- a,c,d,e,f,h,i,k,l,m

SYLLABUS

UNIT I Introduction- Security trends, OSI Security Architecture. Security attacks, Security Services, Security Mechanisms, model for network security, Classical encryption techniques- Symmetric cipher model, substitution, transposition techniques, Rotor machines, Steganography.

UNIT II Mathematics of Cryptography-Mathematics of Symmetric Key and Asymmetric Key Cryptography-Groups, Fields-GF fields, Random Number generation, Introduction to Number theory- Prime and Relatively prime numbers, Modular arithmetic, Fermats and Euler's theorems ,Testing of Primality, Euclid's algorithm. The Chinese Remainder Theorem, Discrete logarithms.

UNIT III Simplified DES, differential and linear cryptanalysis, block cipher design principles, 3-DES, AES, IDEA, Blowfish, RC4, CAST, Public key encryption- Principle of public key cryptosystems, RSA algorithm, key management, Diffie- Hellman key exchange ,Elliptic Curve Cryptography.

UNIT IV Message authentication and Hash functions- Authentication requirements, Authentication Functions, Codes, Hash functions, Security of Hash functions and MACs ,Message Digest Algorithm, SHA- 1, RIPEMD-160 , HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard (DSS).

UNIT V Authentication applications-Kerberos, X.509, PKI, E-mail Security-PGP, S/MIME, IP Security architecture, Authentication header, Encapsulating security pay load, Security Associations , Key management- IKE, Oakley, ISAKMP.

UNIT VI Security at transport Layer-Secure Sockets Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), System Security- Intruders, Intrusion Detection, Viruses and related threats, Virus Countermeasures, Firewall- characteristics, types, trusted systems.

TEXT BOOKS:

1. Cryptography and Network Security Principles and Practices , 4/e, by William Stallings (Pearson Edu Asia).
2. Cryptography and Network Security, 2/e by Behrouz A. Forouzan, The McGraw-Hill Pub.
3. Networks Security Essentials, Applications and Standards,4/e by William Stalling (Pearson Edu).

SEMESTER: VIII								
CT418	PE4: DIGITAL IMAGE PROCESSING				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To provide understanding of basics of Digital Image Processing, discuss fundamental concepts of neighborhood pixel, Spatial Domain Image Processing, provide in sight of histogram processing, study the frequency Domain Image Processing, provide the details of segmentation and provide the regional and descriptors concept.	1. Apply Image Enhancement techniques in Spatial Domain. 2. Know and Apply Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging on images. 3. Perform Fourier Transform on images. 4. Understand and apply Homographic Filtering. 5. Apply different segmentation techniques on images.

PO, PSO MAPPING :- a,b,c,d,e,i,k,l

SYLLABUS

UNIT I Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception, Fundamentals of Image processing, A Simple Image Model, Sampling and Quantization, Some Basic Relationships. between Pixels, Image Geometry in 2D.

UNIT II Image Enhancement in the Spatial Domain: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

UNIT III Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Discrete Cosine Transform, Typical Applications

UNIT IV Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering, Implementation.

UNIT V Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.

UNIT VI Image Representation: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models, introduction to image file formats: TIFF, JPEG, BMP, etc.

TEXT BOOKS:

1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
2. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing by A.K.Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya & Ajoy K. Ray, Willey Inter-Science.

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CT419	PE4: DIGITAL IMAGE PROCESSING LABORATORY	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Practical List:

Sr.No.	PracticalName
1	Study Practical on basic gray level transformation.
2	Write a program to create a contrast of image.
3	Create a histogram of given image.
4	Resize a given Image.
5	Write a program to create negative of an image.
6	Create a Binary Image.
7	Write a program to smooth an image.
8	Write a program to Sharpe an image.
9	Segment a given image.
10	Create a skeleton of region.
Beyond Syllabus Practical List:	
1	Apply wavelet transform to decompose an image.
2	Apply gabor filter to enhance an image.

SEMESTER: VIII								
CT420	PE4: PATTERNRECOGNITION				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. The study of Pattern Recognition to equip the students with the brief knowledge of Statistica. 2. Decision Theory, Image processing, clustering, different error at esinpattern recognition, decision making techniques and application of pattern recognition in different fields.	1. Apply Pattern Recognition technique for recognition. 2. Know and Apply knowledge of Statistical Decision Theory. 3. Perform Image processing concepts on images. 4. Understand and apply clustering concepts on raw 5. Apply decision making techniques.
PO, PSO MAPPING :- a,b,d,e	

SYLLABUS

UNIT I Introduction: Statistical Decision Theory, Image Processing and Analysis, Probability-probabilities of events, random variables, joint distribution & densities.

UNIT II Moments of random variables, estimation of parameters from samples, minimum risk estimators.

UNIT III Non parametric decision Making - Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error, estimation functions, choosing a decision making technique.

UNIT IV **Linear Classifier** Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Least Squares Methods , Mean Square Estimation Revisited, Support Vector Machines.

UNIT V **Feature Generation** Introduction ,Basis Vectors and Images, The Karhunen-Loeve Transform ,The Singular Value Decomposition , Independent Component Analysis,The Discrete Fourier Transform,The Haar Transform.

UNIT VI Clustering-Introduction, hierarchical clustering, partition clustering.

TEXT BOOKS:

1. Pattern recognition & Image Processing by Ealr Gose, Richard Johnson daugh & Steve Jost. (PHIPub.).
2. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification” 2nd Edition, John Wiley.

REFERENCE BOOKS:

1. Pattern recognition by Sergios Theodoridis, Konstantinos Koutroumbas 3rd Ed.

CT421	PE4: PATTERN RECOGNITION LABORATORY	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Practical List:

Sr.No.	PracticalName
1	Enhance an image using Average Filter.
2	Detect the edges using Sobel operator.
3	Plot a histogram of a given image.
4	Classify an objects based on adadptive desion boundary technique.
5	Classify an objects based on nearest neighbor classification techniques.
6	Implement The Perceptron Algorithm.
7	WAP to implement SVM.
8	Extract features using ICA.
9	Extract features using DFT.
10	Extract features using Haar Transform.

SEMESTER: VIII								
CT422	PE4: MOBILE OPERATING SYSTEM				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To understand basic concepts about Mobile Operating System. 2. To understand features and development framework of Android platform. 3. To get an overview of various Android development tools, debugging techniques and performance optimization considerations. 4. To understand Android application development lifecycle and building process. 5. To understand User Interface elements for Android application and create UI designs. 6. To understand data storage, network connection and data parsing for Android applications.	1. To understand fundamentals of Mobile Operating System. 2. Create sample Android application and deploy on Android mobile. 3. Create Android Application using Android Application development tools, debug application and incorporate performance and memory optimization considerations. 4. To generate and study APK file content and manifest. 5. To design Android application User Interface, views, layouts and styles. 6. To create Android application with SQLite database connectivity and network connection.
PO, PSO MAPPING :- a,b,c,d,e,f,i,j,k,l	

SYLLABUS

UNIT I Introduction to Mobile OS, Characteristics, comparison with desktop OS, examples, various mobile application development platforms (Android, iOS, Windows etc) comparative study in terms of features, technology and tools.

UNIT II Introduction to Android Computing Platform, History, Myths, features, Development framework. (basic deployment of application on android mobile, Application signing and distribution, Available market stores and update management, SQL Connectivity).

UNIT III Hardware requirements, Monitoring and Controlling of Hardware, Types of Android applications, Android development tools, application development and debugging, Using tools like Lint, Findbug, MAT, DDMS. Performance and memory optimization considerations.

UNIT IV Building blocks of Android applications, Application life cycle, Priority, Process state, Activity and its states, Intent, Actions, Android manifest, Broadcast receivers, permissions, Services, APK file content and building process.

UNIT V User interface, Views, Layouts, Menus,Adapters, Dialogs, styles, theme, 9-patch images To design User Interface.

UNIT VI Persistence data storage using files, SQLite database and shared preferences, Content resolver and observers, Network connection over http and https, Data parsing using XML and JSON.

TEXT BOOKS:

1. Professional Android Application Development by Reto Meier, Wiley Publishing Inc.

CT423	PE4: MOBILE OPERATING SYSTEMS LABORATORY	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Practical List:

Sr.No.	PracticalName
1	Create an application having login functionality. This should provide the facility of entering login name, password and “Remember Me” functionality. On successful login user should be taken to Home screen displaying the custom welcome message. On failed attempt user should be shown error dialog.
2	Create an application showing the list of fix number of contacts including name, photo, email and number. User should be able to call, SMS, email to any contact directly from the list.
3	Create an application to play audio/video file using native player. User should able to play/pause/stop at all time. User should get toast notification for each activity and confirmation dialog before exit/stop.
4	Create an application that supports entering two numbers and functionality to add/subtract/multiply/divide and display the result in next screen.
5	Create an application that provides the functionality of stop watch.
6	Create an application having one screen that change its color based on the selection of option menu.
7	Create an application which shows an image and spinner having list of options (at least 4). On selecting the item images should perform the selected animation.
8	Create an application that shows the list of employees with some basic information like first name, last name, designation. On selecting the list item application shows more details for particular employee and provide the option to edit the information. On Edit screen provide support for edit few (at least 4) filed.
9	Create an application that provides the option to enter the student information and save into database. App should provide the functionality to view the list of students.
10	Create an application that reads contacts from the native address book and supports edit/add new contact information.
Beyond Syllabus Practical List:	
1	Create an application which has the date/time picker dialog. Take user selection as input and provide the options to see selected date/time in different formats.
2	Create a demo application listing different type of notification mechanism available in android. On selecting create notification of specific type.

SEMESTER: VIII							
CT430	PE5: BUSINESS INTELLIGENCE AND ITS APPLICATIONS				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

OBJECTIVES	OUTCOMES
1 The proposed elective course exposes students to Business Intelligence domain. The objectives of this course include introduction to BI terminologies and framework, basics of data integration (Extraction Transformation Loading), introduction to multi-dimensional data modeling, basics of enterprise reporting and application of the concepts using open source/Microsoft tools.	1 Extract and transform data from an operational database to a data warehouse. 2 Map operational data to a data warehouse. 3 Design multidimensional data models. 4 Design reports using various reporting tools and methods . 5 Use BI tools to identify trends. 6 Exploit business analytics and performance measurement tools. 7 Design a BI solution for a business problem.

PO, PSO MAPPING :- a,b,c,d,e,f,g,i,j,k,l,m

SYLLABUS

UNIT I Introduction to Business Intelligence: Introduction to digital data and its types – structured, semi-structured and unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.

UNIT II Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data – types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle).

UNIT III Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using Microsoft Excel.

UNIT IV Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards.

UNIT V Tools used for OLAP Design and BI Models: Overview of tools and techniques that are in use to design BI and OLAP model, common BI and OLAP models, popular OLAP cube formats, design tools for BI and OLAP modeling, tools for OLAP cube building and data population.

UNIT VI Case study: Overview and use of products from Pentaho and other open software .

TEXT BOOKS:

1. Business Intelligence by David Loshin.
2. Business intelligence for the enterprise by Mike Biere.
3. Business intelligence roadmap by Larissa Terpeluk Moss, Shaku Atre.
4. An introduction to Building the Data Warehouse, IBM.
5. Business Intelligence For Dummies, Swain Scheps.
6. Successful Business Intelligence: Secrets to making Killer BI Applications by Cindi Howson Information dashboard design by Stephen Few.

CT431	PE5: BUSINESS INTELLIGENCE AND ITS APPLICATIONS	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Practical List:

Sr. No.	PracticalName
1	Design a conceptual multidimensional model for the given data.
2	Implement the algorithm to extract the data from various sources.
3	Implement the algorithm to clean the data according to business requirement.
4	Transform the data into final 'ready to load' form.
5	Implement the algorithm to load the data in the multidimensional format.
6	Solve the given business queries from the multidimensional model (Phase I).
7	Solve the given business queries from the multidimensional model (Phase II).
8	Design the report for output of Phase I.
9	Design the report for output of Phase II.
Beyond Syllabus Practical List:	
1.	Download and install any one free open source tool for reporting
2.	Take the reports from the system for the given data.

SEMESTER: VIII							
CT432	PE5:Software Project Management			L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

OBJECTIVES	OUTCOMES
1 To learn basic concepts project, contract and to get an overview of various activities under project planning. 2 To understand techniques for cost benefit analysis and risk evaluation. 3 To understand project scheduling and various network planning models. 4 To understand Risk Management, Risk Planning and control. 5 To understand various activities like visualizing progress, earned value analysis etc. under monitoring and controlling of a project. 6 To understand the role of continuing training and learning, to improve group working and to select appropriate leadership styles.	1 To understand basic concepts about project, project management and project planning. 2 To assess given requirements and perform cost benefit analysis. 3 To create a project schedule using some network planning model for given requirements. 4 To identify and create a risk management plan for given requirements. 5 To perform earned value analysis for given requirements and current completion state of project. 6 To form teams for any given exercise, work as a team and understand leadership qualities.

PO, PSO MAPPING :- a,b,c,d,e,f,g,h,i,j,k,l,m

SYLLABUS

UNIT I Introduction to Software Project Management:
Project Definition, Contract Management, Activities Covered By Software Project Management, Overview of Project Planning, Stepwise Project Planning.

UNIT II Project Evaluation
Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation.

UNIT III Activity Planning
Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks.

UNIT IV Risk Management:
Risk Management, Nature Of Risk, Types Of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning And Control.

UNIT V Monitoring and Control
Creating Framework , Collecting The Data , Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting Project Back To Target, Change Control, Managing Contracts, Introduction, Types Of Contract, Stages In Contract Placement, Typical Terms of A Contract, Contract Management, Acceptance.

UNIT VI Managing People and Organizing Teams:
Introduction, Understanding Behavior, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods , Motivation, The Oldman – Hackman Job Characteristics Model, Working In Groups – Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety.

TEXT BOOKS:

1. Bob Hughes, Mikecotterell, “Software Project Management”, Third Edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. Ramesh, Gopalaswamy, «Managing Global Projects, Tata McGraw Hill.
2. Royce, “Software Project Management”, Pearson Education.
3. Jalote, “Software Project Manangement in Practive”, Pearson Education.

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CT433	PE5: SOFTWARE PROJECT MANAGEMENT LAB.	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Practical List:

Sr.No.	PracticalName
1	Introduction to Software Project Management fundamentals.
2	To analyze requirements for a given case study .
3	To create a WBS for the given case study.
4	To perform risk management for the case study – 1.
5	To perform risk management for the case study – 2.
6	Overview of Planning tool.
7	To create Project Schedule for the case study -1.
8	To create Project Schedule for the case study -2.
9	To perform cost benefit analysis for case study.
10	To study contract management and contract document.
Beyond Syllabus Practical List:	
1.	To study and calculate Software Project Metrics.
2.	To study implementation of change control.

SEMESTER: VIII								
CT434	PE5: SPEECH PROCESSING				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To acquaint with fundamentals of Speech signals, classification of signals, applications of speech processing . 2. To understand Time domain methods for performing speech processing and Mathematical foundations of signal processing and pattern recognition. 3. To familiarize students with Frequency domain methods for performing speech processing. 4. To know methods of speech recognition, various issues in speech recognition. 5. To become aware about Issues in speaker recognition and speech synthesis of different speakers. 6. To understand various techniques for Speech Enhancement and compare them.	After the course is delivered the students would be able to demonstrate the ability to : 1. Classify the speech signals. 2. Use time domain methods for performing speech processing and Pattern recognition. 3. Use Frequency domain methods for performing speech processing and compare it with time domain methods. 4. Select suitable speech recognition method considering various issues. 5. Analyze issues in speaker recognition and speech synthesis. 6. Differentiate various speech enhancement techniques.
PO, PSO MAPPING :- a,b,c,e,h,k,l,	

SYLLABUS

UNIT I Speech production and Perception:
Anatomy and physiology of speech production, Articulatory, Linguistic, acoustic and perceptual descriptions. Classification of speech, sounds, nature of speech signal, models of speech production, purpose of speech processing, Digital processing of speech signals, Significance, short time analysis, Introduction to pitch detection.

UNIT II Time Domain Methods for Speech Processing:
Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation , Overlapping function theory of speech, Detection of overlapping tones, Methods to calculate ACF, Software tools to calculate ACF.

UNIT III Frequency domain methods for speech processing:
Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format extraction, pitch extraction, Analysis - synthesis systems, Pitch classification methods, DFT to calculate pitch function, Modules of speech synthesis system, Mathematical formulation of speech synthesis modules.

UNIT IV Speech Recognition:
Issues in Speech recognition, Spectrum distance measures for speech recognition, auditory measures for speech recognition, Dynamic programming based speech recognition algorithms, HMM models for speech recognition, Neural network approach, SVM and its implementation, Approximation functions for speech recognition.

UNIT V Speaker Recognition:
Issues in speaker recognition and speech synthesis of different speakers, Text to speech conversion, Letter to sound rules, Dictionaries, prosody, Intonation, Calculating acoustic parameters, synthesized speech output performance and characteristics of text to speech, application of text to speech technology products, Voice processing hardware and software architectures, Confusion resolving in speech recognition, Confusion/ambiguity resolving in TTS Design.

UNIT VI Speech Enhancement:
Noise suppression with pattern matching, adaptive echo cancellation for speech signals, Noise calculation using ACF.

CT434	PE5: SPEECH PROCESSING				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		
OBJECTIVES				OUTCOMES				

TEXT BOOKS:

1. L.R. Rabiner and R. E. Schafer : Digital processing of speech signals, Prentice Hall,1978

REFERENCE BOOKS:

1. Furui S.Sondhi, M, “Advances in Speech Signal Processing”, Dekker.
2. Syrdal A. Benett, R. Greenspan, S ,“Applied Speech Technology”, CRC Press.
3. Test Schner W, “Voice Processing”, Artech House.
4. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, Wiley.
5. Speech and Language Processing by Jurafsky, Dan and Martin, James, Second Edition, Prentice Hall,2008

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CT435	PE5: SPEECH PROCESSING LAB	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Practical List:

Sr. No.	PracticalName
1	Introduction to Matlab.
2	Study of Matlab functions for Speech Processing.
3	Implementation of Basic functionalities for speech processing using Matlab. (Read speech file, play/plot the file).
4	Write speech array into speech file, record using Matlab.
5	Perform Fourier analysis of a speech file using Matlab.
6	Implementation of Homomorphic methods using Matlab.
7	Implementation of linear predictive methods using Matlab.
8	Pitch determination and excitation identification using Matlab.
9	Implementation of Hidden Markov model for speech recognition using Matlab.
10	Implementation of Compression techniques for audio file using Matlab.
Beyond Syllabus Practical List:	
1.	Study of IBM tool for Speech Processing.
2.	Study of Text to Speech System.

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

Department of Information Technology

SCHEME OF EXAMINATION 2010

Sr. No.	Sub Code	Subject	Contact Hours				Credits	%Weightage				
			L	T	P	Total Contact Hours		MSE-I	MSE-I	TA	ESE	ESE Duration Hrs.
SEMESTER VII												
1	IT401	Computer Networks	3	1	0	4	4	15	15	10	60	3 Hrs
2	IT402	Computer Networks lab.	0	0	2	2	1			40	60	
3	IT403	Principles of Compiler Design	3	1	0	4	4	15	15	10	60	3 Hrs
4	IT404	Principles of Compiler Design Lab.	0	0	2	2	1			40	60	
5		Prof. Elective 4	4	0	0	4	4	15	15	10	60	3 Hrs
6		Free Elective 2	4	0	0	4	4	15	15	10	60	3 Hrs
7	IT409	Seminar/Industrial Visit	0	0	0	2	3			100		
8	IT410	Project Phase-I(Analysis & Design)	0	0	4	4	4			40	60	
		Total	14	2	8	26	25					
	IT405	PE4: Pattern Recognition	4	0	0	4	4	15	15	10	60	3 Hrs
	IT406	PE4: Distributed and Object Oriented Databases	4	0	0	4	4	15	15	10	60	3 Hrs
	IT407	PE4: Real Time Systems	4	0	0	4	4	15	15	10	60	3 Hrs
	EL412	FE 2 : Electrical Energy Audit and Safety	4	0	0		4	15	15	10	60	
	EL413	FE 2: Utilisation of Electrical Energy	4	0	0		4	15	15	10	60	
	CV418	FE 2 : Elements of Earthquake Engineering	4	0	0	4	4	15	15	10	60	
	CV419	FE 2 : Air Pollution & Solid Waste Management	4	0	0	4	4	15	15	10	60	
	ET411	FE2 : Soft Computing	4	0	0	4	4	15	15	10	60	
	ET412	FE2 : Industrial Instrumentation	4	0	0	4	4	15	15	10	60	
	ME429	FE 2 : Total Quality Management	4	0	0	4	4	15	15	10	60	
	ME430	FE 2 : Reliability Engineering	4	0	0	4	4	15	15	10	60	
	EE411	FE 2 :Fuzzy Logic & Neural Network	4	0	0	4	4	15	15	10	60	
	EE429	FE 2 :Basic of Analog and Digital Communication Systems	4	0	0	4	4	15	15	10	60	
SEMESTER VIII												
1	GE402	Project Management	3	0	0	3	3	15	15	10	60	3 Hrs
2	IT411	Data Warehousing & Mining	3	1	0	4	4	15	15	10	60	3 Hrs
3	IT412	Data Warehousing & Mining Lab	0	0	2	2	1			40	60	
4		Prof. Elective 5	4	0	0	4	4	15	15	10	60	3 Hrs
5		Prof. Elective 5 Lab	0	0	2	2	1			40	60	
6		Prof. Elective 6	4	0	0	4	4	15	15	10	60	3 Hrs
7	IT424	Project Phase-II (Implementation)	0	0	6	6	6			40	60	
8	IT425	Comprehensive Viva Voce					3			40	60	
9	IT426	Extra Curricular / Compentative Exm.	0	0	0	0	2			100		
		Total	14	1	10	25	28					
	IT413	PE5: Digital Signal Processing	4	0	0	4	4	15	15	10	60	3 Hrs
	IT414	PE5: Digital Signal Processing Lab.	0	0	2	2	1			40	60	
	IT415	PE5: Neural Networks and Fuzzy Logic	4	0	0	4	4	15	15	10	60	3 Hrs
	IT416	PE5: Neural Networks and Fuzzy Logic Lab.	0	0	2	2	1			40	60	
	IT417	PE5: TCP/IP	4	0	0	4	4	15	15	10	60	3 Hrs
	IT418	PE5: TCP/IP Lab	0	0	2	2	1			40	60	
	IT419	PE5: Software Testing	4	0	0	4	4	15	15	10	60	3 Hrs
	IT420	PE5: Software Testing Lab	0	0	2	2	1			40	60	
	IT421	PE6: Distributed Systems	4	0	0	4	4	15	15	10	60	3 Hrs
	IT422	PE6: Network Security	4	0	0	4	4	15	15	10	60	3 Hrs
	IT423	PE6: Human Computer Interaction	4	0	0	4	4	15	15	10	60	3 Hrs

Chairperson		**Date of Release**	MAY 2013	**Applicable for**
Dean (Acad. Matt.)		**Version**	**1.03**	**AY 2013-14 Onwards**

SEVENTH SEMESTER

IT401	Computer Networks		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1.To master the terminology and concepts of the OSI reference model and the TCP-IP reference model and types of computer networks .

2. To study the concepts of protocols, network interfaces, and design/performance issues in local area networks.

3. To understand the basic knowledge of hardware, software and types of transmission media used in computer networks.

4. To know the various data link layer protocols used in networks.

5.To become familiar with IP Addressing and routing algorithms.

6. To understand the basics of Internet, its applications and network security.

UNIT I **[05 Hrs.]**

Introduction: The use of computer networks, LAN's, MAN's, WAN's. topologies and their characteristics, wireless networks, protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference model, x.25 network, frame relay, Asynchronous transfer mode.

UNIT II **[05 Hrs.]**

Physical layer: theoretical basis for data communication, Guided transmission media, wireless transmission: electromagnetic spectrum, radio transmission, infrared transmission. Communication satellites: orbits, satellites Vs. fibers. Switching techniques: circuit, packet and message, virtual circuits and datagram. Mobile telephone system: I, II and III generation.

UNIT III **[07 Hrs.]**

Data link layer: design issues, error detection and correction codes, sliding window protocols.

Medium access layer: channel allocation problems, multiple access protocols: ALOHA, CSMA, collision free protocols, limited contention protocols, Ethernet MAC sublayer.

Data link layer switching: local internetworking, repeaters, hubs, bridges, switches, routers and gateways, virtual LAN.

UNIT IV **[09 Hrs.]**

Network layer: design issues, Classful and classless Internet Addresses, subnet addressing, implementation of subnet with mask, supernetting, Address block and CIDR notation, examples.

Routing algorithms, congestion control algorithms, quality of service, internetworking, network layer in Internet: IP protocol, Internet control protocols, OSPF, BGP, Internet multicasting.

UNIT V **[08 Hrs.]**

Transport layer: services, elements of transport protocol, User Datagram Protocol (UDP), Reliable Stream Transport Service (TCP), TCP connection establishment and release, flow control in TCP, TCP segment format. Performance issues: performance problems in networks, network performance measurement

UNIT VI **[06 Hrs.]**

Application layer : DNS, remote logging, Electronic mail, file transfer, world wide web, HTTP

Network security: cryptography, introduction to symmetric and public key algorithms, digital signatures, authentication protocols, e-mail and web security.

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Dean (Acad. Matters)		Version	1.00	

IT401	Computer Networks		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Outcomes:

1. Distinguish between various types of computer networks.
2. Demonstrate basic understanding of hardware , software and types of transmission media used in computer networks.
3. Describe the concept of various protocols used in data link layer.
4. Demonstrate the knowledge of adaptive and nonadaptive routing algorithms.
5. Understand the concept of Quality of Service provided by the transport layer.
6. Apply basic knowledge cryptography techniques for network security.

Program outcome mapped: a, b, e, i, m

Text books:				
1	Computer Networks	5th Edition	Andrew Tanenbaum	Pearson Prentice Hall
2	Data Comminication & Networking	Fourth Edition (2007)	Behrouz Forouzan	TMH

Reference books:				
1	Data & Computer Communication	8th Edition	William Stallings	PHI
2	Internetworking with TCP/IP	5th Edition	Douglas Comer	Prentice Hall of India.
3	TCP/IP protocol Suite	4th Edition	Behrouz Forouzan	TMH

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
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IT403	Principles of Compiler Design		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1. To understand the process of Compilation. Learn different types of Parsing technique.
2. To learn design and implementation of different types of parsers. Learn intermediate code generation, code optimization and code generation.

UNIT I **[05Hrs.]**

Introduction to Compilation Process, Compilers & Translators, Phase structure of Compiler, Design of Lexical Analysis.

UNIT II **[8 Hrs.]**

Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, and Bottom up Parsing, Predictive Parsers, and Recursive Decent Parser.

UNIT III **[7 Hrs.]**

Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table.

UNIT IV **[8 Hrs.]**

Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/Flex, Yacc /Biason).

UNIT V **[6 Hrs.]**

Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase.

UNIT VI **[8 Hrs.]**

Introduction to Code Optimization, The principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.

Note: Practical based on the above syllabus

Course Outcomes: The Students will be able to

1) Build lexical analyzers and use them in the construction of parsers; express the grammar of a programming language; build syntax analyzers and use them in the construction of parsers.
2) Understand and explain the main techniques and algorithms used in compilers.
3) Describe the runtime structures used to represent constructs in typical programming languages.
4) Use compiler construction tools, such as parser generators, to build a simple compiler.

Program outcome mapped: b, c, i, k, l

Text books:				
1	Compilers Principles, Techniques & Tools	2nd Edition	Alfred V. Aho , Ravi Sethi , Jeffrey D. Ullman	Addison Wesley
2	Compiler Design	4th edition	O.G. Kakde	Laxmi Publication

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IT403	Principles of Compiler Design		*L=3*	*T=1*	*P=0*	*Credits=4*
Evaluation Scheme	***MSE-I***	***MSE-II***	***TA***	***ESE***	***Total***	***ESE Duration***
	15	**15**	**10**	**60**	**100**	**3 Hrs.**

Reference books:				
1	Principles of Compiler Design	2nd Edition	Alfred V. Aho ,Jeffrey D. Ullman	Addison-Wesley
2	Introduction to Compiling Techniques: First Course Using ANSI C, Lex and YAAC	2nd edition, 1996	J.P. Bennett	McGraw-Hill Companies

Chairperson		Date of Release	May 2013	Applicable for AY 2013-14 Onwards
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IT405	Pattern Recognition		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES:

The subject gives a review of the pattern classification and recognition from the mathematical point of view and at the same time, applies the methods to several areas of signal processing.

The structure of the general problem of pattern recognition (i.e., pre-processing, feature extraction and classification), can be applied to different areas, such as quality control, biomedical applications and diagnosis, communication systems, image processing, and speech recognition.

UNIT I **[05 Hrs.]**

Machine perception, Components of Pattern recognition systems, the design cycle, learning and adaptation, Statistical Decision Theory.

UNIT II **[08 Hrs.]**

Probability-probabilities of events, random variables, joint distribution & densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.

UNIT III **[06 Hrs.]**

Statistical Decision Making, Baye's Theorem, Decision boundaries, estimation of error rates.

UNIT IV **[08 Hrs.]**

Non parametric decision Making-Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error, estimation functions, choosing a decision making technique.

UNIT V **[07 Hrs.]**

Clustering-Introduction, hierarchical clustering, partition clustering.

UNIT VI **[07 Hrs.]**

Problem of dimensionality, Principal component analysis, First order Hidden Markov models, Applications of Pattern Recognition.

Course Outcomes:

1. To understand the basic principles of pattern recognition system.
2. To understand the probabilistic distributions and to estimate the parameters of the density from the data available in the training samples.
3. To understand the parametric classification/ decision making concept and to determine the optimal boundary between two classes.
4. To comprehend the non-parametric classification/ decision making concept and to choose an appropriate decision making technique for solving the classification given problem.
5. To understand basic principles of different clustering methods and to select appropriate method for solving the given classification problem.
6. To understand the problem of feature dimensionality, Principal Component Analysis and Hidden Markov Models to design efficient and cost effective Pattern Recognition Systems.

Program outcome mapped: a, c, e

Text books:				
1	Pattern recognition & Image processing	2003	EarlGose, Richard Johnsonbaugh& Steve Jost	Pearson Education.
Reference books:				
1	Pattern Classification	2006, 2nd Edition	RichardDuda, Peter Hart and David G. Stork	Wiley

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IT406	Distributed and Object Oriented Databases		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1. Explain the features of distributed databases and object oriented databases.
2.Describe the characteristics of variety of distributed database environments
3. Outline the steps involved in processing a query in a distributed and object oriented database and several approaches used to optimize query processing.
4. provide a grounding in object-oriented database design and distributed database design
5. Compare and contrast the relational database with object-oriented and distributed database.

UNIT I **[08 Hrs.]**

Distributed database concepts: Distributed database management systems-Review of databases and computer networks, Advantages and disadvantages of DDBMSs, Homogeneous and heterogeneous DDBMSs, references architecture,Component Architecture.Distributed relational database design:Data allocation, fragmentation, Transparencies in DDBMS:Distribution transparency for read only applications and update applications, levels of distribution transparency, Distributed database access primitives and integrity constraints.

UNIT II **[07 Hrs.]**

Distributed database design: A frame work for distributed database design, the design of database fragmentation, the allocation of fragments, translation global queries to fragment queries, equivalence transformation for queries, transforming global queries into fragment queries, distributed grouping and aggregate function evaluation, parametric queries.

UNIT III **[07 Hrs.]**

Distributed Query Optimization: Query optimization, distributed query transformation, distributed joins, computation of join costs and access costs.

UNIT IV **[08 Hrs.]**

Transaction and concurrency control: Concurrency control: concept of two phase commit protocol, Resolving distributed transaction, concept of replication, snapshot on replication and multimaster replication, conflict resolution in multimaster replication concurrency control and database recovery in distributed database.

UNIT V **[08 Hrs.]**

Object Oriented DBMS: concepts and architectures : Characteristics of an object-oriented data model, object schemas, class-subclass relationship, Similarities & differences between OODM and other data models , ADTs ,object identity, nested collections, Features of an object-oriented databases management system, OODBMS architecture, performances issues in OODBMS,Object definition language and object query language.

UNIT VI **[07 Hrs.]**

Object Relational DBMS : Introduction to Object Relational Database system , Comparison of RDBMS, ODBMS, ORDBMS. Object oriented extensions in oracle: user defined data types ,manipulating object tables, object views.

Course outcomes

After the end of the course students should be able to :

1. Compare and contrast the relational database with object-oriented and distributed database.
2. Describe the characteristics of variety of distributed database environments
3. Outline the steps involved in processing a query in a distributed database and several approaches used to optimize query processing.
4. Introduce object databases, databases that handle complex data types.
5. differentiate between object oriented databases and object-relational databases

Program outcome mapped: e, k, m

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IT406	Distributed and Object Oriented Databases		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Text books:				
1	Distributed data bases principle and systems	1984	Ceri&Pelagatti	McGraw Hill Pub
2	Object Oriented Databases System –Approaches & Architectures	2nd revised edition	C.S.R. Prabhu	PHI Pub.
3	Database systems A practical approach to design, implementation and management	5th Edition	Thomas Connolly, Carolyn Begg	Pearson education
4	Fundamental of Databases System	5th Edition (2006)	Elmasri& S.B. Navathe	Pearson pub.

Reference books:				
1	Databases System – Design Implementation & Management		Peter rob & Carlos Coronel	Course Tech.
2	Databases Management Systems		Raghu Rmakrishnan& Johannes Gehrke	McGraw Pub.

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IT407	Real Time Systems		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1. To learn the concepts of Real Time Systems.
2. To study the different design issues of Real Time Systems.
3. To study the techniques for scheduling, resource access control and validation.
4. Provide experience in the implementation of typical algorithms used in real time systems.

UNIT I **[06 Hrs.]**

Introduction to real time systems: Digital control, high-level controls, signals processing, real time applications. **Hard and soft real time system** : Jobs & processors, release times, deadlines, timing, constraint, Hard & Soft timing constraint, Hard real time systems , soft real time systems. Modeling of real time systems.

UNIT II **[06 Hrs.]**

Approach to real time scheduling : Clock-driven approach, weighted round-robin approach, priority-driven approach, dynamic versus static systems, effective release times and deadlines, optimality of EDF & LST algorithms, non optimality of the EDF & LST, challenges in validating timing constraints in priority-driven systems, off line versus on-line scheduling.

UNIT III **[07 Hrs.]**

Clock driven scheduling : notation & assumptions, static timer-driven scheduler, general structure of cyclic schedules, cyclic executives, improving the average response time of a periodic jobs, scheduling sporadic jobs, practical consideration and generalizations, algorithms for constructing static schedules, pros-cons of clock-driven scheduling.

UNIT IV **[08 Hrs.]**

Priority-driven scheduling: Static assumptions, fixed-priority versus dynamics priority algorithms, maximum schedulable utilization, optimality of the RM & DM algorithms, a schedulability test for fixed priority tasks with short response times & with arbitrary response times, sufficient schedulability conditions for the RM & DM algorithms.

UNIT V **[08 Hrs.]**

Scheduling aperiodic & sporadic jobs in priority-driven systems: assumptions & approaches, deferrable servers, sporadic servers, constant utilization, total bandwidth and weighted fair-queuing servers, slack stealing in dead-line driven systems, slack stealing in fixed-priority systems, scheduling of sporadic jobs.

UNIT VI **[07 Hrs.]**

Resources and resource access control : assumption on resources and their usage, effects of resource contention & resource access control, non preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack-based priority –ceiling protocol, use of priority-ceiling protocol in dynamic-priority systems, preemption-ceiling protocol, controlling accesses to multiple-unit resources, controlling concurrent accesses to data object.

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Dean (Acad. Matters)		Version	1.00	

IT407	Real Time Systems		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course outcomes

After the end of the course students should be able to :

1. Understand the basics and importance of real-time systems
2. Generate a high-level analysis document based on requirements specifications
3. Generate a high-level design document based on analysis documentation
4. Generate a test plan based on requirements specification
5. Generate a validation plan based on all documentation
6. Understand basic multi-task scheduling algorithms for periodic, aperiodic, and sporadic tasks as well as understand the impact of the latter two on scheduling
7. Understand capabilities of at least one commercial off-the-shelf R-T kernel
8. Participate in a team design project, utilizing varying skill sets of members.

Program outcome mapped: b, c, d, f, d, h

Text books:				
1	*Real Time Systems*		Jame W.S.Liu	Pearson education
Reference books:				
1	*Real Time Systems*		C.M. Krishna & Kang G. Shin	McGraw Pub.

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IT408	Applications of Computer Networks		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1. To understand the concepts in Computer Networking.
2. To understand the OSI and TCP/IP reference model.
3. To understand various networking devices and its functions.
4. To understand basic networking protocols
5. To understand the basics of Internet and its applications and security threats

UNIT I **[07Hrs.]**

Introduction: Overview of a Network: Terminal, Growth of Computer Networking, Computer Networking devices: Hubs, switches, routers, repeaters, modems, NIC, Types of Networks: Local Area Network(LAN),Wide Area Network(WAN) and MAN, Network Architecture: Peer-to-peer Architecture, Client/Server Architecture.

UNIT II **[07 Hrs.]**

LAN Topologies: Star Topology, Ring Topology, Bus Topology, Different Transmission Media: Copper Wires, Glass Fibers, Radio, Satellites. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference model.

UNIT III **[06 Hrs.]**

Types of services: connection-oriented, connectionless, Switching techniques: Circuit switching, Packet switching and message switching. Virtual and Datagram circuit, Error detection and correction techniques.

UNIT IV **[07 Hrs.]**

Introduction to Network Addressing: Physical, Logical and Port addresses, IP protocol, Classful & classless IP addresses, examples, subnetting & supernetting.

UNIT V **[08 Hrs.]**

Internet and World Wide Web: Working of web browser architecture, URL and its types Internet Protocols: Transmission Control Protocol , User Datagram Protocol, File Transfer Protocol, Hypertext Transfer Protocol, Telnet, email, MIME, SMTP.

UNIT VI **[07 Hrs.]**

Network Security: attacks, security services, a model for internet work security, encryption model, steganography, System security: Intruders, viruses and worms – intruders, viruses and related threats, Fire walls: design principles, trusted system, Introduction to electronics-commerce and Security overview of electronic-commerce.

1. Distinguish between various types of computer networks.
2. Demonstrate basic understanding of hardware , software and types of transmission media used in computer networks .
3. Understand classful and classless IP Addressing.
4. Understand the concept of protocols used in different layers.
5. Understand basic knowledge of cryptographic techniques and its applications.

Program outcome mapped: a, b, e, i, m

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IT408	Applications of Computer Networks		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Text books:				
1	Computer Networks	5th edition	Andrew Tanenbaum	Prentice Hall
2	TCP/IP Protocol Suite	3rd edition	Behrouz.A.Forouzan	Tata McGraw Hill Pub
3	Cryptography & Network Security	2nd edition	Behrouz.A.Forouzan	Tata McGraw Hill Pub
2	Computer Networks and Internets with Internet applications	4th edition (2003)	Douglas E.Comer	Prentice Hall
3	Fundamentals of Information Technology	2nd edition (2009)	Alexis Leon	Vikas publishing house
4	Web Technologies TCP/IP Architecture,and Java Programming	Second Edition	Achyut S. Godbole and Atul Kahate	Tata McGraw Hill Pub

Reference books:				
1	Computer Networks & E-commerce	2000	Parag Diwan	Pentagon Pub

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EIGTH SEMESTER

GE402	Project management			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Objective

This subject helps student to understand the Functions of management, Marketing Management, project Management, project risk management, Inventory management and Finance Management in the organization.

UNIT-1: Principles of management

Concepts of management, development of scientific management, Taylor Principles Fayol, functions of management such as planning, decision making, organizing, communication, controlling, span of control.

[8Hours]

UNIT-2: Project management

Types of projects, various phases of project, Project Proposal, Components of planning, Objectives of planning, Factors affecting planning, Organizational setup, Network techniques Introduction and Use of CPM &PERT for planning. Estimation of critical path and project duration. Resource planning, Resource Allocation, Resource leveling, Optimization of project cost, Cost slope concept.

[7Hours]

UNIT-3 Project Risk Management

Risk Management Planning, Common Sources of Risk in Projects, Risk Identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk Response Planning, Risk Monitoring and Control, Case studies on IT Project Management.

[7Hours]

UNIT IV Marketing Management:-

Definition & scope, selling & modem concepts of marketing, market research, rural marketing, Customer Behaviors, marketing strategies, product launching, product life cycle, sales promotion, pricing, channels of distribution, Advertising, market segmentation, marketing mix, positioning, targeting

[8 Hours]

UNIT V Inventory Management :-

Principles of Inventory Management , Importance & objectives of Effective Inventory Management , Types of Inventory Control Systems, Inventory Control Procedures, Concept of ABC Analysis Benefits of ABC Analysis.

[7 Hours]

UNIT VI Financial Management:-

Definition & Functions of Finance department Sources of finance ,financing organizations, types of capital, elements of costs & allocations of indirect expenses, cost control, break even analysis, budgets & budgetary control, equipment replacement policy, make or buy analysis, balance sheet, ratio analysis, profit & loss statement.

[8Hours]

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GE402	Project management			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Outcome

1. As a studying functions of management it helps us to know administration of organization.
2.It is more concerned with decision making to make the best under a given situations & to be ethically and socially responsive to the needs of society .
3. It helps to formulating strategies to exploit rewarding opportunities thereby maximizing its return on investment.
4. Students are expected to understand & demonstrate the effect of time value of money, depreciation & foreign currency, inventory and material required for trade.
5.students are expected to understand the planning of project and managing risk factor which is involved in that.

mapped Program Outcomes: d,f,g,h,j

TEXT BOOKS:

I) Principles of Management: Koontz & O Denial
2) Industrial Organization & Engineering Economics: T. R. Banga & S. c. Sharma
3) Financial Management – Kuchal

REFERENCES:

1) Principles of marketing management; Philip Kotler & William Stauton
2) Customer Behavior : Leon G. Schiffman, & Leslie Lazar Kanuk

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IT411	Data Warehousing & Mining		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1. To understand the process of data mining and the key steps involved well enough to Lead/manage a real-life data mining project.
2. Know the basics of data warehousing and how it facilitates data mining.
3. To understand fundamental issues in statistical data analysis that cut across all Procedures, such as generalization to other data, basic tradeoffs, and validity of models.

UNIT I

Introduction to Data Warehousing: Definition, Usage & trends, characteristics of Data Warehouses, Data Marts, Metadata, Multidimensional data model, Data cubes.

[06 Hrs.]

UNIT II

Data Warehouse process & architecture: OLAP vs. OLTP,3 Tier data warehouse architecture.
OLAP models, ROLAP vs. MOLAP.

[06 Hrs.]

UNIT III

Dimensional modeling: Principles & advance topics in dimensional modeling, data Extraction Transportation Loading, ETL design & techniques of implementation

[07 Hrs.]

UNIT IV

Introduction to data mining: Data mining primitives, Data mining definitions & task, Knowledge Discovery vs. Data mining, DBMS vs. Data Mining, Data mining techniques, tools & applications.

[07 Hrs.]

UNIT V

Data Mining Techniques: Association rules, clustering, classification, decision trees.

[07 Hrs.]

UNIT VI

Introduction to Business Intelligence:
BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices

[07 Hrs]

Course outcomes

At the end of the course student should be able to:
1. Identify different application areas of data mining , data warehousing and business intelligence.
2. Compare OLTP and OLAP and data warehouse environment.
3. Design a data warehouse model
4. Define and apply different data mining techniques to solve different business problems and decide which works best for which business problem.

Program outcomes mapped: e, j, k

IT411	Data Warehousing & Mining		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Text books:				
1.	Data Warehousing Fundamantals	Reprint 2009	PaulrajPonniah	Wiley India edition,
2	Data Mining Techniques	2nd edition	Arun .K.Pujari	University press
3	Data Warehousing: concepts, products and applications	3rd edition	C.S.R.Prabhu	PHI Publication
4	Business Intelligence	2nd edition	David Loshin	Morgan Kaufmann
Reference books:				
1	Data Mining Techniques	1st edition, (2000)	Han Kamber	Morgan Kaufmann
2	Data Warehousing, Data Mining, & OLAP,	Eighth reprint2006	Alex Berson and Stephen J. Smith,	Tata McGrawHill,

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IT413	Digital Signal Processing		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES:-

1. To Classify signals and systems and to describe sampling theory and various operations on discrete time signals such as convolution, correlation etc.
2. To interpret discrete time signals and systems in frequency domain and to summarize properties of Fourier transform.
3. Understanding the Z-transform and its application to identify system properties, solving difference equations and determining the frequency response of a system to predict the stability of the system through pole-zero analysis.
4. To analyze the frequency response of LTI system and block diagram representation and signal flow graph representation of IIR and FIR systems. Implementing digital filters in verities of forms: Direct form-I and II, parallel, cascade and lattice.
5. To design Digital FIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation. Design digital FIR filters using the window method.
6. To analyze signals using discrete Fourier transform (DFT), Understand circular convolution, its relationship to linear convolution and how linear convolution can be achieved via the discrete Fourier transform. To develop the Decimation in time and frequency FFT algorithms for efficient computation of the DFT.

UNIT I **[08 Hrs.]**

Basics of Signals & Systems, Discrete time signals and systems, linearity, time variance, causality, stability properties of LTI casual system, response of LTI system to various input, convolutions.

UNIT II **[08 Hrs.]**

Frequency Domain description of signals & systems, Fourier Transform of Discrete time signal, Properties of DFT, DFT's of typical discrete time signals.

UNIT III **[07 Hrs.]**

The Z-Transform properties, ROC's relation with Fourier Transform, System function, Inverse Z-Transform, solution of difference equation using unilateral Z-transform.

UNIT IV **[05 Hrs.]**

Structure Realization of Filters: FIR, IIR Filters, Direct Form-I, Direct Form-II, Cascade Parallel Implementation.

UNIT V **[07 Hrs.]**

Introduction to FFT algorithms: Decimation in time- FFT algorithms, decimation in frequency FFT algorithms, DCT.

UNIT VI **[07 Hrs.]**

Digital filter design techniques: Design of FIR Filters based on Windows, Design of IIR digital filters from analog filters

IT413	Digital Signal Processing		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Note: - PRACTICALS based on above syllabus using MATLAB & TMS C320 C50

Outcomes:

- Understand digital to analog (D/A) and analog to digital (A/D) conversion and to operate on a signal and model these operations mathematically.
- Apply DSP techniques to real-world signal acquisition, spectral analysis and signal filtering.
- Analyze and characterize the signals and system through Z-transform.
- Understand system characterization and able to classify and design it.
- Design digital IIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation.
- Understand Discrete Fourier Transform and improved algorithms for fast DFT calculation.

Program outcomes mapped: a, b, c, e, h, i, j, k

Text books:				
1	Digital Signal Processing	2003	Alen V. Oppenheim, W. Schaffer	PHI
2	Digital Signal Processing	4th Edition (2007)	John G. Proakis, Dimitris G. Manolakis	Pearson Prentice Hall

Reference books:				
1	Theory & Application of Signal Processing'	1975	Rabiner & Gold	Prentice-Hall
2	Digital Filter Design & Analysis	1993	Andreas Antoniou	McGraw-Hill

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IT415	Neural Networks & Fuzzy Logic		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES: -

1. To focus on the foundations of neural network theory and the application of neural network models in engineering, cognitive science, and artificial intelligence;
2. To introduce the neural networks as means for computational learning and to present the basic network architectures and learning algorithms for classification and regression;
3. To demonstrate neural network applications on real-world tasks;
4. To emphasize the need for fuzzy logic as a means to model linguistic knowledge in human experts;
5. To understand fuzzy inference and reasoning so as to build systems based on fuzzy control

UNIT I **[08 Hrs.]**

Fundamentals concepts and models of artificial neural systems: Biological neurons and their artificial models, models of artificial neural networks, learning and adaption, neural network learning rules, feed forward and feedback networks, single-layer perceptron classifiers, Discriminant functions, linear machine and minimum distance classification, training and classification using the perceptron, single layer perceptron networks for linearly separable classification.

UNIT II **[08 Hrs.]**

Multilayer feed forward networks: linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors, classifying and expert layered networks.

UNIT III **[07 Hrs.]**

Hopfield model-Mathematical analysis, Hopfield learning algorithm, discrete time, Hopfield net and competitive learning model. Self Organizing Feature Maps, Applications of artificial neural networks

UNIT IV **[08 Hrs.]**

From classical (CRISP) sets to fuzzy sets, characteristics and significance of the paradigm shift, fuzzy sets versus crisp sets, representation of fuzzy sets, properties of fuzzy sets. Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersection s-norms, fuzzy unions: t-Conorms.

UNIT V **[06 Hrs.]**

Fuzzy Arithmetic: fuzzy numbers, Linguistics variables, Fuzzy relations, extension principles for fuzzy sets, arithmetic operations on fuzzy numbers.

UNIT VI **[08 Hrs.]**

Defuzzification methods, design of fuzzy controllers, Fuzzy inference).

Course Outcomes:

1. To focus on the mathematical foundations of neural network theory and to understand the working of Neural Networks as pattern classifier.
2. To comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for supervised learning.
3. To comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for unsupervised learning.
4. To understand the basics of fuzzy sets, its operations and the need for fuzzy logic.
5. To understand fuzzy numbers, their operations and fuzzy inference techniques to model the human intelligence**.**
6. To build systems based on fuzzy control and to understand the basics of hybrid Neuro Fuzzy systems

Program outcomes mapped:a,b,c,e,k,l

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IT415	Neural Networks & Fuzzy Logic		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Introduction to Artificial Neural Systems'	Second Edition (1994)	J. M. Zurada	Jaico Publishing House
2	Fuzzy sets and Fuzzy logic, Theory and Applications	Facsimile edition,1997	George J. Klir and Bo Yuan	Prentice Hall
Reference books:				
1	Fuzzy Logic With Engineering Applications'	2004	T. J. Ross	McGraw Hill
2	An introduction to Fuzzy Control	2nd Edition,1993	D. Driankov	Narosa Pub. House
3	Artificial Neural Networks	1999	Yegnanarayan	PHI,1999
4	Neuro-fuzzy and Soft Computing	1996	Jang.Sun and E. Mizutani	Prentice Hall

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IT417	TCP/IP		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1. To understand internals of TCP/IP protocol.
2. To understand how TCP/IP is actually implemented.
3. To understand interaction among the protocols in a protocols stack.

UNIT I **[07 Hrs.]**

Internetworking- Concepts, architecture and Protocol, Comparison of OSI model and TCP/IP model.
Internet Protocol (IPv.4)- IP addresses, Classful and Classless IP addresses, IP datagrams, IP datagram Forwarding. ARP, RARP.
Internet Protocol (IPv.6)-Characteristics of features, datagram frame format, base address format, addressing.

UNIT II **[08 Hrs.]**

IP, ICMP and IGMP : Datagram, fragmentation, options, checksum, IP package, ICMP, messages, formats, error reporting, query, checksum, ICMP package, IGMP, messages, operation, encapsulation, IGMP package

UNIT III **[08 Hrs.]**

UDP: UDP datagram, checksum, operation, uses, UDP package. TCP: TCP, Services, flow, congestion and error control, TCP package and operation.

UNIT IV **[08 Hrs.]**

Unicast And Multicast Routing Protocols: unicast routing protocols, RIP, OSPF, BGP, multicast routing, trees, protocols, MOSPF, CBT, PIM .

UNIT V **[07 Hrs.]**

Application Layer, Sockets: Client server model, concurrency, processes, sockets, byte ordering, socket system calls, TCP and UDP client-server programs, BOOTP -DHCP, Services: Domain Name System , name space, resolution, types of records, concept, mode of operation, , FTP, TFTP and electronic Mail: SMTP, MIME, IMAP, POP.

UNIT VI **[07 Hrs.]**

Network management: SNMP, Middleware: RPC, RMI. Internet Security: IPSec, PGP, Firewalls, SSL.

Course outcomes

Students will learn

IP Addressing

Data Link and Network Layer TCP/IP Protocols

Internet Control Message Protocol (ICMP)

Transport Layer TCP/IP Protocols

Basic TCP/IP Services

Domain Name System (DNS)

The Dynamic Host Configuration Protocol (DHCP

Securing TCP/IP Environments

latest Security techniques and Trends

Program outcomes mapped: a, e, m

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IT417	TCP/IP		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Text books:				
1	TCP/IP protocol suite	4th edition	Behrouz Forouzan	Tata McGrawhill

Reference books:				
1	Internetworking with TCP / IP, Vol – 1	4th edition (2000)	Douglas Comer	PHI
2	Computer networks	4th edition	Andrew S.Tanenbuam	PHI
3	TCP/IP illustrated Volume 2	2003	W.Richard Stevens	Pearson Education

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IT419	Software Testing		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

COURSE LEARNING OBJECTIVES :-

1.To study classification of Software measures and software measurement validations.
2. Understand key testing challenges that demand thoughtful tradeoffs by test designers and managers.
3. To study Software Testing and its quality.
4. Develop skills with several test techniques.
5.To learn different software quality metrics & tools.
6. To study how to do software maintenance.
7. Improve the critical thinking and rapid learning skills that underlie good testing

UNIT I **[08 Hrs.]**

Principles of Measurement:

Representation Theory of Measurement, Measurement and models, Measurement Scales, Measurement in small, Measurement in Large systems. Classification of Software Measures, Determining what to measure, Applying Framework, Software Measurement Validation, Measurement tools, Four principles of Investigation, Planning Formal Experiments, What is a good data, How to define/collect data, How to Store and Extract data.

UNIT II **[06 Hrs.]**

Internal Product attributes Measurement

Size: Aspects of software size, length, reuse, functionality, complexity
Structure: Types of structural measures, control-flow structures, and Modularity and information flow attributes, Object-oriented metrics, Data structure, Difficulties with general complexity measures, Halstead's Software Science.

UNIT III **[10 Hrs.]**

Software Measurement Programs and Principles of Testing:

What is a metric plan?, Goal-Question-Metric model Defects: Origins of Defects, Defect Classes, Defect repository and Test Design, Developer/Tester support for Defect Repository ,Test Case Design I [White-Box]: Test Adequacy criteria, Structural Testing, Code Complexity testing, Mutation Testing ,Test Case Design II [Black-Box**]:** Test case Design Criteria, Requirement based testing, Boundary Value analysis, Equivalence Partitioning, State-based or Graph-based Testing, Compatibility Testing, User Documentation Testing, Domain Testing

UNIT IV **[06Hrs.]**

Software testing:

Test plan, Management, Execution and Reporting, GUI testing, Validation testing, Integration testing, System and Acceptance testing, Scenario testing, Regression testing, Specification-based testing, Performance Testing, Ad hoc Testing, Usability and Accessibility Testing, Software Test Automation.

UNIT V **[06 Hrs.]**

Software Quality metrics and tools:

Quality concepts, Software Quality Assurance, Six Sigma principles, Malcolm Baldridge Assessment, ISO 9000, Edward Deming's principles, Total Quality Management, Product Quality Metrics, In process Quality Metrics, Software maintenance, Ishikawa's 7 basic tools, Checklists, Pareto diagrams, Histogram, Run Charts, Scatter diagrams, Control chart, Cause Effect diagram. Defect Removal Effectiveness & Process Maturity Level, Quality Assurance for modern development methodologies: RAD, Agile and extreme, Automated testing types.

UNIT VI **[06 Hrs.]**

Software Maintenance:

Problem Reporting: Customer side Preliminary activities, Defects reported by Internal Customers, Logistics and Tooling, Challenges and Best Practices. Problem Resolution: Overview of Problem Resolution, Categorizing and Identifying problem, Making the Fix and Testing it, Challenges and Best Practices. Fix Distribution: Overview of Fix Distribution, Choosing method of Fix Distribution, Composing Fixes, Preparing and Testing Shipment unit**.**

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IT419	Software Testing		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

COURSE LEARNING OUTCOMES :- After completion of this course, students would be able to :

1. Use various test processes and continuous quality improvement
2. Differentiate between types of errors and fault models
3. Generate methods of test generation from requirements
4. Test adequacy assessment using: control flow, data flow, and program mutations
5. Use various test tools
6. **Apply software testing techniques in commercial environments**

Program outcomes mapped: b, c, k, l

Text books:				
1	Software Metrics: A Rigorous and Practical Approach	ISBN 981-240-385-X	Fenton, Fleeger	Thomson
2.	Metrics & Models in Software Quality Engineering	ISBN 81-297-0175-8	Stephen H. Kan	Pearson Education

Reference books:				
1	Software Maintenance	ISBN 0-07-048345-0	Ramesh, Bhattiprolu	Tata McGraw Hill
2	Software Testing : Principles and Practices	ISBN 81-7758-121-X	Desikan, Ramesh	Pearson Education
3	Practical Software Testing	ISBN 81-8128-089-X	Burnstein	Springer International Edn.
4	The Art of Software Testing		Glenford J. Myers	John Wiley & Sons, Inc

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IT421	Distributed Systems		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1. To study the different design issues of Distributed Operating Systems
2. Create an awareness of the major technical challenges in distributed systems design and implementation;
3. Expose students to current technology and distributed infrastructure software;
4. Expose students to past and current research issues in the field of distributed systems;
5. Provide experience in the implementation of typical algorithms used in distributed systems.

UNIT I **[08 Hrs.]**

Introduction: Introduction to distributed Systems, examples of distributed systems, goals, hardware and software concepts, design issues. System models: Introduction, Architectural Model, Fundamental Model, Client Server Model.

UNIT II **[08 Hrs.]**

Communication: Interprocess Communication: Message oriented Communication, Stream Oriented Communication Layered Protocols: Lower Level, Transport Level and Higher-Level Protocols Distributed Objects: RPC & LRPC, Remote Method Invocation, Events and Notifications.

UNIT III **[07 Hrs.]**

Distributed File Systems: SUN NFS, AFS, Synchronization : Time and Global States: Clock Synchronization, Logical clocks, global state, Event ordering Distributed Deadlock Algorithms for Avoidance, Prevention, Detection Co-ordination: Election Algorithms, mutual exclusion, Distributed Transaction

UNIT IV **[07 Hrs.]**

Distributed Mutual Exclusions: Classification, requirement, Leader election, Ring based leader election, bully algorithm, token based & non token based algorithms.

UNIT V **[07 Hrs.]**

Distributed Deadlock Detection

Resource vs Communication deadlocks, graph theoretic model, deadlock prevention, avoidance, detection, Issues in deadlock detection, Centralized deadlock detection algorithms, distributed deadlock detection algorithms

UNIT VI **[08 Hrs.]**

Fault Tolerance : Process Resilience, Reliable client server communication, Reliable group communication, Distributed Commit and Recovery

Course Outcomes : After completing this course, students will be able to

1. Analyze and design distributed algorithms for reliable distributed systems.
2. Know how to specify the properties of distributed algorithms, so called liveness and safety properties.
3. Explain the different models of distributed systems, including failure and timing models
4. Master basic algorithms for failure detection, leader elections, broadcast and multicast, basic shared memory in distributed systems, agreement protocols, and group communication
5. Practice in design and implementation of selected distributed algorithms in middleware designed for group communication.

Program outcome mapped: b, e ,j, k , m

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IT421	Distributed Systems		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Text books:				
1	Advanced Concepts in Operating Systems		Mukesh Singhal and Niranjan Shivaratri	TMH
2	Distributed Systems Principles and Paradigms'	1st Edition,2002 2002.	Andrew S. Tanenbaum & Maarten van Steen	PHI
Reference books:				
1	Distributed Operating Systems Concepts and Design	2nd Edition, 2000.	George Coulouris, Jean Dollimore & Tim Kindberg	Pearson (LPE)

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IT422	Network Security		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES: -

1. To know the methods of conventional encryption.
2. Understanding the concepts of public key encryption and number theory
3. Understanding the network security tools and applications
5. Understanding various vulnerabilities posing security threats to computer networks and information systems
6. Understanding solutions proposed to ensure network and information security
7. Understand the pros and cons of cryptographic techniques, their feasibility and security, social implications of network security

UNIT I **[07 Hrs.]**

Introduction- attacks services, mechanisms, security attacks, security services, model for internet work security, conventional encryption- classical techniques- encryption model, steganography, classical encryption techniques, modern techniques-simplified DES, differential and linear cryptanalysis, block cipher design principles, Block Cipher modes of operation.

UNIT II **[08 Hrs.]**

Conventional encryption-algorithm RC5, Blowfish, DES, triple DES etc. characteristics of advanced symmetric block cipher, confidentiality using conventional encryption- placement of encryption function, traffic confidentiality, key distribution, random number generation.

UNIT III **[08 Hrs.]**

Public key encryption- principle of public –key cryptosystems, the RSA algorithm, key management, Diffie-Hellman key exchange ,Ellipse Curve Cryptography, Introduction to number theory prime and relatively prime numbers, modular arithmetic, Formats and Euler's theorems ,testing for primarily, discrete Logarithms.

UNIT IV **[08 Hrs.]**

Message authentication and hash functions- authentication requirements, functions, codes, hash functions, security of hash functions and MACs, SHA-1, HMAC, digital signatures, authentication protocols, digital signature standard.

UNIT V **[07 Hrs.]**

Authentication applications-Kerberos, Directory authentication service, E-mail security-pretty good privacy, S/MIME, IP security-overview, architecture, authentication header, encapsulating security pay load, combining security associations, key management.

UNIT VI **[07 Hrs.]**

Web security-requirements, secure sockets layer, secure electronic transaction, network management security-SNMP, System security-intruders, viruses and related threats, firewall-design principles, trusted systems.

OUTCOMES: -

1. After completing this course, students will be able to explain common attacks against network assets, the associated threats and vulnerabilities, and what network security personnel do to secure assets.
2. They would be able to protect information in an organization by using encryption and number theory for providing authentication and access control.
3. They would be able to identify types of security policies to manage operational security, and then use these policies to ensure compliance by users in an organization.
4. They would be able to conduct research in network security

Program outcomes mapped: a, c, f, h,

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IT422	Network Security		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Text books:				
1	Cryptography and network security principles and practices	3rd edition,2002	William Stallings	Pearson Education Asia
2.	Network Security	2008	BehrouzForouzan	Tata Mgraw Hill
3	Networks Security Essentials, applications and standards	3rd edition (2007)	William Stalling	Pearson Education
Reference books:				
1	Cryptography in C and C++	2001	Michael Welschenbach	Apress

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IT423	Human Computer Interaction		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES :

1. To study interface design tools.
2. To design user interfaces.
3. To study interactive devices.
4. To make use of the human components functions.
5. To make use of the Computer components functions. .
6. To study the Interaction between the human and computer components.
7. To study the Interaction design basics

UNIT I **[07 Hrs.]**

Introduction: Importance of user Interface – definition, importance of good design.
Benefits of good design, a brief history of Screen design,
The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, Principles of user interface.

UNIT II **[07 Hrs.]**

Design process – Human interaction with computers, importance of human characteristics, human consideration, Human interaction speeds, and understanding business functions.

UNIT III **[08 Hrs.]**

Screen Designing:- Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information–focus and emphasis – presentation
information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT IV **[06 Hrs.]**

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls.
Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT V **[06 Hrs.]**

Software tools – Specification methods, interface – Building Tools.

UNIT VI **[06 Hrs.]**

Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

OUTCOMES: -

1. Explain the human components functions regarding interaction with computer
2. Explain Computer components functions regarding interaction with human
3. Demonstrate Understanding of Interaction between the human and computer components.
4. Implement Interaction design basics

Program outcomes mapped: a, c, f, h, k, m

Text books:				
1	Human Computer Interaction	Third Edition Edition	Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg	Pearson Education
2	Interaction Design		Rogers, Sharps	Wiley Dreamtech
3	User Interface Design		Soren Lauesen	Pearson Education

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PG SoE & Syllabus 2014

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE-I	MSE-II	TA	ESE	
I SEMESTER												
1	GE1901	Computational Methods	3	0	0	3	3	15	15	10	60	3
2	CV1951	Environmental Chemistry and Microbiology	3	0	0	3	3	15	15	10	60	3
3	CV1952	Lab: Environmental Chemistry and Microbiology	0	0	2	2	1			40	60	
4	CV1953	Water Supply and Wastewater Collection	3	0	0	3	3	15	15	10	60	3
5	CV1954	Municipal Water Treatment	3	0	0	3	3	15	15	10	60	3
6	CV1955	Municipal Waste Water Treatment and Disposal	3	0	0	3	3	15	15	10	60	3
7	CV1956	Seminar-I	0	0	2	2	1			100		
		Total	**15**	**0**	**4**	**19**	**17**					

II SEMESTER												
1	CV1961	Industrial Waste Water Treatment and Disposal	3	0	0	3	3	15	15	10	60	3
2	CV1962	Environmental Management	3	0	0	3	3	15	15	10	60	3
3	CV1963	Air Quality Management	3	0	0	3	3	15	15	10	60	3
4	CV1965	Lab: Air Quality Management	0	0	2	2	1			40	60	
5	CV1964	Municipal Solid Waste Management	3	0	0	3	3	15	15	10	60	3
6	**Professional Elective- I**		3	0	0	3	3	15	15	10	60	3
	CV1967	Hazardous Waste Management										
	CV1968	Water Resource Management										
	CV1969	Advanced Water Treatment										
7	CV1966	Seminar II	0	0	2	2	1			100		
		Total	**15**	**0**	**4**	**19**	**17**					

III SEMESTER

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1	**Professional Elective- II**		3	0	0	3	3	15	15	10	60	3
	CV1971	Environmental Modelling										
	CV1972	Rural Water Supply and Sanitation										
2	**Professional Elective- III**		3	0	0	3	3	15	15	10	60	3
	CV1973	Applied Structures										
	CV1974	Environmental Biotechnology										
3	CV1975	Project Phase - I	0	0	16	16	8			100		
Total			**6**	**0**	**16**	**22**	**14**					

IV SEMESTER												
1	CV1981	Project Phase - II	0	0	24	24	12			40	60	
Total			**0**	**0**	**24**	**24**	**12**					
Grand Total of Credits							**60**					

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Semester - I

GE1901	Computational Methods			L=3	T=0	P=0	CREDITS = 6
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

COURSE OBJECTIVES

At the end of the course the student will be able to

- Understand different statistical methods.
- Understand different numerical methods and their applications.

SYLLABUS

UNIT – I
PROBABILITY AND STATICS:
Random Variables-discrete and continuous, cumulative distribution function and probability density function, concept of most probable member, elementary ideas of joint probability distribution, Sampling distribution t.F and x2 distribution, test of hypotheses.

UNIT – II
CALCULUS OF VARIATION:
Distributions and their extreme values. Variation of functional and its properties, Euler-Lagrange's equation. Minimization of functional. Gaderkin and Ritz method.

UNIT – III
NUMERICAL METHOD:
Solution of system of linear algebraic equation. Gansseidel method, Crout's method.
Solution of transcendental equation by Newton- Raphsons method and method of false position.

UNIT – IV
OPTIMIZATION:
Linear programming (up to simplex method). Non linear and dynamic programming

ARTIFICIAL NEURAL NETWORK (ANN)
Training method, fuzzy logic

Text Books:

1. Goyal M., Computer Based Numerical and Statistical Techniques
2. Shastri S.S.,Numerical methods

Reference Books:

1. Kreyszig, Advanced Engineering Mathematics.
2. Dass H.K., Advanced Engineering Mathematics.

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CV1951	Environmental Chemistry and Microbiology			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

Course Objective	Course Outcome
• To bring into focus those aspects of chemistry that are particularly valuable for solving problems of environmental monitoring and pollution control. • To give a fundamental perspective of the microbial technology for adopting cleaner environmental practices.	• Understand the concepts Environmental chemistry& to learn how the concepts of environmental chemistry can be put to practical applications. • To ensure applications of microbial technology in environmental engineering practices

UNIT – I

General Chemistry:-Theory of valancy, oxidation, numbers, oxidation-reduction reaction, law of mass action, Stochiometry, gas laws.

Physical Chemistry:- Buffer solution, indicators. Amphoteric hydroxide, chemical equilibrium Osmosis, Dialysis.

UNIT – II

Organic Chemistry and Biochemistry:-

Organic compounds of interest to environmental engineers, general properties of the functional groups of organic compounds.

Enzymes, classification of enzymes catalyzed reaction, energy considerations, coupling of reaction. Breakdown and synthesis of carbohydrates, fats, proteins under aerobic and anaerobic conditions. CNP cycles under aerobic and anaerobic conditions.

Concept of BOD, COD, TOC.

UNIT – III

Colloidal Chemistry: -Colloids, dispersion of colloids, general and electro-kinetic properties of colloids, colloidal solution and mixtures.

Environmental Chemistry: -Chemistry involved in water treatment procedure like coagulation, softening, defluoridation, iron and manganese removal, demineralization, analysis of pesticide and heavy metals.

UNIT – IV

Environmental Microbiology

Introduction of microbiology, Haeckel's classification and characterization of microorganisms, viruses.

Morphology and structure of bacteria, nutrient requirement, growth of bacteria.

Basic microbiology of water and sewage. Basic principals involved in the analysis of feacal indicator bacteria – coli forms and streptococci, plankton analysis, analysis of pseudomonas & streptococci.

Kinetics of microbial growth.

Text Book:-

1. Sawyer, C.N. and McCarty, P.L., and Parkin, G.F. Chemistry for Environmental Engineers, 4th Edn. McGraw Hill, New Delhi, 1994.
2. Benefield, Judkins and Weand – Process Chemistry for Water and Wastewater Treatment, Prentice Hall
3. Maier R M, Pepper I L and Gerba C P. Environmental Microbiology, Second Edition, Elsevier- AP, 2009.
4. Pelczar, Jr, M.J., Chan, E.C.S., Krieg, R.N., and Pelczar M. F, Microbiology, 5th Edn., Tata McGraw-Hill Publishing Company Limited, New Delhi, 1996.
5. Rittman B, McCarty P L McCarty P, Environmental Biotechnology: Principles and Applications, 2nd edition, McGraw-Hill, 2000

References:-

1. Powar & Daginawala, General Microbiology Vol. I &II, Himalaya Publishing House, Latest.

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CV1952	Lab: Environmental Chemistry and Microbiology			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
--	--	40	60	100	--		

Any TEN experiments of the following will be performed.

1. To determine Alkalinity of a water sample.
2. To determine Available Chlorine in given bleaching powder sample
3. To determine Total, Calcium and Magnesium hardness of given water sample.
4. To determine Dissolved Oxygen concentration in given water sample.
5. To determine Sulphates concentration in given water sample.
6. To determine Biochemical Oxygen Demand (B.O.D.)of a wastewater sample.
7. To determine Chemical Oxygen Demand (C.O.D.)of a wastewater sample.
8. To determine Maximum Probable Number (MPN) of coli form bacteria present in water sample by Multiple Tube Dilution (MTD) technique-presumptive test.
9. To determine Density of bacteria in a water sample pour plate (Standard Plate Count) method.
10. To determine concentration of Chlorides in a given water sample.
11. To determine Hydrogen ion concentration (p^H) of a solution
12. To determine Turbidity of a solution using Nepheloturbidimeter.
13. To determine optimum coagulant dose by Jar test.
14. To determine effective size and co-efficient of uniformity of a given sand sample and to separate required sand from given stack of sand for required effective size and coefficient of uniformity.
15. To determine total, dissolved and suspended solids in given water sample.

CV1953	Water Supply and Waste Water Collection			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

Course Objective	Course Outcome
• To provide an understanding of analysis, design and operation of water distribution system, including water storage tanks, pumping facilities, water mains, and service lines reservoir, sewers, drains and sewer appurtenances	• Understand different methods of analysis of pipe network for water distribution. • Understand methods of design of sewers.

UNIT – I
Analysis of Water Distribution System
Flow through pipes- Equation for flow through pipes, Moody diagram, Analysis of flow through pipe network
1. Hardy cross method 2. Newton Raphson's method 3. Linear Theory method

UNIT – II
Design of Water Distribution System
Reservoirs, pumps and valves in the distribution system, Node flow analysis.
Rising Main, water hammer, cause and prevention. Maintenance of distribution system
Critical path method for design of water distribution networks.

UNIT – III
Waste Water Collection
General – Objectives, types of system and sewers, requisites for sewerage system design – survey and investigations. Hydraulics of sewer – flow equations, pipe and open channel flow, self cleansing and scouring velocities through sewer, flow in partially filled sewers, velocity of equal cleansing, sewer shape vis-a-vis their usefulness, sewer invert drop.

UNIT – IV
Design Of Sewers And Sewer Appurtenances
Storm sewers- Estimation of design flow, rational and other method of estimation of design storm flow, rainfall intensity–duration–frequency relationships, design to a typical storm sewerage system.
Sanitary sewers- House plumbing system, estimation of design flows, fluctuation flows, and sewer ventilation. Sulfide generation in sewers, depth of sewer, design of a typical sanitary sewerage system.
Pumps and pumping stations
Manholes, street inlets, catch basins, building connections, sewer junctions, inverted siphon, flushing tanks, air ejectors, regular and measuring devices, design and operations.

Text Book:-
1. Bhave P. R. And Gupta R, Analysis of Water Distribution Networks, Narosa Publishing Co., New Delhi (2006).
2. Fair G. M., Geyer J. C. & Okun D. A., Water & Wastewater Engg. Vol.I & II, John-Willey & Sons, New York.
3. McGhee N. J. & Steel E. W., Water supply and sewerage, McGraw hill publications, 1991.
4. Bhave P.R, Optimal design of water distribution networks, Narosa Publishing Co., New Delhi (2003).

Reference:-
1. CPHEEO, Manual on water supply and treatment, Ministry of urban development, GoI.
2. CPHEEO, Manual on Sewerage and Sewage Treatment, Ministry of urban development, GoI.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

CV1954	Municipal Water Treatment			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

Course Objective	Course Outcome
• To provide a basic description and understanding of the principal unit operations used in the treatment of municipal water including coverage of the scientific basis of each unit process, as well as the conventional approach to their engineering design	• Understand the fundamental, scientific basis governing the design and performance of the treatment technologies. • Understand the role of each unit process within typical treatment process trains, their interaction and the context of when they are applied

UNIT I

Water quality criteria and standards, Requirement of water treatment facilities, Unit operation & Unit process, Synthesizing water treatment system, Site selection, Process selection.

Aeration: Objective, Principles, Types of aerator, Design of aerators.

UNIT II

Coagulation: History, Need of coagulation, Chemistry of coagulation, Various coagulants used in process, Factors affecting efficiency of coagulation process, Operation of feeders, Types of rapid mixing devices, design of flash mixer.

Flocculation: Theory of flocculation, Slow mixing devices.

UNIT III

Sedimentation: Principle, Stoke' law, Working of ideal sedimentation tank, Types of sedimentation tank, Design of working of clariflocculator, Operational problems in sedimentation tank.

UNIT IV

Filtration: Theory of filtration, Types of filters, working of slow and rapid sand filter, operational difficulties and design of rapid sand filter.
Disinfection: Methods of disinfection, Kinetics of chemical disinfection, Chlorination, Chemistry of chlorination, Methods of chlorination

Text books :

1. N.J. McGhee, Steel E.W., Water Supply and Sewerage, McGraw hill 1991.
2. N.J. Weber, Physicochemical Process for Water Quality Control, John Wiley & Sons 1972.
3. Fair Geyer & Okun, Water and Waste water Engineering, Vol I and II, John Wiley & Sons 1st.

Reference Book:-

1. Nordel, E, Water Treatment For Industrial And Other Uses, Reinhold Publishing Corporation, N.Y.
2. CPHEEO, Manual on Water supply and Treatment, Govt. of India Publication.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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CV1955	Municipal Waste Water Treatment and Disposal			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

Course Objective	Course Outcome
• Design various treatment units for sewage treatment • Design various units for sludge treatment and disposal.	• To understand different units and processes in sewage treatment. • To understand the design methodologies for all such sewage treatment units. • To understand different methods of treatment and disposal of sludge.

UNIT I

General objectives of sewage treatment, sewage characteristics, conventional sewage treatment flow sheet, functions of different unit processes.
Reactor types and their hydraulic characteristics, mass balance analysis, reaction order, rates and coefficients

UNIT II

Physical treatment: screening, gravity separation theory, grit removal, primary sedimentation. Chemical Treatment: chemical coagulation and precipitation, removal of phosphorus, heavy metals and dissolved organic substances.

UNIT III

Biological treatment:- Suspended and attached growth processes, aerobic and anaerobic treatment of sewage. Nitrification and Denitrification

Activated sludge process: process description, recent developments, process analysis, process design considerations

Tricking filter: process description, classification, process design considerations.

UNIT IV

Treatment of biosolids: process flow diagram, pumping, preliminary operations, thickening, stabilization, aerobic and anaerobic digestion, conditioning, dewatering, heat drying.

Text Books:

1. S.J. Arceivala, Wastewater Treatment And Disposal, Marcel Dekker,1981.
2. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal And Reuse, Inc. Third edition McGraw – hill 1991.
3. Qasim S.R. Wastewater Treatment Plant Planning, Design And Operation, Holt, Rinehart and Winston, N.Y.

References:-

1. N.F. Grey Activated Sludge Process, Theory And Practices, Oxford University Press 1990

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CV1956	**Seminar-I**		**L=0**	**T=0**	**P=2**	**CREDITS = 1**
EVALUATION SCHEME						
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION	
--	--	100		100	--	

Seminar on any related topic to environmental engineering will be presented by the student. The topic of seminar will be approved by the teacher in charge. Evaluation will be based on the subject contents and skill of presentation. Evaluation will be done by a panel of teachers from the department.

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Semester - II

CV1961	**Industrial Wastewater Treatment and Disposal**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

Course Objective	Course Outcome
• Design various treatment units for treatment of industrial wastewater. • Design a treatment facility for a typical industrial wastewater.	• To understand importance of industrial wastewater treatment. • To understand the fundamentals of various treatment processes. • To understand treatment methodologies for various industrial wastewaters.

UNIT I
Environmental impact due to industrial water pollution, problems associated with industrial wastewater, sampling and analysis of wastewater, toxicity testing, statistical analysis of data, standards for waste disposal.

UNIT II
Reuse, recycling and resource recovery. Industrial waste volume and strength reduction methods.
Equalization and proportioning of wastewater, design of equalization tank.
Neutralization of wastewater, Floatation.

UNIT III
Stabilization pond, oxidation ponds, biological denitrification processes, membrane biological reactors.
Anaerobic treatment of industrial wastewater, general design considerations, UASB, attached growth processes.

UNIT IV
Treatment of specific industrial wastes: textile, dairy, tanning, sugar, brewery and distillery, iron and steel, food industries.
Common effluent treatment plant, concept, advantages.

Text Books:
1. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal And Reuse, Inc. Third Edition Mcgraw Hill 1991.
2. W.W. Eckenfielder, Industrial Pollution Control, McGraw Hill Int. Edition 1990.
3. W.J. Weber, Physicochemical Processes For Water Quality Control, John Wiley and Sons, 1972.
4. Nemerow, N.L. Theories and Practices Of Industrial Waste Treatment. New York : Addison Wisely.
5. Bess Elivievre, E.B. The Treatment Of Industrial Wastes, McGraw Hill Book co.
6. Culp R L et al, Handbook Of Advanced Wastewater Treatment Van No Strand Reinhold Publ. N.Y.
7. Arceivala, S.J., (1998) "Wastewater Treatment for Pollution Control ", Tata McGraw Hill.

References:
1. Central pollution control board, India, comprehensive industry document series.
2. World Bank Group (1998) "Pollution Prevention and Abatement Handbook – Towards Cleaner Production ", World Bank and UNEP, Washington D.C.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

CV1962	Environmental Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

Course Objective	Course Outcome
• Understand environmental policies of Government of India. • Understand different methods of environmental impact assessment. • Understand different national and international environmental laws	• Able to explain the fundamentals and identify the tools used for EM • Able to discuss environmental impact assessment (EIA) as an environmental management tools and trace the evolution of EIA • Able to discuss the evolution of environmental policies and laws and implications of international policies and laws for India.

UNIT I

Development and Environment, Global and Indian scenario.
National Environmental Policy, Environmental organizations for planning and implementation sustainable development. Concept of carrying capacity, assimilative and supportive capacityPreventive and reactive strategies for environmental pollution control, Nature of impact – primary, secondary, tertiary, short –term long-term, local and regional, reversible & irreversible impacts.

UNIT II

Environmental impact and risk assessment Methodologies: Ad hoc, check-lists, network, matrix etc. Environmental Management plan. Typical case studies of environmental impact assessment. MoEF questionnaire for environmental clearance

UNIT III

Eco Labeling, Concept of Cleaner Technology Environmental Audit definition, concept of EA, types of environmental audit benefits of environmental audit, scope & objectives, environmental statement, procedural aspects of conducting environmental audit, pre-audit phase, on-site audit phase & post-audit phase, waste minimization, economic benefits of environmental audit.

UNIT-IV

Environmental Legislations and its basic concepts, critical issues, civil liability, various enactment and their provisions – Water Act (1974, 1988), forest Conservation Act (1980), Air Act (1981, 1988), Water (Cess) Act 1977, Environmental Protection Act 1986, Role of State & Central boards of pollution control, local government social action groups, and environmental policies.

Text Books :-

1. S. Mushraf, Legal Aspects of Environmental Pollution and Its Management, C.B.S. publishers, Delhi 1932.
2. R. K. Jain, L.V. Urban G.S. Stacey, H.E. Balbach, Environmental Assessment McGraw – Hill, Inc. N.Y.
3. Rao, J.G. and Wooten, Environmental Impact Analysis, Hanfbook, 1980.
4. Canter, L.W. Environmental Impact Assessments,-- N.Y. McGraw – hill book Co.1977.

Reference

1. Rosencrannz, S. Divan, M.L. Noble, Environmental Law and Policy in India, Cases, Materials And Statutes, Tripathi Pvt. Ltd. Bombay.

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CV1963	Air Quality Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

Course Objective	Course Outcome
• To provide the knowledge of major air pollutants; their sources and their effects (environmental, economic and health) • To provide insight into the dispersion of air pollution in the atmosphere • To provide insight into the control equipment's of air pollution • To provide insight about the laws and legislations for the control & prevention of air pollution.	• Understand various sources & their effects • Understand the meteorological factors that influence wind and turbulence, the relationship of air current stability, and the effect of each of these factors on air pollution , transport and dispersion; understand the role of topography and its influence on air pollution • Understand of the basic principles, equipment, and methods used to control particulate matter, gaseous emission and automobile emission • Understand of the different types of laws, the constitutional limitations on governmental actions and laws, basic administrative law, and where laws are recorded

UNIT I

Sources & classification of air pollutants: Nature of air pollutants, Industrial processes causing air pollution, Effects of pollutants on health, vegetation, materials & atmosphere

UNIT II

Meteorology & Dispersion of pollutants: Stability, Inversions, Diffusion of pollutants, Dispersion models.

UNIT III

Control of air pollutants: Particulate emission control, Gaseous emission control, Automobile Exhaust Emission Control

UNIT IV

Air quality standards and legislation:- Ambient air quality standards, air quality emission standards, air pollution control legislation, Air pollution index. IndoorAir Pollution.

Text Book:

1. Air Pollution, M.N. Rao., Tata McGraw Hill, 2006.
2. Fundamentals of Air Pollution, Stern, Wohlers, Bouble and Lower, Academic Press, 1984.
3. Air Pollution and Control, P. P. Mowli and N. Venkata Subbayya., Divyajyoti Prakashan, Jodhpur, 1989.
4. Environmental Pollution Control Engineering, C.S. Rao, New Age International, 2007

References:-

1. Air Quality Monitoring- A Course Manual, NEERI, 1981.
2. Air Pollution, Vol. I to IX, A. C. Stern, Academic, New York, 1968.

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CV1965	**Lab : Air Quality Management**			**L=0**	**T=0**	**P=2**	**CREDITS = 1**
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
--	--	40	60	100		--	

Any FIVE of following experiments will be conducted:

1. To measure CO % & NO % of the exhaust gases from vehicles or gasoline engine.
2. Determination of Particulate (SPM and RSPM) matter concentration in atmosphere by using high volume sampler
3. Statistical Calculations of observed air pollution data.
4. Sampling and analysis of SO_2 in atmosphere
5. Determination of dust fall in atmosphere.
6. Study of various sampling and analytical equipment in air pollution
7. Determination of wind velocity, wind direction, temperature, cloud cover, humidity & preparation of wind rose diagram.

CV1964	Municipal Solid Waste Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

Course Objective	Course Outcome
• Develop insight into the collection, transfer, and transport of municipal solid waste. • To examine the engineering and scientific principles of municipal solid waste (MSW) management. • Processing and disposal methods for solid waste.	• Understand different characteristics of solid waste. • Understand different methods of collection, Transfer and Transport of solid waste. • Understand different Processing and disposal methods for solid waste.

UNIT I

Problems and impacts of solid waste in developing countries, Solid waste management and organization.Sources, Types, Quantity and Composition of municipal solid waste.
Characteristicsof solid waste – Sampling – physical, chemical and biologicalAnalysis.
Functional Elements of MSWM,Legislation and byelaws in solid waste management.

UNIT II

Storage, Collection, Transportation, Optimization of roots, Tools and equipment, Transfer station, Volume reduction.

UNIT III

Composting – Process microbiology, Aerobic and anaerobic composting.
Sanitary Landfill – Process, mechanism, Classification, types, site considerations,Maintenance of site.
Incineration- Mechanism, types and Operation.

UNIT IV

Future processing method, Pyrolysis, Refuse derived fuel.

Text Books:

1. Solid waste management in developing countries – A.D. Bhide, B.B.Sudresan
2. Solid waste water management – D. JoshepHangertey, Joseph L. Pavoni.
3. George Techobanoglous etal,"Integrated Solid Waste Management", McGraw-Hill Publication, 1993.

Reference

1. Municipal Refuse Disposal – Institute of America Public Health Association, Interstate printer and publisher inc – TanvilElinoy

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Dean (Acad. Matters)		Version		

CV1967	PE-I Hazardous Waste Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

Course Objective	Course Outcome
• To provide insight into sources of hazardous waste & the treatment given thereafter.	• Able to understand principle of methods given to hazardous waste.

UNIT I

Definition of hazardous waste, U.S.E.P.A. classification, global scenario, episodes. Hazardous waste (management and handling) rules, 1989 and Indian scenario.

UNIT II

Source of hazardous waste, types of waste inventorisation procedures.Sampling and analytical procedures.Overview of treatment and disposal method – waste minimization.

UNIT III

Physicochemical method and biological method. Thermal Processes. Solidification/stabilization and innovation techniques.

UNIT IV

Secure landfill.
Site selection methodology for establishing treatment and disposal methods and EIRA methodology.

Text Books:

1. Charles A. Wentz; " Hazardous Waste Management ", McGraw-Hill Publication, 1995

Reference:-

1. The safe disposal of hazardous waste. Vol. I, II, & III Bat stone, Smith, Wilson, Joint study Sponsored by the world bank, the WHO, & UN Environmental Program UNEP,
2. The world bank Freeman, H.M. standard Handbook of Hazardous Waste Treatment and Disposal, 1989.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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CV1968	PE-I Water Resources Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

Course Objective	Course Outcome
• To understand water resources planning • To understand water policies and application of remote-sensing. • To understand different methods of conservation and recharging of water resources • To understand interbasin transfer and EIA of water Resource development projects	• Understand water resources planning • Understand water policies and application of remote-sensing. • Understand different methods of conservation and recharging of water resources • Understand interbasin transfer and EIA of water Resource development projects

UNIT I

Introduction: water resources planning, multi–objective planning role in national development, basic concepts of hydrology and hydrogeology.
River monitoring, gauging silting, silt load etc.

UNIT II

National water policy. Water resources planning and processes. Management of water bodies.
Application of remote sensing Techniques. Integrated approach – carrying capacity based planning.

UNIT III

Water resources conservation : quantity aspects, surface and ground water development,
Rain water harvesting, ground water recharge, conjunctive use of ground and surface water.

UNIT IV

Water resources development in coastal areas.
Basic concepts of economics, welfare economics.
Inter basin transfer of water.
EIA of water Resource development projects.

Text Books:

1. Linsey, R. K. &Franzini, J.B. water resources Engineering. New Delhi : McGraw Hill
2. Grigg N.S. Water Resources planning McGraw Hill Book company.

Reference

1. Neil S. Grigg, Water resource management – principles, regulations and cases New Delhi : McGraw Hill

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

CV1969	PE-I Advanced Water Treatment			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

Course Objective	Course Outcome
• To provide insight into various advanced methods used for the treatment of municipal and industrial water including coverage of the scientific basis of each operation/process, as well as the conventional approach to their engineering design	• Understand the fundamental, scientific basis governing the design and performance of the treatment technologies. • Understand the role of each unit operation /process within typical treatment process trains, their interaction and the context of when they are applied

UNIT I

Necessity of Advances/modifications/modern development in water treatment. Industrial water quality requirement, specific treatment for industrial purpose.
Softening of water, Boiler feed water, lime soda process, ion exchange process.

UNIT II

Desalination: Theory of desalination, various methods of Desalination- Distillation,
Electro dialysis, Freezing, Demineralization, Solar evaporation. Membrane filtration process

UNIT III

Adsorption: Theory, Granular and powder activated carbon, Performance and Reactivation.
Materials and Reactions, Kinetics, Applications.

UNIT IV

Fluoride Removal, Arsenic Removal, Fe and Mn removal, Taste, odor and colour removal.
Water treatment for Swimming Pool.

Text Book:

1. N.J. McGhee, Steel E.W., Water Supply and Sewerage, McGraw hill 1991.
2. N.J. Weber, Physicochemical Process for Water Quality Control, John Wiley & Sons 1972.
3. Fair Geyer & Okun, Water and Waste water Engineering, Vol I and II, John Wiley & Sons 1st.

Reference Book:-

1. Nordel, E, Water Treatment For Industrial And Other Uses, Reinhold Publishing Corporation, N.Y.
2. CPHEEO, Manual on Water supply and Treatment, Govt. of India Publication.

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Dean (Acad. Matters)		Version		

CV1966	**Seminar-II**			**L=0**	**T=0**	**P=2**	**CREDITS = 1**
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
--	--	100		100		--	

Seminar on any related topic to environmental engineering will be presented by the student. The topic of seminar will be approved by the teacher in charge. Evaluation will be based on the subject contents and skill of presentation. Evaluation will be done by a panel of teachers from the department.

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Semester - III

CV1971	**PE-II Environmental Modeling**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

Course Objective	**Course Outcome**
• To provide an emphasis on the role and nature of modeling environmental system	• To understand the role and nature of environmental modeling

UNIT I

Computational methods in Environmental modeling, Definition; Classification; Examples and Models of Environmental Systems.

UNIT II

Introduction to Air Quality Models;
Metrology; Atmospheric Stability and Turbulence; Gaussian Plume Model and Modifications; Numerical Models, Urban Diffusion Models;

UNIT III

Introduction to river, estuarine and lake thermodynamics, Stratification of lakes, Dissolved Oxygen Model for streams, Temperature Models, Prediction of fate of organisms and toxic substances.

UNIT IV

Models for predicting water quality changes in water distribution systems, Environment model for Stationary and mobile sources.

Text Book:-

1. Introduction To Environmental Engineering and Science ,Gilbert M. Masters Practice hall, India
2. Principles Of Surface Water Quality Modelling And Control,Thomann R. V. And Muller J.A,Harper, International edition,1987

Reference Book:

1. Water Quality, Technobangolous G., Schroader E.D., Addison Wesley publishing co., Reading Massachusetts

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CV1972	PE-II Rural Water Supply and Sanitation			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

Course Objective	Course Outcome
• To understand scheme of rural water supply and sanitation. • To understand improvised method of treatment of wastewater • To understand compact systems of treatment and disposal.	• Student will acquire knowledge regarding rural water supply and sanitation scheme. • Students will be in a position to tell different compact units of treatment of rural water supply. • Students will be able to tellsimple wastewater treatment for rural water supply.

UNIT I

Concept of environmental and scope of sanitation in rural areas. Magnitude of problem of water supply and sanitation, National policy. Various approaches for planning of water supply systems in rural areas.

UNIT II

Selection and development of preferred sources of water, springs, wells, Infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source. Specific problems in rural water supply and treatment e.g. iron, manganese, fluorides etc. Low cost treatment.

UNIT III

Improvised methods and compact system of treatment of surface and ground waters such as MB settlers, slow sand filter, chlorine diffusion cartridges etc. Water supply through spot sources, hand pumps, open dug wells Planning of distribution system in rural areas Water supply during fairs, festivals and emergencies

UNIT IV

Treatment and disposal of wastewater/sewage various methods of collection and disposal of night soil Onsite sanitation system and community latrines, Ecosan system, Phytorid system. Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tank and soakage pits etc. Disposal of solids waste: Compostingand Biogas plants

Text Books

1. Low cost on site sanitation option, Hoffman and Heijno Occasional Nov.1981 Paper No.21 P.O. Box 5500 2280 HM Rijswijk, Yhe Netherlands offices,J.C.Monkeniaan,5Rijswijk(The Haque)
2. Wagner, E.G. and Lanoik, J.N., Water supply for Rural areas and small communities, Geneva: WHO 19593.

Reference

1. Manual of water supply and treatment, 3rdEdition,CPHEEO,GOI, New Delhi

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CV1973	**PE-III Applied Structures**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

Course Objectives	Course Outcomes
• To provide detailed concept of structural design of various environmental structures	• Understand structural design of various environmental structures.

UNIT I

Structural design of water supply and water collection system:
Design of pipes such an R.C.C. prestressed mild steel asbestos cement, cast iron etc.

UNIT II

Estimation of loads such as gravity earth forces, super imposed loads, moving loads etc. On rigid and flexible conduits under various types of field conditions

UNIT III

Design of pipe, supports, beddings, shallow and deep manholes, inverted siphons and other appurtenances etc.

UNIT IV

Design of tanks and prestressed structures for water and waste water such as circular and hopper bottom, setting tanks, pump and pump house, intakes, channels, water storage tanks, etc. Durability criteria for environmental structures.

Text Book:

1. Jai Krishna & Jain O.P. plain & reinforced concrete, Vol. II, Roorkee: New chand & Bros, 1980.

Reference Book:

1. N. Krishna Raju, advanced concrete structures, Tata McGraw Hill 1995

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CV1974	PE-III Environmental Biotechnology			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

COURSE OBJECTIVES	COURSE OUTCOMES
• To learn basic concepts of biochemistry and microbial interaction. • To learn basic concepts of genetic engineering and mutation of DNA.	• Able to explain the range of chemical reaction that are undergone by the hydroxyl group of carbohydrates, proteins, fats and nucleic acids' • Able to understand the Relationship between cell signaling and gene transcription.

UNIT-1:

Basic concept of microbial biochemistry-carbohydrates, proteins, fats and nucleic acids
Basic concept of biodegradation, biotransformation, biobenification, biorestoration / bioreclammation, microbial interaction

UNIT-2:

Environmental monitoring-signification of monitory bacterial viral and protozoan pathogens.
Technique of monitoring-standard methods of monitoring viral bacterial and protozoan pathogens, Advance techniques-gene probes biosensor, immunoassay.

UNIT-3

Basic concept of genetic engineering-chromosomal DNA, plasmid DNA transformation, transudation conjugation, protoplast fusion, mutation recombinant DNA techniques Biotransformation of biomass/organic waste into value added chemicals, energy, fertilizers and single cell protein

UNIT-4:

Aerobic and anaerobic waste treatment processes-microorganisms involved and biochemical changes of different pollutants present in liquid and solid waste, reactor technology, mathematical modeling and simulation, design and optimization.

Text Books:

1. C.S. Forster and D.A. John Wase,, Environmental Biotechnology, Ellis Harwood, 1987
2. Trehan K. Biotecnology, New Delhi, Willey Eastern Ltd.1990

Reference Books:

1. Forster C.F.N Biotechnology and Wastewater Treatment ,Cambridge 1992
2. N.F. Grey, Biology of Wastewater Treatment Oxford University Press ,1989

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CV1975	**Project Phase I**			**L=0**	**T=0**	**P=16**	**CREDITS =8**
EVALUATION SCHEME							
MSE – I	MSE – II	CA	ESE	TOTAL		ESE DURATION	
--	--	100		100		--	

The Project Phase – I shall start in semester III, and should preferably be literature survey.

The work shall be continuously evaluated as per the norms/ guidelines set up by the B.O.S. for its assessment of 100 marks.

Evaluation of Project Phase – I shall consist of submission of report in a prescribed format based on review of literature related to the topic selected for dissertation. Report should cover introduction, literature review, objective and scope of investigation and pilot studies carried out during the semester. The student will deliver the seminar thereon which will be assessed by panel of examiners.

CV1981	**Project Phase II**			**L=0**	**T=0**	**P=24**	**CREDITS = 12**
EVALUATION SCHEME							
MSE – I	MSE – II	CA	ESE	TOTAL	ESE DURATION		
--	--	40	60	100	--		

Project Phase – II shall consist of detailed study of a work that the student has executed in continuation with report submitted by the student in the Project Phase – I and should involve scientific research, design, collection and analysis of data, determining solutions and must preferably bring out the individuals contribution.

The work shall be continuously evaluated as per the norms/ guidelines set up by the B.O.S. for its assessment of 40 marks.

End Semester Evaluation of Project Phase –II shall consist of submission of dissertation in a prescribed format. The student shall present the entire work on Dissertation, followed by viva-voce which will be assessed by panel of examiners.

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Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE-I	MSE-II	TA	ESE	
I SEMESTER												
1	CV1901	Numerical Methods	3	0	0	3	3	15	15	10	60	3
2	CV1902	Theory of Elasticity and Elastic Stability	3	0	0	3	3	15	15	10	60	3
3	CV1903	Structural Dynamics	3	0	0	3	3	15	15	10	60	3
4	CV1904	Lab: Structural Dynamics	0	0	2	2	1			40	60	
5	CV1905	Matrix Analysis of Structures	3	0	0	3	3	15	15	10	60	3
6	CV1906	Lab: Matrix Analysis of Structures	0	0	2	2	1			40	60	
7	CV1907	Design of Substructures	3	0	0	3	3	15	15	10	60	3
8	CV1908	Research Practice	0	0	2	2	1			100		
Total			**15**	**0**	**6**	**21**	**18**					

II SEMESTER												
1	CV1911	Finite Element Method	3	0	0	3	3	15	15	10	60	3
2	CV1912	Theory of Plates and Shells	3	0	0	3	3	15	15	10	60	3
3	CV1913	Earthquake and wind effects on Structures	3	0	0	3	3	15	15	10	60	3
4	**Professional Elective-I**		3	0	0	3	3	15	15	10	60	3
	CV1914	Advanced Concrete Structures										
	CV1915	Prestressed Concrete										
	CV1916	Composite Structures										
5	**Professional Elective-II**		3	0	0	3	3	15	15	10	60	3
	CV1917	Advanced Steel Structures										
	CV1918	New Engineering Materials										
	CV1919	Smart Structures and Applications										
6	CV1920	Lab: Steel Design Studio	0	0	2	2	1			40	60	
7	CV1921	Lab: RCC Design Studio	0	0	2	2	1			40	60	
8	CV1922	Seminar	0	0	2	2	1			100		
Total			**15**	**0**	**6**	**21**	**18**					

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III SEMESTER												
1	**Professional Elective-III**		3	0	0	3	3	15	15	10	60	3
	CV1923	Tall Building										
	CV1924	Design of Environmental Strucutres										
	CV1925	Bridge Engineering										
2	**Professional Elective-IV**		3	0	0	3	3	15	15	10	60	3
	CV1926	Plastic Analysis and Design of Structures										
	CV1927	Seismic Analysis and Design of Structures										
	CV1928	Design of Industrial Structures										
3	CV1929	Project Phase-I	0	0	16	16	8			100		
Total			**6**	**0**	**16**	**22**	**14**					

IV SEMESTER											
1	CV1931	Project Phase- II	0	0	24	24	12		40	60	
Total			**0**	**0**	**24**	**24**	**12**				
Grand Total of Credits							**62**				

I SEMESTER

CV1901	Numerical Methods			L=3	T=0	P=0	Credits = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
• Introduce students to the area of numerical methods and illustrate the far reaching nature and usefulness of these methods for engineering applications. • Motivate students to learn more about, and to use numerical techniques in other courses and in future professional career • Provide a solid understanding of the basic elements underlying development and use of numerical methods in engineering applications. • Develop numerical skills and proficiency in using computer techniques • Expose students to elements and challenges involved in numerically implementing the underlying mathematical derivations • 6. Provide a training environment in use of computational tools / languages	• An ability numerically solve many types of problems such as Roots of equations, Systems of linear simultaneous equations, Numerical Differentiation and integration, Eigen value problems etc. • An ability able to select from alternative methods the one method that is most appropriate for a specific problem. • An ability to understand the limitations of each numerical method, especially the conditions under which they fail to converge to a solution. • An ability to formulate algorithms to solve problems numerically.

UNIT – I
Solution of algebraic and transcendental equation:
Regula Falsi Method, Newton-Raphson method, Development of Computer Program

UNIT – II
Solution of linear algebraic equations:
Gauss elimination, Cholesky method, Given's method, Householder's method.

UNIT – III
Eigen values problems:
Direct, Jacobi, Rutishauser's LR method, QR method.

UNIT – IV
Initial & two point boundary value problem:
Euler's, Runge-Kutta, Milne's Methods, Development of Computer Program.

UNIT – V
Numerical Integration:
Trapezoidal Method, Simpson's Method, Gauss Quadrature method, Development of Computer Program.

UNIT – VI
Direct Integration Methods:
Central difference method, Houbolt method, Newmark's method, Wilson - θ method.

Text Books
1. Balachandra Rao S., Santha C. K. ;Numerical Methods with programs in BASIC, FORTRAN and Pascal, University Press (India) Limited, Hyderabad 1992.
2. Bathe K. J., Wilson E. L., Numerical Methods in Finite Element Analysis, Prentice-Hall of India Private Limited, New Delhi, 1987

Referrence Books
1. Kandasamy P. ,Thilagavathy K, Gunavathi K.; Numerical Methods, S. Chand & Company Ltd, New Delhi, Edition-I,1997.
2. Chapra S.C. and Canale,R.P., " Numerical Methods for Engineers with Programming and Software Applications"- 3 Ed., Tata McGraw Hill, New Delhi, 2009
3. Salvadori M., "Numerical Mehtods"- PHI learning Pvt., ltd., New Delhi, 1987
4. Jain, Iyanger & Jain "Numerical Methods for Scientific Engineering computation"- Wiley Eastern Ltd., 1985
5. Gupta S. K.; Numerical Methods for Engineers, New Age International Limited Publishers, New Delhi, 1997

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CV1902	Theory of Elasticity and Elastic Stability			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
• To define plane stress and plane strain condition. • .To derive differential equations, boundary conditions and compatability conditions for 2D and 3D stress analysis. • To study the effect of bending of beams and torsion of non circular sections. • To analyze the beam column, beam on elastic foundation. • To study the buckling of column and simply supported rectangular plate.	• After completion of course students will able to, • Define plane stress and plane strain condition. • Derive differential equations, boundary conditions and compatability conditions for 2D and 3D stress analysis. • Understand the effect of bending of beams and torsion of non circular sections. • Analyze the beam column, beam on elastic foundation. • Understand the buckling of column and simply supported rectangular plate.

UNIT- I

I ntroduction to Two Dimensional Stress Analysis, Types of forces, Components of stresses and strains, Stress-strain relation, Plane stress and plane strain, Strain at a point, Differential equation of equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Airy's stress function.

UNIT- II

Introduction to Three Dimensional Stress Analysis, Components of stress, Principal stresses, Stress invariants, Maximum shearing stress, Differential equation of equilibrium, Boundary conditions and compatibility equations.

UNIT- III

Bending of cantilever of narrow rectangular section loaded at end, bending of simply supported beam with uniform load, torsion of non-circular and elliptical cross section.

UNIT- IV

Differential equation for beams columns with concentrated loads, continuous lateral loads and couples for simply supported ends, Application of trigonometric series, Lateral buckling of beams.

UNIT- V

Energy method for elastic bucking of columns, Approximate method, Buckling of Columns on elastic foundation, Columns with intermediate compressive forces and distributed axial load, Columns with varying cross section.

UNIT- VI

Effect of shearing force on critical load, Buckling of built up columns, Buckling of simply supported rectangular plates uniformly compressed in middle plane.

Text Books

1. Timoshenko, S.P. and Goodier, J.N., Theory of Elasticity, 3rd Edition, Mc-Graw Hill Book Company, New Delhi, 1963
2. Timoshenko, S.P. and Gere J. M., Theory of Elastic Stability , 2nd Edition, Mc-Graw Hill Book Company, New Delhi,1963

Reference Books

1. Srinath, L.S., Advanced Mechanics of Solids India, 2nd Edition, Tata Mc-Graw Hill Book Company, 2003.
2. Ameen, M., Computational Elasticity—Theory of Elasticity, Finite and Boundary Element Methods, 1st Edition, Narosa publication, 2007
3. Mikhait Filonenko borodich, Theory of Elasticity, 1st Edition, University press of pacific, 2003

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CV1903	Structural Dynamics			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
• To provide the students clear and thorough understanding of modeling of discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems. • To provide the students clear and thorough understanding of Calculation of the mode shapes and frequencies for the free response of continuous vibratory systems and use modal methods to calculate the forced response of these systems. • To provide the students understanding of modeling continuous vibratory systems – vibration of strings, axial and torsional vibration of bars and beams. • To provide the student with a basic understanding of IS codes related to earthquake loading.	• An ability to apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response. • Ability to identify, formulate and solve engineering problems having motions varying with time. This will be accomplished by having students model, analyze and modify a vibratory structure, in order to achieve specified requirements. • Understanding professional and ethical responsibilities. This will be accomplished by emphasizing the importance of understanding how structural vibrations may affect safety and reliability of engineering systems. • An ability to Understand IS codes related to earthquake loading.

UNIT - I

Fundamentals of Rigid / Deformable body dynamics, Analysis of undamped and viscously damped single degree freedom systems.

UNIT - II

Response of single degree freedom systems to harmonic loading, support motion and transmissibility, Duhamel's integral.

UNIT - III

Multiple degree of Freedom system: Vibration of undamped 2 DOF systems; Response of 2 DOF to harmonic excitation, mode superposition, vibration absorber, Free vibration of MDOF (up to 3 DOF) systems, Dynamic response of MDOF (2 DOF) systems-modal superposition method. Energy Principle, Rayleigh's method (2 DOF)

UNIT - IV

Dynamic analysis of systems with distributed properties, Approximate design method, Transformation factors.

UNIT – V

Response spectra, generation and types of response spectra , Vibration of Continuous Systems: Free vibrations of Continuous systems-axial and transverse vibration of bars / beams. Response of continuous systems to dynamic loads.

UNIT - VI

Introduction to vibrations due to earthquake, Study of IS 1893 applicable to Buildings and Water Tanks.

Text Books:

1. Mario Paz, Structural Dynamics Theory & Application, CBS Publ.; N-Delhi, 1995.
2. Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2nd Edition., Pearson Education (Singapore) Pvt. Ltd, New Delhi, 1995

Reference Books:

1. Clough / Penzien, "Dynamics of Structures", McGraw Hill, 1993
2. Humar, J. L., "Dynamics of Structures", Prentice Hall, 1993
3. Timoshenko, S., "Advanced Dynamics", McGraw Hill Book Co; NY, 1948
4. Biggs, J.M., "Introduction to Structural Dynamics", McGraw Hill; NY, 1964
5. Damodarasamy and Kavitha," Basics of structural Dyanamics and Aseismic design, Phi Publisher, New Delhi.

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CV1904	Lab: Structural Dynamics			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
--	--	40	60	100		--	

PRACTICALS

1. To study various instruments for imparting dynamic forces.
2. To study various instruments for the response of vibrating structure.
3. To study the response of a single degree of lumped mass system subjected to base excitation.
4. To study the response of a two degree of freedom system building frame subjected to base motion.
5. To study the response of a multi degree of lumped mass system.
6. Verification of natural frequency of SDOF model under free vibration.
7. To study the liquefaction of soil structure.
8. To study the Earthquake induced waves in rectangular water tank.
9. To calculate horizontal seismic force of building using IS-1893.
10. To calculate the lateral forces in water tank due to Earthquake when water tank is empty and water tank is full by IS-1893.

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CV1905	Matrix Analysis of Structures			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES

After completion of syllabus students will able to,

- Understand basic concepts of stiffness method of matrix analysis.
- Analyse the structures using stiffness method.
- Apply softwares of structural analysis based on this method.

UNIT - I

Introduction to stiffness and flexibility approach, Stiffness matrix for spring, Bar, torsion, Beam (including 3D), Frame and Grid elements, Displacement vectors, Local and Global co-ordinate system, Transformation matrices, Global stiffness matrix and load vectors, Assembly of structure stiffness matrix with structural load vector, application to spring and bar problems.

UNIT - II

Analysis of Plane Truss, Space Truss by Stiffness Method

UNIT - III

Analysis of Beam, Plane Frame, Space Frame by Stiffness Method

UNIT - IV

Analysis of Plane Grid by Stiffness Method

UNIT - V

Analysis for member loading (self, Temperature & Imposed) Inclined supports, Lack of Fit, Initial joint displacements. Effect of shear deformation, internal member end releases

UNIT - VI

Analysis of building systems for horizontal loads, Buildings with and without rigid diaphragm, various mathematical models and introduction to Solution techniques.

Text Books:-

1. Gere, W. and Weaver; J. M., Matrix Method of Structural Analysis 3rd Edition, Van Nostrand Reinhold; New York; 1990
2. Meghre A.S. & Deshmukh S.K. ; Matrix Method of Structural Analysis, 1st edition, Charotar publishing house, Anand, 2003
3. Kasmali Aslam, Matrix Analysis of Structures, Brooks /Cole Publishing Co. 1999
4. Kanchi, M. B., Matrix Method of Structural Analysis, 2nd Edition; John Willey & Sons, 1999

Reference Books:-

1. Cheng, F.Y., M. Dekke; Matrix Analysis of Structural Dynamics, NY 2000
2. Bathe, K.J., Finite Element Procedures, 2nd Edition Springer,; 2002
3. Cook, R.D Concepts and Applications of Finite Element Analysis, et. al, John Willey & Sons;NY 1995
4. Martin; H.C., Introduction to Matrix Method of Structural Analysis, McGraw Hill Book Co. 1966
5. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991

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CV1906	Lab: Matrix Analysis of Structures			L= 0	T= 0	P= 2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
--	--	40	60	100		--	

PRACTICALS

Analysis of following structural elements by using commercial software

1. Continuous beam without sinking of support.
2. Continuous beam with sinking of support.
3. Plane truss.
4. Plane truss with inclined roller.
5. Plane truss with temperature effect and lack of fit.
6. Space truss.
7. Plane frame without axial deformation.
8. Plane frame with axial deformation.
9. Plane grid.

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CV1907	Design of Substructures			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES

After completion of syllabus students will able to

- Understand design of composite foundation systems of shallow foundations.
- Understand design of deep foundation systems.
- Analyze and understand various foundation failures.

UNIT – I

Introduction to soil structure interaction, Bearing Capacity of Foundations, Theories, In-situ tests; Settlement Analysis, factors affecting settlement, control of excessive settlements; Soil classification, Geotechnical design parameters. Design of different isolated and combined footings including eccentric loading.

UNIT – II

Design of raft foundation. Types of rafts, Design of Flat slab raft foundation and Design of beam and slab raft foundation.

UNIT – III

Function and Classification of piles, Concrete piles, Precast and cast-in-situ piles, Static point and skin resistance capacity of a Pile, pile load tests, Pile settlements, design of RCC piles, Various pile group patterns, Efficiency of Pile in group, Negative skin friction, Pile Cap design, Under reamed pile foundation, design of well foundation.

UNIT – IV

Introduction to machine foundations and its practical considerations for construction IS code of practice, introduction to analysis and design of simple machine foundation. Theory of sub grade reaction, beam on elastic foundation.

UNIT – V

Effects of earthquakes on foundation structures, IS1893-2002 recommendations for layout of foundation, classification of foundation strata, types of foundations allowed in sandy and other soils, soil liquefaction, ground settlement, methods to prevent liquefaction and settlement.

UNIT – VI

Analysis and design of Cantilever, counter fort and basement retaining walls and abutments. Introduction to reinforced earth retaining walls, skin walls.

Text Books

1. Sawmi Saran, " Analysis and Design of Substructures", , Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
2. Kurain N. P," Design of foundation systems- Principles and Practice", Narosa Publishing house, New Delhi, 2005.
3. Poulose H.G. and Davis E.H.," Pile foundation Analysis and Design", John-Wiley Sons, NY, 1980.
4. Karuna Moy Ghosh , "Foundation Design in practice", PHI Learning Pvt. Ltd, New Delhi 2012
5. P. C. Varghese, "Design of Reinforced Concrete Foundations", PHI Learning Pvt. Ltd., New Delhi, 2009.

References Books

1. J. E. Bowles, "Foundation Analysis and Design", Tata McGraw Hill New York
2. Kurain N.P," Modern Foundations: Introduction to Advance Techniques", Tata McGraw Hill, 1982
3. Winterkorn H.F. and Fang H.Y. Ed., "Foundation Engineering Hand Book", Van-Nostrand Reynold, 1975
4. Bowles J.E., "Foundation Analysis and Design" (4th Ed.), Mc.Graw –Hill, NY, 1996
5. Sreenivasalu & Varadarajan, "Handbook of Machine Foundations", Tata McGraw Hill
6. Hetenyi, M. "Beam on Elastic Foundation", University of Michigan Press, 1946.
7. Swami Saran, "Soil Dynamics and machine Foundations", Galgotia Publications (P) Ltd, New Delhi, 1999.

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CV1908	Research Practice			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	CA	ESE	TOTAL		ESE DURATION	
----	---	100		100		----	

Contents

I. Research Methodology
II. Literature Review
III. Data compilation and interpretation
IV. Writing a technical paper
V. Writing a funding proposal

Each student shall prepare a paper and funding proposal based on the reviewed literature and shall submit a copy to the department. Marks will be awarded on the basis of content and presentation.

II SEMESTER

CV1911	Finite Element Method			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
• To provide the student with knowledge and analysis skills in applying basic laws and steps used in solving the problem by finite element method. • To provide the student the knowledge of various interpolation functions and elements to solve simple problems by finite element method. • To provide the student with some knowledge in isoparametric transformation. • To provide students the knowledge of mathematical modelling techniques. • To develop the student's skills in applying FEM solution steps by using software.	• Students will demonstrate an ability to derive element matrix equation by different methods by applying basic laws in structural analysis. • Students will demonstrate an ability to apply the steps required for FEM solution to variety of physical systems. • Students will demonstrate an ability to create models for simple structures. • Students will demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes. • Students will be able to extend the knowledge of the application of FE to solve civil engineering problems.

UNIT – I

Principles and discretization, Elements stiffness formulation based on direct and, variational techniques, Rayleigh Ritz Method for Bar and Beam analysis.

UNIT – II

Shape functions, Finite Element Formulation using Cartesian Coordinates, Application to 1D problems, Convergence criteria

UNIT – III

Triangular and Rectangular element formulation using Cartesian Coordinates, Application to 2D stress analysis.

UNIT – IV

Natural coordinates, Numerical integration, Isoparametric elements, Application to 1D Problems, Isoparametric elements for two-dimensional stress analysis.

UNIT – V

Shape Functions for three Dimensional Stress analysis, Axi-symmetric Stress Analysis.

UNIT – VI

Modelling techniques and solution techniques, Computer Implementation of FEM Procedure for 1D & 2D problems.

Text Books:

1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Rajasekaran S, Finite Element Analysis in Engineering Design, S. Chand & Co.Ltd.New Delhi, 1999.

Reference Books:

1. Zienkiewicz O.C. and Taylor R.L., The Finite Element Method (Volume -I), 1st Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1989
2. Cook R. D. , Concepts and Applications of Finite Element Analysis, 3rd Edition, Wiley India Text books, Wiley India Pvt Limited, New Delhi, 1989.
3. Krishnamurthi C. S. ,Finite Element Analysis: Theory and Programming , 2nd Edition, Tata Mc Graw Hill Publishing Company Limited, 1994, Reprint 2005.
4. Bathe K. J., Finite Element Procedure, Prentice-hall of India, New Delhi, 1997.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

CV1912	Theory of Plates and Shells			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES	COURSE OOTCOMES
• To correlate moment curvature relation in pure bending and to derive equation of deflection for circular and thin rectangular plates. • To derive Lagrange's equation and Navier's solution for thin plates. • To explain the concept of finite difference method and its application. • To study the shear deformation theories for plates. • To classify the shells and its geometry and to explain the concept of various theory for shells.	• After completion of syllabus students will able to Correlate moment curvature relation in pure bending and to derive equation of deflection for circular and thin rectangular plates. • Derive Lagrange's equation and Navier's solution for thin plates. • Explain the concept of finite difference method and its application. • Understand the shear deformation theories for plates. • 5. Classify the shells and its geometry and to explain the concept of various theory for shells

UNIT – I

Development of governing differential equations by Kirchoff's theory with reference to thin rectangular plates with various boundary conditions. Symmetrical bending of laterally loaded circular plates with different boundary conditions.

UNIT- II

Study of Simply supported plates under different loadings. Navier's solution. Introduction to Levis solution. Finite difference method.

UNIT – III

Introduction to shear deformation theories for plates.

UNIT – IV

Classification of Shells. Membrane theory of cylindrical shells with different directrix such as circular, cycloidal, catenary, and parabolic.

UNIT – V

Bending theory of cylindrical shells, Finsterwalde, Schorer's, and D-K-J theory.

UNIT – VI

Approximate analysis of cylindrical shells by beam arch method.

Text Books

1. Timoshenko S.P and Krieger S.W, Theory of Plates and Shells,2nd Edition, McGraw-Hill Book Company, New Delhi, 1970.
2. Chadrashekhara K, Theory of Plates, 1st Edition, Universities Press (India) Ltd, Hyderabad, 2001.
3. Ramaswamy, G.S, Design of Concrete Shells, Krieger Publ. Co., 1984

Reference Books

1. Ramachandran S., Thin Shells (Theory and Problems) 1st Edition, Universities Press (India) Ltd, Hyderabad
2. Szilard R., Theory and Analysis of Plates, Prentice Hall Publication, 1974.
3. Philipee G Ciarlet, Mathematical elasticity Vol.II: Theory of plates, 1st Edition, Elsevier Science B V, 1997.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

CV1913	Earthquake & Wind Effects on Structures			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 hours		

COURSE OBJECTIVES

After completion of syllabus students will able to

- Understand basic concepts of earthquake engineering
- Understand behavior of structural components under earthquake and wind loading
- Understand concepts of earthquake resistance design
- Understand various codes related to earthquake and wind effects on structures
- Understand Wind Characteristics and concept of Mathematical Modeling.

UNIT – I

Origin of earthquake, Engineering geology of earthquakes, faults, Propagation of earthquake waves, quantification of earthquake (magnitude, energy, intensity of earthquake), Measurement of earthquake (accelerograph, accelogram recording and analysis of earthquake records), determination of magnitude, epicenter distances, Seismicity of the world.

UNIT- II

Causes or sources of earthquake damage, damage due to ground failure, History of past Earthquakes, generation of response spectrum from available earthquake records, Earthquake design spectrum and inelastic spectrum. Evolution of seismic risk.

UNIT – III

Concepts of earthquake resistance design, Design philosophy, four virtues of earthquake resistance design (stiffness, strength, ductility and configuration). Introduction to capacity design concept, Study of IS: 1893, Study of IS: 13920 for analysis and ductile design of RCC structures.

UNIT – IV

Wind Characteristics: Historical Wind Speed Data, Mathematical Models, Wind Speed Map of India, Practical Knowledge of Cyclones and Tornadoes.

UNIT-V

Static Wind effects and Building Codes with particular reference to IS – 875 (Part III).

UNIT-VI

Dynamic Wind Effects: Wind Induced Vibrations, Self excited motion, Analysis for dynamic wind loads, Vibration Control and Structural Monitoring.

Text Books:

1. Kramer, S.L, “Geotechnical Earthquake Engineering”, Prentice Hall, New Jersey, 1996.
2. Arya A. S., “Introduction to earthquake engineering structures”.
3. C. Scruton, “An Introduction to Wind Effects on Structures”, Oxford University Press, Oxford, UK., 1981

Reference books

1. Murthy, C.V.R, “Earthquake tips”, IIT Kanpur documents.
2. Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2nd Edition., Pearson Education (Singapore) Pvt. Ltd, New Delhi, 1995
3. Dowrick, D.J, “Earthquake Resistant Design for Engineers and Architects”, 2nd Edition; 1987
4. Peter Sachs, “Wind Forces in Engineering”, Pergamon Press. Oxford UK, 1972
5. Lawson T. V., “Wind Effects on Buildings”, Applied Science Publishers, London, UK, 1980
6. Emil Simiu and R. H. Scanlan, “Wind Effects on Structures – An Introduction to Wind Engineering”, John Wiley and Sons, New York., 1986
7. Cook, N. J., The designer’s guide to wind loading of building structures. Part 1 Background, damage survey, wind data and structural classification. Building Research Establishment, Butterworths, U. K., 1985
8. Cook, N. J., Designer’s guide to wind loading of building structures. Part 2: Static structures. Building Research Establishment, Butterworths, U. K., 1990
9. Simiu, E., Scanlan, R. H. Wind Effects on Structures: fundamentals and applications to design. 3rd Edition., John Wiley & Sons, New York, 1996.
10. Dyrbye, C., Hansen, S. O., Wind loads on structures., John Wiley, New York, 1997

Reference IS codes:

IS 1893-2002 Earthquake criteria
IS 13920-1993 ductile detailing

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CV1914	PE-I Advanced Concrete Structures			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES

After completion of syllabus students will able to get the knowledge about the design of

- Bridges.
- Water tanks.
- Multistoried buildings.
- Silos & Bunkers.

UNIT – I

Analysis and design of Multistoried buildings, calculation of loads, Approximate analysis, Preliminary sizing, Ductile detailing.

UNIT – II

Analysis and Design of Elevated service Reservoirs, IS Recommendations for wind & earthquake, Ductile detailing.

UNIT – III

Analysis and Design of bridges and Culverts, IRC Recommendations.

UNIT – IV

Analysis and design of Cylindrical Shells, Silos, and Bunkers, IS recommendations.

Text Books:

1. Bhavikatti S. S., Advanced R. C. C. Design Volume-II, New age international publisher, New Delhi, Ist edition - 2006
2. Krishna Raju N, Advanced R. C. C. Design, CSB Publisher and Distributor, New Delhi, 2nd edition-2005
3. Ramaswamy, G.S, Design of Concrete Shells, Krieger Publ. Co., 1984

Reference Books:

1. Johnson and Victor, “Essentials of Bridge Engineering” Oxford and IBH publisher, 1980
2. Jain O.P. and Jai Krishna, Plain and Reinforced concrete structures–Volume –II, Nemchand and brothers, 1987
3. Chattergee, B K, “Theory and design of Concrete Shells” Oxford and IBH publisher, 1978
4. Chen, W.F. and Duan, L. “Bridge engineering Handbook”

CV1915	PE-I Prestressed Concrete			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
• To understand the basic concepts of Prestressed concrete. • To study various devices used for Prestressing. • To analysis and design the basic structural members in Prestressed concrete • To analysis and design the special structures like Prestressed Concrete Pipes, Liquid Storage Tanks and Ring Beams	• After completion of syllabus students will able to • Understand the basic concepts of prestressed concrete. • Define various devices used for prestressing. • Analysis and design the basic structural members in Prestressed concrete. • 5. Analysis and design the special structures like Prestressed Concrete Pipes, Liquid Storage Tanks and Ring Beams.

UNIT – I

Limit state design of statically determinate prestressed beams - limit state of collapse against flexure, shear, torsion - limit state of serviceability - Design of end block - Anchorage zone stresses for post tensioned members.

UNIT – II

Statically indeterminate structures - analysis and design of continuous beams and frames Choice of cable profile - linear transformation - concordancy.

UNIT – III

Composite sections of prestressed concrete beam and cast in situ RC slab - analysis of stresses - differential shrinkage - deflections - Flexural and shear strength of composite sections - Design of composite sections.

UNIT – IV

Time dependant effects such as creep, shrinkage - Partial prestressing - Limit State design of partially prestressed concrete beams - Balanced moment capacity of rectangular and flanged sections - Crack and crack width computations. Analysis and design of prestressed concrete pipes, tanks, slabs – one way and two way (numerical problems restricted to pipes and tanks only).

Text Books:

1. N. Krishnaraju, Prestressed Concrete, 3rd edition, Tata McGraw Hill Publishing Co., 1995
2. S.K. Mallick and A.P.Gupta, Prestressed concrete, Oxford and IBH Publishing Co., New Delhi.

Reference Books:

1. Lin, T.Y. and Burns, N.H. , Design of Prestressed Concrete Structures, , 3rd edition, John Wiley & Son's, 2004
2. IS : 1343 – 1980, Code of Practice of Prestressed Concrete, Indian Standards Institution.
3. Guyon Y., Prestressed Concrete vol.I and II, Contractors Record Ltd., London.
4. Abels P.W., An Introduction to Prestressed Concrete, Vol.I and II', Concrete Publications Ltd., London.
5. Dayaratnam P. ,Prestressed Concrete Structures, , 5th edition, Oxford & IBH, 1996

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

CV1916	PE-I Composite Structures			L=3	T=0	P=0	CREDITS =3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

Unit I

Introduction: definition, Classification and characteristics of Composite materials, advantages and limitations. Current Status and Future Prospects; Basic Concepts and characteristics: Homogeneity and Heterogeneity, Isotropy, Orthotropy and Anisotropy; Characteristics and configurations of lamina, laminate, micromechanics and macromechanics.

Unit II

Constituent materials and properties ; Elastic behavior of unidirectional lamina: Anisotropic, separately orthotropic and transversely isotropic materials, stress-strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters ; Strength of unidirectional lamina:

Unit III

Macromechanical failure theories- Maximum stress theory, maximum strain theory, Deviatoric strain energy theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu); Elastic Behavior of multidirectional laminates: Basic assumptions, Stress-strain relations, load deformation relations, symmetric and balanced laminates, laminate engineering properties ;

Unit IV

Bending and vibration of laminated plates: Governing equations, Deflection of simply supported rectangular symmetric angle-ply, specially orthotropic, anti-symmetric cross-ply laminates ; Recent advances: Functionally graded materials, Smart materials.

Text / Reference Books:

1. R.M. Jones, Mechanics of Composite materials, Taylor and Francis, 1999.
2. M. Daniel and O. Ishai, Engineering mechanics of Composite materials, Oxford university press, 1999
3. P.K. Mallick, Fiber-reinforced Composites, Marcel Dekker Inc, 1988.
4. D. Hull and T. W. Clyne, An introduction to composite materials, Cambridge university press, Second Edition, 1996.
5. J.N. Reddy, Mechanics of laminated composite plates and shells-Theory and Analysis, CRC Press, BocaRaton, Second Edition, 2003.

CV1917	PE-II Advanced Steel Structures			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES

At the end of the course student will be able to

- Understand different types of loading With respect to structural parameters.
- Application of IS code & SP code for detailing and drafting of different structural components.
- Analysis and design of different types of structures.

UNIT – I

Design of steel industrial buildings

UNIT – II

Design of Steel Storage Vessels

UNIT – III

Design of steel Bridges.

UNIT – IV

Design of steel multistoried building

Reference Book

1. Arya A.S and Ajmani J.L. Design of Steel Structures, Nem chand & bross, Roorkee, new edition
2. Duggal S.K., Design of Steel Structures, Mc Graw Hill publication, 2007
3. RamChandra Design of Steel structures Vol-I & Vol-II Std. book house / Rajsons Publication Pvt. Ltd.,, Delhi, 2006
4. Gaylords, E.H. & Gaylords, C. N., Design of Steel Structures, Blackwell, 1994.
5. Dayaratnam P., Design of Steel Structures, Wheeler Publications, Allahabad, 1992
6. Ghosh, " Analysis and Design practice of Steel Structure", (Forthcoming), Phi Publisher, New Delhi

CV1918	PE-II New Engineering Materials			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

Course Objectives	Course Outcome
• Understand various civil engineering materials • Understand various methods of testing of materials • Understand and use various codes related to the civil engineering materials	• To introduce different high quality materials for civil engineering applications. • To be able to use engineering materials for better and durable Civil Engineering Structures.

UNIT-I

Steel fiber reinforced concrete, Properties, Aspect ratio, strength and durability.
Fiber reinforced plastics, other types of fibers and their applications.

09 Hrs.

UNIT-II

Light weight concrete, foam concrete, flyash concrete, workability, durability and application.

10 Hrs.

UNIT-III

High-grade concrete, high strength performance concrete, trimix concrete.

New engineering materials like light weight steel profile, aluminum profile, pressed steel sections.

10 Hrs.

UNIT-IV

Introduction to steel concrete composite including infill, encased section, properties of shear connectors, use of IS:11384, IRC 220.

10 Hrs.

Text books:

1. Neville A. M., Properties of Concrete, Pearson Education Limited.
2. Rafat siddhequi , Special Concretes, Galgotia Publications.
3. M Gambhir, Concrete Technology, Tata Mcgraw Hill Education Private Limited.

Reference books:

1. Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
2. Shetty M. S, Concrete Technology, S. Chand Publisher.

CV1919	PE-II Smart Structures and Applications			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

UNIT – I

Introduction to passive and active systems – need for active systems– smart systems – definitions and implications - active control and adaptive control systems – examples.

UNIT – II

Components of smart systems– system features and interpretation of sensor data – pro active and reactive systems – demo example in component level – system level complexity Materials used in smart systems – characteristics of sensors – different types smart materials – characteristics and behavior of smart materials – modeling smart materials – examples

UNIT – III

Control Systems – features – active systems – adaptive systems – electronic, thermal and hydraulic type actuators – characteristics of control systems – application examples.

UNIT – IV

Integration of sensors and control systems – modeling features – sensor-response integration– processing for proactive and reactive components – FE models – examples.

References Books

1. Srinivasan, A.V. and Michael McFarland, D., Smart Structures: Analysis and Design, Cambridge University Press, 2000.
2. Yoseph Bar Cohen, Smart Structures and Materials 2003, The International Society for Optical Engineering 2003.
3. Brian Culshaw, Smart Structures and Materials , Artech House, Boston, 1996.
4. M.V.Gandhi and B.S.thompson, Smart Materials and Structures , Chapman and Hall 1992.

CV1920	Lab: Steel Design Studio			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
--	--	40	60	100		--	

Contents
1. Review of IS 800
2. Elementary Design of Beam including open web sections
3. Elementary Design of various types of truss.
4. Design of Plate Girders
5. Structural Fasteners and Connections (Bolted/ Welded Connections all types)

Reference Books:
1. Duggal S.K., Design of Steel Structures, Mc Graw Hill publication, 2007
2. Arya A.S and Ajmani J.L. Design of Steel Structures Nem chand & bross, Roorkee, New Edition
3. Inglekrik
4. Subramanyam

CV1921	Lab: RCC Design Studio			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	CA	ESE	TOTAL		ESE DURATION	
--	--	40	60	100		--	

PRACTICALS

1. Review of IS 456, IS 962 Basics of Limit State Design (Beams, Columns, Slabs) Design of Multistoried buildings
2. Design for axial force, flexural, shear and combined effects
3. Slabs (one way & two way) and slabs on grades. Preliminary sizing and modeling of RC structures.

Reference Books:

1. Bhavikatti S. S., Advanced R. C. C. Design Volume-II, New age international publisher, New Delhi, Ist edition – 2006
2. Krishna Raju N, Advanced R. C. C. Design, CSB Publisher and Distributor, New Delhi, 2nd edition-2005.

CV1922	SEMINAR			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	CA	ESE	TOTAL		ESE DURATION	
-----	-----	100		100		-----	

Each Student shall prepare a Paper and present a Seminar based on the reviewed literature from various sources on current topic related to the structural engineering under the guidance of a staff member. The student shall submit typed copy of the paper to the Department. Grades will be awarded on the basis of contents of the paper and the presentation.

III SEMESTER

CV1923	PE-III Tall Buildings			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES

After completion of syllabus students will able to

- Understand horizontal load acting on a building i. e. earthquake and wind and design the building for above loading by providing shear walls / shear core
- Understand various aspects of high rise buildings such as the effect of torsion, soft storey effect, p- delta effect and drift index
- Understand detailing of RCC members for ductile behavior as IS Code provisions

UNIT – I

Earthquake & wind load Calculations along with dead load & live loads by Static analysis.
Introduction to Frame – shear wall buildings, Mathematical modeling of buildings with different Structural systems. Analysis & Design of shear walled buildings.

UNIT – II

Special aspeets in Multi- Story buildings like effect of torsion, flexible first storey, p- delta effect, Soil – Structure Interaction on building response, drift limitations.
Ductility of reinforced members subjected to flexure.
Design of braced columns using codal provisions.

UNIT – III

Beam – column jointed for ductile behaviors.
Multistory building with bracings & infills.

UNIT – IV

Introduction to Diaphragm. Seismic design of floor diaphragm..

Text Books:

1. Agrawal P. & , Shrikhande M., Earthquake Resistant Design of Structures, Prentice hall India, New Delhi, 4th Edition, 2007.
2. Verghese P.C., Advance Reinforced Concrete Design, Prentice hall of India, New Delhi, 2001.

Reference Books:

1. Park, R. & Paulay, T., Reinforced Concrete Structures, John Willey & Sons; 2nd Edition, 1975
2. Paulay, T. & Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
3. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
4. Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

CV1924	PE-III Design of Environmental Structures			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 hours		

COURSE OBJECTIVES

At the end of the course the student will be able to

- Analysis and design of structures related to water supply and treatment plants.

SYLLABUS

UNIT - I

Design of rectangular RCC reservoirs.

UNIT - II

Design of circular RCC reservoirs.

UNIT - III

Design of jack well/Pump house / approach bridges.

UNIT - IV

Design of pretreatment units: clarifloculators, aerators, flash Mixture, sand filters etc.

Text Books:

1. Ramamrutham S., “Design of Reinforced Concrete Structures”, Dhanpat Rai & Sons publications, 12th edition, 1995
2. Jain A.K., “Reinforced Concrete limit stste design”, Nem Chand & Bros. Roorkee., 4th edition, 1993

Reference Books:

1. Ghali, A., Circular Storage Tanks and Silos, E & F N Spon, London, (1979)
2. Jain, S.K. & Jaiswal, O.R., Guidelines for seismic design of liquid storage tanks, NICEE, IITK, 2004
3. Anchor, R.D., Design of liquid retaining concrete structure, Edward Arnold, London, (1992)

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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CV1925	PE-III Bridge Engineering			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES

After completion of syllabus students will able to

- Understand various types of bridges and loadings.
- Understand seismic behavior of bridges.
- Understand design philosophy for bridges.

UNIT – I

Types of bridge superstructure and introduction to their design, sub-structure, bearings, IRC / IRS Bridge loadings and other codal recommendations.

UNIT – II

Seismic design philosophy for Bridges, State of art modeling of bridges, Seismic Design of Substructures, Capacity design of substructures and ductile detailing, Seismic design of well and pile foundations.

UNIT – III

Earthquake behavior and Design of retaining wall and Abutments, IS code recommendations.

UNIT – IV

Design of Bearings (Free, Guided and Restrained). Introduction to long span bridges: cable stayed bridges and suspension bridges.

Text Books:

1. N. Krishna Raju, Design of bridges, Oxford & IBH publishing Co. Ltd., New Delhi.
2. D. Johnson Victor, Essentials of bridge engineering, Oxford & IBH publishing Co. Ltd., New Delhi.
3. Jagdeesh R. and Jairam M., " Design of bridges", PHI Publication New Delhi, 2nd edition,

Reference Books:

1. IRC: 5 -1970, Standard specifications and code of practice for road bridges, Sections I to V, Indian Roads Congress, New Delhi.
2. Chen, W.F. and Duan, L., Bridge Engineering Handbook, CRC Press, 1999
3. Indian railway standard code of practice for the design of steel or wrought iron bridge carrying rail, road or pedestrian traffic, Govt. of India, Ministry of Railways, 1962.
4. Hambly, E.C., Bridge deck behaviour, Chapman and Hall, London
5. O'Brien E.J. and Keogh D.L., Bridge deck analysis, E& FN Spon, New York

CV1926	PE-IV Plastic Analysis& Design of Steel Structure			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 hours		

UNIT I:

Plastic behavior, review curves of structural steel, plastic moments, shape factors, load factors, plastic hinge, types of collapse, collapse mechanism, collapse load factor.

UNIT II:

Upper and lower bound, uniqueness theorems, principle of virtual work, statical method, minimum and maximum theorems, step by step method.

UNIT III:

Methods of release of restrains, load interaction diagrams, method of inequalities.

UNIT IV:

Plastic Moment distribution applied to continuous beams & portal frames (Max. two bays single storey)

UNIT V:

Effect of Axial force & Shear force on Plastic moment of resistance

UNIT VI:

Design of beams, continuous beams and portal frames up to two storey – two bays. Minimum weight analysis, introduction to stability.

Reference Books:

1. “Limit state Design of Steel Structures”, S K Duggal , McGraw Hill education, 2010
2. “Limit State Design of Steel Structures”, Dr. M R Shiyekar, PHI Publication, 3rd Print
3. A.S. Arya and J.L. Ajmani – Design of Steel Structures, Nemchand& Bros., Roorkee
4. Ramchandra – Design of Steel Structures Vol – II, Standard Book House, Delhi
5. B.G. Neal – Plastic Method of Structural Analysis, Chapman & Hall
6. L.S. Beedle – Plastic Design of Steel Frames, John Willey & Sons
7. Structural design in steel by Salwar Alam Raz New Age International Publishers 15/44
8. Steel Designers Manual – ELBS

General Reading Suggested:

1. Codes: IS: 800 - 2007 Code of Practice for General Construction in SteelHand books
2. SP: 6 (6) – 1972 Handbook for Structural Engineers: Application of plastic Theory in Design of Steel Structures
3. Handbook for Structural Engineers SP 6 (8) 1972 (Reaffirmed 1993) – Bureau of Indian Standards.
4. NPTEL
5. Teaching Resource for Structural Steel Design – INSDAG Kolkatta

CV1927	PE-IV Seismic Analysis and Design of Structures			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 hours		

COURSE OBJECTIVES

After completion of syllabus students will able to

- Understand the behavior of structures subjected to lateral loads.
- Understand design aspects of RCC and Steel members subjected to earthquake loads.
- Understand detailing of RCC and steel members for ductile behavior as per codal provisions.

RCC Structures

UNIT - I

Performance of RC buildings, behavior of RC buildings in past earthquakes, influence of unsymmetry, infill walls, foundations, soft story, confinement of concrete, and ductility.

UNIT - II

Capacity Design of RC Members, Design for Strong column & weak beam, Design of Beam-Column Joints.

UNIT - III

Shear wall with ductile detailing. Preliminary sizing and Modeling of RC Buildings, Ductility and factors affecting ductility of RC members.

Steel Structures

UNIT - IV

Performance of steel structures in past earthquakes, basics of Steel Design, introduction to plastic analysis and design, design philosophy for steel structures.

UNIT - V

Capacity design concept, Ductility of steel buildings, Seismic behavior of steel structures, Stability considerations.

UNIT - VI

Seismic Design and detailing of Moment Resistant Frames, Beams and Columns.

Text Books:

1. Agrawal P. & , Shrikhande M., Earthquake Resistant Design of Structures, Prentice hall India, New Delhi, 4th Edition, 2007.
2. Agrawal P. &, Shrikhande M., Earthquake Resistant Design of Structures, PHI Publisher, New Delhi.
3. Bruneau, M.; Uang, C.M.; & Whittaker, A Ductile Design of Steel Structures McGraw Hill.
4. Mazzolani, F.M.; & Piluso Theory and Design of Seismic Resistant Steel Frames E&FN Spon

Reference Books:

1. Paulay, T. & Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
2. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
3. Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

CV1928	PE-IV Design of industrial structures			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 hours		

UNIT-1: PLANNING OF INDUSTRIAL STRUCTURES :

Classification of industries and local regulations - Factors affecting planning - General Aspects – Civil Engineering Aspects - Light and Ventilation.

UNIT-2:

LARGE SPAN STRUCTURES IN INDUSTRIES

Cable roofs - Types of cable roofs - Analysis of a cable subjected to concentrated loads and uniformly distributed load, Complexities in the analysis of a cable roof, Overview of deep beams, Virrendel Girder,Castellated Girders - Introduction to earthquake forces.

UNIT-3

SILOS AND BUNKERS

Concept of Angle of Repose - Pressure distribution - Dynamic loads - Stability of bunkers – Foundations.

UNIT-4:

FOUNDATIONS FOR INDUSTRIAL STRUCTURES

Machine foundations - General requirements - Design criteria - General analysis - Design of a block foundation for vertical compressor - Vibration Isolation - Foundations for Chimney and Microwave Towers.

Text books:

1. Srinivasula P. Hand Book of Machine Foundation Tata McGraw Hill Publications, New Delhi. First Edition, 2000
2. Ramchandra Design of Steel Structures Standard Book House, New Delhi Seventh Edition, 2000
3. Raghupati M. Design of Steel Structures Tata McGraw Hill Publication, Delhi First Edition, 2003
4. Dayaratnam P. Design of Steel Structures Wheelr's Publishers, Allahabad 1995
5. Anand Arya & Ajmani J. L. Design of Steel Structures Nemchand & Bros., Roorkee, U.P., India Forth Edition, 2004
6. Lambert F.W. The Theory & Practical Design of Bunkers The British Constructional Steelwork Association Ltd., London, UK 2000

CV1929	Project Phase I			L=0	T=0	P=12	CREDITS = 6
EVALUATION SCHEME							
MSE – I	MSE – II	CA	ESE	TOTAL		ESE DURATION	
		100		100			

The Project Phase – I shall start in semester III, and should preferably be literature survey of a live problem or a macro issue in the industry.

The work shall be continuously evaluated as per the norms/ guidelines set up by the B.O.S. for its assessment of 100 marks.

Evaluation of Project Phase – I shall consist of submission of report in a prescribed format based on a comprehensive and critical review of literature related to the topic selected for dissertation. Report should cover introduction, literature review, objective and scope of investigation and pilot studies carried out during the semester. The student will deliver the seminar thereon which will be assessed by panel of examiners.

IV SEMSTER

CV1931	Project Phase II			L=0	T=0	P=20	CREDITS = 10
EVALUATION SCHEME							
MSE – I	**MSE – II**	**CA**	**ESE**	**TOTAL**		**ESE DURATION**	
-----	-----	**40**	**60**	**100**		-----	

The Project Phase – II shall consist of detailed study of a work that the student has executed in continuation with report submitted by the student in the Project Phase – I and should involve scientific research, design, collection and analysis of data, determining solutions and must preferably bring out the individuals contribution.

The work shall be continuously evaluated as per the norms/ guidelines set up by the B.O.S. for its assessment of 40 marks.

End Semester Evaluation of Project Phase –II shall consist of submission of dissertation in a prescribed format. The student shall present the entire work on Dissertation, followed by viva-voce which will be assessed by panel of examiners.

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE - I	MSE - II	TA	ESE	
I SEMESTER												
1	ME1951	Engineering Statistics & Design of Experiments	3	0	0	3	3	15	15	10	60	3
2		**Professional Elective I**	**3**	**0**	**0**	**3**	**3**	**15**	**15**	**10**	**60**	**3**
	ME1957	PEI:Quality Control & Metrology										
	ME1958	PEI:Reliability Engineering										
	ME1959	PEI: Design for Manufacturing and Assembly										
3	ME1952	Industrial Engineering	3	0	0	3	3	15	15	10	60	3
4	ME1953	Manufacturing Engineering - I	3	0	0	3	3	15	15	10	60	3
5	ME1954	Manufacturing Engineering - I lab	0	0	2	2	1			40	60	
6	ME1955	Computer Integrated Manufacturing	3	0	0	3	3	15	15	10	60	3
7	ME1956	Computer Integrated Manufacturing lab	0	0	2	2	1			40	60	
			15	**0**	**4**	**19**	**17**					
II SEMESTER												
1	ME1961	Tool Engineering	3	0	0	3	3	15	15	10	60	3
2	ME1962	Production Management	3	0	0	3	3	15	15	10	60	3
3	ME1963	*Manufacturing Engineering - II	3	0	0	3	3	15	15	10	60	3
4	ME1964	Manufacturing Engineering - II Lab	0	0	2	2	1			40	60	
5	ME1965	Computer in Production Management	3	0	0	3	3	15	15	10	60	3
6		**Professional Elective II**	**3**	**0**	**0**	**3**	**3**	**15**	**15**	**10**	**60**	**3**
	ME1967	PEII:Maintenance Engineering										
	ME1968	PEII:CNC and Robotics										
	ME1969	PE:II Welding Technology										
7	ME1966	Seminar	0	0	2	2	1			100		
			15	**0**	**4**	**19**	**17**					
III SEMESTER												
1	ME1971	Productivity Management	3	0	0	3	3	15	15	10	60	3
2		**Professional Elective III**	**3**	**0**	**0**	**3**	**3**	**15**	**15**	**10**	**60**	**3**
	ME1973	PEIII:Quantitative Techniques										
	ME1974	PEIII:Plastics and Composites										
	ME1975	PEIII:Project Evaluation & Management										
3	ME1972	Project Phase -I	0	0	16	16	8			100		1
			6	**0**	**16**	**22**	**14**					
IV SEMESTER												
1	ME1981	Project Phase -II	0	0	24	24	12				100	2
GRAND TOTAL OF CREDITS							**60**					

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I Semester

ME1951	ENGINEERING STATISTICS AND DESIGN OF EXPERIMENT	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course. **(a,b,c,d,h,j,k)**

Unit 1 **[7 Hrs]**

Frequency Distribution & Histograms, Probability & its Distribution, Measures of Central Tendency & Distribution, Presentation of Statistical Data. Importance and significance of statistic in engineering industry, historical developments in quality improvement, introduction to probability and statistics. (a,j)

Unit 2 **[8 Hrs]**

Confidence intervals, Hypothesis Testing, Correlation, Liner & Multiple Repression Analysis, Signification Testing. Hypothesis testing of means (t, z test), variance (F, chi-square test), curve fitting. **(b,k)**

Unit 3 **[7 Hrs]**

Full & fractional factorial experiments, analysis of variance, Randomized experiments with single factor, drawbacks of Randomized designs, Multifactor Experiments and interaction effects estimation, MINITAB Introduction and application. **(b,c)**

Unit 4 **[7 Hrs]**

Group Method of Data Handling, Shainin Variable search technique (SVST), Latin square design, Response surface methodology (RSM), Mixture design, Regression Equation in Matrix form, Statistical optimization using criterion like 'D' optimal design. **(b,h)**

Unit 5 **[8 Hrs]**

Taguchi techniques. Taguchi's philosophy, gradient loss function and its assessments for NB, HB, LB conditions, S/N ratio, Orthogonal arrays (OA), OA selection, DOE with Taguchi and Comparison with conventional DOE, case studies. **(b,k)**

Unit 6 **[8 Hrs]**

Concept of six sigma, DMAIC and DFSS, DOE and six sigma, DMAIC, case studies of six sigma implementation. **(d,k)**

Suggested Readings:-

1. Experimental Design by Cochran & Cox
2. Taguchi Techniques in Quality Engineering by Phillip J. Ross
3. Statistical Analysis for Engineers and Scientist by Barnes
4. Introduction to Probability and Statistics by Milton
5. Engineering Statistics by Bowker & Liberman
6. Montgomery D.C. " Design and analysis of experiments" John Wiley and sons, 7th edition 2009.
7. Mitra A, " Fundamentals of Quality control and Improvement", PHI, 2007
8. Miller and Fraud,"Probability and statistics for Engineers".

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ME1952	INDUSTRIAL ENGINEERING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To understand the concept of work study and work measurement. Also to study different material handling equipments and plant layout. **(a,b,c,e,h,k)**

UNIT 1 **[8 Hrs]**
Introduction to production system, Types of production system, graph theory tech in manufacturing, (or industrial engineering) **(a,c,e,h,k)**

UNIT 2 **[8 Hrs]**
Plant location analysis, considerations in factory building design, classical plant layouts, evolution and evaluation of factory layout**,** Work measurement. **(a,b,c,e,h,k)**

UNIT 3 **[6 Hrs]**
Work measurement techniques, assessment of rating and determination of allowances. Method study Tech. **(a,c,e,h,k)**

UNIT 4 **[7 Hrs]**
Woks sampling techniques and assessment of plant utilization. **(a,c,e,h,k)**

UNIT 5 **[8 Hrs]**
Basic principles of Human factor engineering and its applications to workstation design, control panel design. Effect of environmental factors, shift planning. **(a,b,c,e,h,k)**

UNIT 6 **[9 Hrs]**
Study of various material handing equipments, considerations in design and selection of material handling systems, guiding principles for reduction in material handling cost. **(a,b,c,e,h,k)**

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Suggested Readings:-
1. Work Study by I. L. O.
2. Time & Motion Study by Barnes
3. Time & Motion Study by Mundal
4. work Sampling by Barnes
5. Methods bww Engineering by Krick
6. Plant Layout and Material Handling by James Apple
7. Plant Layout by J. M. Moore
8. Ergonomics by Murral
9. Human Factor Engineering by McCormick
10. Work Study by Shan
11. Industrial Safety by Black
12. Accident Prevention by Henrich

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ME1953	MANUFACTURING ENGINEERING –I	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To enable students gain basic understanding metals cutting and manufacturing processes used in industry today and its techno-economic analysis. **(a,b,c,d,e,h,j,k)**

Syllabus

UNIT 1 **[7 Hrs]**

Theoretical basis of metal forming**,** classification, cold forming, hot working, effect of variables on metal forming processes, methods of analysis of forming processes. **(a,c,e,h)**

UNIT 2 **[8 Hrs]**

Techno economic analysis of forging, Open Die forging, Closed Die forging, Rolling, Rolling load, Rolling Torque and Power, Drawing, Wire Drawing, Tube drawing, Extrusion, Analysis of extrusion, Variation of extrusion pressure. **(a,b,c,e,h)**

UNIT 3 **[8 Hrs]**

Pattern design, sprue design, riser design based on A / V ratio, volumetric shrinkage, FEA of metal casting, latent heat incorporation, time stepping procedure. **(a,b,c,e,h,k)**

UNIT 4 **[6 Hrs]**

Shell moulding, precision investment casting, CO2 casting, Die casting, Continuous casting, counter gravity low pressure casting, layout of mechanized foundry, CAD of foundry. **(a,b,c,e,h,k)**

UNIT 5 **[7 Hrs]**

Advanced welding Techniques:- Ultrasonic, electron beam welding, laser beam welding, plasma welding, electro slag welding ,Robot in welding, nuclear welding, under water welding. **(a,c,e,h,j,k)**

UNIT 6 **[7 Hrs]**

Advanced Powder metallurgy. Fundamental Properties of Metal powders, Fabrication methods, advantages applications, forging, rolling, cutting tools. **(a,c,d,e,h)**

Suggested Readings: -

1. Processes & Materials of Manufacture by Roy A. Lindberg
2. Manufacturing Science & Technology Vol- I by S. Dalela
3. Materials & Processes in Manufacturing by Degarmo, black & Koster
4. Manufacturing processes for engineering materials by S. Kalpakiran and Schmit
5. ASM handbook Vol 15 Casting.
6. Manufacturing And science Ghosh and Mallik,

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ME1954	LAB:MANUFACTURING ENGINEERING –I	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Practicals:

1. To study methods of analysis of forming process.
2. Demonstrations of principles of forging/Rolling operations. (Case study)
3. Introduction to patterns and preparation of patterns for casting process.
4. Demonstration of Preparation of mould for casting.
5. Testing of casting sand.
6. To study the Hydraulic Molding Process.
7. To study the characteristics of Pouring of metal to produce casting.
8. To study testing of casting for defects and Mechanical properties.

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ME1955	COMPUTER INTEGRATED MANUFACTURING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES:
To develop in the engineering students the ability to analyze any engineering problem related to CIM, introduction of Group Technology, Material handling systems and integrated process planning system and its components. **(a,b,c,d,h,k,l)**

UNIT 1 Concept and scope of CIM, components of CIM, benefits, limitations, selection criteria for CIM. Introduction to CAD-CAM hardware and softwares. **(a,c,d,h,l)** [7hrs]

Unit 2 Introduction CNC and Robotics: NC, CNC and DNC, machining centers, adaptive control. Robots and their application. Robot cell layouts, multiple robots and considerations in work cell design. **(a,b,d,h,k,l)** [7 hrs/]

Unit 3 Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT .cellular manufacturing system.Part families , classification and coding , Production flow analysis , Machine cell design , Benefits. **(a,b,d,k,l)** [8 hrs]

Unit 4 Introduction & Components of FMS , Application work stations ,Computer control and functions , Planning, scheduling and control of FMS , Scheduling , Knowledge based scheduling , Hierarchy of computer control , Supervisory computer Manufacturing data systems , data flow , CAD/CAM considerations , Planning FMS database, case studies on practical applications. **(a,b,d,h,k,l)** [8 hrs]

Unit 5 Automated material handling systems, AS/RS, general considerations , selection, evaluation and control . Inspection and Quality control, CAQC ,CMM types, working, applications. **(a,b,d,h,l)** [8 hrs]

Unit 6 Process Planning in the Manufacturing cycle , Process Planning and Production Planning Process Planning and Concurrent Engineering, CAPP, Variant process planning , Generative approach , Forward and Backward planning, Input format,Logical Design of a Process Planning , Implementation considerations ,manufacturing system components,**(a,c,d,h,l)** [7 hrs/]

Books for Reference:

1. Nanua Singh,"Systems Approach to Computer Integrated Design and Manufacturing", John Wiley & Sons, 1996.
2. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
3. Jha, N.K., "Handbook of Flexible Manufacturing Systems", Academic Press Inc., 1991.
4. Burbidge, J.L. "Group Technology in Engineering Industry", Mechanical Engineering pub. London, 1979.
5. Askin, R.G. and Vakharia, A.J., "G.T Planning and Operation, in The automated factory-HandBook: Technology and Management", Cleland, D.I. and Bidananda, B (Eds), TAB Books, NY, 1991.
6. Irani, S.A. "Cellular Manufacturing Systems", Hand Book.
7. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), " Planning, design and analysis of cellular manufacturing systems" , Elsevier, 1995.
8. Gideon Halevi and Roland D. Weill, "Principles of Process Planning", a logical approach, Chapman & Hall, 1995.
9. Parashar BSN," Cellular Manufacturing" (PHI). R.V.Rao, "Decision making in manufacturing".

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ME1956	LAB : COMPUTER INTEGRATED MANUFACTURING	L=0	T=0	P=2	Credits= 1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	

OBJECTIVES

Practicals: Based on above syllabus.

1. Concepts of Manufacturing systems and computer applications
2. CAD–CAM integration
3. GT
4. FMS
5. Robots and their application
6. AS/ RS
7. CAPP
8. CAQC
9. NC, CNC, DNC
10. Automated material handling,
11. Shop floor control

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ME1957	QUALITY CONTROL & METROLOGY	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To emphasis the need of metrology and its role in quality control. To enable the students to take up metrology work in Industries using latest metrological equipments to impart knowledge to TQM and ISO-9000 and various associated techniques. **(a,b,e,h,l,m)**

Unit 1 **[8 Hrs]**

Concept of Quality, aspects of Quality, PDCA Cycle, Quality Control Methods of QC, QC tools, and tech, SPC Six Sigma, poka yoke, Measurement and inspection, significance and importance.
(a,e,h)

Unit 2 **[7 Hrs]**

OC curve, Quality Control charts and their applications, process capabilities and indices Quality cost, online and offline QC, Robust design Application software for QC . **(a,e,l)**

Unit 3 **[8 Hrs]**

TQM, ISO 9000, 14000, and implementation and related issues. **(a,e,h)**

Unit 4 **[7 Hrs]**

Principles of metrology, sources of errors, standards of measurement, geometrical testing (alignment test of machine tool), surface roughness measurement, interferrometry , calibration, measurement of linear, angular and other geometric features like straightness, flatness parallelism & circularity. **(a,b)**

Unit 5 **[7 Hrs]**

Limit fit and tolerances:- design of plane and screw limit gauges. **(a,b,l)**

Unit 6 **[10 Hrs]**

Machine vision, CMM, configuration, measuring techniques for internal and external dimensions, CMM applications, Reverse Engineering and dynamic measurement, Applications of LASER in metrology. **(a,m).**

Suggested Readings:-

1. Handbook of metrology-ASTME
2. Text book of engineering metrology by I. B. Gupta
3. Metrology by A. J. Scarr
4. Metrology by Gayler & Shotbolt
5. Assurance sciences by S. Halpern
6. managing for total quality by N. Logothetis

Reference Book:-

CMM manual - www.mitutoyo.com

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ME1958	RELIABILITY ENGINEERING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit 1: **[8 Hrs]**

Introduction to reliability- Reliability definition, Failure rate, hazard rate, Reliability function and their variation with respect to time, MTTF and its calculations for discrete data. Reliability analysis and its relation with other parameters like strength etc.

Unit 2: **[8 Hrs]**

Reliability analysis for continuous data. Probability density function, failure rate and derivation of Reliability for various types of failures like constant failure rate, logarithmic failure rate in increasing/ decreasing failure rate etc. and there physical significance

Unit 3: **[7 Hrs]**

System Reliability series parallel and mixed configuration, system Reliability for complex systems using various tech. like successful path method, composite method etc. Redundancy, various types, parallel operations.

Unit4: **[8 Hrs]**

Reliability allocation and improvement, life cycle estimation, fault tree analysis, FMEA, FMECA etc,

Unit 5: **[7 Hrs]**

Reliability testing, accelerated life testing, sequential testing.

Unit 6: **[7 Hrs]**

Reliability availability, maintainability, maintainability improvement, Reliability economics.

Suggested Books:-

1. Introduction to Reliability Engineering by E.E.lewis and John wiley and sons
2. Reliability Engineering by L.S. Srinath
3. Reliability and engineering systems by L. Ryabinir
4. Practical Reliability Engineering by Patric Dtoconnor

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ME1959	DESIGN FOR MANUFACTURING AND ASSEMBLY	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT NO	DETAILS	Hours
Unit 1	Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods.	**[7 Hrs]**
UNIT 2	Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart	**[7 Hrs]**
UNIT 3	Evaluating part configurations for manufacturability, Evaluating parametric designs for manufacturability, Process selection – Impotence types of manufacturing processes and their classification, sources of information, selection criteria, introduction to material and process selection software	**[8 Hrs]**
UNIT 4	Benchmarking – DFM, DFX, Early supplier involvement, robust design, QFD and concurrent engineering. DFM analysis for various manufacturing processes,	**[8 Hrs]**
UNIT 5	Product design for manual assembly, product design for high-speed automatic assembly and product design for robot assembly.	**[8 Hrs]**
UNIT 6	Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereolithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations	**[7 Hrs]**

Book for reference:

1. Dieter George E. “Engineering Design”, McGraw Hill Pub. Company, 2000
2. Ulirich Karl T. and Eppinger Steven D., “Product Design and Development” McGraw Hill Pub. Company, 1995.
3. Bralla, James G., “Handbook of Product Design for Manufacturing” McGraw Hill Pub. Company, 1986
4. A. K. Chitale and R. C. Gupta, Product Design and Manufacturing, PHI Pvt. Ltd., 2002.
5. HARRY NYSTROM, " Creativity and innovation", John Wiley & Sons, 1979.
6. BRAIN TWISS, " Managing technological innovation", Pitman Publishing Ltd., 1992.
7. HARRY B.WATTON, " New Product Planning ", Prentice Hall Inc. 1992.
8. P.N.KHANDWALLA - " Fourth Eye (Excellence through Creativity) – Wheeler Publishing ",Allahabad, 1992.
9. I.P.R. Bulletins, TIFAC, New Delhi,

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2nd Semester

ME1961	TOOL ENGINEERING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To learn the mechanism of metal cutting and the design of metal cutting tools. Also to understand various presses working operations along with tools to dies design. **(a,b,c,d,e,f,g,h,i,j,k)**

Unit 1 **[8 Hrs]**

Theory of metal Cutting. Cutting tool materials, dynamics of metal cutting, Single point cutting tool, Merchant's Theory, Cutting power, Energy consideration in metal cutting, Tool life and dynamometry, Tool life criteria, variable affecting tool life, Machinability. **(b,c,e,g,i,j,k)**

Unit 2 **[8 Hrs]**

Design of single Point Cutting Tool .Form tools- design of form tools. Design of milling cutters. Design of Gauges, Materials, heat treatments, Taylor's Principals of gauge design, design of limit gauges.Design of broaching and reamers. **(b,c,e,g,i,j,k)**

Unit 3 **[10 Hrs]**

Press tool Design
Introduction, Press operations - Press working equipment - Classification, Rating of a press, Press tool Equipment, working of dies and their components. **(b,c,e,f,g,h)**

Unit 4 **[10 Hrs]**

Bending Forming & Drawing dies Bending methods, Design Principles, Design consideration.
(a,b,c,e)

Unit 5 **[7 Hrs]**

Forging Die Design .Die design for machine forging Tools for flash trimming & hole piercing, materials & manufacture of forging dies. Mould Design. **(a,b,c,e,h,i,j,k)**

Unit 6 **[10 Hrs]**

Design of jigs & fixture: - Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures. Drilling Jigs: - Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures, Automatic clamping Devices. **(d,e,f,g,h,i,j,k)**

Books for reference:

1. Donaldson, "Tool design"
2. ASTME, "Fundamentals of Tool design"
3. Pollock, "Fundamentals of Tool design"
4. Grant, "Unconventional Clamping Systems"
5. Kempster, "Fundamentals of Tool design"
6. Ramnathan "Design of Jig, Fixture & cutting dies"

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ME1962	PRODUCTION MANAGEMENT	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To study and learn the pre production activities and post production activities, forecasting, also to study and understand the material management functions. **(a,b,c,d,i,j)**

Unit 1 [8 Hrs]
Forecasting, type of forecasts, demand pattern, qualitative and quantitative forecasting models and applications. **(a,i)**

Unit 2 [9 Hrs]
Materials management functions – standardization, simplification and diversification, purchasing functions, inventory control – static and dynamic models, selective control, inventory control under constrains, stores functions & records, spares parts and in-process inventory, Fundamentals of supply chain management, Relevant case studies. **(b,d)**

Unit 3 [6 Hrs]
Generalized model of production system, design, optimization & control of production system, Layouts. **(c,j)**

Unit 4 [7 Hrs]
High volume production systems – analysis of automated flow lines, assembly systems and line balancing **. (c)**

Unit 5 [6 Hrs]
Aggregate production and capacity planning, master planning scheduling and rough- cut capacity planning. Process Planning and MPS. **(b,c)**

Unit 6 [8 Hrs]
Production control functions, loading charts, sequencing and scheduling models, expending functions and short-term capacity control. **(b,c)**

Suggested Readings:-

1. Production & Operation Management by Adam & Ebert
2. Production & Operation Management by Buffa
3. Automation, Production System and CIM by M. P. Groover
4. Handbook of Material Management by Gopalkrishanan
5. Material Management – procedures, Test and cases by A. K. Datta
6. Production and operation management by Russel & Taylor III
7. Introduction and operation management by John Willey, Joseph S. Martinich

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ME1963	MANUFACTURING ENGINEERING -II	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To enable students gain basic understanding metals cutting and manufacturing processes used in industry today and its techno-economic analysis **(a,b,c,e,k,l,m)**

Syllabus

Unit 1 **[8 Hrs]**

Analysis and mechanics of metal cutting by single point cutting tool, milling , drilling and broaching, tool geometry, economics of machining process, tool life, tool wear. **(a,b,c,k,l)**

Unit 2 **[7 Hrs]**

Material removal by grinding, introduction, abrasive, mechanics of grinding, selection of grinding wheel, effect of temperature, types of grinding operation, grinding wheel wear, grinding wheel glazing, operating conditions, effective wheel hardness, trueing and dressing. **(a,b,k)**

Unit 3 **[8 Hrs]**

Control of material properties, heat treatment process, recovery, recrystalization and grain growth, defect in steel due to heat treatment, heat treatment of steel casting, shaft, axle, wires etc., types of heat treatment furnace **(a,b,k,l)**

Unit 4 **[7 Hrs]**

Plastic and composite processing, properties of plastic, additives in plastics, extrusion of plastics, injection molding, glow molding, thermo forming, thermo setting materials, composite processing, plastic product design. **(a,b,k)**

Unit 5 **[7 Hrs]**

Super finishing operations, super finishing operations, honing, lapping, electro forming, metal spraying , electron beam coating, chemical vapor deposition , laser treatment for surface modification. **(a,b,l)**

Unit 6 **[6 Hrs]**

Non conventional machining, effect of various process parameters on metal removal rate in AJM, ultrasonic machining, ECM, EDM, LVM, EBM, PAM, explosive fabrication, economics of machining**. (a,l)**

Suggested Readings:-

1. Production Technology by HMT
2. Metal Cutting - Theory & Application by A. Bhattacharya
3. Manufacturing Science by Ghosh, Mallick
4. Modern Machining Processes by Pandey & Shan
5. Modern Machining methods by M. Adithan

Reference Books:-

- ASM Handbook Vol. 6 Welding Brazing & Soldering 2003.
- Manufacturing process for engg. Material by kalpak jain & Schmid S.R,2004
- ASM Handbook, Forming &Forging, Ninth Edition Vol 14,2003

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ME1964	LAB: MANUFACTURING ENGINEERING –II	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Practicals:

1. Testing of machine tool.
2. Experiment to study the effect of process variable on any one NCMP like EDM, LASER, ECM etc.
3. Heat Treatment of HSS
4. Study of joining methods for plastics
5. Injection molding of plastics & study of Process characteristics.
6. Curing studies of resign to study effect of additives & variables.
7. Preparation of sheet moulding components using SMC
8. Preparation of compression moulding components using SMC.
9. Testing of Composites products For Mechanised Properties.

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ME1965	COMPUTERS IN PRODUCTION MANAGEMENT	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

This engineering course focuses on understanding the structure of database, design of database, different types of database and query languages and constraints and pitfalls in database design.
(a,d,e,h,k)

Unit 1 **[7 Hrs]**
DBMS: Drawbacks of general files processing system, basic concept of database system, architecture of database system, data structures & corresponding operators, distributed & relational databases. **(a,d,e,h,k)**

Unit 2 **[8 Hrs]**
Relational DBMS, data structures, architecture of system – R, data structure, data definition language (SQL-DDL), SQL – DML, internal and external level of system, QBE. **(a,d,e,h,k)**

Unit 3 **[7 Hrs]**
Normalization, SQL forms, triggers, SQL loader. Hierarchical approach to DBMS, mapping techniques, IMS structure. **(a,d,e,h,k)**

Unit 4 **[8 Hrs]**
Network approach to DBMS (DBTG), External level of DBTG, subschema, schema definitions, data manipulation constructs. **(a,d,e,h,k)**

Unit 5 **[7 Hrs]**
Overview of MIS, Concept of DSS, expert system, artificial Intelligence. **(a,d,e,h,k)**

Unit 6 **[8 Hrs]**
Selection of computer system architecture networking time sharing and cost analysis, Exposure to latest packages. Case Studies on Design of MRP, Design of Inventory control system, Payroll system, Maintenance Management System, Sales Management system, HRD system.
(a,d,e,h,k)

References:

- Abraham Silberschatz, Henry F. Korth, S.Sudarshan, “Database System Concepts”, McGraw Hill International Editions, Third Edition
- P. Beynon-Davies, “Expert Database Systems – A Gentle Introduction”, McGraw Hill International; 1991
- James Martin ,“Database Management Systems Oracle unleased series.
- Principles of Database Management by Martin. James Obrien,” Management Information System.”
- Rolston D.W.,”Artificial Intelligence and Expert System”.
- Goyal D.P ,” Management Information System.”

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ME1966	SEMINAR	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	100		100	

Each student of the concern project shall present and seminars using audio visuals, aids of on their project methodology. Seminar delivery will be followed by question – answer session. The student shall also require to submit minimum 3 page report about the progress. The minimum 3 member seminar committee shall be constituted for the purpose of evaluating seminar.

ME1967	MAINTENANCE ENGINEERING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The overall objective is to gain the knowledge about recent trends in maintenance and measure the efficiency/ effectiveness of production systems. After completing the course students should obtain the knowledge of theoretical fundamentals and practical methods for decisions making according tribological problems in design and maintenance of machines and develop the ability to apply them to practical situations:

• understand the principles and know the methodology of performing the condition monitoring;
• have good knowledge about the technologies and methods to increase the reliability of machinery elements
• know the basic principles of maintenance and trends important for reliable operation of machinery.

Unit 1 **[8Hrs]**

Maintenance – Objective and functions, Types of Maintenance and their industrial applications, Organization for maintenance R,A,M, Bath tub curve and its relevance to maintenance .

Unit 2 **[7 Hrs]**

Maintenance cost estimation – various tech. Evaluation of maintenance performance.

Unit 3 **[8 Hrs]**

Failure analysis, its importance to maintenance, various tech, Engineering analysis of failure and report writing.

Unit 4 **[8 Hrs]**

Lubrication, its importance, lubrication properties, management of effective lubrication system, lubricant testing- various tech.

Unit 5 **[7 Hrs]**

Condition monitoring- online offline, Use of various NDT tech, for monitoring of thickness, cracks, corrosion etc.

Unit 6 **[7Hrs]**

Machine diagnostics, machine condition monitoring and significance analysis, vibration and noise monitoring, fault identification.

Referance Books:

1. Reliability Engineering by L. S. Shrinath
2. Reliability of Engineering System by L. Ryabinin
3. Practical Reliability Engineering by Patric D.T. O' Connor
4. The Assurance Science by Helpern:-
5. Maintenance Engineering Hand Book by Hinggins
6. Maintenance Planning & Control by Anthony Kelly
7. Industrial Maintenance by H. P. Gerg
8. Industrial Maintenance Management by Newborangh
9. Maintenance and spare parts management by Gopalkrishnan and Banarjee
10. Management of Indutrial Maintenance by A. Kelly & M.J.Harris

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ME1968	CNC AND ROBOTICS	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective: To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines robots and their components, functions, functions, programming and applications and integration of machines with the computers.

CNC and Robotics:

Unit 1:

Concepts of NC, CNC, DNC. Classification of CNC machines, Machine configurations, Types of control,CNC controllers characteristics, Interpolators.
Cutting tool materials, carbide inserts classification, qualified; semi qualified and preset tooling, tooling.system for Machining centre and Turning centre, work holding devices, of CNC Machines.

Unit 2:

Programming CNC machines, Part print analysis and Process planning, Advanced Programming features,Canned cycles, Subroutines, Macros, special cycles etc. APT part programming using CAD/CAM, Computer assisted part programming techniques, Conversational and Graphics based software.

Unit 3:

Adaptive CNC control techniques. Integration of CNC machines for CIM.

Unit 4:

Robotics, Basic concepts, Robot configurations, Basic robot motions, Types of drives, Applications. Homogeneous transformations and Manipulator, Forward solution, Inverse solution.

Unit 5:

Controls and end effectors, Control system concepts , Analysis , control of joints , Adaptive and optimal control. End effectors, Classification, Mechanical , Magnetic ,Vacuum , Adhesive , Drive systems , Force analysis and Gripper design**.**

Unit 6:

Robot programming, Methods, Languages ,Computer control and Robot Software – Programming Languages. Sensory devices, Non optical and optical position sensors , Velocity and Acceleration , Range , Proximity, touch , Slip , Force ,Torque.
Integration of Robots for CIM.

Books for Reference:

1. Krar, S., and Gill, A., “CNC Technology and Programming”, McGraw Hill publ Co, 1990.
2. Gibbs, D., “An Introduction to CNC Machining”, Casell, 1987.
3. Seames, W.S., “Computer Numerical Control Concepts and Programming”, Delmar Publishers,1986.
4. Lynch, M., “Computer Numerical Control for Machining”, McGraw Hill, 1992.
5. Koren Y, “Computer Control of Manufacturing Systems”, McGraw, 1986.
6. Fu K.S., Gonzalez R.C., and Lee C.S.G.,” Robotics control, sensing, vision, and intelligence”, McGraw-Hill Book Co., 1987.
7. Klafter R.D., Chmielewski T.A. and Negin M.,” Robot Engineering An Intergrated approach”, Prentice Hall of India, New Delhi, 1994.
8. Deb S.R., ”Robotics Technology and Flexible Automation”, Tata McGraw-Hill Publishing Co.,Ltd., 1994.
9. Craig J.J., ”Introduction to Robotics Mechanics and Control”, Addison-Wesley, 1999

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ME 1969	WELDING TECHNOLOGY	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To Study and analyse various welding methods with advanced techniques to pin engineering materials.

UNIT-I: . **[7 hrs]**
Classification of welding processes, present status, joint design, welding symbols, welding parameters, welding polarity, heat input and power density of heat sources **[a,m]**

UNIT-II: . **[7 hrs]**
Study of welding processes such as oxyacetylene, resistance, spot, seam, electron beam, laser beam welding: Scope, Keyholing techniques**. [c,e,m]**

UNIT-III: . **[8 hrs]**
Study of different parameters affecting quality Electrode classification, Properties of shielded gases used in welding, study of special welding processes such as Plasma arc, TIG, MIG, submerged arc welding**. [a,m]**

UNIT-IV: . **[7 hrs]**
Mode of metal transfer, Welding problems and remedies in steels, cast irons, stainless steels and non-ferrous metals and alloys, requirements for quality control. **[a,m]**

UNIT V: **[8 hrs]**
Importance of welding metallurgy, weld ability, heat flow in welding, HAZ and distortion, numerical based on heat transfer and width of heat affected zone. **[a,e,m]**

UNIT VI: **[8 hrs]**
Classification and analysis of welding defects, Weldment testing Destructive and Non-Destructive, visual inspection, Dye penetrant test, Eddy current testing and ultrasonic testing. **[a,c,m]**

Text books/Reference Books:

1	Welding and welding Technology	1st Edition (1997)	R.S.Parmar	Khanna Publications
2	Welding	10th Edition	A.C. Davies, Davies	Cambridge University press, 2002
3	Laser Machining and Welding	Edition (2007)	Rykalin, Uglov, Kokora	Pergamon Press, 1978
4	Welding and welding Technology	1st Edition (2008)	Richard Little	McGraw Hill
5	Weding Metallurgy	2nd Edition (2003)	Sindo Kou	John Wiley & Sons, 2003
6	Manufacturing Science	-	Ghosh and Mallik	Ellis Horwood
7	Manufacturing Technology Vol-1 3E	3rd Edition (2009)	P.N.Rao	Tata McGraw Hill

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3rd Semester

ME1971	PRODUCTIVITY MANAGEMENT	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective: To develop engineering student to use different techniques of quality improvement and productivity improvement. New techniques for product quality, elimination of poor production and to eliminate the waste to continuous improvement of activities.. **(a,b,c,d,e,h,i,j,k)**

Unit 1: Introduction **[7 Hrs]**

Basic concepts of productivity, definitions, productivity cycle, phases of productivity management productivity and organizational performance, issues of productivity management in manufacturing and service organizations, organizations for productivity management. **(a,c,h,k)**

Unit 2: Product Development **[7 Hrs]**

Customer focus and orientation. New product development, QFD, product life cycles. Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods. **(a,c,h,k)**

Unit 3: Costing **[7 Hrs]**

Pricing decisions under different markets conditions, market structures, managing products and services, determination of cost production, economies and dis-ecomnies of scale, returns to scale. Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates. Industrial Engineering Approach, Parametric Approach, **(a,b,c,d,e,h,k)**

Unit 4: Productivity Measurement **[8 Hrs]**

Total factor and partial factor productivities, measurement of productivity, Productivity Models: Productivity Measurement at International, National and organization level, total productivity models. Productivity Management in manufacturing and service sector. Productivity evaluation models. **(a,b,c,d,h,k)**

Unit 5: Productivity Improvement **[8 Hrs]**

Productivity improvement model and techniques, Quantitative techniques for improving productivity. Productivity improvement through quality and people, TQM concepts, strategies and techniques. **(a,c,h,k)**

Unit 6: Modern Productivity Improvement Techniques **[8 Hrs]**

Modern approach for productivity improvement – TPM, JIT, Kanban, SPF, SMED, Autonomation, poka-yoke. Kaizen and innovation, QC, 5S, BPR, Quality system and ISO 9000. **(a,b,c,d,h,i,j,k)**

Text Books :-

1. A. V. Feigenbann , “Total quality control “
2. D. J. Simanth ,”Productivity Engineering & Management “
3. S. R. Udpa ,”Quality circles “
4. Philip Kotlar,”Marking Management “
5. M. Imai ,”Kaizen “
6. Hammer & Champy ,”Re-engineering the corporation “

Reference Books :-

1. Productivity engineering and management Sumanth, D.J. – Tata McGraw-Hill,New Delhi 1990.
2. Organisational transformation and process re-engineering – Edsomwan, J.A., -British Library Cataloging in Pub. data 1996.
3. Productivity Plus: How Today’s Best Run Companies Are Gaining the Competitive Edge – John G., Jr. Belcher – Butterworth-Heinemann
4. Business Process Improvement: The Breakthrough Strategy for Total Quality,Productivity and Competitiveness – H. James Harrington – McGraw-Hill
5. Handbook for Productivity Measurement and Improvement – Carl G. Thor Productivity Press
6. Re-engineering and re-inventing the enterprise – Rastogi, P.N., – Wheeler publications, New Delhi 1995.
7. Productivity Management – Systems approach – Premvrat, Sardana, G.D. and Sahay, B.S. – Narosa Publications, New Delhi, 1998.
8. The new Manufacturing Architecture – Mahadevan

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ME1972	PROJECT PHASE I	L=0	T=0	P=16	Credits=8

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			100		100	

OBJECTIVES

As the project methodology for the batches is decided in the 2nd semester the student shall carry out the project work further 3rd semester. The project work consists of ;

1. A comprehend since and update survey of literature.
2. Study of processes /phenomenon related to project.
3. Design of any equipment its fabrication and testing.
4. Critical analysis of design or process for optimization
5. Verification by experimentation.
6. In case of industrial project the necessary modifications with the proper drawing / design suggested to the industry should be explained. The letter from the industry should be attached in the report related to the performance of the student.

ME1973	QUANTITATIVE TECHNIQUES	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective: To understand concept of different quantitative techniques that include linear programming, dynamic programming and non-linear programming and the students should be able to use different decision making theories**.**

Unit 1: Linear Programming **[7 Hrs]**

Liner programming: formulation of or problems, solution of LPP by revised simplex methods. Duality theory and dual simplex method. Sensitivity analysis.

Unit 2: Advanced Linear Programming **[7 Hrs]**

Pure & mixed integer programming, Zero-one programming. Introduction to multi objective programming. Goal programming and application

Unit 3: Dynamic Programming **[7 Hrs]**

Dynamic programming : Decision tree. Bellman's principle of optimality. Application in industry.

Unit 4: Queuing System **[7 Hrs]**

Waiting line models: M/M/1 Model, single channel multiphase models with various distribution. Monte Carlo simulation and its application.

Unit 5: Game Theory **[7 Hrs]**

Decision making, decision theory, game theory

Unit 6: Non Linear Programming **[7 Hrs]**

Non-liner programming : Fibonacci and golden section search: Powells pattern search algorithm, the Kuhn tucker conditions, complimentary Pivot algorithm, optimizations by geometric programming.

Text Books :-

1. Gupta ,Swaroop," Operation Research"
2. Hira , Gupta," Operation Research Techniques"

Reference Books:

1. Ravindran, Phillips Solberg , "OR Principles & Practice "
2. Hiller Libermen, "OR (Operation Research)"
3. Taha ,"OR (Operation Research) "
4. S.S. Rao , " Optimization Techniques"

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ME1974	PLASTICS AND COMPOSITES	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to learn the basic structure of plastic, its properties and the manufacturing of objects from plastics & composites. The students will also learn the concept of machining and joining of plastics. **(a,b,d,e,j,k,l,m)**

UNIT1 **[7 hrs]**

Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages. Various plastic materials and their Applications . **(a,k,l,m)**

UNIT 2 **[7 hrs]**

Study of molding processes and mold design for :
Extrusion - Blow Molding – Casting – Thermo Forming – Rotomolding . **(a,b,j,k,l,m)**

UNIT 3 **[8 hrs]**

Study of molding processes and mold design for :
Compression and Transfer Molding - Injection Molding. **(a,b,k,l)**

UNIT 4 **[8 hrs]**

General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics - Mechanical Fasteners - Thermal bonding - Press Fitting. **(a,b,k,l)**

UNIT 5 **[8 hrs]**

Fibers - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics.
Open Mould Processes, Bag Molding, Compression Molding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Molding - Application of PMC's.
(a,b,d,e,k,l)

UNIT 6 **[7 hrs]**

Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques - Plasma Spray,Chemical and Physical Vapor Deposition of Matrix on Fibers - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting - Compocasting - Application of MMCS. **(a,b,d,e,k,l)**

.**Books for Reference**:

1. Harold Belofsky, Plastics , “Product Design and Process Engineering”, Hanser Publishers, 1995.
2. Bera, E and Moet, A, “High Performance Polymers”, Hanser Publishers, 1991.
3. Hensen, F, “Plastics Extrusion technology”, Hanser Publishers, 1988.
4. Johannaber F, “Injection Moulding Machines”, Hanser Publishers, 1983.
5. Rauwendaal, C, “Polymer extrusion”, Hanser Publishers, 1990.
6. Rosatao, D.V., “Blow Moulding Handbook”, Hanser Publisher, 1989.
7. Seamour,E.B., “Modern Plastics Moulding”, John Wiley.
8. John Dalmonte, “Plastics Moulding”, John Wiley.
9. Akira Kobyashi, “Machining of Plastics”, Mc-Graw Hill.
10. Krishan K.Chawla, “Composite Materials science and Engineering”, Springer-Verlag, 1987.
11. Agarwal. D. and Broutman L.J., “Analysis and Performance of Fiber Composites” , Wiley, 1990.
12. Mallick, P.K. and Newman, S.,“Composite Materials Technology”, Hanser Publishers, 1990.

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ME1975	PROJECT EVALUATION & MANAGEMENT	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT NO	DETAILS	Hours/Marks
Unit 1	**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty.	**[7 H/M]**
UNIT 2	**Technical feasibility** : Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation:	**[7 hrs/M]**
UNIT 3	**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Break even point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.	**[9hrs/M]**
UNIT 4	Mathematics of Time Value of Money, Cost Comparison, Depreciation, Taxes, Inflation, Profitability of Investment and Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates. Industrial Engineering Approach, Parametric Approach	**[7 hrs/M]**
UNIT 5	**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital	**[7 hrs/M]**
UNIT 6	**Project review :** Initial review, performance analysis , ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects.	**[8hrs/M]**

Recommended books :

- Projects, Prasanna chandra, Tata mc graw Hill publishing company Ltd.
- CPM & PERT, Shrinath, East West publisher
- Projects, P.K. Joy, Macmillon
- Engineering Economy H. G Thuesen, W J Fabricky, G,J, Thuersen, Printce Hall of India Pvt. Ltd.
- ICFAI, Finance series 'Project management' , Vol-I1 and Vol-III, ICFAI,Press Hyderabad
- M.Y.Khan 'Finance Management' Tata McGraw hill, 4th Edition, 2004
- Prasanna Chandra 'Finance Management'
- Thusen 'Engineering Economics' ELBS Ed.

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4th Semester

ME1981	PROJECT PHASE II	L=0	T=0	P=24	Credits=12

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			40	60	100	

Objectives:

As per the Project Phase 1, the students should carry out and submit the project work that include the implementation of all Semesters subjects knowledge with required validation and certification.

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

M. Tech. SoE and Syllabus 2014-15

CAD / CAM

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE - I	MSE - II	TA	ESE	
I SEMESTER												
1	ME1901	Stress Analysis	3	0	0	3	3	15	15	10	60	3
2	ME1902	Computer Integrated Manufacturing	3	0	0	3	3	15	15	10	60	3
3	**Professional Elective- I**		3	0	0	3	3	15	15	10	60	3
	ME1907	Project Engineering										
	ME1908	Tool Design										
	ME1909	Object Oriented Programmings										
	ME1910	Reliability Engineering										
4	ME1903	Computer Graphics and Solid Modeling	3	0	0	3	3	15	15	10	60	3
5	ME1904	Lab: Computer Graphics and Solid Modeling	0	0	2	2	1			40	60	
6	ME1905	CNC Technologies	3	0	0	3	3	15	15	10	60	3
7	ME1906	Lab: CNC Technologies	0	0	2	2	1			40	60	
			15	**0**	**4**	**19**	**17**					

II SEMESTER												
1	ME1911	Robotics	3	0	0	3	3	15	15	10	60	3
2	ME1912	Modelling & Simulation	3	0	0	3	3	15	15	10	60	3
3	ME1913	Finite Element Method	3	0	0	3	3	15	15	10	60	3
4	ME1914	Lab: Finite Element Method	0	0	2	2	1			40	60	
5	ME1915	Artificial Intelligence	3	0	0	3	3	15	15	10	60	3
6	**Professional Elective-II**		3	0	0	3	3	15	15	10	60	3
	ME1917	Product Data Management										
	ME1918	Mechatronics										
	ME1919	Machine Tool Design										
	ME1920	Plant Design										
7	ME1916	Seminar	0	0	2	2	1			100		
			15	**0**	**4**	**19**	**17**					

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III SEMESTER												
1	ME1921	Product Design & Development	3	0	0	3	3	15	15	10	60	3
2	**Professional Elective - III**		3	0	0	3	3	15	15	10	60	3
	ME1923	Computational Fluid Dynamics										
	ME1924	Design Optimization Techniques										
	ME1925	Rapid Prototyping										
	ME1926	Design for Manufacturing and Assembly										
3	ME1922	Project Phase -I	0	0	16	16	8			100		
			6	**0**	**16**	**22**	**14**					

IV SEMESTER											
1	ME1931	Project Phase-II	0	0	24	24	12		40	60	
			0	**0**	**24**	**24**	**12**				
Grand Total of Credits							**60**				

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ME1901	STRESS ANALYSIS		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:

- To develop the student understands of the foundations of stress and strain.
- To develop students skills in analyzing two dimensional problems.
- To provide the student with knowledge stress & strain analysis

Unit-I

Two Dimensional Problems in. Cartesian Coordinate system -Fundamentals of stress & strain, stress-strain relationship, Elastic constant, plane stress, plane strain., differential equation of equilibrium Boundary conditions, Saint Venant's principle, compatibility equation, Airys stress function. Stress analysis of cantilever subjected to concentrated load at its end and simply supported beam subjected to uniformly distributed load.

[7hrs]

Unit-II

Two dimensional problem in polar coordinate systems -General equations of equilibrium in polar coordinate compatibility equation, stress distribution about symmetric. axis, stress analysis of cylinder subjected to internal & external pressure, Pure bending of curved beams, effect of hole on the stress distribution in plates, Stress analysis of rotating circular disk

[7hrs]

Unit-III

Two Dimensional Photoelasticity - Introduction to basic optics related to photo elasticity, stress optic law, plane & circular polariscope arrangements, effect of stressed model in plane & circular polariscope, Isoclinic & Isochromatics, stress trajectories, calibration of photo elastic material (determination of fringe constant). Various photoelastic materials and their properties, Casting of photoelastic models, Tardy's compensation technique, Separation techniques like, shear difference, oblique incidence & electrical analogy.

[8hrs]

Unit-IV

Introduction to 3-D photo elasticity -Phenomenon of Stress freezing, Method of stress freezing, slicing techniques, determination of material fringe constant at critical temperature. Scaling Model- Prototype relations. Birefringerent coating method - Reflection polariscope. Introduction to fringe sharpening & fringe multiplication.

[8hrs]

Unit V

Strain gage technique for stress & strain analysis -Introduction to electrical resistance strain gages, gage . factor, bridge circuit, bridge balance, output voltage of Wheatstone bridge, balancing of bridge, temperature compensation, various bridge configurations, bonding of strain gages to the specimen, determination of principle strains & stresses using strain rosettes. Environmental effects on performance of strain gages, Strain gages response to dynamic strains, Effect of lead wires. Introduction to Strain measurement on rotating components, Static & Dynamic Strain Measurement introduction to semiconductor gages, high temperature strain gages & self-temperature compensated gages. Introduction to Commercial strain indicators.

[8hrs]

Unit VI

Grid technique of strain analysis, Brittle coating method for stress & strain analysis, Moire fringe method for stress & strain analysis implementation, ACIS & DXF.

[7 hrs]

Suggested books:

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1) Theory of Elasticity -S.P. Timoshenko
2) Experimental Stress Analysis -Dally & Riley
3) Experimental Stress Analysis -T.K. Ray
4) Experimental Stress Analysis -L.S. Srinath
5) Cook and Young, “Advanced Mechanics of Materials”, Prentice Hall, 2nd edition (August 28, 1998).
6) Richard G Budynar, “Advanced strength and Applied stress analysis”, McGraw Hill.
7) Boresi/Schmidt/Sidebottom, “Advanced Mechanics of Materials”, Willey.
8) Timoshenko and Goodier, “Theory of elasticity”, McGraw Hill, 1970.
9) Timoshenko, “Advance Strength of Materials”, vol 1 & 2, CBS.
10) Den Hartog, “Advance Strength of Materials” McGrawHill, 1952.
11) Advanced strength of material – Timoshenko.
12) Photoelasticity vol I & II – M. M. Frocht.

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ME1902	COMPUTER INTEGRATED MANUFACTIRING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem related to CIM, introduction of Group Technology, Material handling systems and integrated process planning system and its components

UNIT 1 Concept and scope of CIM, components of CIM, benefits, limitations, selection criteria for CIM. **[7hrs]**

UNIT 2 Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT .cellular manufacturing system.
Part families , classification and coding , Production flow analysis , Machine cell design , Benefits. **[7 hrs]**

UNIT 3 Introduction & Components of FMS , Application work stations , Computer control and functions , selection criteria for FMS,Planning, scheduling and control of FMS , Scheduling , Knowledge based scheduling , Hierarchy of computer control , Supervisory computer Manufacturing data systems , data flow , CAD/CAM considerations , Planning FMS database, case studies on practical applications. **[8 hrs]**

UNIT 4 Automated material handling systems, AS/RS, general considerations , selection, evaluation and control . Inspection and Quality control, CAQC ,CMM types, working, applications. **[8 hrs]**

UNIT 5 Process Planning in the Manufacturing cycle , Process Planning and Production Planning Process Planning and Concurrent Engineering, CAPP, Variant process planning , Generative approach , Forward and Backward planning, Input format,
Logical Design of a Process Planning , Implementation considerations ,manufacturing system components, **[8 hrs]**

UNIT 6 Totally integrated process planning systems , An Overview , Modulus structure , Data Structure, operation , Report Generation, Expert process planning.
Agile manufacturing ,Introduction to ERP concept(SAP). **[7 hrs/]**

Books for Reference:

1. Nanua Singh,"Systems Approach to Computer Integrated Design and Manufacturing", John Wiley & Sons, 1996.
2. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
3. Jha, N.K., "Handbook of Flexible Manufacturing Systems", Academic Press Inc., 1991.
4. Burbidge, J.L. "Group Technology in Engineering Industry", Mechanical Engineering pub. London, 1979.
5. Askin, R.G. and Vakharia, A.J., "G.T Planning and Operation, in The automated factory-HandBook: Technology and Management", Cleland, D.I. and Bidananda, B (Eds), TAB Books, NY, 1991.
6. Irani, S.A. "Cellular Manufacturing Systems", Hand Book.
7. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), " Planning, design and analysis of cellular manufacturing systems" , Elsevier, 1995.
8. Gideon Halevi and Roland D. Weill, " Principles of Process Planning", A logical approach, Chapman & Hall, 1995.
9. Parashar BSN," Cellular Manufacturing" (PHI).
10. R.V.Rao, "Decision making in manufacturing".

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ME1907	PROJECT ENGINEERING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To understand the project identification, planning and execution techniques. To learn the designing and erection of steel structure. To plant layouts, cost estimations, material handling and design and selection of pumps, blocks, compressors, etc.

Unit 1 INTRODUCTION **[7 hrs]**
The nature of projects. Project Identification considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project.

Unit 2 PROJECT PLANNING **[7 hrs]**
Basic Scheduling, Critical Path. Scheduling under probabilistic durations, Time Cost tradeoffs, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion

Unit 3 DESIGN OF STEEL STRUCTURE **[8 hrs]**
Introduction to stability and buckling concepts; Structural steel and properties; Riveted, bolted and welded connections; Working stress and plastic design Methods.

Unit 4 DESIGN OF STEEL STRUCTURE **[8 hrs]**
Design of tension, compression and flexural members (including built-up members); Column bases; Roof trusses Specification and design of simple structural members;

Unit 5 PLANT DESIGN **[8hrs]**
Plant layout, Flow sheeting, Auxiliaries, Cost estimation, Selection and detailed design of equipments e.g Pumps, Blowers and compressors ,Mixers, etc.;

Unit 6 MATERIAL HANDLING SYSTEM DESIGN **[7 hrs]**

Materials handling equipments, offsite facilities, Selection and detailed design of equipments e.g Conveyors etc.

Reference Books:

- **Prasanna Chandra- Project Management**
- **Couper, Penny, Roy-Chemical Process Equipment (Selection and Design)**
- **Iger karasik- Pump Handbook**

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ME1908	TOOL DESIGN	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To learn the mechanism of metal cutting and the design of metal cutting tools. Also to understand various presses working operations along with tools to dies design with the help of computer software.

Unit 1 **[8 Hrs]**

Theory of metal Cutting. Cutting tool materials, dynamics of metal cutting, Single point cutting tool, Merchant's Theory, Cutting power, Energy consideration in metal cutting, Tool life and dynamometry, Tool life criteria, variable affecting tool life, Machinability.

Unit 2 **[8 Hrs]**

Design of single Point Cutting Tool .Form tools- design of form tools. Design of milling cutters. Design of Gauges, Materials, heat treatments, Taylor's Principals of gauge design, design of limit gauges. Design of broaching and reamers.

Unit 3 **[10 Hrs]**

Press tool Design
Introduction, Press operations - Press working equipment - Classification, Rating of a press, Press tool Equipment, working of dies and their components.

Unit 4 **[10 Hrs]**

Bending Forming & Drawing dies Bending methods, Design Principles, Design consideration.

Unit 5 **[7 Hrs]**

Forging Die Design .Die design for machine forging Tools for flash trimming & hole piercing, materials & manufacture of forging dies. Mould Design.

Unit 6 **[10 Hrs]**

Design of jigs & fixture: - Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures. Drilling Jigs: - Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures, Automatic clamping Devices.

Books for reference:

1. Donaldson, "Tool design"
2. ASTME, "Fundamentals of Tool design"
3. Pollock, "Fundamentals of Tool design"
4. Grant, "Unconventional Clamping Systems"
5. Kempster, "Fundamentals of Tool design"

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ME1909	OBJECT ORIENTED PROGRAMMINGS	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

This engineering course focuses on detail study of various data structures used in computer environment. Also learning the concept of OOPs and programming for data structures using OOPs.

UNIT1 Review of basic Concepts of OOPs, objects, classes, polymorphism, inheritance, application in CAD/CAM codes **[7 hrs]**

UNIT 2 Introduction to data structures, abstract data types, array as an adt, using one-dimensional arrays, arrays as parameters, character string operations, multi-dimensional arrays, structures and classes. **[8 hrs]**

UNIT 3 Stack and its Application, Definition and Examples, Primitive Operations, Recursion, Fibonacci sequence, Binary Search, Recursive Chains, Recursive Definition of Algebraic Expressions **[8 hrs]**

UNIT 4 Queues and Lists, the queues representation insert operation, priority queue, array implementation of a priority queue, linked lists, inserting and removing nodes from a list, linked implementation of stacks, linked implementation of queues, linked list as a data structure, non integer and non homogeneous lists, dynamic and array implementation of lists, simulation using linked lists simulation process, data structures, other list structures, circular lists, doubly linked lists , multiple linked lists **[7 hrs]**

UNIT 5 Trees, Binary Trees Operations, Applications Representations of Binary Tree. Internal and External Nodes, Implicit Array Representation of Binary Trees, Choosing a Binary Tree Representation, Binary Tree Traversals, Heterogeneous Binary Trees, **[7 hrs]**

UNIT 6 Sorting, Efficiency Considerations, O Notation, Efficiency of Sorting, Exchange Sorts, Bubble sort, Quick sort, Selection and Tree Sorting, Straight Selection Sort, Binary Tree sorts, Heap sort, Insertion Sorts, Simple Insertion, Shell Sort,
searching, basic search techniques, algorithmic notation, sequential searching, reordering a list searching an ordered table, indexed sequential search, binary search, interpolation search, tree searching, inserting/deleting in a binary search tree **[7 hrs]**

Books for Reference:

1. Langsam Y., Augenstein M. J. And Tenenbaum A. M., “Data Structures Using C and C++”, Prentice Hall of India Pvt. Ltd.
2. Trembly J. P. And Sorenson P. G., “An Introduction to Data Structures with Applications”, Tata McGraw Hill Pub. Co. Ltd.
3. Horowitz E. And Sahani S., “Fundamentals of Computer Algorithms”, Galgotia Publications Ltd.

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ME1910	RELIABILITY ENGINEERING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit 1: [8 Hrs]
Introduction to reliability- Reliability definition, Failure rate, hazard rate, Reliability function and their variation with respect to time, MTTF and its calculations for discrete data. Reliability analysis and its relation with other parameters like strength etc.

Unit 2: [8 Hrs]
Reliability analysis for continuous data. Probability density function, failure rate and derivation of Reliability for various types of failures like constant failure rate, logarithmic failure rate in increasing/ decreasing failure rate etc. and there physical significance

Unit 3: [7 Hrs]
System Reliability series parallel and mixed configuration, system Reliability for complex systems using various tech. like successful path method, composite method etc. Redundancy, various types, parallel operations.

Unit4: [8 Hrs]
Reliability allocation and improvement, life cycle estimation, fault tree analysis, FMEA, FMECA etc,

Unit 5: [7 Hrs]
Reliability testing, accelerated life testing, sequential testing.

Unit 6: [7 Hrs]
Reliability availability, maintainability, maintainability improvement, Reliability economics.

Suggested Books:-

1. Introduction to Reliability Engineering by E.E.lewis and John wiley and sons
2. Reliability Engineering by L.S. Srinath
3. Reliability and engineering systems by L. Ryabinir
4. Practical Reliability Engineering by Patric Dtoconnor

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ME1903	Computer Graphics and Solid Modeling		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To educate the students on main concepts of computer aided design, representation of curves, surface and solids.

UNIT-I: CAD TOOLS

Definition of CAD Tools, Types of system CAD/CAM system evaluation Criteria, functional areas of CAD, Modeling and viewing, efficient use of CAD software.

Wire frame modeling -Types of mathematical representation of curves, wire frame models, wire frame entities, parametric representation of analytical and synthetic curves – Hermite cubic splines, Bezier curves, B-Splines, rational curves-NURBS.

[8hrs]

UNIT-II: SURFACE MODELING

Mathematical representation of surfaces, Surface model, Surface entities, surface representation, parametric representation of surfaces, plane surface, ruled surface, surface of revolution, Tabulated surface.

[7hrs]

UNIT-III: PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES

Hermite Bicubic surface, Bezier surface, B-Spline surface, COONs surface, Blending surface, Sculptured surface, Surface manipulation - Displaying, Segmentation, Trimming, Intersection, Transformations - 2D and 3D, Orthogonal and Perspective transformations.

[9hrs]

UNIT-IV: SOLID MODELLING

Solid Representation - Boundary Representation (B-rep), Constructive Solid Geometry (CSG) and other methods, Design Applications: Introduction to Feature based and Assembly modelling.

[7hrs]

UNIT V:ADVANCED MODELING CONCEPTS

Feature Based Modeling, Assembly Modeling, Behavioral Modeling, Conceptual Design & Top-down Design. Techniques for visual realism – hidden line – Surface removal – Algorithms for shading and Rendering. Parametric and variational modeling, Feature recognition, Design by features, Assembly and Tolerance Modeling, Tolerance representation – specification, analysis and synthesis, AI in Design.

[8hrs]

UNIT VI: CAD/CAM DATA EXCHANGE

Evaluation of data- exchange formats, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.

[6 hrs]

Text books:				
1	CAD/CAM, Theory & Practice	1st Edition (1991)	Ibrahim Zeid	McGraw-Hill
2	Procedural elements for computer Graphics	1st Edition (1998)	D Rogers	WCB/McGraw-Hill
3	Introduction to Finite Elements in Engineering	2nd Edition (2002)	Chandrupatla&Belegundu A.D	Prentice Hall
4	Optimization for Engineering Design	1st Edition (2005)	Kalyanmoy Deb	Prentice Hall
5	P. N. Rao,	-	CAD/CAM	McGraw Hill
6	Martenson, E. Micheal	1995	Geometric Modelling	John Wiley & Sons
7	P. Radhakrishnan, S. Subramanyam		CAD/CAM/CIM	New Age International

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Reference books:				
1	Computer Graphics	McGraw-Hill	Hearn D. & Baker M.P	Prentice Hall
2	Computer Graphics	2nd Edition (1987)	S. Harrington	Mcgraw-hill Professional
3	Mathematical Elements for Computer Graphics	1st Edition (1990)	RoggersDravid F., Adams J. Alan	McGraw-Hill
4	Theory & Problems of Computer Graphics	1st Edition (1986)	Roy A. Plastock, Gordon Kalley	McGraw-Hill
5	V. Ramamurti	1992	Computer Aided Mechanical Design and Analysis	Tata Mc Graw Hill-

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ME1904	LAB : Computer Graphics and Solid Modeling	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	

List of Practical

1) Introduction to CAD softwares.
2) Generation of at least two simple solid models showing geometric properties using any CAD software.
3) To generate at least two simple assembly model using any CAD software
4) Simulate assemble model using any CAD software
5) Programs on 2 D transformations – scaling, rotation, reflection, translation

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ME1905	CNC TECHNOLOGIES	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines their components, functions, functions, programming and applications and integration of machines with the computers , PLC , machine control through computers, data acquisition.

UNIT 1 **Introduction** to Numerical control. Development of NC system. Concepts of NC, CNC, DNC. Classification of CNC machines, Machine configurations, Advantagges and limitations. . **[6 hrs]**

UNIT 2 **Constructional Features of CNC Machines**: Structure, Drive Mechanism, gearbox, Main drive, feed drive, Spindle Motors, Axes motors. Timing belts and pulleys, Spindle bearing, Arrangement and installation. Slide ways. Re - circulating ballscrews, Backlash measurement and compensation, linear motion guide ways. Tool magazines, ATC, APC, Chip conveyors **[6 hrs]**

UNIT 3 **Control Systems, Feed Back Devices and Tooling** **[9 hrs]**
Description of a simple CNC control system. Types of control, CNC controller's characteristics, Interpolation systems. Incremental and absolute rotary encoders, linear scale – resolver – Linear inductosyn – Magnetic Sensors for Spindle Orientation. Carbide inserts classification, qualified; semi qualified and preset tooling , Principles of location, Principles of clamping–Workholdingdevices.

UNIT4 **Programming CNC machines**, Part print analysis and Process planning,. APT part programming using CAD/CAM, Parametric Programming. Manual part programming for CNC turning, milling and machining center.. Computer assisted part programming techniques, Conversational and Graphics based software, Solids based part programming. Freeform surface machining. Simulation and Verification of CNC programs, **[8 hrs]**

UNIT 5 **Advanced Programming features**, Canned cycles, Subroutines, Macros, special cycles etc for CNC lathe and milling machines. **[8hrs]**

UNIT 6 Adaptive CNC control techniques, types and benefits. Integration of CNC machines for CIM. Introduction to multiaxes CNC machines. **[8 hrs]**
Case studies of completed jobs.

Books Recommended::

1. Krar, S., and Gill, A., "CNC Technology and Programming", McGraw Hill publ Co, 1990.
2. Gibbs, D., "An Introduction to CNC Machining", Casell, 1987.
3. Seames, W.S., "Computer Numerical Control Concepts and Programming", Delmar Publishers, 1986.
4. Lynch, M., "Computer Numerical Control for Machining", McGraw Hill, 1992.
5. Koren Y, "Computer Control of Manufacturing Systems", McGraw, 1986.
6. Fu K.S., Gonzalez R.C., and Lee C.S.G.," Robotics control, sensing, vision, and intelligence", McGraw-Hill Book Co., 1987.
7. Klafter R.D., Chmielewski T.A. and Negin M.," Robot Engineering An Intergrated approach", Prentice Hall of India, New Delhi, 1994.
8. Craig J.J., "Introduction to Robotics Mechanics and Control", Addison-Wesley, 1999.

Reference Books:

- Richard D. Klafter , Thomas A. Chemielewski, Michael Negin, Robotic Engineering : An Integrated Approach , Prentice Hall India, 2002.

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ME1906	LAB : CNC TECHNOLOGIES	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	3 Hrs

LIST OF PRACTICALS:

1. Study of Automation through development in machines.
2. Numerical control – Fundamental & Application.
3. Manual Part Programming.
4. APT Part Programming.
5. CNC- Lathe – Features, Specification,
6. CNC Lathe – Programming , Simulation & Actual Machining of Part.
   (Facing , Turning , Multiple turning cycles, etc.)
7. CNC Lathe – Programming , Simulation & Actual Machining of Part.
   (Advance programming like Thread Cutting , Grooving etc.)
8. CNC- Milling – Features, Specification,
9. CNC Milling – Programming , Simulation & Actual Machining of Part.
   (Profile Cutting , Various Interpolation , etc.)
10. CNC Milling – Programming , Simulation & Actual Machining of Part.
    (Advanced programming like Pocketing , Mirroring, etc.)

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II nd Semester

ME1911	ROBOTICS	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To understand Robots, their components, functions, functions, programming and applications.

UNIT 1 Robotics, Basic concepts, Robot configurations, Basic robot motions, Types of drives, End effectors, Classification, Mechanical, Magnetic, Vacuum, and Adhesive, Drive systems, Force analysis and Gripper design **[7 hrs]**

UNIT 2 Manipulator Kinematics Transformation matrices and their arithmetic, link and joint description, Denavit-Hartenberg parameters, frame assignment to links, solvability, algebraic and geometrical methods, Velocities and Static forces in manipulators Motion of the manipulator links, Jacobians, singularities, static forces, Jacobian in force domain. **[9 hrs]**
Robot Applications :-Spray Painting
- Assembly
- Welding
- Material Handling
- Processing etc

UNIT 3 Manipulator Dynamics Iterative Newton-Euler dynamic formulation, structure of the manipulator dynamic equations, introduction to the Lagrangian formulation and generalized D'Alembert's equations of motion, Trajectory Generation Considerations in path description and generation, joint space schemes, paths with via points, Cartesian space schemes, geometrical problems with Cartesian paths **[6 hrs]**

UNIT 4 Manipulator Control: Introduction to closed loop control, second order linear systems and their control, control law partitioning, trajectory-following control, modeling and control of a single joint. Introduction to non-linear control, non-linear and time-varying systems, the control problem of manipulators, practical considerations, present industrial robot control systems, introduction to force control, brief introduction to robot actuators, need for sensors and vision system in the working and control of a robot, **[8 hrs]**

UNIT 5 Programming: Methods of robot programming, lead through programming, motion interpolation, branching capabilities, WAIT, SIGNAL and DELAY commands, subroutines, RAIL and VAL II programming languages **[8 hrs]**

UNIT 6 Sensory devices, Non optical and optical position sensors , Velocity and Acceleration , Range , Proximity , touch , Slip , Force ,Torque. **[7 hrs]**
Machine vision , Image components , Representation , Hardware , Picture coding , Object recognition and categorization
Integration of Robots with CNC machines for CIM.

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Books for Reference:

1. Fu K.S., Gonzalez R.C., and Lee C.S.G.," Robotics control, sensing, vision, and intelligence", McGraw-Hill Book Co., 1987.
2. Klafter R.D., Chmielewski T.A. and Negin M.," Robot Engineering An Intergrated approach", Prentice Hall of India, New Delhi, 1994.
   Deb S.R., "Robotics Technology and Flexible Automation", Tata McGraw-HillPublishing Co.,Ltd., 1994.
4. Craig J.J., "Introduction to Robotics Mechanics and Control", Addison-Wesley, 1999.
5. L. Sciavicco, B. Siciliano "Modelling and control of robot manipulators", The McGraw-Hill Co. Inc., 1996.
6. R.J. Schillin, "Fundamentals of Robotics: Analysis and Control", Prentice Hall.
7. K.S. Fu, R.C. Gonzales, C.S.G. Lee, "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill,1987.
8. Groover, "Industrial Robotics: Technology, Programming and Applications", McGraw Hill, 1986.
9. R. K. Mittal – Fundamentals of robotics, PHI.

Tutorials

1) Numericals on kinematics and dynamics using MatLab.

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ME1912	MODELLING AND SIMULATION	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various modeling techniques leading to complete understanding and simulation the processes including its optimization is envisaged in this course. Students are able to design the electronic and informatic means to implement them on control systems.

Unit 1 Introduction to mathematical modeling, Need, Advantages, Limitations, Disadvantages & Applicable to mechanical, manufacturing, process, Automotive, Electrical & Control System, Software tools available for modeling [Matlab- Simulink, AutoLISP, ADAMS/Pro-Mechanica/ Visual Nastran/Working Model 4D, MathCAD/Mathematica, Lab View and computer languages [C/C++/Fortran/AutoLISP/ Simula /SIMSCRIPT/GASP/GPSS] for mathematical modelling **[7 hrs]**

UNIT 2 Introduction to automatic controls. Modeling of general second order system(mechanical systems [spring, mass, damper], flow, heat transfer and electrical, pneumatic and vibration systems). Block diagram and transfer function, Modeling of continuous system, Extraction of reduced order models. Transient and frequency response evaluation using Laplace transform, Control loop and its elements, Dynamic behaviour of first, second and higher order physical systems. Linearization of non-linear systems. Controller hardware, sensors, transmitters and control valves **[7 hrs]**

UNIT 3 Characteristics of hydraulic controller, pneumatic, electronic controller, electro hydraulic and electro-pneumatic controllers, PID control, Stability, Gain and phase margins, Control system design using root and compensation **[8 hrs]**

UNIT 4 Simulation Introduction, Advantages, Limitations, Disadvantages, Concept of System, Process, Activity, Attributes, Closed & Open System, Activities: Deterministic & Stochastic, Models: Static, Dynamic, Transient, Simulation Approaches: Event Scheduling, Process Interaction, Activity Scanning, Steps in Simulation Study **[8 hrs]**

UNIT 5 Instrumentation and Process Control-Introduction, Study of various measuring parameters of a process/system and Measuring instruments for: Temperature, pressure, level, flow, Control schemes with applications to Machine tool, Boiler, Engine Governing, Aerospace, Active vibration control, Manufacturing, Process control, etc. **[8 hrs**

UNIT 6 Application to Control panel modeling, Virtual Instrumentations using Lab View, Auto-tuning, Sequence control, Logic diagram, Introduction to digital control, Implementation using computer language /software, Introduction to control of MIMO systems, State Space modeling **[7 hrs]**

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Text Books:

1. S.R Bhonsale, K.J., "Mathematical modeling for design of machine components", Weinmann, 1999, Prentice Hall.
2. A.F. D'souza V K Gar, "Englewood Cliffs Advanced Dynamics: Modelling and Analysis," N. J., Prentice Hall, 1984
3. Averal M. Law, W. David Kelton, "Simulation, Modelling and analysis", McGraw Hill, 1992.

Reference Books:

1. Reference manuals: Matlab- Simulink/AutoLISP/ADAMS/Pro-Mechanica/VisualNastran/WorkingModel 4D/ MathCAD/Mathematica, Lab View.
2. Mathematical modeling for design of machine components, S.R Bhonsale, K.J. Weinmann, 1999, Prentice Hall.
3. Advanced Dynamics: Modelling and Analysis, A.F. D'souza V K Gar, Englewood Cliffs, N. J., Prentice Hall, 1984
4. Simulation, Modelling and analysis, Averal M. Law, W. David Kelton, McGraw Hill, 1992.
5. Jean Ulrich, Thoma, "Modelling and Simulation in Thermal and Chemical Engineering: a bond graph approach", Springer, 2000, ISBN 3540663886
6. Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice", Wiley-Interscience, 1998, ISBN: 0471134031
7. Christopher A. Chung, "Simulation Modeling Handbook: a practical approach", CRC,2003, ISBN: 0849312418
8. Averill Law, W. David Kelton, "Simulation Modeling and Analysis (Industrial Engineering and Management Science Series) ", McGraw-Hill Inc, 1999, ISBN: 0070592926
9. Philip J. Thomas, "Simulation of Industrial Processes for Control Engineers", Butter worth-Heinemann 1999,ISBN: 0750641614
10. Sheldon M. Ross, "Simulation", Academic Press, 2001, ISBN: 0125980531
11. John Montgomery, Vjekoslav Damic, "Mechatronics by Bondgraphs ", Springer, ISBN: 3540423753
12. Bernard P. Zeigler, Tag Gon Kim, Herbert Praehofer, "Theory of Modeling and Simulation"Academic Press, 2000, ISBN: 0127784551
13. Nicholas M. Karayanakis , "Advanced System Modelling and Simulation with Block Diagram Languages", CRC 1995, ISBN: 0849394791
14. Giancarlo Genta, "Motor Vehicle Dynamics: Modeling and Simulation (Series on Advances in Mathematics for Applied Sciences)",Publisher: World Scientific Publishing Company 1997, ISBN: 9810229119
15. Damian Flynn, "Thermal Power Plant Simulation and Control",Institution Electrical Engineers 2003, ISBN: 0852964196
16. Ian Cameron, K. M. Hangos, Katalin Hangos, "Process Modelling and Model Analysis (Process Systems Engineering) Elsevier Limited, 2006, ISBN: 0121569314
17. Reinhold von Schwerin , "MultiBody System SIMulation: Numerical Methods, Algorithms, and Software",Springer2005,ISBN: 1402033923

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ME1913	FINITE ELEMENT METHOD	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

FEM a numerical technique will be useful subject for the students in finding approximate solutions of partial differential equations as well as of integral equations. FEM allows detailed visualization of where structures bend or twist, and indicates the distribution of stresses and displacements. FEM software provides a wide range of simulation options for controlling the complexity of both modeling and analysis of a system. Similarly, the desired level of accuracy required and associated computational time requirements can be managed simultaneously to address most engineering applications. FEM allows entire designs to be constructed, refined, and optimized before the design is manufactured.

UNIT 1 Fundamentals of stress & strain, stress & strain components, stress strain relationship, Elastic constants, plane stress, plane strain., differential equation of equilibrium, compatibility equations, boundary conditions, Saint Venant's principle, Airy's stress function. **[7Hrs]**

UNIT 2 Fundamental concepts of FEM -' Historical background, Scope of FEM in Engg.Applications, Principle of minimum potential energy. Concept of Virtual work. Variational method. FEM analysis procedure. Mathematical understanding required for FEM, Matrix algebra & operations, Eigen values & Eigen vectors. Methods for solution of simultaneous equations. like Gauss elimination. Matrix decomposition method.
Concept of discritization of body into elements. Degrees of freedom, bandwidth, and Basic types of 2-D & 3-D elements, displacement models, convergence requirements, shape function. Commercial FE Software's. **[7Hrs]**

UNIT 3 Finite element modeling & analysis using Bar & Beam element -stiffness matrix, assembly, boundary conditions, load vector, temperature effects.
Two dimensional plane 'b11ss -Local & Global coordinate system, element stiffness matrix, assembly, boundary conditions, load vector, force & stress calculations. **[8Hrs]**

UNIT 4 Two dimensional problems using CST & LST -formulation of CST & LST elements, elemental stiffness matrix, assembly, boundary conditions, load vector. Stress calculation. Temperature effect.
Axi-symmetric solids subjected to axi-symmetric loading -axi-symmetric formulation using CST ring, element, stiffness matrix, boundary conditions, load vector, calculation of stresses. **[8Hrs]**

UNIT 5 Introduction to Isopearametric & Higher order elements. Introduction to Numerical Integration. Introduction to dynamic analysis, formulation of mass matrix for one-dimensional bar element, free vibration analysis using one-dimensional bar element. Torsion of prismatic bars using triangular elements **[7Hrs]**

UNIT 6 Steady state one dimensional & two dimensional heat conduction problems using I-D and triangular element respectively. Programming aspects of FEM -Algorithms for, reading Finite Element modeling data, formation of elemental stiffness matrix, and formation of elemental load vector. assembly of individual elemental spiffiness matrix into global' stiffness' matrix, assembly of individual elemental load vector into global load vector, application of boundary .conditions, solution of equations, determination of stresses and strains. Pre & Post processing in FEA. **[8Hrs]**

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Suggested books

1) Introduction to Finite Elements in Engineering -T.R. Chandrupatla & AD. Belegundu .
2) Finite Element Analysis for engineering-T.R.Chandrupatla.
3) Theory of Elasticity -S.P. Timoshenko
4) Concept and applications of Finite element Analysis -RD. Cook
5) The Finite Element Method -A basic introduction for engineers -D. W. Griffiths, D.A Nethercot – Granada Publishing
6) Finite element methods – Krishnamurthy & Desai
7) Finite element methods – Zeinkeiwiz
8) Finite element methods – J. N. Reddy
9) Finite element methods – Finite to Infinite series

Tutorials

1) C – programming for stress analysis of elements to be carried out.
2) Comparison of a)Analytical result b) C- programming result and c) result due to Ansys to be made.

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ME1914	LAB: FINITE ELEMENT METHOD	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			40	60	100	

List of Practical :

Students should use the commercial software or programmes from the text-books or self developed programs, to verify the results obtained by manual calculations. The input data and output results of the problem solved using the computer programs should be included in the Journal.

1) Any two problem using bar element
2) Any two problems using truss element
3) Any two problems using CST element
4) Any one problem using axisyrmnetric element
5) Any one problem of free vibration analysis using bar element
6) Any one problem of Torsion of Prismatic bars.
7) Any one problem on Steady State Heat conduction.

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ME1915	ARTIFICIAL INTELLIGENCE	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To learn about the automation of machines tools making the system intelligent. Understanding the different techniques used for implementation of artificial intelligence.

Unit 1 Human and machine intelligence, Artificial Intelligence (AI), Programming in AI environment,. Natural Language processing (NLP), Need of AI. **[7hrs]**

UNIT 2 Architecture of an Expert system, Knowledge base, inference engine forward and backward chaining, use of probability and fuzzy logic. Selection of inference mechanism, (Relevant case studies) **[8 hrs]**

UNIT 3 Neural Network and application artificial neural network models, NN applications in Cellular manufacturing and other areas of mechanical Engg..(Relevant case studies) **[8 hrs]**

UNIT 4 Introduction to Rule Based System. Conflict Resolution Advantages and Drawbacks of Rule Based Systems Clausal Form Logic, Rule Base Verification, Refinement and Validation.
Creating Knowledge Base, Knowledge Engineer and Domain Expert, Phases of Knowledge Engineering, Tools for Knowledge Engineering. **[7 hrs]**

UNIT 5 Fundamentals of OOP (Object oriented programming), creating structures and objects, object operations, invoking procedures, programming applications, Object oriented expert systems.
Semantic nets, structure and objects, ruled systems for semantic nets, certainty factors, automated. **[7 hrs]**

UNIT 6 Relevant case studies. **[8 hrs]**

Books for Reference:

- Addis, T.R., “Designing Knowledge Based System”, Prentice Hall, 1985.
- Rolston, D.W., “Principles of Artificial Intelligence and Expert Systems Development”, McGraw Hill, 1988.
- Maus, R. and Keyes, J., “Handbook of Expert Systems in Manufacturing”, McGraw Hill, 1991
- Robert Levine, “A comprehensive guide to artificial intelligence and expert systems",Elain Rich ,”Artificial Intelligence”,
- Sasikumar, Ramani, et al ,”Rule based expert systems”.
- Graham Winstanley, “Program Design for Knowledge Based Systems”, Galgotia Publications.
- Artificial Neural Networks", Zurada
- V.B. Rao and H.V. Rao, “C++ : Neural Networks and Fuzzy Logic”, BPB Publications.

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ME1917	PRODUCT DATA MANAGEMENT	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

This engineering course focuses on understanding the structure of database, design of database, different types of database and query languages and constraints and pitfalls in database design .Also provides the learning of Expert Database Architectures; Semantic Data Models,Decision-Support Systems and databases for product design and other CAD/CAM applications.

Unit 1 Purpose of Database Systems; View of Data; Data Models; Database Languages; Database Users; Overall System Structure **[7hrs]**

UNIT 2 Design Issues; Mapping Constraints; Keys; Entity-Relationship Diagram; Weak Entity Sets; Extended E-R Features; Design of an E-R Database Schema; **[8 hrs]**

UNIT 3 Structure of Relational Databases; The Relational Algebra; The Tupple Relational Calculus; The Domain Relational Calculus; Extended Relational Algebra Operations; Modifications of the Database; Views **[8 hrs]**
Basic Structure; Set Operations; Aggregate Functions; Null Values; Nested Sub queries; Derived Relations; Views; Modification of the Database; Joined Relations; Data-Definition Language; Other Relational Languages - Query-by-Example; Quel; Datalog; Views

UNIT 4 Domain Constraints; Referential Integrity; Assertions; Triggers; Functional Dependencies Views **[7 hrs]**
Pitfalls in Relational-Database Design; Decomposition; Normalization Using Functional Dependencies; Views

UNIT 5 New Database Applications; The Object-Oriented Data Model; Object-Oriented Languages; Persistent Programming Languages; Persistent C++ Systems; Object-Relational Databases Views: Indexing and Hashing Ordered Indices **[7 hrs]**
Centralized Systems; Client-Server Systems; Parallel Systems; Distributed Systems; Network Types; Parallel Databases; Distributed Databases; Security and Integrity; Standardization Views

UNIT 6 Expert Database Architectures; Semantic Data Models; Views **[7 hrs]**
Decision-Support Systems; Data Analysis; Data Warehousing; Spatial and Geographic Databases; Multimedia Databases; Mobility and Personal Databases; Information-
Product Design Databases; CAD-CAM Data Management Requirements; Databases for Shop floor control and Factory information system; Enterprise Resource Planning; Database requirements of Computer Integrated Manufacturing Views:
Assignment for hands on experience on computer using any commercial database for different applications to be given. The assignment to be given in the groups.

Books for Reference:

1. Abraham Silberschatz, Henry F. Korth, S.Sudarshan, “Database System Concepts”, McGraw Hill International Editions, Third Edition
2. P. Beynon-Davies, “Expert Database Systems – A Gentle Introduction”, McGraw Hill International; 1991
3. James Martin ,“Database Management Systems”,
4. Mark Swank and Drew Kittel , “Worldwide Web - Database Developer's Guide”
5. Fredrick H.Jones and Lloyd Martin “The AutoCAD Database Book - Accessing and Managing CAD Drawing Information”; Galgotia Publications, Third Edition.

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ME1918	MECHATRONICS	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

Develop the ability to understand the working of various electronically and computer control devices. This will help to bridge the existing gap between machines, Automation and Computer control system

Unit 1 [7 hrs]

Introduction to Mechatronics. Components of mechatronics system. Signal Conditioning Process, Operational Amplifier, Data Acquisition Systems.

Unit 2 [7 hrs]

Introduction, sensors, actuators, modeling of systems. Recent trend of designing machine units along with electronic circuits for operation and supervision of mechanisms. Actuators, Sensors and Transducers: Hydraulic, pneumatic and electrical actuators and their system modeling, performance terminology, system modeling of sensors; displacement, position and proximity sensors, velocity and acceleration sensors, flow sensors, force sensors, temperature sensors, ultrasonic and fiber-optic sensors, selection of sensor, piezo-electric sensors Techniques of interfacing mechanical devices with computer hardware

Unit 3 [8 hrs]

Basic principles ,working and specific applications of armature and field controlled D.C. Motors, Variable voltage and variable frequency control of 3 phase and single phase Induction motors, speed control of synchronous motors, Different types of stepper motors-Constriction ,working and application. Position control of stepper motors.

Unit 4 [7 hrs]

Comparison between microprocessor and microcontroller, organization of microcontroller system, architecture of controller, pin diagram of 8051, addressing modes, programming of 8051, interfacing input and output devices, interfacing D/A converters and A/D converters, Various applications for automation and control purpose.

Unit 5 [8 hrs]

Programmable Logic Controller: Review of logic gates, basic structure, features, input/output processing, programming, functional block diagram (FBD), ladder diagram, logic functions, latching, sequencing, jumps, internal relays, counters, shift registers, master and jump control, data handling, data movement, data comparison, arithmetic operations, code conversion, analog input and output, applications for automation, diagnostics and condition monitoring.

Unit 6 [7 hrs]

General philosophy of Artificial Neural Network simulations, Fuzzy logic for operation and control of mechatronic systems.

Study of systems used in Ink Jet Printers, Photo copying, Washing Machines, IC Engine fuel injection system etc

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Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Introduction to Mechatronics and Measurement Systems	2007	Michael B.Histand and David G. Alciatore	Tata McGraw-Hill Education
2	Mechatronics	2007	Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ.,	Chapman and Hall, 1991
3	Microprocessor Architecture, Programming and Applications	2002	Ramesh.S, Gaonkar	Prentice Hall
4	Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics	1996	Lawrence J.Kamm	John Wiley and Sons
5	Introduction to Microprocessors for Engineers and Scientists	2004,	Ghosh, P.K. and Sridhar	PHI Learning Pvt. Ltd.

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ME1919	MACHINE TOOL DESIGN	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles. This subject deals with the basic structure of machine tools , its design and design of gear box, guides , and other machine tool elements.

Unit No. 1: Machine Tools **(8 Hrs.)**

Introduction, classification, general requirements, characteristics, technical and economical prerequisites for machine tool design, machine tool design process, machine tool layout, motion in machine tool, machine tool drives, hydraulic and mechanical drives, types and elements, individual and group drives, devices for intermittent motion, reversing and differential mechanism, selection of electric motor.

Unit 2 : Regulation of Speed and Feed Rates: **(8 hrs.)**

Aim of speed and feed regulations, stepped regulations of speed-Various laws of step regulation, Selection of range ratio, Standard value of Geometric progression ratio and guidelines for selection proper values, Breakup of speed steps, Structure diagrams and its analysis, Classification of speed and feed boxes, design of feed box, machine tool drives using multiple speed motors, Special cases of gear box Design speed box with Overlapping speed steps, Speed box with combine structure, Speed box with Broken geometric progression, electromechanical system of regulation, Friction, Pressure and Ball Variations, Epicyclic Drive.

Unit 3 : Design of machine Tool Structure: **(8 Hrs.)**

Function and requirement of machine tool structure, design criteria from strength and stiffness consideration, concept of unit rigidity, unit strength under bending for material of machine tool structures, compare steel and cast iron on the basis of material properties, manufacturing problems and economy, role of static and dynamic stiffness in design of elements of machine tools, profiles of machine tool structures, factors affecting stiffness of machine tool structures.

Unit 4: **Design of Guideway and Power Screws**: **(8 hrs.)**

Function and types of Guideways, types of slideways and antifriction ways, functional features of slides ways, its shapes and materials, methods of adjusting clearance, design criteria (wear resistance and stiffness) and calculations for slideways operating under semi liquid friction condition, stick slip phenomenon affects accuracy of setting and working motions, comparision of design and stiffness of hydrodynamic, hydrostatic and aerostatics slide ways, design of antifriction Guideways, concept of combination of Guideways, Design of sliding friction power screw for wear resistance, strength, stiffness and buckling stability, design of rolling friction power screw for strength under static loading.

Unit 5 : Design of Spindle: **(7hrs.)**

Function and requirements of spindle units, their materials, effect of machine tool compliance on machining accuracy, design of spindles for bending stiffness: deflection of spindle axis due to a) bending b) compliance of spindle supports c) compliance of tapered joints, optimum spacing between spindle supports permissible deflection and design for stiffness: additional check for strength like additional supports, location of bearings and drive elements, balancing.

Unit 6 : **Design of spindle supports:** **(7hrs.)**

Requirements of spindle supports, features of antifriction bearings, load bearing abilities of ball and roller bearing. Parameters which access the violability of combinations of roller and ball and roller bearings in spindle units. Preloading of antifriction bearing and its method design of sliding bearing: sleeve, hydrodynamic journal, hydrostatic journal, air lubricated (aerodynamic, aerostatic)

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Text Books:

I) Machine Tool Design -N. K. Mehata TMH
2) Principles of Machine Tools –Gopal Chandra Sen , Amitabh Bhattacharya New central book agency
3) Machine Tool Design -Basu, Pal Oxford IBH
4) Technology of Machine Tool by Steve F. Krar Indian Edition 2013 (Mc-Graw Hill)

Reference Books:
All about Machine Tool – by Henrich Gerling (New Edge Publication)

ME1920	PLANT DESIGN	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To learn the design consideration and methodology of various equipment used in plants like pressure vessels and its foundation, storage tanks, heat exchangers etc. To learn about the components and design of piping systems.

Unit 1 Pressure Vessel Design [7 Hrs]

Introduction to Pressure Vessels: Fired & Un-fired vessels. Vessel Mechanics & Design considerations: Thick/Thin shells -cylindrical, spherical & different types of end-covers. Design of a typical pressure vessel using industrial Software.

UNIT 2 Shell and Mounting Design [8 Hrs]

Design of spherical/ cylindrical shells and heads/ closures for cylindrical shells under internal and external pressure;

Design of a self- supporting tall vertical cylindrical vessel under wind/ seismic loading; Design of RCC foundation for a tall vessel; Compensation for openings in cylindrical shells; Design of special flanges;

UNIT 3 Design of Storage Tank and Heat Exchangers [7 Hrs]

Design of storage tanks for liquids.

Design of heat exchanger and heat exchanger network

UNIT 4 Valves [7 Hrs]

Selection of valves, Pressure reducing valves and fittings; Water treatment, Storage; Steam: Steam handling ,Steam Trap, Ejectors etc.;

UNIT 5 Piping Design [7 Hrs]

Pipe Size and pressure drop calculation for single and two phase flow, multiple pipe line networking ..

UNIT 6 Piping Analysis [7 Hrs]

Introduction to Piping Engineering – their design. Method of stress analysis of piping system – Thermal & other static modes of loading. Design of a typical piping problem using industrial software

Text Books:

- Bedworth, Wolfe & Henderson -Computer Aided Design & Manufacturing - McGraw Hill

Reference Books:

- Ibrahim Zeid – CAD/CAM –Theory & Practice –TMH
- Couper, Penny, Roy-Chemical Process Equipment (Selection and Design)
- Shashi Menon- Piping Calculation

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ME1916	SEMINAR	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
					100	

Objective:

Each student of the concern project shall present and seminars using audio visuals, aids of on their project methodology. Seminar delivery will be followed by question – answer session. The student shall also require to submit minimum 3 page report about the progress. The minimum 3 member seminar committee shall be constituted for the purpose of evaluating seminar

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III Semester

ME1921	PRODUCT DESIGN AND DEVELOPMENT	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES
To understand the Product Life Cycle. Study different design techniques, product development phases, process selection, material selection and costs associated with PDD.

Unit 1 **Introduction** **[7 hrs]**
Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods.

UNIT 2 **Material selection** **[7 hrs]**
Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart

UNIT 3 **Process selection**
Process selection – Importance types of manufacturing processes and their classification, sources of information, selection criteria, Material and Process selection Methods- Expert systems, Computer Database Approach, Performance indices, decision matrix, AHP and fuzzy approach, introduction to material and process selection software **[8 hrs]**

UNIT 4 **Benchmarking**
Benchmarking – DFM, DFA, DFX, Early supplier involvement, robust design, QFD and concurrent engineering. **[8 hrs]**

UNIT 5 **Costing & Assembly**
Mathematics of Time Value of Money, Cost Comparison, Depreciation, Taxes, Inflation, Profitability of Investment and Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates. Industrial Engineering Approach, Parametric Approach, **[8 hrs]**
Introduction to Assembly Modelling, Top-Down and Bottom-Up Approaches of AM, Mating Conditions, Representation Schemes, Generations of Assembly Sequences

UNIT 6 **Rapid Prototyping** **[7 hrs]**
Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereolithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations

Book for reference:

1. Dieter George E. “Engineering Design”, McGraw Hill Pub. Company, 2000
2. Ulirich Karl T. and Eppinger Steven D., “Product Design and Development” McGraw Hill Pub. Company, 1995.
3. Bralla, James G., “Handbook of Product Design for Manufacturing” McGraw Hill Pub. Company, 1986
4. A. K. Chitale and R. C. Gupta, Product Design and Manufacturing, PHI Pvt. Ltd., 2002.
5. HARRY NYSTROM, " Creativity and innovation", John Wiley & Sons, 1979.
6. BRAIN TWISS, " Managing technological innovation", Pitman Publishing Ltd., 1992.
7. HARRY B.WATTON, " New Product Planning ", Prentice Hall Inc. 1992.
8. P.N.KHANDWALLA - " Fourth Eye (Excellence through Creativity) – Wheeler Publishing ",Allahabad, 1992.
9. I.P.R. Bulletins, TIFAC, New Delhi,

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ME1923	COMPUTATIONAL FLUID DYNAMICS	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The aim of this course is to provide basic knowledge on modern computational methods which are commonly used for laminar and turbulent flows. Furthermore, the intention is to provide skills in the analysis and evaluation of results from numerical flow simulations. This knowledge should be sufficient to be able to chose an appropriate solution strategy and estimate the accuracy of the results for a given flow case.Knowledge and understanding : For a passing grade the student must be able to:

- discuss the potential and limitations of computational fluid dynamics
- describe different methods for numerical solution of flow problems and their applicability for different types of flow
- describe the sources of errors in the process from mathematical description to numerical solution of a fluid mechanical problem and how these errors affect the solution

Unit 1 **Introduction** **[7 hrs]**

Introduction –Theoretical, Computational and Experimental Techniques and their comparison. Scope of CFD. Different CFD Approaches. Modeling, Discretization and Basic Solution Module. Convergence, Stability and Consistency

UNIT 2 **Modelling** **[7 hrs]**

Modeling in CFD – Navier-Stokes Equation for Laminar Flow in Cartesian Coordinate System. Potential, Boundary-Layer and Fully Viscous Modeling. Streamfunction-Vorticity Formulation

UNIT 3 Boundary Conditions in Different Formulations and Case Studies like Potential and Viscous Modeling of Flow in a Cavity, Boundary-Layer Modeling of Flow over a Flat Plate and Viscous Modeling of Flow in Entrance-Region for Flow between Parallel Plates. **[8 hrs]**

UNIT 4 **Discretization** **[8 hrs]**

Finite-Difference Discretization of CFD Model – Discretization of First and Second Derivatives by Forward, Backward and Central Differencing. Truncation and Order of Error, and Accuracy.

UNIT 5 Case Studies like Potential and Viscous Modeling of Flow in a Cavity, Boundary-Layer Modeling of Flow over a Flat Plate and Viscous Modeling of Steady Flow in Entrance-Region for Flow between Parallel Plates in Streamfunction-Vorticity Formulation along with Role of Upwinding. Unsteady Flow Modeling and Stability **[8 hrs]**

UNIT 6 Special Topics in CFD – Solution of Simultaneous Linear Algebraic Equations by TDMA and ADI Techniques. Viscous Flow Modeling in Primitive-Variable Formulation: SIMPLE Algorithm **[7 hrs]**

Book for reference:

1. Anderson John; "Computational Fluid Dynamics"
2. Chung T.J;"Computational Fluid Dynamics"
3. Thévenin Dominique, Janiga Gábor; "Optimization and Computational Fluid Dynamics"
4. Date Anil Waman; "Introduction to Computational Fluid Dynamics"

Softwares:

1. PHOENICS
2. Fluent
3. Ansys CFX - 5

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ME1924	Design Optimization Techniques	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course

UNIT 1 Introduction to optimization, classification of optimization problems, classical optimization techniques, Linear programming, simplex method and Duality in linear programming, sensitivity or post-optimality analysis, **[7hrs]**

UNIT 2 Non-Linear Programming: - One dimensional minimization, constrained optimization, direct and indirect methods **[8 hrs]**

UNIT 3 Geometric programming, unconstrained and constrained minimization, complimentary geometric programming, applications of geometric programming, **[8 hrs]**

UNIT 4 Dynamic programming, multistage decision process, concept of sub optimization and principle of optimality, continuous dynamic programming **[7 hrs]**

UNIT 5 Optimum design of tension bar, stepped bar, links connected to other elements by pins, beams, shafts, stepped shafts, shafts with keyways **[7 hrs]**

UNIT 6 Optimum design of members subjected to both bending and twisting, cams, spur gears, pressure vessels **[7 hrs]**

Reference Books:

1. S.S.Rao," Optimization theory and applications" Willey Eastern Ltd
2. J. S. Arora, "Introduction to Optimum Design", McGraw Hill, New York, 1989.
3. L.C.W. Dixon, "Non-Linear Optimisation - Theory and Algorithms", Birkhauser, Boston, 1980.
4. R.J. Duffin, E.L. Peterson and C.Zener "Geometric Programming-Theory and Applications", Willey, New York, 1967.
5. G.B. Dantzig "Linear Programming and Extensions Princeton University Press", Princeton, N. J., 1963.
6. R. Bellman "Dynamic Programming-Princeton" University Press, Princeton, N.J. 1957.
7. R.C. Johnson, "Optimum Design of Mechanical Elements", Willey, New York, 1980.
8. S. S. Stricker, "Optimising performance of energy systems" Battelle Press, New York, 1985.

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ME1925	Rapid Prototyping		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT - I INTRODUCTION

CAD-CAM and its integration, Development of CAD CAM., The importance of being Rapid, The nature of RP/T, The state of RP/T industry. Rapid Prototyping Defined. Time compression Technologies, Product development and its relationship with rapid prototyping.

UNIT - II PROCESS CHAIN FOR RAPID PROTOTYPING

Data Preparation (Pre-processing), Part Building, Post Processing. CAD Model Preparation, Reverse Engineering and CAD model, Digitizing Techniques: Mechanical Contact Digitizing, Optical Non-contact Measurement, CT Scanning Method, Data Processing for Surface Reconstruction.

Data interface for Rapid Prototyping: STL interface Specification, STL data generation, STL data Manipulation, Advantages and limitations of STL file format. Open files. Repair of STL files. Alternative RP interfaces.

Part orientation and support generation: Factors affecting part orientation, various models for part orientation determination, the function of part supports, support structure design, Automatic support structure generation.

UNIT - III MODEL SLICING AND CONTOUR DATA ORGANIZATION

Model slicing and skin contour determination, Identification of external and internal contours, Contour data organization, Direct and adaptive slicing: Identification of peak features, Adaptive layer thickness determination, Skin contour computation. Tool path generation.

Part Building: Recoating, parameters affecting part building time, part quality.

Post Processing: Part removal, finishing, curing.

Other issues: Shrinkage, Swelling, Curl and distortion, Surface Deviation and accuracy, Build Style Decisions,

UNIT – IV RAPID PROTOTYPING MACHINES

Classification, Description of RP Machines: SLA, SLS, FDM, 3D Printing, LOM, SDM, Contour Crafting

UNIT – V RAPID TOOLING AND MANUFACTURING

Classification of RT Routes, RP of Patterns, Indirect RT: Indirect method for Soft and Bridge Tooling, Indirect method for Production Tooling, Direct RT: Direct RT method for Soft and Bridge Tooling, Direct method for Production Tooling, Other RT Approaches. Rapid Manufacturing: Methods, limitations.

UNIT – VI APPLICATION OF RP

Heterogeneous objects, Assemblies, MEMES and other small objects, Medicine, miscellaneous areas including art.

BOOKS RECOMMENDED

1 Bjorke, Layer Manufacturing, Tapir Publisher. 1992.
2 Jacobs, PF (Ed), Rapid Prototyping and Manufacturing, Society of Manuf. Engrs, 1992.
3 Burns, M., Automated Fabrication: Improving Productivity in Manufacturing, 1993.
4 Jacobs, P.F. (Ed.), Stereo lithography and Other RP&M Technologies: From Rapid Prototyping to Rapid Tooling, Society of Manuf. Engrs. NY, 1996.
5 Chua C. k. and L. K. Fai, Rapid Prototyping: Principles and Applications in Manufacturing.
6 Gibson, I. (Ed.), Software Solutions for Rapid Prototyping, Professional Engineering Publications, London., 2002.

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ME1926	Design for Manufacturing and Assembly		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT- I INTRODUCTION: [6 hrs]

Design philosophy steps in Design process — General Design rules for manufacturability — basic principles of design Ling for economical production — creativity in design. Materials: Selection of Materials for design Developments in Material technology -- criteria for material selection — Material selection interrelationship with process selection process selection charts.

UNIT II: METAL CASTING: [7 hrs]

Appraisal of various casting processes, selection of casting process, - general design considerations for casting — casting tolerances — use of solidification simulation in casting design — product design rules for casting.

UNIT III: MACHINING PROCESS: [9 hrs]

Overview of various machining processes -- general design rules for machining - Dimensional tolerance and surface roughness — Design for machining — Ease — Redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT IV: METAL JOINING: [8 hrs]

Appraisal of various welding processes, Factors in design of weidments — general design guidelines — pre and post treatment of welds — effects of thermal stresses in weld joints — design of brazed joints. Forging — Design factors for Forging — Closed die forging design — parting lines of die5 drop forging die design — general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, and Deep Drawing— Keeler Goodman Forming Line Diagram — Component Design for Blanking.

UNIT-V ASSEMBLY : [8hrs]

Assemble Advantages: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.

Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

UNIT-VI: DESIGN OF MANUAL ASSEMBLY [7 hrs]

Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

TEXTBOOK:

1. Geoffrey Boothroyd, "Assembly Automation and Product Design", Marcel Dekker Inc., NY, 1992.
2. Engineering Design – Material & Processing Approach – George E. Deiter, McGraw Hill Intl. 2nd Ed. 2000.

REFERENCE BOOKS:

1. Geoffrey Boothroyd, "Hand Book of Product Design" Marcel and Dekken, N.Y. 1990.
2. A Delbainbre "Computer Aided Assembly London, 1992.

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ME1922	**PROJECT PHASE I**	**L=0**	**T=0**	**P=16**	**Credits=8**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
			100		**100**	

OBJECTIVES

As the project methodology for the batches is decided in the 2nd semester the student shall carry out the project work further 3rd semester. The project work consists of ;

1. A comprehend since and update survey of literature.
2. Study of processes /phenomenon related to project.
3. Design of any equipment its fabrication and testing.
4. Critical analysis of design or process for optimization
5. Verification by experimentation.
6. In case of industrial project the necessary modifications with the proper drawing / design suggested to the industry should be explained. The letter from the industry should be attached in the report related to the performance of the student.

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IV Semester

ME1931	PROJECT PHASE II	L=0	T=0	P=24	Credits=12

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			40	60	100	

Objectives:

As per the Project Phase 1, the students should carry out and submit the project work that include the implementation of all Semesters subjects knowledge with required validation and certification.

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YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

M. Tech. SoE and Syllabus 2014-15

Integrated Power System

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE - I	MSE - II	TA	ESE	
I SEMESTER												
1	EL1901	Advance Power Electronics	3	0	0	3	3	15	15	10	60	3
2	EL1902	Analog & Digital Protection	3	0	0	3	3	15	15	10	60	3
3	EL1903	Digital Control System	3	0	0	3	3	15	15	10	60	3
4	EL1904	HVDC Power Transmission	3	0	0	3	3	15	15	10	60	3
5	EL1905	Power System Modeling	3	0	0	3	3	15	15	10	60	3
6	EL1906	Lab: Analog & Digital Protection	0	0	3	3	1.5			40	60	
8	EL1907	Lab: Advance Power Electronics	0	0	3	3	1.5			40	60	
		Total	**15**	**0**	**6**	**21**	**18**					
II SEMESTER												
1	EL1911	Power System planning	3	0	0	3	3	15	15	10	60	3
2	EL1912	Application of Power Electronics to Power System	3	0	0	3	3	15	15	10	60	3
3	EL1913	Power Quality	3	0	0	3	3	15	15	10	60	3
4	**Professional Elective- I**		3	0	0	3	3	15	15	10	60	3
	EL1916	Electrical Drives and Controls										
	EL1918	Renewable Energy System										
5	**Lab: Professional Elective I**		0	0	4	4	2			40	60	
	EL1917	Lab: Electrical Drives and Controls										
	EL1919	Lab: Renewable Energy System										
6	**Professional Elective II**		3	0	0	3	3	15	15	10	60	3
	EL1920	Advanced Digital Signal Processing										
	EL1921	EHV Power Transmission										
	EL1922	Restructuring of Power System										
7	EL1914	Power System Simulation	0	0	4	4	2			40	60	
8	EL1915	Seminar	0	0	2	2	1			100		
		Total	**15**	**0**	**10**	**25**	**20**					
III SEMESTER												
1	**Professional Elective - III**		3	0	0	3	3	15	15	10	60	3
	EL1933	Power System Stability										
	EL1934	Electrical Distribution Systems										
	EL1935	Power System Operation and Control										
	EL1936	Transients in Power Systems										
2	**Professional Elective - IV**		3	0	0	3	3	15	15	10	60	3
	EL1937	Distributed Automation										
	EL1938	Power Electronics for Renewable Energy Systems										
	EL1939	Control System Design										
3	EL1931	Power System Design	0	0	4	4	2			40	60	
4	EL1932	Project Phase -I	0	0	16		8			100		
		Total	**6**	**0**	**20**	**10**	**16**					
IV SEMESTER												
1	EL1941	Project Phase-II	0	0	20	24	12			40	60	
		Total	**0**	**0**	**20**	**24**	**12**					
		Grand Total of Credits					**66**					

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Integrated Power System

First Semester

EL1901	Advance Power Electronics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To study power semiconductor devices and circuits and their applications

UNIT-1:Power Semiconductor Devices
Overview of power semiconductor devices SCR ,IGBT ,MOSFET ,IGCT their characteristics protection

UNIT-2:DC to DC Converters
Buck, Boost, Buck-Boost, Cuk and switch mode power supply (SMPS).

UNIT-3:Pulse Width Modulation
Types of PWM,SPWM,SVPWM and RPWM. Voltage & Frequency control of inverter.

UNIT-4:Inverters
Principle of Operation, Performance parameters, series and parallel inverter, single phase and three phase bridge inverters and their voltage Control, Harmonic Reduction, types of PWM techniques, different methods to control output voltage.

UNIT-5 : Advanced Converters
Multi level converter,Multi pulse converter , Resonant converters, Three-phase to three phase Matrix converter, Front end rectifier.Resonant converter (Types of resonant converter)

UNIT-6 :Design of converters
Magnetic circuit ,active elements, passive elements

Text books:

1	Power Electronics Circuits Devices application	1994	M.H. Rashid	PHI
2	Modern Power Electronics		P. C. Sen	A. H. Wheeler Publishing Co.
3	Power Electronics	1993	P S .Bimbhra	Khanna Publishers
4	IEEE/IEE Publication			

Reference books:

1	Power Electronics	1993	Cyril W Lander	MHL
2	Power Electronics	1998	M.D Singh & K.B. Khanchandani	TMH
3	Power Electronics		Ned Mohan, Tora M. Udeland, William P. Robbins	John Wiley & sons

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EL1902	Analog & Digital Protection	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To study analog protection and digital protection.

UNIT-1:EHV line Protection
Relay coordination using over current relay, Drawback of over current relay, Distance protection of three phase lines, carrier aided schemes. Stability of protection on power swing.

UNIT-2: **Transformer & Machine Protection**
Various fault occurring on transformers, alternators & large motors & complete protection against these fault.

UNIT-3: Basic elements of Digital Protection
Evolution of digital relays from electromechanical relays , Performance & operational characteristics of digital protection, Basic elements of digital protection, Signal conditioning, transducers, surge protection, analog filtering, analog multiplexer.
Conversion system- Sampling theorem, signal aliasing error, sample & hold circuit, multiplexer, analog to digital conversion, digital relay as a unit .
Digital filtering system- Low pass, High pass, FIR &IIR Filters.

UNIT-4 : Algorithms-I
Sinusoidal wave based algorithm, first & second derivative method, two sample & three sample technique.

UNIT-5: Algorithms-II
Fourier analysis &Fourier transform based algorithm.
Walsh function based algorithm, Differential equation based technique.

UNIT-6: Algorithm-III
Incident & reflected wave, coefficient of reflection, superimposed quantities & their properties & polarity versus fault location, reverse & forward faults, elliptical trajectory, Bergerons equation, discriminant function for single phase lines.
Recent advances-Synchrophasors & Wavelet analysis.

Text books:

1	Fundamentals of Power System Protection 2005	Y.G.Paithankar&S.R.Bhide	Prentice Hall of India
2	Digital Protection for power system	A.T.Johns&S.K.Salman	Peter Peregrinus Ltd.

Reference books:

1	Power System Protection	Ungradetal	Marcel Dekker Pub
2	Transmission Network Protection	Y.G.Paithankar	Marcel Dekker Pub
3	Power System Protection (Static Relays)	T.S. MadhavaRao	Tata McGraw-Hill,
4	English Electric Relay Application Guide		
5	IEEE/IEE Publications		

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EL1903	Digital Control System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand the advance concepts in control system.

UNIT-1:Introduction
Revive of state variable analysis, types of sampling operations, Sample and Hold operations, Sampling theorem, Basic discrete time signals, Discretisation of continuous time system.

UNIT-2:Analysis of Digital Control Systems and Stability Methods
Z-Transforms, Properties of Z-Transform, Inverse Z-Transforms, Pulse Transfer Function, Difference equations, Z-Transform method for solving the difference equations, Block diagram and signal flow graph analysis, Time response of digital control systems. Mapping between s-plane and z-plane, stability methods: Modified Routh's Criterion, Jury's method, Lyapunov stability analysis.

UNIT-3:Models of Control Systems
Problem of pole placement, effect of addition of poles & zeros to open loop transfer function, design of Digital compensator using root locus plots.

UNIT-4:State Variable analysis of Digital Control Systems
State variable description of digital control systems, conversion of state variable models to transfer function and vice versa, solution of state difference equations, controllability and observability, design of state feedback and state estimation.

UNIT-5:PID control
Conventional tuning methods such as Ziegler Nichols methods, Refined zeigler Nichols method etc., Introduction to optimization methods for tuning of PID controller; Particle swarm optimization (PSO), Genetic Algorithms (GA) etc.

UNIT-6:Optimal and Robust control system design
Review of optimal control, Linear Quadratic Regulators (LQR), LQR tracking problem, H_2-optimal control, H_∞-optimal control, Introduction to multivariable robust controls.

Text books:

1	Digital Control and State Variable Methods	M. Gopal	Tata Mc-Graw-Hill
2	Discrete Time Control Systems	K.Ogata	Pearson Education,(Singapore) (Thomson Press India).
3	Digital Control Systems	B.C Kuo	Prentice Hall
4	Optimal control: Linear Quadratic Methods	B.D.O. Anderson	Dover publications
5	Robust control design & optimal control Approach	Senglin	John Wiley & sons

Reference books:

1	Control System Engg	I.J. Nagrath&M.Gopal	John Wiley & sons
2	Control System Analysis and Design	K.K. Aggarwal	Khanna Publishers
3	Optimal Control	BDO Andersom, Moore	Dover Publications

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EL1904	HVDC Power Transmission	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To learn the principles of conventional High Voltage Direct Current Transmission and modern trends in it. Multiterminal HVDC systems are also studied. Also voltage source converter technology is introduced.

UNIT-1:Introduction to HVDC

Development of HVDC technology comparison between HVAC and HVDC, Applications of HVDC transmission, Type of DC transmission, Selection of converter configuration.

UNIT-2:Rectifier and inverter

Rectifier and inverter operation of Line commutated converters, Analysis of rectifier with two-valve condition, Analysis of rectifier with two-three valve conduction, Analysis of inverter with two valve conduction, Analysis of inverter with two-three valve conduction.Introduction to HVDC with Voltage Source Converters(VSC)

UNIT-3: Digital simulation

Digital simulation of converters, Generalized equation for simulation of converters, Derivation of converter equations with Two valve conduction, Three valve conduction.

UNIT-4:Control of HVDC converters and system

Requirements of control system for HVDC converter, Rectifier compounding, Inverter compounding, Converter control characteristics, Converter firing schemes: Individual phase control (IPC) , Equidistant pulse control (EPC), Draw backs of individual phase control, Draw backs of EPC, Higher level controls, power controllers, Characteristics & non characteristics harmonics, Different methods to overcome problem of non-characteristics Harmonics.,Filters.Starting and stopping of DC links.

UNIT-5 : Multiterminal HVDC system

Fault development and protection, Inter action between AC-DC power system, Over-voltage on AC/DC side Multi-terminal HVDC system, Control of MTDC system,

UNIT-6:Modeling of HVDC system

Per unit system representation for power flow solution, Representation for stability studies.Effect of HVDC Link on Stability. Faults and Protection of HVDC Systems. HVDC circuit breaker

Text books:

1	High voltage direct current transmission		J. Arrillaga	Peter Peregrinus ltd. London, U.K.
2	Direct Current Transmission (Vol.I)	1971	E. W. Kimbark	Wiley Interscience
3	HVDC power Transmission Systems	1990	K. R. Padiyar	Wiley Eastern Ltd.

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EL1905	Power System Modeling	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand the concept of modelling of Electrical equipment such as synchromous machines, transformer, transmission line etc.To understand the excitation system used for thermal power generator. Students also learn the load modelling.

UNIT-1: General Background

Evolution of electric power system, structure of power system, power system control, design and operating criteria for stability.

Power System stability Problems

Basic Concepts & definition, rotor angle stability, voltage stability & Voltage collapse, mid-term & long term stability, Classification of Stability.

UNIT-2:Synchronous Machine Modeling I

Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation.

UNIT-3 : Synchronous Machine Modeling II

Per Unit Representations: The Park's transformation, power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values.

UNIT-4 : Excitation and prime-mover controllers

Excitation system, excitation system modeling, excitation system –standard block diagram, system representation by state equations, prime mover control system, examples.

UNIT-5 : Transformer modeling & the per unit system

Introduction, single phase transformer model , three phase transformer connection , per phase analysis, p.u. normalization, p.u. three phase quantities, p.u. analysis of normal system , regulating transformer for voltage & phase angle control.

UNIT-6:Load modeling

Basic load- modeling concept, static load models, dynamic load model, modeling of I.M., acquisition of load model parameters.

Transmission line Modeling

Introduction, derivation of terminal V,I relations, waves on transmission lines, transmission matrix, lumped circuit equivalent, simplified models, complex power transmission (short line,medium & long line, Radial line).

Text books:

1	Power System Stability and Control	1993	P. Kundur	McGraw-Hill
2	Dynamic Models for Steam and Hydro Turbines in Power System Studies			IEEE Committee Report
3	Power System Control and Stability	1978	P.M Anderson and A.A Fouad	Iowa State University Press, Ames, Iowa

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EL1906	Lab: Analog & Digital Protection	L=0	T=0	P=3	Credits=1.5

Evaluation Scheme	TA	ESE	Total
	40	60	100

Objective: To study/ perform the practicals based on syllabus

1. To plot the characteristic of IDMT relay ICM 21N.
2. To plot the characteristic of directional relay with calculation of maximum torque angle.
3. To plot the characteristic of reactance relay.
4. To plot the characteristic of impedance relay.
5. To plot the characteristic of fuse wire.
6. To study the differential protection of single phase transformer.
7. To study mho relay & offset mho relay.
8. To study the undercurrent & overcurrent relay.
9. To study the harmonic restraint effect on differential relay.
10. To plot the characteristic of earth fault relay.
11. To study undervoltage relay.
12. To study air circuit breaker.
13. To study MICOM P430 distance protection relay.
14. Study of relay co-ordiantion using SKM Power tools software.

Practicals based on MATLAB:-

15. To calculate peak value by full cycle window (Fourier Analysis)
16. To calculate peak value by half cycle window(Fourier Analysis)
17. Analytical Analysis by two sample method
18. Analytical Analysis by three sample method
19. Analytical Analysis by sample and derivative method
20. Analytical Analysis of first and second derivative method
21. To calculate peak values by Walsh coefficient
22. To calulate walsh function

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EL1907	Lab: Advance Power Electronics	L=0	T=0	P=3	Credits=1.5

Evaluation Scheme	TA	ESE	Total
	40	60	100

Objective: To study/ perform the practical based on syllabus

Advanced power electronics Laboratory
The list of practical will be according to the syllabi of Advanced power Electronics

Second Semester M.Tech (I.P.S.)

EL1911	Power System Planning	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand the load forecasting for the planning of power generation. To do the generation planning considering reliability, environmental aspects. Students also understand how to design the optimal power availability .

UNIT-1: Introduction

Introduction of power planning, National and Regional Planning, structure of P.S., planning tools, Electricity Regulation

UNIT-2: Load Forecasting & Generation Planning

Electrical Forecasting, forecasting techniques modeling. Generation planning, Integrated power generation cogeneration/captive power, Power pooling and power trading.

UNIT-3 : Transmission planning and Power System Economics

Transmission and distribution planning, Power system Economics, Power sector finance, financial planning, private participation Rural Electrification investment, concept of Rational tariffs.

UNIT-4: Reliability

Power supply Reliablity, Reliability planning, Reliability evaluation, Functional zones, Generation reliability, Generation & Transmission reliability, Quality of Supply.

UNIT-5 : System Operation & Environmental Aspects in Planning

System operation planning, load management, load prediction, reactive power balance, online power flow studies, state estimation, computerized management, power system simulator.

Computer aided planning, wheeling, Environmental effects, Greenhouse effect, Technological impacts, Insulation coordination, Reactive compensation.

UNIT-6:

Optimal Power Calculation

Solution of optimal power flow using gradient & newton method, linear programming method, security constraint, optimal power flow, formulation of least cost optimization problem incorporating capital operating and maintenance cost.

Text books:

1	Electrical Power System Planning	**Edition (Year of publication)**	A.S.Pabla	Macmillan India Ltd.
2	Power Generation, Operation & Control	**2011**	Allen J. Wood, B.F. Wollenberg	Wiley India, Reprint
3	Modern Power System Analysis	**4th Edition**	D.P. Kothari, I.J. Nagrath	Tata Mcgraw Hill Education Pvt. Ltd.

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Integrated Power System

EL1912	Application of Power Electronics to Power System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand how the constraints of the AC power transmission can be solved and performance of AC transmission can be enhanced by different FACTS controllers. The objective is also study comprehensively different FACTS controllers like shunt, series, shunt-series and phase angle regulators.

UNIT-1:Introduction

Introduction of Semiconductor Devices , Steady state and Dynamic Problems in AC Systems, Flexible AC transmission system : Introduction , types of Facts controllers.

UNIT-2:Shunt FACT Controllers

TCR(Thyristor Controlled Reactor) , TSC(Thyristor Switched Capacitor) ,FC-TCR(Fixed Capacitor - thyristor controlled reactor),TSC-TCR(Thyristor Switched Capacitor Thyristor switched Capacitor),Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of svc for power flow and transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping – Prevention of voltage instability.

UNIT-3 : Series FACT Controller

TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping-SSR Mitigation, TSSC, GCSC.

UNIT-4: Converter based Shunt and Series controllers

STATCOM – Different modes of operation of working, different control strategies. Comparison with Static VAR Compensator (SVC). Different advantages and the constraints.

SSSC- Introduction, Inductive and the capacitive modes of operations. Different control strategies. Comarison with Thyristor based series controllers. Constraints of the SSSC

UNIT-5:Phase Shifter and Phase angle Regulator

TCPAR, TCVR, Voltage Controlled Source Based Phase Shifter and Angle Regulator, Introduction working and control strategies.

UNIT-6 :Other FACTS Controller

UnifiedPower Flow Controller(UPFC), Interline Power Flow Controller(IPFC): Introduction ,Controlled Strategies and Application

Text books:

1	Thyristor – Based Facts Controllers for Electrical Transmission Systems	R.MohanMathur, Rajiv K.Varma	IEEE press and John Wiley & Sons, Inc
2	Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems	Narain G. Hingorani	Standard Publishers Distributors, Delhi
3	FACTS Controllers in Power Transmission and Distribution	K.R.Padiyar	New Age International(P) Limited, Publishers, New Delhi

Reference books:

1	Flexible A.C. Transmission Systems	1999	A.T.John	Institution of Electrical and Electronic Engineers (IEEE)
2	HVDC and FACTS controllers – Applications of Static Converters in Power System	APRIL 2004	V.K.Sood	Kluwer Academic Publishers

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Dean (Acad. Matters)		Version		

EL1913	Power Quality	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: The objective is to understand the different power quality problems, its causes, effects and various mitigating custom power devices. Further the subject is concentrated to analyse the different control strategies and algorithm.

UNIT-1:Introduction

Introduction – Characterisation of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

UNIT-2:Non Linear Loads

Single phase / Three phase static converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

UNIT-3: Measurement and Analysis Method

Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace's, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

UNIT-4:Analysis and Conventional Mitigation Methods

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices.

UNIT-5 : Voltage Sag

Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

UNIT-6:Power Quality Improvement

Utility-Customer interface –Harmonic filters: passive,–Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC – control strategies: P-Q theory, Synchronous detection method – Custom power park – Status of application of custom power devices.

Text books:

1	Power Quality Enhancement Using Custom Power Devices	2002	ArindamGhosh	Kluwer Academic Publishers
2	Electric Power Quality	1994(2nd edition)	G.T.Heydt	Stars in a Circle Publications
3	Power Quality	**Edition (Year of publication)**	R.C. Duggan	**Publisher**

Reference books:

1	Power system harmonics	A.J. Arrillga	**Publisher**
2	Power electronic converter harmonics	Derek A. Paice	**Publisher**
3	**Title of the book**	**Author(s)**	**Publisher**

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Integrated Power System

EL1916	Electrical Drives And Controls	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:: To understand the mathematical modeling of drives and the latest technology. Stress is given on Vector control, space vector modulation control of induction motor and synchronous motor. Adaptive control and introduction to fuzzy and neural control of drives is introduced.

UNIT-1:**Analysis of DC Motor:** State variable representation of seperately excited DC motor and DC shunt motor, Converters for DC drives,Average value analysis of DC drive.Machine control with voltage controlled converter, Machine control with current controlled converter.

UNIT-2:**- Analysis of Induction Motor:**
Reference frame theory, Balanced Set,Transformation of resistance and flux linkages, Theory of symmetrical Induction motor, voltage and torque equations in machine variables and their transformation to arbitrary reference frame, state vector representation of the equations, free acceleration characteristics,

UNIT-3: **Induction motor control systems**
Voltage Source Inverter Drive with PWM,Current Source Inverter Drive, Forced commutated inverter drive control of Induction motor, Flux Vector control of Induction motors, Direct torque control.

UNIT-4:Synchronous motors Drives:
Synchronous machines equations in different reference frames,
Synchronous motor drives with sinusoidal waveforms, True Synchronous mode and Self controlled mode Load commutated inverter drives
Synchronous motor drive with trapezoidal waveforms(Brushless DC motor).,Vector Control of Synchronous motors, Switched reluctance motor and its control.

UNIT-5 : Space vectors:
Stator space current, stator voltage space vector, stator flux linkage space vector, transformation of space vector coordinates from one reference frame to another. Space vector Modulation ,Control of Induction motor by Space vector Modulation.

UNIT-6:Digital Control of Drives
Adaptive control principles,Gainscheduling,Self tuning control,Model referencing adaptive control,Sliding Mode control,Idea of Fuzzy and Neural Control.
Necessity and Application of Digital signal processors to control of AC/DC Drives.BasicArchitectoure of Texas Instruments TMS320LF2407 processor,Programming methods
Idea of Field Programmable Gate Arrays(FPGA) Technology.

Text books:

1	Analysis of Electric Machinery		Paul, C. Krause	McGraw Hill
2	Modern Power Electronics and AC Drives		B.K. Bose	Prentice Hall
3	Texas Instruments TMS320LF2407 processor Manual			
4	Variable frequency AC motor Drive system		David Finney	IEE Press
5	Control of Electrical Drives	1996	W. Leonhard	Springer Verlag
6	Electric Drive		VedamSubramanyam	Tata McGraw Hill

Reference books:

1	High-Power Converters and AC Drives	2006	Bin Wu	Wiley & IEEE Press
2	Power Electronics, Converters, Applications and Design	3rd Edition	Ned Mohan, T. M. Undeland, W. P. Robbins	Media Enhanced
3	'Power Semiconductor Controlled Drives	1989	G.K. Dubey	Prentice Hall, N. Jersey
4	Electric Drives	2002	Krishnan	Prentice Hall of India

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EL1917	Lab Electrical Drives and control	L=0	T=0	P=3	Credits=1.5

Evaluation Scheme	TA	ESE	Total
	40	60	100

List of Practicals

1. Study of program written in C to generate Pulse width modulated pulses with DSP
2. Closed Loop Speed control of separately excited D.C. motor
3. Closed Loop Speed control of Brushless DC motor
4. Closed Loop Speed control of Induction motor
5. Vector control of Induction motor
6. Control of Switched Reluctance motor with DSP program
7. To study the Simulation of DC Drive in MATLAB
8. To study the Simulation of Vector Control in MATLAB

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EL1918	Renewable Energy System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To study the major renewable energy sources including solar, wind, Biomass for different applications.

UNIT-1:Introduction to Energy Sources

World Energy Futures, Conventional Energy Sources, Renewable Energy Sources, Prospects of Renewable Energy Sources. Environmental aspects of Electrical Energy Generation.

UNIT-2:Solar Energy -

a) Introduction to Solar Radiation and its measurement, Introduction to Solar Energy Collectors and Storage.

b) Applications of Solar Energy: Solar Thermal Electric Conversion, Thermal Electric Conversion Systems, Solar Electric power Generation

Solar Photo- Voltaics, Solar Cell Principle, Semiconductor Junctions, Conversion efficiency and power output, Basic Photo Voltaic System for Power Generation. Solar photovoltaic modules, maximum power point tracking and algorithms

UNIT-3: Wind Energy:

a) Introduction to wind energy Conversion, the nature of the wind, Power in the wind.

b) Wind Energy Conversion: Wind data and energy estimation, Site Selection Considerations, Basic Components of a Wind Energy Conversion System, Classification of WEC Systems, Schemes for Electric Generation using Synchronous Generator and Induction Generator, Wind energy Storage.

UNIT-4:Direct Energy Conversion Processes (Overview) :

a) Information on Magneto Hydro Dynamic Power Generation:

b) Thermo-Electric Generation: Basic principles of thermo-electric powergeneration, Seebeck, Peltier, Thomson effects, Thermo-Electric power generator, Analysis, materials.

c) Thermionic Generation: Thermionic emission and work function, Basic thermionic generation.

d) Fuel Cells H_2O_2**C**ell, Classification of fuel Cells, Types, Advantages, Electrodes, Polarization.

e) Thermo Nuclear Fusion Energy: The basic Nuclear Function and Reactions Plasma Confinement, Thermo Nuclear function Reactions.

UNIT-5 : Energy from Biomass:

a) Introduction: Biomass conversion technologies, photosynthesis, Bio-gas generation, types of bio-gas plants.

b) Biomass as a Source of Energy: Method for obtaining energy from Bio-mass, Biological Conversion of Solar Energy.

UNIT-6:

Applications of Renewable energy

Wind Farms: Grid interfacing of wind farm, methods of grid connection, grid system and properties. Small hydro power, Hybrid systems: Wind- solar, wind photovoltaic etc,

Text books:				
1	Non-Conventional Sources of Energy	4th Edition, 2010	G.D. Rai	Khanna Publishers
2	Non Conventional Energy Sources	2nd Edition.2009	B. H. Khan	The McGraw Hill Companies
3	Renewable energy sources and conversion technology	1990	N.K. Bansal, M. Kleemann, M. Heliss	Tata McGraw Hill
Reference books:				
1	Direct Energy Conversion		R. A. Coombie	Pitman
2	Renewable energy sources and emerging technologies	1st Edition,2008	D. P. Kothari	PHI
3	Related IEEE/IEE Publications			

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EL1919	Lab : Renewable Energy System	L=0	T=0	P=3	Credits=1.5

Evaluation Scheme	TA	ESE	Total
	40	60	100

List of Practicals

EL1920	Advanced Digital Signal Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:

UNIT-1:Introduction

Mathematical description of change of sampling rate – Interpolation and Decimation, Filter implementation for sampling rate conversion – direct form FIR structures, DTFT, FFT, Wavelet transform and filter bank implementation of wavelet expansion of signals

UNIT-2:Estimation Techniques

Discrete Random Processes – Ensemble averages, Stationary processes, Autocorrelation and Auto covariance matrices, Parseval's Theorem, Wiener-Khintchine Relation – Power Spectral Density**,** AR, MA, ARMA model based spectral estimation, Parameter Estimation,

UNIT-3: **Prediction Techniques**

Linear prediction – Forward and backward predictions, Least mean squared error criterion – Wiener filter for filtering and prediction, Discrete Kalman filter.

UNIT-4:Digital Signal Processor

Basic Architecture – Computational building blocks, MAC, Bus Architecture and memory, Data Addressing, Parallelism and pipelining, Parallel I/O interface, Memory Interface, Interrupt, DMA.

UNIT-5 : APPLICATION OF DSP

Design of Decimation and Interpolation Filter, FFT Algorithm, PID Controller, Application for Serial Interfacing, DSP based Power Meter, Position control.

UNIT-6:VLSI IMPLEMENTATION

Basics on DSP sytem architecture design using VHDL programming, Mapping of DSP algorithm onto hardware, Realisation of MAC & Filter structure.

Text books:

1	Adaptive Signal Processing	Third edition, 2004	Bernard Widrow, Samuel D. Stearns	Pearson Education
2	Statistical & Adaptive signal processing, spectral estimation, signal modeling, Adaptive filtering & Array processing	2000	**Author(s)**	McGraw-Hill International
3	Statistical Digital Signal Processing and Modelling	**Edition (Year of publication)**	Monson H. Hayes	John Wiley and Sons, Inc

Reference books:

1	Digital Signal Processing	2002	John G. Proaks, Dimitris G. Manolakis	Pearson Education
2	Digital Signal Processing		S. Salivahanan, A. Vallavaraj and C. Gnanapriya	TMH
3	Digital Signal Processing- Implementation using DSP Microprocessors with Examples from TMS320C54xx	**2004**	Avatar Sing, S. Srinivasan	Thomson India
4	DSP Integrated Circuits	1999	Lars Wanhammer	Academic press, New York
5	Digital Signal Processing: A Modern Introduction	2007	Ashok Ambardar	Thomson India edition, 2007.

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Integrated Power System

EL1921	EHVAC Power Transmission	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: Mention the objectives of the course here. Not more than 5 lines

UNIT-1:Introduction

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

UNIT-2:Calculation of Line Parameters

Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

UNIT-3: Voltage Gradients Of Conductors

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

UNIT-4:Corona Effects-I :

Power losses and audible losses: I^2R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference.

UNIT-5 : Corona Effects – II :-

Corona pulses (their generation and properties),Frequency spectrum,Properties of pulse trains and filter response ,Limits for radio interference fields ,the CIGRE formula,The RI excitation functionProcedure for obtaining excitation fudnction from CIGRE Formula,Design of filter, television Interference.

UNIT-6:Electrostatic Field Of EHV Lines

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference.

Text books:

1	Extra High Voltage AC Transmission Engineering	Second Edition, 1990	Rakosh Das Begamudre	New Age International Pvt. Ltd
2	Power Engineer's Handbook	6th Edition, Oct. 2002		TNEB Engineers' Association
3	Microtran Reference Manual www.microtran.com		Microtran Power System Analysis Corporation	

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EL1922	Restructuring of Power System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1:Deregulation of Electricity Market

uction to Power System Deregulation, Reform Motivations, Traditional Model, Separation of Ownership, Competition and Direct Access in the Electricity Market, Role of ISO, Retail Market, International Experiences

UNIT-2:Electricity Market Characteristics

Access and Power Wheeling, Pool & Bilateral trading, Bidding and Auction Mechanisms, Market Timing, Sequential and Simultaneous Markets, Scheduling, Gaming, Congestion and its Management

UNIT-3: Transmission Open Access

mission Open Access, Transmission Pricing, Impact of Congestion and Management, ATC and Factors affecting ATC, Determination of ATC, Ancillary Services and their management, Electricity Bill 2003 and its impact.

UNIT-4 Optimal Power Flow

and its Formulation, Constraints, Different solution Techniques, Non Linear Programming (NLP) and Genetic Algorithm with simulation

UNIT-5: SCADA and Distribution Automation

)A & Distribution Automation, Energy management system

UNIT-6: Power System Communication

r system communication, PLCC, Digital Communication, Utility communication architecture, Web based technologies,.

Text books:

1	Power System restructuring and deregulation	2001	Loi Lei Lai	John Wiley and Sons, UK.
2	Operation of Restructured Power Systems	2001	K. Bhattacharya, MHT Bollen and J.C Doolder	Kluwer Academic Publishers, USA
3	Power System Operation and Control		A.J Wood and B.F Wollenberg	John Wiley and Sons

Reference books:

1	Computational Methods for large Sparse Power System Analysis: An Object Oriented Approach	**Edition (Year of publication)**	S.A Soman, S.A Khafasok, ShubhaPandit	Kluwer Academic Publishers

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EL1914	Power System Simulation	L=0	T=0	P=4	Credits=2

Evaluation Scheme	TA	ESE	Total
	40	60	100

Development of algorithms & flowcharts and digital simulation of the following using ETAP/MATLAB Software package:

1. Z-bus and Y-bus formulation
2. Load flow studies
3. fault analysis
4. Transient stability studies.

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EL1915	Seminar	L=0	T=0	P=2	Credits=1

Evaluation Scheme	TA	ESE	Total
	100		100

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Third Semester M. Tech (I.P.S.)

EL1933	**Power System Stability**	L=0	T=0	P=3	Credits=3

Evaluation Scheme	TA	ESE	Total
	40	60	100

Practices may be carried out on the following topics but are not limited.

- HVDC Transmission
- HVAC transmission.
- Steady state and transient stability.
- Voltage stability.
- Different fault analysis.
- Sub synchronous resonance.
- Reactive power compensation (shunt, series etc.).

Groups can be formed for some of the practical's consisting of four or five students for the following reasons to get every student involved in the practical

(a) Different voltages and different power ratings in some of the practical may be assigned to them.
(b) Various reactive power compensators etc.

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EL1934	ELECTRICAL DISTRIBUTION SYSTEMS	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand the various aspects of distribution including type of distribution system, voltage level, equipment's used, protection etc.

UNIT-1:Introduction to Distribution systems, Regulations, Electricity Act 2003, Energy conservation act-2001, electricity rules-2005, electricity authority regulations, distribution code, consumer values, consumer satisfaction, measurement standards of consumer satisfaction, Model distribution system.

Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor-Relationship between the load factor and loss factor - Classification of loads. Load, Management Strategies : Differential tariff, load staggering, interruptible load, supplies, maintenance of essential services, integrated system operation, use of captive generation & cogeneration in distribution network, distribution system measures, conservation.

UNIT-2:Feeders : Radial and loop types, Engineering considerations for voltage levels and loading, causes of unbalance and unequal drops. System analysis : Voltage drop and power loss calculations, manual methods of solution of radial networks, three-phase & non-three-phase primary lines load flow and symmetrical component applications.

UNIT-3: Voltage control : Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop calculations and compensations, Reactive power requirements, economic consideration & best location.

UNIT-4: Distribution System Reliability : Basic defination, Appropriate levels of distribution reliability, Series & Parallel System, Markov Processes, Distribution reliability Indices, System and customer based indices, load and energy based indices, usage of reliability indices.

UNIT-5 : Introduction to Distribution Automation, Data acquisition system and decentralized control, data acquisition and protection considerations of control panel. Circuit breaker, reclosers, sectionalizers, location of sectionalizers, fuses, low voltage and current limiting fuses, expulsion fuses, fuses applications considerations, lightning protection, disconnect switches, non load break disconnect switches, break disconnect switches., relays.

Earthing System: Earth and safety, nature of an earth electrode, earth conductor sized, design of earthing electrode, electrode earth resistance, temporary earthing, system earthing, line and substation earthing, substation earthing mat, consumer installation earthing.

UNIT-6: Substation :-Substation layout, selection criteria, voltage and spacing load, space and location, distribution substation protection needs, distribution substation construction methods, trends in distribution substation, insulation coordination, voltage regulation, distribution substation layout, one feeder substation, single bus substation, two transformer distribution substation, automatic switching, double bus substation, bus arrangements, fault, distribution substation protection, zones of protection, transformer and bus protection, feeder overcurrent protection, substation grounding.

Text books:

1	Electric Power Distribution	4th edition, 1997	A.S.Pabla, , .	Tata McGraw-Hill Publishing Company
2.	Electric Power Distribution System Engineering	2nd Edition 2008	Turan Gonen	CRC Press

Reference books:

1	A Text Book of Electric Power Distribution Automation	Edition (Year of publication)	K. Khedkar and Dr. G. M. Dhole,.	Laxmi Publications

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Integrated Power System

EL1935	Power System Operation and Control	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: Mention the objectives of the course here. Not more than 5 lines

UNIT-1:Load Forecasting

Introduction – Estimation of Average and trend terms – Estimation of periodic components – Estimation of Stochastic components : Time series approach – Auto- Regressive Model, Auto-Regressive Moving – Average Models – Kalman Filtering Approach – On-line techniques for non stationary load prediction.

UNIT-2:Unit Commitment

Constraints in unit commitment – Spinning reserve **–** Thermal unit constraints **–** Other constraints – Solution using Priority List method, Dynamic programming method - Forward DP approach Lagrangian relaxation method – adjusting .

UNIT-3: **Generation Scheduling**

The Economic dispatch problem – Thermal system dispatching with network losses considered – The Lambda – iteration method – Gradient method of economic dispatch – Economic dispatch with Piecewise Linear cost functions – Transmission system effects **–** A two generator system **–** coordination equations **–** Incremental losses and penalty factors-Hydro Thermal Scheduling using DP.

UNIT-4:Control of Power Systems

Review of AGC and reactive power control -System operating states by security control functions – Monitoring, evaluation of system state by contingency analysis – Corrective controls (Preventive, emergency and restorative) - Energy control center – SCADA system – Functions – monitoring , Data acquisition and controls – EMS system.

UNIT-5 : State Estimation

Maximum likelihood Weighted Least Squares Estimation: - Concepts - Matrix formulation - Example for Weighted Least Squares state estimation ; State estimation of an AC network: development of method **–** Typical results of state estimation on an AC network **–** State Estimation by Orthogonal Decomposition algorithm.

UNIT-6:Advance Measurements

Introduction to Advanced topics : Detection and Identification of Bad Measurements , Estimation of Quantities Not Being Measured , Network Observability and Pseudo **–** measurements **–** Application of Power Systems State Estimation .

Text books:

1	Electric Energy System Theory - an Introduction	**2002**	O.I.Elgerd	Tata McGraw Hill, New Delhi
2	Power System Stability and Control		P.Kundur	EPRI Publications, California
3	Power System Operation and Control		A.J Wood and B.F Wollenberg	John Wiley and Sons

Reference books:				
1	Computer Aided Power System Analysis and Control	**1984**	A.K.Mahalanabis, D.P.Kothari. and S.I.Ahson	Tata McGraw Hill publishing Ltd

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EL1936	Transients in Power Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: The insulation system be capable of withstanding such high normal system voltages, it should also be capable of withstanding transient overvoltage associated with external lighting discharges or internal switching operations without any outage.

UNIT-1:Travelling Waves On Transmission Line
Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

UNIT-2:Computation Of Power System Transients
Principle of digital computation – Matrix method of solution, Modal analysis,Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

UNIT-3 : Lightning, Switching And Temporary Overvoltages
Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

UNIT-4:Behaviour Of Winding Under Transient Condition
Initial and Final voltage distribution - Winding oscillation - traveling wave solution -
UNIT-5 : Transformer under Surge Condition
Behaviour of the transformer core under surge condition – Rotating machine – Surge in generator and motor

UNIT-6:
Insulation Co-Ordination
Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

Text books:

1	Electromagnetic transients in Power System	1996.	PritindraChowdhari	John Wiley and Sons Inc
2	Electrical Transients in Power System	1991	Allan Greenwood	Wiley & Sons Inc. New York
3	Surges in High Voltage Networks	1980	Klaus Ragaller	Plenum Press, New York

Reference books:

1	Extra High Voltage AC Transmission Engineering	Second edition,1980	Rakosh Das Begamudre	Newage International (P) Ltd., New Delhi
2	High Voltage Engineering	2004.	Naidu M S and Kamaraju V	Tata McGraw-Hill Publishing Company Ltd., New Delhi
3	. IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000			
	Very fast transient phenomena associated with Gas Insulated System'		CIGRE, Working Group 33/13-09 (1988)	

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EL1937	Distribution Automation	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: Mention the objectives of the course here. Not more than 5 lines

UNIT-1:Distribution Automation and the utility system
Introduction to Distribution Automation (DA), control system interfaces, control and data requirements, centralized (Vs) decentralized control, DA System (DAS), DA Hardware, DAS software.

UNIT-2:Distribution Automation Functions
DA capabilities, Automation system computer facilities, management processes, Information management, system reliability management, system efficiency management, voltage management, Load management.

UNIT-3:Communication Systems for DA
DA communication requirements, Communication reliability, Cost effectiveness, Data rate requirements, Two way capability, Ability to communicate during outages and faults, Ease of operation and maintenance, Conforming to the architecture of data flow.

UNIT-4:Communication systems used in DA
Distribution line carrier (Power line carrier), Ripple control, Zero crossing technique, telephone, cable TV, Radio, AM broadcast, FM SCA, VHF Radio, UHF Radio, Microwave satellite, fiber optics, Hybrid Communication systems, Communication systems used in field tests.

UNIT-5 : Technical Benefits
DA benefit categories, Capital deferred savings, Operation and Maintenance savings, Interruption related savings, Customer related savings, Operational savings, Improved operation, Function benefits, Potential benefits for functions, function shared benefits, Guide lines for formulation of estimating equations, Parameters required, economic impact areas, Resources for determining benefits impact on distribution system, integration of benefits into economic evaluation.

UNIT-6:Economic Evaluation Methods
Development and evaluation of alternate plans, Select study area, Select study period, Project load growth, Develop Alternatives, Calculate operating and maintenance costs, Evaluate alternatives, Economic comparison of alternate plans, Classification of expenses and capital expenditures, Comparision of revenue requirements of alternative plans, Book Life and Continuing plant analysis, Year by year revenue requirement analysis, short term analysis, end of study adjustment, Break even analysis, Sensitivity analysis computational aids.

Text books:

1	A Text Book of Electric Power Distribution Automation	K. Khedkar and Dr. G. M. Dhole,.	Laxmi Publications
2	Electric Power Distribution	A. S. Pabla	Tata McGraw Hill Publication, New Delhi
3	Distribution Automation	IEEE Tutorial Course	

Chairperson		Date of Release	May 2014	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version		

EL1938	**Power Electronics for Renewable Energy Systems**	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To overview the different renewable energy system and generator usedand to understand their different configurations and topology. The objective is to study the various Grid interactive power converter topologies used in Wind and solar energy conversion system and their hybrid combination and the related power quality issues.

UNIT-1:introduction

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT-2:Electrical Machines For Renewable Energy Conversion

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT-3 : Power Converters

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing.

Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT-4:Analysis of Wind and PV Systems

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECSGrid Integrated solar system

UNIT-5 : Hybrid Renewable Energy System

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind- VMaximum Power Point Tracking (MPPT).

UNIT-6:Power Quality Issues of Grid Interfacing

Grid requirements for interconnections, transients developed due to connections / disconnections, voltage flicker, remedial measures for voltage flickers.

Text books:

1	power electronics Hand book	2001.	Rashid .M. H	Academic press,
2	Non conventional energy sources	1993	Rai. G.D	Khanna publishes,
3	Solar energy utilization	1993	Rai. G.D	Khanna publishes,

Reference books:

1	Wind energy system	1995	Gray, L. Johnson	prentice hall inc
2	Non-conventional Energy sources		B.H.Khan	Tata McGraw-hill Publishing Company,New Delhi
3	Modern Power Electronics and AC Drives		B. K. Bose	Prentice Hall PTR
	Analysis of Electric Machinery and Drive Systems		P. C. Krause, O. Wasynzuk, and S. D. Sudhoff	John Wiley & Sons, New York

Chairperson		Date of Release	May 2014	Applicable for AY 2013-14 Onwards
Dean (Acad. Matters)		Version		

EL1939	Control System Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course objectives

The theory of design of control system is particularly useful for various analytical design approaches in various power system problems. Students will study the time domain and frequency domain approach for linear time invariant systems. They shall be explored to design of discrete state variable and state estimation using observers and the optimal control methods are covered for specific systems.

Course Outcomes

Upon successful completion of this course you should be able to:
1) Design PID controller and compensators for practical systems 2) Understand time domain and frequency
3) domain interpretations of various controller 4) Apply the controller design methods for discrete systems
5) Design discrete state variable systems 6) Formulate the observer design procedures
7) Understand and solve the formulation of optimal control problems

UNIT-1: CONVENTIONAL DESIGN METHODS IN TIME DOMAIN

Design specifications, Fixed configuration design, Time domain interpretations of PI, PD and PID controllers and lead, lag and lag-lead compensators- Root locus based design, Design examples.

UNIT-2: CONVENTIONAL DESIGN METHODS IN FREQUENCY DOMAIN

Frequency domain specifications, Correlation between time and frequency domain, Frequency domain interpretations of PI, PD and PID controllers and lead, lag and lag-lead compensators, Design examples

UNIT-3 : DESIGN IN DISCRETE TIME DOMAIN

Design of Discrete-time control system by conventional methods: Introduction, Digital implementation of analog controller (PID and lead-lag controllers) : Digital controllers, Realization of pulse transfer function by direct, Cascade and parallel programming. Design based on root locus method. Dead beat controller.

UNIT-4 : DISCRETE DESIGN IN FREQUENCY DOMAIN

Mapping between S plane and Z plane, Bilinear transformation, Design based on frequency domain for PID and lag lead compensators. . Design examples

UNIT-5: DISCRETE STATE VARIABLE DESIGN

Discrete pole placement- state and output feedback-estimated state feedback, state feedback with integral control, State Estimation Problem -State estimation- Luenberger's observer and reduced order observer. Concept of Sliding Mode controller.

UNIT-6: OPTIMAL CONTROL

Formation of optimal control problems-Results of Calculus of variations- Hamiltonian formulation-solution of optimal control problems- Evaluation of Riccati's equation. State and output Regulator problems-- dynamic programming-Design examples.

Text books:

1	Modern control system Theory	2005	M. Gopal	New Age International
2	Digital control systems	2004	Benjamin C. Kuo	Oxford University Press
3	Discrete time control systems	2002	Katsuhiko Ogata	Pearson Education Asia
4	Control systems principals and design	2003	M. Gopal	TMH

Reference books:

1	Control system Design	2003	Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado	PHI (Pearson), 2003
2	Digital Control of Dynamic Systems	2002.	G. F. Franklin, J. D. Powell and M Workman	PHI (Pearson),

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Dean (Acad. Matters)		Version		

EL1931	**Power System Design**	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand various types of stabilities in power system, their analysis and means to overcome the instability.

UNIT-1: Introduction

Power System Operation and Control, power system stability, classification of stability, mid-term and long term stability, Impact on Power System Operation, classical representation of synchronous machine in a single machine infinite bus system (SMIB), limitations of classical model

Unit 2: Excitation and Prime Mover

Characteristics and types of excitation systems, IEEE type-I excitation system, Prime mover and energy supply systems, simulation of simple excitation system, power system stabilizers

UNIT-3: Steady state and transient characteristics of system

Phasor diagrams in terms of voltages Eq, Eq', and Vg for salient and non salient pole machines, Derivation of power expressions, saliency, Characteristics of system with generator operating at synchronous speed

UNIT4: Steady state stability

Steady state stability, characteristics, effect of damping, positive, negative resistance and turbine regulation, effect of induced currents in field winding, stability analysis with excitation

Unit 5: Transient stability

Transient stability, swing equation, equal area criterion, solution of swing equation, Numerical methods- Modified Euler's method, Runge-Kutta method, Multimachine stability, Extended equal area criterion

Unit 6: Voltage stability

Classification of voltage stability, voltage stability analysis: static and dynamic, comparison with angle stability, Voltage collapse, prevention of voltage collapse

Text books:		
1	Power System Stability and control	Prabha Kundur
2	Power System Stability Vol. I, II. III	Kimbark
3	Introduction to Electrical Energy System	O. I Elgerd
4	Power System Dynamics, Stability and Control	K.R. Padiyar
5	Computational Techniques for voltage stability assessment and control	Aijarapu V.

Reference books:		
1	Power System Stability Vol- I. II	Crary
2	Power System Analysis	Stevenson

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EL1932	Project Phase-I	L=0	T=0	P=16	Credits=8

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	100	0	100	

EL1941	Project Phase-II	L=0	T=0	P=24	Credits=12

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Sl. No.	Course Code	Course Title	Contact Hours					% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.	Credits	MSE-I	MSE-II	TA	ESE	
I SEMESTER												
1	EE1901	Advanced Digital Signal Processing	3	0	0	3	3	15	15	10	60	3
2	EE1902	Digital IC Design	3	0	0	3	3	15	15	10	60	3
3	EE1903	RISC & DSP Processor Architecture	3	0	0	3	3	15	15	10	60	3
4	EE1904	Advanced Digital System Design	3	0	0	3	3	15	15	10	60	3
5	EE1905	Advanced Communication Systems	3	0	0	3	3	15	15	10	60	3
6	EE1906	Lab: Advanced Digital Signal Processing	0	0	2	2	1			40	60	
7	EE1907	Lab: Digital IC Design	0	0	2	2	1			40	60	
8	EE1908	Lab: Advanced Digital System Design	0	0	2	2	1			40	60	
Total			**15**	**0**	**6**	**21**	**18**					
II SEMESTER												
1	EE1911	RF Circuit Design	3	0	0	3	3	15	15	10	60	3
2	EE1912	Soft Computing Techniques	3	0	0	3	3	15	15	10	60	3
3	EE1913	Digital Image Processing	3	0	0	3	3	15	15	10	60	3
4	**Professional Elective- I**		3	0	0	3	3	15	15	10	60	3
	EE1916	Analog IC Design										
	EE1917	Multirate signal Processing										
	EE1918	Low Power CMOS VLSI Design										
5	**Professional Elective- II**		3	0	0	3	3	15	15	10	60	3
	EE1919	Wireless Communication										
	EE1920	VLSI Signal Processing										
	EE1921	Verification & testing of VLSI Circuit										
6	EE1914	Lab : Digital Image Processing	0	0	2	2	1			40	60	
7	EE1915	Lab: RF Circuit Design	0	0	2	2	1			40	60	
8	EE1922	Seminar	0	0	2	2	1			100		
Total			**15**	**0**	**6**	**21**	**18**					

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III SEMESTER

1	**Professional Elective- III**		3	0	0	3	3	15	15	10	60	3
	EE1932	Wireless Sensor										
	EE1933	Biomedical Instrumentation										
	EE1934	Mixed signal VLSI Design										
	EE1935	Cryptography & Network Security										
2	**Professional Elective- IV**		3	0	0	3	3	15	15	10	60	3
	EE1936	Adaptive Signal Processing										
	EE1937	Embedded System & RTOS										
	EE1938	Advanced Computer Architecture										
	EE1939	Pattern recognition										
3	EE1931	Project Phase - I	0	0	16	16	8			100		
Total			**6**	**0**	**16**	**22**	**14**					

IV SEMESTER

1	EE1941	Project Phase - II	0	0	24	24	12	40	60	
Total			**0**	**0**	**24**	**24**	**12**			
Grand Total of Credits							**62**			

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EE1901	Advanced Digital Signal Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To acquaint students with advanced methods of digital signal processing and their application in practice. Design and testing of systems for advanced signal processing, aiming at optimum and adaptive noise reduction, identification and modeling of systems, reconstruction and restoration, analysis and classification of signals and images	• Graduates will be able to apply, solve and analyse Z transform, discrete Fourier transform & Fast Fourier Transform on DSP systems. • Graduates will understand and able to design and realize FIR and IIR filters using different methodologies. • Graduates will understand and able to do statistical and parametric analysis of the signals. • Graduates will understand and analyse multirate signal processing concepts.
Mapped Program Outcomes: a, d	

Unit I: LTI Discrete Time Systems in the Transform Domain

Transfer function classification based on Magnitude characteristics, Transfer function classification based on phase characteristics, Types of linear phase transfer functions, Simple Digital Filters, Complementary Transfer Functions, Inverse Systems, System Identification, Digital Two pairs, Algebraic Stability Test.

UNIT II: Digital Filter Structures

Block Diagram representation, Equivalent Structures, Basic FIR Digital filter structures, Basic FIR Digital filter structures, All pass Filters, Tunable IIR filters, IIR Tapped Cascaded Lattice Structures , IIR Tapped Cascaded Lattice Structures, Parallel All pass Realization Of IIR Transfer Functions, Digital Sine-Cosine Generator, Computational Complexity of Digital Filter Structures.

UNIT III: IIR Digital Filter Design and FIR Digital Filter Design

Preliminary Considerations, Bilinear Transformation Method of IIR Filter Design, Design of Lowpass IIR Digital Filters, Design of High pass, Band pass, and Band stop IIR Digital Filters, Preliminary Considerations, FIR Filter Design Based on Windowed Fourier Series, Design of linear phase, minimum phase FIR filters, Design of Computationally efficient FIR Digital filters.

UNIT IV: DSP Algorithm Implementation

Computation of Discrete Fourier Transform, Fast DFT Algorithms Based on index mapping, DFT and IDFT Computation, Sliding Discrete Fourier Transform, DFT Computation over a Narrow Frequency Band, Number representation, Arithmetic Operations, Handling of Overflow, Tunable Digital Filters.

UNIT V: Analysis of Finite Word length effect

The Quantization Process and Errors, Quantization of Fixed point Numbers, Quantization of floating point Numbers, Analysis of Coefficient Quantisation Effects, A/D conversion Noise Analysis, Analysis Of Arithmetic Round off Errors, Dynamic Range Scaling, Signal To noise ratio in low order IIR Filters, Low Sensitivity Digital Filters, Reduction of product round off errors using Error Feedback, Limit Cycles in IIR Digital Filters, Round Off Errors in FFT Algorithm.

UNIT VI: Multirate DSP

Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion, Polyphase filter structure.

Resources:

1. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata Mc Graw-Hill, 2008,3rd edition.
2. Digital Signal Processing. Principles, algorithms, and applications by John G. Proakis and Dimitris G.Manolakis, PHI, 1997.3rd edition
3. Oppenheim and Schafer, Discrete Time signal Processing, Prentice Hall, 2nd edition.
4. Theory and applications of digital signal processing by Lawrence R. Rabiner and Bernard Gold, PHI,1st edition

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1902 / EE1952	Digital IC Design	L= 3	T = 0	P = 0	Credits =3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The aim of this course is to give knowledge and skills in the area of CAD design of digital circuits, units and systems on currently usable VLSI chips.	• Graduates will able to demonstrate issues related to the development of digital integrated circuits including fabrication, circuit design, implementation methodologies • Graduates will able to Solve complex circuit problems and optimization techniques • Graduates will able to design CMOS combinational, sequential logic design
Mapped Program Outcomes: a, d	

Unit I: CMOS processing technology:
MOS transistors, CMOS logic, NAND gate, combinational logic, NOR gate, Compound gates, Pass transistor and transmission gates, tristates, multiplexers, latches and flip flops, inverter cross section, fabrication process, Layout design rules, CMOS processing technology, CMOS Process enhancements, stick diagram, VLSI design flow ,Euler path in a CMOS gate.

Unit II: MOS transistor theory:
MOS transistor theory, Working of nMOS enhancement transistor & PMOS enhancement transistor, Ideal Current voltage characteristics, threshold voltage , nonideal current voltage effects, velocity saturation, mobility degradation, channel length modulation, Body effect, sub-threshold conduction, Junction leakage, Tunnelling, Temperature dependence, Geometry dependence, Small signal AC characteristics, CMOS inverter DC transfer characteristics, Beta ratio effects, noise margin, Ratioed inverter transfer function, switch level RC delay models

Unit III: Circuit characterization and performance estimation:
Delay estimation, RC delay models, linear delay model, logical effort, parasitic delay, Delay in a logic gate, delay in a multistage logic networks, power dissipation, interconnect, design margin, Reliability, Scaling

Unit IV: Combinational circuit design:
Circuit families, static CMOS, Ratioed circuits, Cascode voltage switch logic, dynamic circuits, pass transistor circuits, differential circuits, sense amplifier circuits, BiCMOS circuits

Unit V: Sequential Circuit design:
Sequencing static circuits, Sequencing methods, Max-delay constraints, Min-delay constraints, Time borrowing, clock skew, circuit design of latches and Flip flops, static sequencing element methodology, Two phase timing types, characterizing sequencing element delays, sequencing dynamic circuits, Synchronizers.

Unit VI: Array subsystems:
Static Random access memory, Dynamic random access memory, serial access memories,Content addressable memory Programmable logic arrays.

Resources:
1. "CMOS VLSI design: A Circuits and Systems Perspective", Neil H. E. Weste, David F. Harris, A.Banerjee, 3rd Edition, Addison Wesley Publication, 2008
2. "CMOS Digital Integrated Circuits: Analysis and Design", Sung-Mo Kang, Yusuf Lebeleci, 3rd Edition, McGraw-Hill Publications, 2002

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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EE1903	**RISC & DSP Processor Architecture**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The aim of this course is to give knowledge and skills in the area of embedded system particularly RISC architecture & develop a system around processor core particularly ARM core. • Also this subject will provide knowledge about DSP Processors and associated hardware experimentation.	• Graduates will understand architectural details of ARM7, DSP processor & Embedded System. • Graduates will be able to demonstrate the Embedded based system design • Graduates will be able to interface various peripheral devices with processor to solve engineering problems.
Mapped Program Outcomes: a, b, d	

Unit - I
Introduction to Embedded Systems, RISC architecture, CISC architecture, Introduction to VLIW architecture, Von Neuman & Harward architecture, pipelining, MEMORY organization.

Unit - II
Architectural Features of ARM: Processor modes, Register organization, ARM exceptions, ARM and THUMB instruction sets, Programming, ARM development tools.

Unit - III
Pipeline ARM organisation, ARM instruction execution, Timing diagrams for data path, Co-processor interface, Hardware and software breakpoints, Exceptions and its handling, Memory faults.

Unit - IV
ARM architectural support for high level language programming, floating point data types, functions and procedures, Thumb instruction set, The ARM memory interface, the advanced buses: AMBA, ASB, APB, ARM Debugger.

Unit – V
Peripherals: Arm ADC, Real Time Clock, UARTs, SPI, Communication Protocols: I2C Bus, Control Area Network, Bluetooth

Unit – VI
DSP Architecture: MAC, Modified bus structures and Memory access schemes, multiple access Memory, Multi-ported memory, Pipelining, Special addressing modes, 32 bit floating point DSP Processor: architecture, block diagram, functional units, on chip memory, on chip peripherals.

Resources:
1. “ARM System-on-Chip Architecture”, Steve Furber ,2nd Edition, Pearson Education,2002
2. “Digital signal processors”,B. Venkataramani, M Bhaskar, 1st Edition, Tata McGraw Hill , 2002
3. “Embedded System Design”, Frank Vahid and Tony Givargis, 1st Edition, Wiely Publication, 2002
4. Technical reference manuals from TI
5. “ARM System Developer's Guide: Designing and Optimizing”, Sloss Andrew N, Symes Dominic, Wright Chris, Morgan Kaufman Publication.2004
6. Embedded Linux, Hardware, Software and interfacing 2002. Craig Hallabaugh Addison-Wesley Professional
7. “Embedded Systems: Architecture, Programming and Design” Raj Kamal 2nd Edition Tata McGraw-Hill Edication

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1904/EE1955	**Advanced Digital System Design**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design.	• Graduates will be able to design and analyse combinational and sequential logic circuits. • Graduates will understand hardware description language and able to design and simulate digital systems using different abstraction levels. • Graduates will be able to understand and apply timing issues in multiple contexts and design the circuit. • Graduates will understand programmable devices and able to design digital systems using modern design tools.
Mapped Program Outcomes: a, c, d	

Unit - I

Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs

Unit - II

HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module

Unit – III

Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog & Testbench, Compilation and synthesis, Timing analysis

Unit – IV

Data Flow Modelling, Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modelling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives

Unit - V

Behavioural Modelling, Initial, Always, Procedural Assignment, Blocking and Non- Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign De-assign, Force Release, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines

Unit - VI

Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Stacks and Queues, Multi bit Adders & Multiplier, Huffman Coding, Processor and Memory Model, CPU, System Tasks and Functions, Design Verification

Resources:

1. "Verilog Digital System Design" - Zainalabedin Navabi , Second Edition, Tata McGraw Hill , 2009
2. "Verilog HDL : A Guide to Digital Design and Synthesis" ,Samir Palnitkar, 2nd Edition , Prentice Hall India, 2003
3. "A Verilog HDL Primer", J. Bhaskar, 2nd Edition, Star Galaxy Press, 1997

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EE1905	Advanced Communication System	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To acquaint students to the advanced communication systems and methodology and various Issues related with Communication.	• Graduates will be able to understand basic theory of digital communications and the most common digital communications techniques. • Graduates will be able to apply and analyze mathematical modeling to the problems in digital communications. • Graduates will be able to demonstrate the concept of modulation techniques, channel coding techniques, optimum receivers in communication systems.
Mapped Program Outcomes: a, d	

Unit I

Random Process: Mathematical Definition of a Random Process, Stationary Processes, Mean, Correlation and Covariance functions ,Transmission of a Random Process Through a linear Time Invariant Filter, Power Spectral Density, Gaussian Process, Noise, Narrowband Noise, Representation of Narrowband Nose in terms of In Phase and Quadrature components, Representation of Narrowband Noise in terms of Envelope and Phase components.

Unit II

Characterization of Communication Signals and Systems- Signal space representation- Vector space concept, signal space concept, orthogonal expansions of signals, representation of digitally modulated signals-memory less modulation methods, linear modulation with memory, nonlinear modulation methods with memory.

Unit III

Pulse Modulation techniques

Minimum Shift Keying (MSK) Modulation, GMSK, Continuous Phase Modulation (CPM) Schemes Channel Characterization and Modeling, Orthogonal Frequency Division Multiplexing (OFDM), Carrier Synchronization, Timing synchronization

Unit IV

Optimum receiver for signals corrupted by AWGN, performance of the Optimum receiver for memory less modulation, Optimum receiver for CPM signals Optimum receiver for signal with random phase in AWGN channel. Baseband reception and probability of error, the ML and MAP detection strategies, ML detection with zero mean AWGN,the optimum filter, Schwarz's inequality, transfer function of optimum filter, matched filter, properties of Matched filter, correlation receiver,equalization,the zero forcing equalizer, adaptive equalizer, scrambling, the eye pattern

Unit V

Channel Capacity and Convolution Coding::Channel models, Channel Capacity, Transfer convolution Codes, Optimum decoding of convolution codes-Viterbi algorithm, Fano algorithm, Punctured convolution codes.

Unit VI

Spread spectrum signals for digital communications: Introduction to Spread Spectrum Modulation, DSSS, FHSS, and CDMA signals, Code Acquisition and Tracking, Spread Spectrum as a Multiple Access Technique

Resources:

1. "Communication Systems", Simon Haykins, 4th edition,John Wiley and sons,INC
2. "Digital Communication", J.G. Proakis, 4th edition, McGraw Hill, 1995.
3. "Digital Communication", Edward. A. Lee and David. G. Messerschmitt, 2nd Edition, Allied Publishers, 2003

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EE1906	**Lab.: Advanced Digital Signal Processing**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practical's based on syllabus of Advanced Digital Signal Processing (EE901)

EE1907/EE1957	**Lab: Digital IC Design**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practical's based on syllabus of Digital IC Design (EE902)

EE1908/EE1958	**Lab: Advanced Digital System Design**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practical's based on syllabus of **Advanced Digital System Design.**

EE1911 / EE1961	**RF Circuit Design**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To study RF component such as resonator, filter, transmission lines, etc • To learn design of RF amplifiers using transistors	• Graduates will have an ability to demonstrate in- depth knowledge of general RF circuits, components and systems and an understanding of resonant circuits • Graduates will be able to understand and use Smith Chart for developing circuits in RF applications. • Graduates will be able to design impedance matching networks, passive RF filters and RF power amplifiers. • Graduates will be able to use CAD tools for RF circuit design.
Mapped Program Outcomes: a, c, d	

Unit – I

Introduction, Importance of Radio frequency Design, RF Behaviour of Passive Components, Chip Components, Transmission Line Analysis, Equivalent Circuit Representation, Circuit Parameters for a Parallel Plate Transmission Line, Microstrip Transmission Line, Terminated Lossless Transmission Line, Special Termination Conditions, Sourced and Loaded Transmission Line.

Unit – II

The Smith Chart, From Reflection Coefficient to Load Impedance, Impedance Transformation, Admittance, Transformation, Parallel and Series Connections, Single- and Multiport Networks, Interconnecting Networks, Network Properties and Applications, Scattering Parameters.

Unit – III

An Overview of RF Filter Design, Basic Resonator and Filter Configurations, Special Filter Realizations, Filter Implementation, Coupled Filter.

Unit – IV

Matching and Biasing Networks: Impedance Matching Using Discrete Components, Microstrip Line Matching Networks, Amplifier Classes of Operation and Biasing Networks.

Unit – V

RF Transistor Amplifier Designs: Characteristics of Amplifiers, Amplifier Power Relations, Stability Considerations, Constant Gain, Noise Figure Circles, Constant VSWR Circles, Broadband, High-Power, and Multistage Amplifiers

Unit – VI

Oscillators, Basic Oscillator Model, High-Frequency Oscillator Configuration, Oscillators describing functions, Colpitt's oscillators Resonators, Tuned Oscillators, Negative resistance oscillators, Phase noise Basic Characteristics of Mixers. Non-linear based mixers, Quadratic mixers, Multiplier based mixers, Single balanced and doubles balanced mixers, sub sampling mixers.

Resources:

1. "RF Circuit Design – Theory and Applications", Reinhold Luduig and Pavel Bretchko, 2nd Edition, Pearson Education, 2000.
2. T.Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004.
3. B.Razavi, "RF Microelectronics", Pearson Education, 1997.
4. B.Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1912	**Soft Computing Techniques**	L= 3	T =0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	**Outcomes**
• To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience & neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems. To provide the mathematical background for carrying out the optimization associated with neural network learning To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations	• Graduates will have an ability to identify and describe soft computing techniques and their roles in building intelligent machines • Recognize the feasibility of applying a soft computing methodology for a particular problem • Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems • Apply genetic algorithms to combinatorial optimization problems • Apply neural networks to pattern classification and regression problems • Effectively use existing software tools to solve real problems using a soft computing approach • Evaluate and compare solutions by various soft computing approaches for a given problem.
Mapped Program Outcomes: a, b, d	

Unit - I
Fuzzy sets- Basic concepts, representation of fuzzy sets, extension principle for fuzzy sets.

Unit - II
Fuzzy arithmetic, Arithmetic operations on intervals and fuzzy numbers, fuzzy equations, Fuzzy relations, Fuzzy expert systems, fuzzy controllers

Unit - III
Introduction to neural networks, Neural Network architectures and learning processes, Single and Multi-layer perceptions.

Unit - IV
Feed-forward nets- Back propagation network, Radial Basis Function networks, Self organizing maps- Kohonen SOM, Learning vector quantization, MAX net, Maxican Hat, Hamming net

Unit – V
Basic concepts of Genetic Algorithms, working principle, methods of encoding, fitness function and reproduction

Unit – VI
Introduction to Neuro - fuzzy Systems, Fuzzy-Neural and Neuro-Fuzzy, Neuro-fuzzy-GA Hybrid models

Resources:
1. “Fuzzy sets and Fuzzy logic – Theory and Applications”, George J. Klir , Bo Yuan ,2nd Edition, Prentice Hall,1995
2. “Neural Networks – A Comprehensive Foundation”, Simon Haykin,2nd Edition, PearsonEducation, 1998
3. “Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications”,S.Rajasekaran, G.A. Vijayalakshmi Pai, 6th Edition , Prentice Hall of India, 2004
4. “Fuzzy Logic – Intelligence, control and Information”, John Yen, Reza Langari, 1st Edition, Pearson Education, 1999
5. “Neural Network Design”, Martin Hagan, Howard Demuth, Mark Beale,1st Edition, Thomson Learning, 1996
6. “Introduction of Artificial Neural Networks”, Jacek Zurada, 2nd Edition, Jaico Publishing House, 2005
7. “Multi-objective Optimization and Genetic Algorithm”, Kalyanmay Deb, Wiley Publications, 2001

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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EE1913/EE1970	**Digital Image Processing**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• Provide deeper knowledge of theoretically demanding methods of image data processing and of their applications.	• Upon successfully completing the course, the student should: • Demonstrate the understanding of fundamentals of Digital image processing wrt to enhancement, filtering, segmentation, restoration & representation • Able to understand the mathematical implementation & interpretation of image transforms • Be able to formulate solutions to general image processing problems • Develop skill base necessary to further explore advanced topics of Digital Image Processing for research
Mapped Program Outcomes: a, e	

Unit I

An image model – sampling & quantization – basic relation between pixels: imaging geometry, Properties of 2-D Fourier transforms, FFT algorithm and other separable image transforms, Walsh transforms, Hadamard, Cosine, Haar, Slant Transforms, KL Transforms and their properties, Wavelets.

Unit II

Spatial domain methods, Frequency domain methods, Histogram Modification technique, Neighbourhood averaging, Median filtering, Low pass filtering, Averaging of Multiple Images, Image sharpening by differentiation, High pass Filtering,

Unit III

Degradation model for Continuous functions, Discrete Formulation, Diagonalization of Circulant and Block –Circulant Matrices, Effects of Diagonalization, Constrained and unconstrained Restorations Inverse filtering, Wiener Filter, Constrained least Square Restoration.

Unit IV

Fundamentals, Image compression models, error free compression, lossy compression, image compression standards Objective an subjective Fidelity Criteria, the encoding process, the Mapping, the Quantizer and the Coder, Contour Encoding, Run length Encoding, Image Encoding relative to a Fidelity Criterion, Differential Pulse Code Modulation, Transform Encoding.

Unit V

The detection of Discontinuities, Point Line and Edge Detections, Gradient Operators, Combined Detection, Image segmentation Thresholding. Region oriented segmentation Representation Schemes, Chain Codes, Polygon Approximation, Boundary Descriptors, Simple Descriptors, Shape Numbers, Fourier Descriptors Dilation and erosion, opening and closing hit-or-miss transformation, morphological algorithms, extension to gray scale images.

Unit VI

Color Image Processing: Color Fundamentals, color models, Pseudocolor image processing, Basics of full color image processing, Color transformations, Smoothing and sharpening, Color segmentation, Noise in color images,

Resources:

1. "Digital Image Processing", Gonzalez RC & Woods RE, 2nd Edition ,Addison Wesley Publishing Company,2002
2. "Fundamentals of Digital Image Processing" ,3rd Edition, Jain AK, Printice Hall of India, 1989
3. "Digital Image Processing", Pratt William K., 4th Edition,John Wiley & Sons 2000.

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Dean (Acad. Matters)		Version		

EE1916/EE1962	**Analog IC Design**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To understand the functions of various digital and analog IC's and their applications in the design of electronic circuits.	• Graduates will able to demonstrate behaviour of single, multiple transistor amplifier • Graduates will able to Solve complex circuit problems • Graduates will able to model integrated circuit devices • Graduates will be able to design nonlinear analog circuits
Mapped Program Outcomes:	

Unit I: Models for integrated circuit active devices:
Depletion region of a p-n junction, Small Signal & large signal behavior of MOS & BJT transistor, short channel effects in MOS transistors, weak inversion in MOS transistor, substrate current in MOS transistor

Unit II: Single transistor and multiple transistor amplifiers:
Basic Single transistor Amplifiers stages: Common Emitter, Common base, Common Collector, Common Drain, Common Gate & Common Source Amplifiers, Multiple Transistor Amplifier stages: CC-CE, CC-CC, & Darlington configuration, Cascode configuration, Active Cascode, Super source follower, Differential pairs, DC transfer characteristics.

Unit III: Current Mirrors, Active Loads & References:
Current Mirrors: Simple current mirror, Cascode current mirrors, Widlar current mirror, Wilson Current mirror, Active loads, Voltage & current references, supply and temperature independent biasing techniques

Unit IV: Operational Amplifier with single ended outputs:
Deviations from ideality in real operational amplifiers, Basic two stage op amp, two stage MOS Operational Amplifier with cascodes, MOS telescopic-cascode operational amplifiers, MOS Folded-cascode operational amplifiers, MOS active cascade operational amplifiers, Bipolar operational amplifiers

Unit V: Frequency response of integrated circuits:
Single stage amplifiers & miller effect, MOS differential amplifier differential mode gain, frequency response of the common mode gain for a differential amplifier, frequency response of voltage buffers, frequency response of current buffers, Multistage amplifier frequency response, frequency response of a current mirror loading a differential pair.

Unit VI: Nonlinear Analog Circuits:
Analysis of four quadrants, Gilbert cell as an analog multiplier, Phase Locked Loops, Integrated circuit phase locked loops, Voltage controlled oscillators, Switched Capacitor Circuits and Switched Capacitor Filters.

Resources:
1. "Analysis and Design of Analog Integrated Circuits", Paul B Gray ,hurst ,Lewis, Meyer ,fifth edition, John Wiley & sons, reprint 2010.
2. "CMOS Analog Circuit Design"P.E.Allen,D.R.Holdberg,second edition,Oxford univ. press.2010
3. "CMOS circuit design, Layout, and simulation" R.Jacob Baker, second edition, Wiley student edition, reprint 2009

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1917	Multirate Signal Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To acquaint the students with Multirate systems, Multirate Filter Banks and wavelet transform and application in signal processing	• Graduates will understand and demonstrate multirate filter bank theory in signal processing area. • Graduates will able to understand and identify perfect reconstruction process. • Graduates will able to understand and identify difference between Fourier Transform, short time Fourier Transform and wavelet Transform • Graduates will understand knowledge of wavelet Transform and its applications.
Mapped Program Outcomes: a, d	

Unit I
Basic multi-rate operations, interconnection of building blocks, poly-phase representation, multistage implementation, applications of multi-rate systems, special filters and filter banks.

Unit II
Maximally decimated filter banks: Errors created in the QMF bank, alias free QMF system, power symmetric QMF banks, M-channel filter banks, poly-phase representation, perfect reconstruction systems, alias-free filter banks.

Unit III
Para-unitary Perfect Reconstruction Filter Banks: Lossless transfer matrices, filter bank properties induced by paraunitariness, two channel Paraunitary lattices, M-channel FIR Para-unitary QMF banks, transform coding. Short-time Fourier transform: trades of between traditional Fourier transform and STFT,STFT as a bank of filter , window selection, STFT verses Wavelet transform, STFT to wavelet conversion .

Unit IV
Continuous Time Wavelets, Definition of CWT, CWT as a correlation, Constant Q factor Filtering Interpretation and Time Frequency Resolution.CWT as an operator. Inverse CWT. Introduction to the discrete Wavelet transform and orthogonal wavelet decomposition.

Unit V
MRA, Orthogonal Wavelets, and their relationship to Filter Banks: Introduction, Formal Definition of an MRN, Construction of a General orthonormal MRN, Wavelet basis For the MRN. Digital Filtering Interpretation, Examples of orthonomal basis generating Wavelets, Interpreting orthonormal MRNs for discrete tine signals, DTWT for Image Compression, Audio Compression

Unit VI
Biomedical signal processing applications; Geophysical signal analysis applications, Efficient signal design and realization: wavelet based modulation and demodulation, Applications in mathematical approximation, Applications to the solution of some differential equations, Applications in computer graphics and computer vision.

Resources:
1. P.P. Vaidyanathan, “Multirate Systems and Filter Banks," Pearson Education.
2. Raghuveer M.Rao ,Ajit Bopardikar, Wavelet Transform; Introduction to theory and application, Pearson Education,2006
3. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata Mc Graw-Hill,1998,3rd edition.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1918 / EE1966	**Low Power CMOS VLSI Design**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To acquaint students with principles of design , analysis , modelling and optimization of low power VLSI , as well as to promote an interest in VLSI design	• Graduates will understand the concepts of sources of power dissipation and basics of CMOS Physics. • Graduates will understand the concepts of levels of abstraction and its power dissipation. • Graduates will understand the Power Optimization methods at Behaviour, Logic and Circuit Level design. • Graduates will understand the challenges in deep submicron technology. • Graduates will understand the principles for low power designs, and have the capabilities to analyze power consumption and develop low power strategies for a given system.
Mapped Program Outcomes: a, b,d	

Unit - I
Need for low power VLSI chips, Sources of power dissipation: Short circuit dissipation, dynamic dissipation, designing Techniques for low power. Physics of power dissipation in MOSFET devices, MOS Capacitance analysis, low power figure of merits, brief overview of low power VLSI design limits.

Unit - II
Probabilistic power analysis: random logic signals, probability and frequency, probabilistic power analysis techniques, signal entropy, Low power circuits: transistor and gate sizing, equivalent pin ordering, network reconstruction and reorganization, Glitching Power, special latches and flip-flops.

Unit - III
Behavioural, Logic and circuit level approaches. Algorithm level transforms. Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre-computation, Logic: gate reorganization, signal gating, logic encoding, state machine encoding.

Unit - IV
Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect. Low voltage design techniques using reverse Vgs. Steep sub threshold swing and multiple threshold voltages. Multiple threshold CMOS based on path critically, multiple supply voltages.

Unit - V
Low energy computing, Energy dissipation in transistor channel. Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and IO Buffer, supply clock generation.

Unit - VI
Introduction, sources of software power dissipation, power estimation and optimization. Co-design for low power**.**

Resources:

1. "Solid State Electronic Devices", 6th Edition, Ben Streetman, Sanjay Benerjee.
2. "Low-Power CMOS VLSI Circuit Design", Kaushik Roy, Sharat C. Prasad, 1st Edition, Wiley India, 2009
3. "Practical Low Power Digital VLSI Design", Gary K. Yeap, Kluwer Academic Publisher, 2002
4. "Low-Power CMOS Circuits-Technology, Logic Design and CAD Tools" Christian Piguet, 2006 by Taylor & Francis Group, LLC
5. "Energy Efficient Microprocessor Design", T. D. Burd and R. A. Brodersen, Boston: Springer, 2002.
6. "Low-Power Digital CMOS Design", A. Chandrakasan and R. Brodersen, Boston: Springer, 1995.
7. "Digital Integrated Circuits: A Design Perspective", 2nd ed., J. Rabaey, A. Chandrakasan, B. Nikolic.

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EE1919	**Wireless Communication**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The course aims to give basic knowledge of different mobile / wireless communication systems	• Will be able to study different standard & generation in mobile communication system • Will be able to understand the need and different methods for enhancing the quality of communication. • Will be able to gain technical knowledge of current practice in wireless systems. • Will be able to analyse & solve the problem to improve quality of communication.
Mapped Program Outcomes: a, d, e,	

Unit - I

Mobile Radio Propagation: Large& Small Scale Path Loss & Fading: Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling. Small Scale Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh & Rician Distribution

Unit - II

Equalization&Diversity: Fundamentals of equalization, classification of equalizer: linear & non-linear equalizer, Diversity Technique: Derivation of selection diversity improvement, Derivation of maximal ratio combining improvement, Space diversity, Polarization Diversity, time diversity & frequency diversity RAKE receivers

Unit - III

Multiplexing & multiple access techniques for wireless communication: FDMA, TDMA, FHMA, CDMA, SDMA, Orthogonal Frequency Division Multiplexing (OFDM)**,** Packet radio protocol: Pure & Slotted ALOHA, CSMA, PRMA, capacity of cellular system

Unit - IV

Wireless Systems and Standards: GSM-GSM services and features, Architecture, Radio Subsystem, GSM channel types, Frame structure and signal processing in GSM, CDMA-Forward CDMA channel, Reverse CDMA channel

Unit – V

Modern Wireless Communication System: 2G, 3G wireless network, Wireless local loop, & LMDS, Wireless Local Area networks (WLANs), Bluetooth & Personal Area Networks (PANs)

Unit – VI

Advanced wireless communication: 4G features and challenges,QoS-enabled MAC Protocol, Class-based QoS over Air Interface in 4G,Wi-Fi,Wi-Max,wirelessRouter,features of wireless routers, Difference between wireless & Wi-Fi,Zigbee

Resources:

1. "Advanced Wireless Communication"-- Savo G. GlisicJohn Wiley & Sons, 13-Dec-2005
2. "Wireless Communication- Principle and Practices" – Rapaport, 2nd Edition,Pearson Education , 2001
3. "Mobile Communications – Design fundamentals" ,William C. Y. Lee,2nd Edition, John Wiley Publication, 1993
4. "Mobile Cellular Communication", W .C .Y. Lee ,2nd Edition, McGraw Hill, 2006
5. "The Mobile Radio Propagation channel", J.D. Parson ,2nd edition, John Willey,2010

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EE1920 / EE1951	**VLSI Signal Processing**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The students shall gain proficiency in subjects like the basic design of theory involved in VLSI for signal processing and communication systems , various software tools related to VLSI, Signal Processing and Communication Systems.	• Graduates will understand and able to design architectures for DSP algorithms. • Graduates will understand and able to apply the optimisation concept in terms of area, speed and power on DSP systems. • Graduates will understand and able to optimize DSP arithmetic.
Mapped Program Outcomes: a, d	

UNIT I:
Introduction to DSP systems, Data flow and Dependence graphs - critical path, Loop bound, iteration bound, longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, parallel processing, Pipelining and parallel processing for low power.

UNIT II:
Retiming – definitions and properties, solving systems of inequalities, Retiming techniques, Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application

UNIT III:
Folding: folding transformation, Register Minimization Techniques, Register minimization in folded architectures folding of multirate systems. Systolic Architecture Design: Introduction, Systolic Array Design Methodology, FIR systolic Arrays, Selection of scheduling vector, Matrix Multiplication and 2D systolic array Design, Systolic design for space representations containing Delays.

UNIT IV:
Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm, Winograd algorithm, iterated and cyclic convolution, Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture, rank-order filters, Odd-Even merge-sort architecture, parallel rank order filters.

UNIT V:
Pipelined interleaving in digital filters, pipelining in first-order digital filters, Parallel processing of digital filters, combined pipelining and parallel processing of IIR filters, Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement, Distributed Arithmetic.

Unit VI:
Redundant number representation, carry free radix-2 addition and subtraction, hybrid radix 4 addition,radix2 hybrid redundant multiplication architectures, data format conversion, redundant to non redundant converter, Numerical strength reduction – sub-expression elimination, multiple constant multiplication, iterative matching.

Resources:
1. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007.
2. U. Meyer – Baese, " Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004

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EE1921 / EE1969	**Verification & Testing of VLSI Circuits**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To gain a knowledge from the area of applying diagnostic principles in the design of modern Electronic systems.	• Students develop an understanding of VLSI design verification and testing issues. • Students learn how to generate test patterns for faults in a system and how to design a system for testability. • Ability to model different faults and carry out fault simulation in digital circuits. • Ability to know about importance of testing and its types in VLSI circuits.
Mapped Program Outcomes: a,d	

Unit – I

Overview Of Testing**:** Design Process, Verification, Faults & Their Detection, Test Pattern Generation, Fault Coverage, Types Of Tests, Test Application, Testing Economics. Defects, Failures, and Faults: Physical Defects, Failures Modes, Faults, Fault Equivalence and Dominance, Fault Collapsing

Unit – II

Design Representation: Graphical representation, Graphs, Binary Decision diagrams, Netlists, VLSI Design Flow: CAD tools, Design Methodologies, Semicustom Design

Unit - III

Simulation: Logic Simulation, Approaches to Simulation, Fault Simulation & Their Results. Automatic Test Pattern Generation: D-Algorithm, Critical Path Extensions to D-Algorithm PODEM, FAN

Unit - IV

Ad Hoc Techniques, Scan–Path Design, Test pattern generation, Test Pattern Application, Scan architectures, multiple scan chains, Partial Scan Testing

Unit - V

Boundary-Scan Testing: Boundary Scans Architecture, Test Access Port, Registers, Tap Controller, Modes of Operation. Built In Self Test: Pseudorandom Test Pattern Generation, Response Compaction, BIST Architectures

Unit - VI

Memory Testing: Types of Memory Testing, Functional Testing Schemes, Testing FPGAs and Microprocessors: Testability Of FPGAs, Testing RAM- Based FPGAs, Testing Microprocessors, Synthesis For Testability.

Resources:

1. “Principles of Testing Electronic Systems”, 2nd edition Samiha Mourad, Yervant Zorian
2. “Essentials of Electronic Testing for Digital, Memory, and Mixed-Signal VLSI Circuits”,Michael L. Bushnell and Vishwani D. Agrawal, B.S.Publications, 2000
3. "Digital Systems Testing and Testable Design" ,Miron Abramovici, Melvin Breuer and Arthur Friedman, IEEE press,
4. “A Guide to VHDL" by Stanley Mazor,2nd Edition, Kluwer Academic Press, 2007
5. "HDL Chip Design" by Douglas Smith, 3rd Edition, Doone Publications, 2008
6. "Rapid Prototyping of Digital Systems", by J. O. Hamblen and M. Furman, Kluwer Academic Publishers.2001

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EE1914	**Lab: Digital Image Processing**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practicals based on syllabus of Digital Image Processing

EE1915	**Lab : RF Circuit Design**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practicals based on syllabus of **RF Circuit Design**

EE1932	Wireless Sensor	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The objective of the course is to give the student good understanding of programming embedded wireless systems where the requirements on low energy dissipation is hard and the real time requirements and the limited resources of memory and processing capability makes it necessary for optimised the implementation of the software functions.	• Students will be able to carry out research with independent and introspective learning. • Students will be able to think critically to indentify, conceive, analyze and solve complex engineering problems in core areas of electronics. • Students will be able to communicate effectively, comprehend and prepare report and acquire professional, ethical and responsible attitude towards sustainable development of the society. • Students will be able to accept and adapt to the technological changes for lifelong learning with enthusiasm and commitment to improve knowledge and competence continuously.
Mapped Program Outcomes: a,b,d	

Unit I

Introduction and Overview of Wireless Sensor Networks, Commercial and Scientific Applications of Wireless Sensor Networks, Basic Wireless Sensor Technology, Sensor Taxonomy, wireless network environment, wireless network trends.

Unit II

Radio technology primer, Available wireless technologies, Wireless Sensors Networks Protocols, Physical Layer, Fundamentals of Medium Access Control Protocols for Wireless Sensor Networks, MAC protocols for WSN, Case Study, IEEE 802.15 4LR WPAN, Standard case study.

Unit III

Sensors Network Protocols, Data dissemination and gathering, Routing Challenges and design issues in wireless sensor network, Routing strategies in WSN.

Unit IV

Protocols, Transport Control Protocols for Wireless Sensors Networks, Traditional transport control protocol, and transport protocol design issues, examples of existing transport control protocol, performance of TCP.

Unit V

Middleware for Sensor Networks, WSN middleware principles, Middleware architecture, existing middleware.

Unit VI

Network Management for Wireless Sensor Networks, Requirements, Design issues, Examples of management Architecture, Performance and Traffic Management Issues.

Resources:

1. "Wireless Sensor Networks: Technology, Protocols, and Applications", Kazem Sohraby, Daniel Minoli, Taieb Znati, WIey Interscience Publication, 2007
2. "Computer Networks" ,Andrew Tanenbaum, 4th ed, Pearson Education,2007

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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EE1933	Biomedical Instrumentation	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• This course is intended for exposing the students to basics of biomedical instrumentation. • It also includes sections on microprocessors and signal acquisition systems as applied to medical instrumentation.	• Graduates will learn the basic concepts of biomedical instrumentation. • Graduates will learn measurement techniques for involved in processes such cardiovascular measurements. • Graduates will also learn techniques in x-rays, EMG, etc.
Mapped Program Outcomes: a, d	

UNIT I:
Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.

UNIT II:
Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers.

UNIT III:
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers.

UNIT VI:
Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG.

UNIT V:
Patient care and monitoring, the elements of intensive care monitoring , diagnosis, calibration, reparability of patient monitoring equipment, instrumentation for monitoring patient, pacemakers, defibrillators.

UNIT VI:
Interfacing the computer with medical instrumentation and other equipments, electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments, Methods of accident prevention.

Resources:
1. Biomedical Instrumentation & Measurement, By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer, 2nd Edition ,PHI
2. Handbook of Biomedical Instrumentation, R.S.Khandpur, 2nd Edition, TMH
3. Bioelectronic Measurement, Dean A Dmane, David Michaels,Jan 1983 edition, PHI
4. Medicine and Clinical Engineering, Jacobson and Webster, 2nd Edition, PHI
5. Introduction to Biomedical Equipment Design ,Carr and Brown, 4th Edition, John Wiley
6. Biomedical Digital Signal Processing, Tompkins, 1993 Edition, PHI

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Dean (Acad. Matters)		Version		

EE1934/EE1982	**Mixed Signal VLSI Design**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To study different types of mixed signal VLSI design and their procedures with methods applied in different stages of design.	• Graduates will understand the basic building blocks of Data converter systems. • Graduates will understand the basics of different data converters that are used in different Mixed signal systems. • Graduates will understand the physical layout representation and the alternative layout solutions of data converter systems. • Graduates will understand the design of various CMOS Op-Amps used in Mixed signal system. • Graduates will understand the design of various analog filers used in data converter systems.
Mapped Program Outcomes: a,b,d	

Unit - I
Introduction to Mixed Signal VLSI System, Signal and Filters, digital comb filter, the z-plane, simple digital filters, Sampling and Aliasing: Impulse Sampling, Sample and Hold. Quantization noise. Spectral density of quantization noise.

Unit - II
Data Converter SNR: Effective number of bits Clock jitter, Using averaging to improve SNR, Decimating filters for ADCs, Interpolating filters for DACs, Band pass and High pass Sync filters, Using feedback to improve SNR.

Unit - III
Sub-Micron CMOS circuit design : Process flow, capacitors and resistors, MOSFET Switch, Delay and Adder elements, Analog circuits – MOSFET Biasing, Op-Amp design, Circuit noise.

Unit - IV
Implementing Data converters: Current mode and voltage mode R-2R DAC, Using Op-Amps in data converters, Implementing ADCs, Cyclic ADC, Introduction to Sigma Delta ADC and Line Drivers.

Unit - V
Integrator Based CMOS Filters: Integrator Building Blocks, Low pass and Active R-C filters, MOSFET-C integrators,gm-C Integrators, Discrete time integrators

Unit - VI
Bilinear and Bi-quadratic transfer functions – Active R-C Transconductor-C and Switched Capacitor implementations both transfer functions, Canonic form of a digital filter.

Resources:

1. "CMOS – Mixed signal circuit design, layout and simulation",R.Jacob Baker, "2nd Edition
   a. IEEE Press and Wiley Interscience, 2002.
2. "CMOS Circuit Design, Layout, and Simulation", Third Edition, R. Jacob Baker
3. "Design of Analog CMOS Integrated circuits", B. Razavi, 1st Edition, McGraw Hill, 2001.
4. "CMOS Analog Circuit Design", P.E. Allen and D.R. Holberg, 2nd Edition, Oxford University Press, 2002.

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EE1935	**Cryptography & Network Security**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• This course will introduce cryptography theories, algorithms, and systems. It will also consider necessary approaches and techniques to build protection mechanisms in order to secure computer networks.	The students who succeeded in this course; • Learn threats to computer networks and protection mechanisms and methods need to thwart these threats. • Understand the theory of fundamental cryptography, encryption, and decryption algorithms, • Build simple cryptosystems by applying encryption algorithms, • Comprehend secure identity management (authentication), message authentication, and digital signature techniques.
Mapped Program Outcomes: a, d	

UNIT I:
Security Goals, Cryptographic Attacks, Services & Mechanisms, Techniques, Mathematics of Cryptography, Traditional Symmetric Key Ciphers.

Unit II:
Mathematics of Symmetric Key Cryptography , Algebraic Structures, GF(2n) Fields, Introduction to Modern Key Ciphers , Modern Block Ciphers, Modern Stream Ciphers.

Unit III:
Data Encryption Standard (DES) , DES Structure, DES Analysis, Security of DES, Multiple DES, Examples of Block Cipers Influenced by DES, Advanced Encryption Standard, Transformation , Key Expansion , AES Ciphers, Analysis of AES.

UNIT IV:
Mathematics of Asymmetric-Key Cryptography , Primes , Primality Testing, Factorization, Chinese's Remainder Theorem, Quadratic Congruence, Exponentiation & Logarithmic.

UNIT V:
Asymmetric – Key Cryptography , RSA Cryptography , Rabin Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem

Unit VI:
Message Authentication and Hash Functions, Digital Signatures and Key Management. IP Security: Architecture, Authentication header, Encapsulating security payloads, Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET). System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

Resources:
1. Cryptography and Network Security, William Stallings. (Second Edition) Pearson Education Asia .
2. Cryptography and Network Security, Behrouz A. Forouzan (Second Edition) Mcgraw-Hill .

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EE1936	Adaptive Signal Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The primary objective of this course is to develop the ideas of optimality and adaptation in signal processing, design, analysis, and implementation of digital signal processing systems	• Graduates will understand and analyze knowledge of adaptive filters • Graduates will able to identify and analyze statistical analysis. • Graduates will understand parametric signal analysis
Mapped Program Outcomes: a, d	

Unit – I

The Filtering Problem, Adaptive Filters, Linear Filter Structures, Approaches to the Development of Linear Adaptive Filtering Algorithms, Real and Complex Forms of Adaptive Filters, Nonlinear Adaptive Filters, Some Historical Notes, Partial Characterization of a Discrete-Time Stochastic Process, Mean Ergodic Theorem, Correlation Matrix, Correlation Matrix of Sine Wave Plus Noise, Stochastic Models, Wold Decomposition, Asymptotic Stationarity of an Autoregressive Process, Yule-Walker Equations, Computer Experiment: Autoregressive Process of Order2, Selecting the Model Order, Complex Gaussian Processes

Unit – II

Power Spectral Density, Properties of Power Spectral Density, Transmission of a Stationary Process Through a Linear Filter, Cramer Spectral Representation for a Stationary Process, Power Spectrum Estimation,Other Statistical Characteristics of a Stochastic Process, Polyspectra,Spectral-Correlation Density, The Eigenvalue Problem, Properties of Eigenvalues and Eigenvectors, Low-Rank Modeling, Eigenfilters, Eigenvalue Computations

Unit – II

Linear Optimum Filtering: Problem Statement, Principle of Orthogonality,Minimum Mean Squared Error, Wiener-Hopf Equations, Error-Performance Surface, Numerical Example, Channel Equalization, Linearly Constrained Minimum Variance Filter, Generalized Sidelobe Cancelers, Forward Linear Predication, Backward Linear Predication, Levinson-Durbin Algorithm, Properties of Prediction-Error Filters, Schur-Cohn Test, Autoregressive Modeling of a Stationary Stochastic Process, Cholesky Factorization, Lattice Predictors, Joint-Process Estimation, Block Estimation, Recursive Minimum Mean-Square Estimation For Scalar Random Variables, The Innovation of the State using the Innovations Process, Filtering, Initial Conditions, Summary of the Kalman Filter, The Extended Kalman Filter

Unit – IV

Overview of the structure and operation of the Least-Mean-Square Algorithm,Stability and Performance Analysis of the LMS Algorithm, Computer Experiment of Adaptive Prediction, Computer Experiment of Adaptive Equalization, Computer Experiment on Minimum-Variance Distortionless Response Beamformer, Directionality of Convergence of the LMS Algorithm for Non-White Inputs, Robustness of the LMS Algorithm, Normalized LMS Algorithm

Unit – V

Block Adaptive Filters, Fast LMS Algorithm, Unconstrained Frequency- Domain Adaptive Filtering, Self-Orthogonalizing Adaptive Filters,Computer Experiment on Adaptive Equalization, Classification of Adaptive Filtering Algorithms,

Unit – VI

Statement of the Linear Least-Squares Estimation Problem, Data Windowing, Principle of Orthogonality , Minimum Sum of Error Squares,Normal Equations and Linear Least Squares Filters, Time-Averaged Correlation Matrix, Reformulation of the Normal Equations in Terms of Data Matrices, Properties of Least- Squares Estimates,

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Parametric Spectrum estimation, Singular Value Decomposition, Pseudoinverse, Interpretation of Singular Values and Singular Vectors, Minimum Norm Solution to the Linear Least-Squares Problem, Normalized LMS Algorithm Viewed as the Minimum-Norm Solution to an Underdetermined Least Squares Estimation Problem,

Resources:

1. "Adaptive Filter Theory ", Simon Haykin, 4th Edition, Prentice Hall of India, 2001
2. "Theory and Design of Adaptive Filters", Michael G Larimore, C Richard Johnson,John R Treichler, Prentice Hall of India, 1987.

EE1937 / EE1954	**Embedded System & RTOS**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To introduce students to the embedded systems, its hardware and software, real time operating systems, inter-task communication and an exemplary case of RTOS.	• Students will be able to understand and learn the concepts, architecture, programming, addressing modes for various embedded systems • Students will be acquainted with the new concepts related to design of embedded systems, introspect themselves for applying their previous knowledge for various parameters, especially, selection of operating systems, processors, controllers, memory, IO devices, etc • Students will be able to establish link for hardware-software interaction for embedded systems, develop build process for signal / data processing through related software and hardware set up • Students will be acquainted with task scheduling, interrupt mechanisms and various managements related to embedded real time operating systems, and will be able to discuss / deliver presentation on contemporary issues related to system on chip and system on slice
Mapped Program Outcomes: a,c,d	

Unit I:
Introduction to embedded systems, basic concepts, application areas and categories of embedded systems: Stand alone Embedded systems, Real Time systems, Requirements, challenges Recent trends and applications of Embedded systems.

Unit II:
New trends in hardware platforms for Embedded system design, Processor selection criteria in Embedded system design, Embedded system design with microprocessors, microcontrollers, and DSP processor.

Unit III:
Issues involved in choosing appropriate development platforms and tools for design of Embedded systems, development environments, operating systems, task scheduling, non real and real time operating systems

Unit IV:
Need for communication Interfaces, RS 232 communication parameters, connector configurations, UART, serial communications, Ethernet, IEEE 802.11, Bluetooth system specifications

Unit V:
Embedded Real Time Operating systems, concepts, architecture of Kernel, tasks, task scheduler, interrupt service routines, semaphores, Mutex, Mailboxes, Message queue management function calls, event register management function calls, signals and timer management function calls, memory management, priority inversion problems in design of Embedded Real Time Operating systems.

Unit VI:
Commonalities of Embedded Real Time Operating systems, Embedded operating systems –LINUX, Real Time Operating systems –RTLINUX, Concept of system on chip and system on Slice.

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Resources:

1. ‘Embedded / Real Time Systems – Concepts, design and programming’ Dr.K.V.K.K.Prasad, (DreamTech Press), Reprint Edition, 2006
2. ‘Designing Embedded Hardware’, John Catsoulis, 2nd Edition, O’reilly Publication, 2005
3. ‘Programming for Embedded systems – Cracking the code’ DreamTech Software Team, WileyPublishing Inc, 2006
4. “An Embedded Software Primer”, David E. Simon, 1st Edition, Pearson Education,1999
5. “Embedded System Design”, Frank Vahid, Tony Givargis, John Wiley & Sons, Inc,2002
6. “Building Embedded Linux Systems”, Karim Yaghmour,2nd Edition, O’reilly,2008
7. “Programming Embedded Systems”, Michael Barr, 2nd Edition, O’reilly,2006
8. “Real-time systems & software”, Alan C. Shaw,3rd Edition, John Wiley & sons, Inc.2001
9. “Computers as Components”, Wayne Wolf, 1st Edition, Harcourt India Pvt. Ltd., 2002

EE1938	**Advanced Computer Architecture**		L=3	T = 0	P = 0	Credits =3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• The objective of this course is to introduce the fundamental techniques on which high-performance computing is based, to develop the foundations for analyzing the benefits of design options in computer architecture, and to give some experience of the application of these techniques.	• Understand and evaluate the hardware components of advanced architectures Understand and analyze architectures performance and select among different ones for particular use scenarios • Understand and analyze the most important parallel architectures in order to distinguish their main difference. • Understand the levels of software and hardware comprising the Instruction Set Architecture (ISA) of a computer • Make design decisions based on performance data
Mapped Program Outcomes: a, d	

Unit – I

The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers. Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit – II

Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Unit – III

Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors,RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Unit - IV

Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Unit – V

Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Unit – VI

Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Resources:

1. “Advanced computer architecture”, Kai Hwang, Tata McGraw Hill,1993
2. “Computer organization and design” ,D. A. Patterson and J. L. Hennessey, 2nd Edition, Morgan Kaufmann,
3. “Computer Architecture and organization”, J.P.Hayes, 3rd Edition, McGraw Hill,1998
4. ”Memory System and Pipelined processors” Harvey G.Cragon , NarosaPublication,1998
5. “Parallel computer”;V.Rajaranam & C.S.R.Murthy, Printice Hall of India,2002
6. “Foundation of Parallel Processing”, K.Ghose, Rajan Moona & Phalguni Gupta, Narosa Publications,2002

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Dean (Acad. Matters)		Version		

EE1939	**Pattern Recognition**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	**Outcomes**
• Provide deeper knowledge of demanding methods of pattern recognition and of their applications.	Upon successfully completing the course, the student should: • Demonstrate the understanding of fundamentals of Bays Decision Theory • Able to understand parameter estimation and supervised learning, non-parametric techniques • be able to use linear discriminate functions, unsupervised learning and clustering • develop skill base necessary to further explore advanced topics of Pattern Recognition and their applications for research
Mapped Program Outcomes: a,d	

Unit I

PATTERN RECOGNITION OVERVIEW: Engineering approach to PATTERN RECOGNITION, relationship of PATTERN RECOGNITION to other areas, Pattern recognition applications, pattern techniques, pattern recognition approaches (StatPR, SyntPR, NeurPR)

FEATURES AND FEATURE EXTRACTIONS TECHNIQUES: Introduction, zoned features, Graph representation techniques, sequentially detected features, feature extraction, feature vector and feature space.

Unit II

BAYS DECISION THEORY: Introduction, bays decision theory continuous case, two category classification, minimum error rate classification, classifier, discriminate functions and decision surfaces (multicategory and two category case). The normal density function (Univariate and multivariate normal density function)

Unit III

PARAMETER ESTIMATION AND SUPERVISED LEARNING: maximum likelihood estimation, Bayes classifier, general Bayesian learning, problem of dimensionally,

Unit IV

NON-PARAMATRIC TECHNIQUES, Density estimation, Parzen windows, k nearest estimation, nearest neighbor rule, k- nearest neighbor rule, approximation by Series expansion, approximation for binary case, Fisher's linear discriminant, Multiple discriminant analysis

Unit V

LINEAR DISCRIMINATE FUNCTIONS: Linear discriminate functions and decision surface, two category and multi-category case generalized linear discriminate functions
, minimizing the perception criteria functions, relaxation procedure, minimum squared error procedures

Unit VI

UNSUPERVISED LEARNING AND CLUSTERING: Mixture densities and identifiability Maximum likelihood estimates, Unsupervised Bayesian learning, Data description and clustering, similarity measures, criterion functions for clustering, iterative optimization, hierarchical clustering

References:

1. Pattern classification and scene analysis, R. O. Duda and P. E. Hart, Wiley Interscience publications.
2. Pattern Recognition and Image Analysis, Earl Gose, Richard Johnsonbaugh, and Steve Jost; PHI Pvte. Ltd.,NewDelhi-1, 1999
3. Pattern Recognition, Sergios Theodoridis and Konstantinos Koutroumbas, Elsevier Academic Press, Second Edition, 2003,

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EE1931	**Project Phase – I**	L= 0	T = 0	P = 16	Credits = 8
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	100			100	

EE1941	**Project Phase – II**	L= 0	T = 0	P = 24	Credits = 12

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

M. Tech. SoE and Syllabus 2014-15

Communication Engineering

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Cont. Hrs.		MSE - I	MSE - II	TA	ESE	
I SEMESTER												
1	ET1951	Mathematical Foundations for Communication Engineering	3	0	0	3	3	15	15	10	60	3
2	ET1952	Passive RF Circuits & Systems	3	0	0	3	3	15	15	10	60	3
3	ET1953	**Lab:** Passive RF Circuits & Systems	0	0	2	2	1			40	60	
4	ET1954	Advanced Digital Communication	3	0	0	3	3	15	15	10	60	3
5	ET1955	Lab: Advanced Digital Communication	0	0	2	2	1			40	60	
6	ET1956	Adaptive Signal Processing	3	0	0	3	3	15	15	10	60	3
7	ET1957	**Lab:** Adaptive Signal Processing	0	0	2	2	1			40	60	
8	**Professional Elective- I**		3	0	0	3	3	15	15	10	60	3
	ET1958	Error Control Coding										
	ET1959	Embedded Systems & DSP Processor										
	ET1960	Pattern Recognition										
Total			**15**	**0**	**6**	**21**	**18**					
II SEMESTER												
1	ET1961	Advanced Antenna Theory	3	0	0	3	3	15	15	10	60	3
2	ET1962	**Lab:** Advanced Antenna Theory	0	0	2	2	1			40	60	
3	ET1963	VLSI Signal Processing	3	0	0	3	3	15	15	10	60	3
4	ET1964	Digital Image processing	3	0	0	3	3	15	15	10	60	3
5	ET1965	**Lab:** Digital Image processing	0	0	2	2	1			40	60	
6	ET1966	Wireless Communications & Networks	3	0	0	3	3	15	15	10	60	3
7	**Professional Elective -II**		3	0	0	3	3	15	15	10	60	3
	ET1967	Selected Topics in Communication Systems										
	ET1968	Speech Processing										
	ET1969	Detection & Estimation Theory										
	ET1973	Real Time Operating System										
8	ET1978	Seminar	0	0	2	2	1			100		
Total			**15**	**0**	**6**	**21**	**18**					
III SEMESTER												
1	**Professional Elective- III**		3	0	0	3	3	15	15	10	60	3
	ET1970	Multimedia Communications										
	ET1971	Active RF Devices and Circuits										
	ET1972	Soft Computing										
2	**Professional Elective-IV**		3	0	0	3	3	15	15	10	60	3
	ET1974	High Speed Networks										
	ET1975	Wireless Sensor Networks										
	ET1979	Micro Electro Mechanical Systems										
3	ET1976	Project Phase-I	0	0	16	16	8			100		
Total			**6**	**0**	**16**	**22**	**14**					
IV SEMESTER												
1	ET1977	Project Phase-II	0	0	24	24	12			40	60	
Total			**0**	**0**	**24**	**24**	**12**					
Grand Total of Credits							62					

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Dean (Acad. Matters)		Version		

ET1951	Mathematical Foundations for Communication Engineering	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

To introduce the fundamentals of probability theory and random processes and illustrate these concepts with Communication engineering applications such as signal processing and digital communications.

UNIT-1:

Definitions, limitations of classical and relative-frequency-based definitions. Sets, fields, sample space and events; axiomatic definition of probability. Combinatory: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes' rule and applications

06Hrs

UNIT-2:

Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties. Jointly distributed random variables, conditional and joint density and distribution functions, independence; Bayes' rule for continuous and mixed random variables.

06Hrs

UNIT-3

Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution

Functions of a random variable, Functions of two random variables; Sum of two independent random variables.

06Hrs

UNIT-4:

Expectation: mean, variance and moments of a random variable. Joint moments, conditional expectation, Moment-generating and characteristic functions and their applications, Bounds and approximations:. Schwarz Inequality, Chebyshev inequality and Chernoff Bound, Central limit theorem and its significance. **06Hrs**

UNIT-5

Random vector: Joint distribution and densities, multiple transformation, mean vector, covariance matrix and properties, simultaneous, characteristic functions of random vectors, parameter estimation

06Hrs

UNIT-6:

Basic definitions, important Random processes, continuous-time linear systems with random inputs white noise, classification of random processes, WSS processes and LSI systems. **06Hrs**

Text books:				
1	Probability and Random Processes	2002	H. Stark, J.W Woods	Pearson Education
2	Probability, Random Variables and Stochastic Processes	2002	A. Papoulis, S. U. Pillai,	McGraw Hill

Reference books:				
1	Probability and Stochastic Processes	1992	R D Yates, D J Goodman	John Wiley and Sons

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1952	Passive RF Circuits and Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
To understand and study the design of RF circuits in communication systems. This course will help in Resonator and RF Filter designing, Study of RF Active components.

UNIT-1:Review of Basic Transmission Line Theory, Planar Transmission Lines - Stripline, microstrip line, Suspended strip line and coplanar line; Parallel coupled lines in Stripline and microstrip – Analysis, Design and characteristics. **06 Hrs**

UNIT-2:
Microwave Network Analysis - Microwave network representation, Impedance and admittance matrices, Scattering parameters, Typical two-port, three port, four port networks; Impedance Matching Techniques - Smith chart, Matching networks using lumped elements, Single- and double-stub matching, Quarter wave transformer, Baluns

06 Hrs

UNIT-3
Basic Passive Components -Lumped elements in MIC, Discontinuities and resonators in microstrip, Analysis and design of Stripline/microstrip components- Directional couplers, Power divider, Hybrid ring.

06 Hrs

UNIT-4:
Switches and Phase Shifters Basic series and shunt switches in microstrip; SPST and SPDT switches, Switched line, branch line coupled and loaded line phase shifters in microstrip, Applications in phased arrays.

06 Hrs

UNIT-5
MIC Filters - Lumped element filter design at RF. Impedance and Low pass scaling, Frequency transformation, High impedance/Low impedance low pass filter, Parallel coupled band pass filter, High pass filter, bandstop filter

06 Hrs

UNIT-6:
Basics of MIC, MMIC and MEMS technologies - Substrates used.

06 Hrs

Text books:

1	Radio Frequency and Microwave Electronics	2001	M.M. Radmanesh,	Pearson Education Asia,
2	Stripline-like Transmission Line for Microwave Integrated Circuits,	1989.	B. Bhat& S.K. Koul	New Age Intl. (P) Ltd.,

Reference books:

1	Radio Frequency and Microwave Communication Circuits – Analysis and Design,	2001.	D. K. Misra,	John Wiley & Sons,

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ET1953	Lab: Passive RF Circuits and Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Ten Experiments based on

1. **Low Pass, Band Pass, Band Stop Filters**
2. **Couplers**
3. **Phase Shifter**
4. **Power Divider**
5. **Hybrid ring Coupler**
6. **Switches**

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1954	Advanced Digital Communication	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

This course discusses the principles that underline the analysis and design of digital communication systems. The focus is on the reliable transmission and reception of symbols over noisy channels. The students will explore linear and nonlinear modulation techniques, various channels like AWGN and fading, Synchronization techniques, Equalization techniques and MIMO channels

UNIT-1: Review of fundamental concepts and parameters in Digital Communications, Performance of BPSK and QPSK in AWGN channel, Performance of binary FSK and M-ary PSK in AWGN channel.

06 Hrs

UNIT-2:

Minimum Shift Keying (MSK) Modulation, GMSK, Continuous Phase Modulation (CPM) Schemes Channel Characterization and Modeling, Orthogonal Frequency Division Multiplexing (OFDM), Carrier Synchronization, Timing synchronization.

06 Hrs

UNIT-3

Representations of band pass signal and systems, signal space representation, representation of digitally modulated signals, spectral characteristics of digitally modulated signals.

06 Hrs

UNIT-4:

Baseband reception and probability of error, the ML and MAP detection strategies, ML detection with zero mean AWGN,the optimum filter, Schwarz's inequality, transfer function of optimum filter, matched filter, properties of Matched filter, correlation receiver,equalization,the zero forcing equalizer, adaptive equalizer, scrambling, the eye pattern.

06 Hrs

UNIT-5

Spread spectrum signals for digital communications: Introduction to Spread Spectrum Modulation, DSSS, FHSS, and CDMA signals, Code Acquisition and Tracking, Spread Spectrum as a Multiple Access Technique.

06 Hrs

UNIT-6:

Multichannel and Multicarrier Systems; Digital Communications through Fading Multipath channels; Multi User Communications.

06 Hrs

Text books:				
1	Digital Communications	1995 4th Edition	J.G.Proakis	McGraw Hill,
2	Digital Communications	1998	Simon Haykin	John Wiley & Sons

Reference books:				
1	Principles of Digital Communications and Coding	1979	J. Viterbi and J. K. Omura	McGraw Hill,
2	Spread Spectrum Communications	1995.	MarvinK.Simon,Jim K Omura,RobertA. Scholtz, Barry K.Levit	John Wiley & Sons
3	CDMA Principles of Spread Spectrum Communications	1995.	Andrew J Viterbi	Addison Wesley

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Dean (Acad. Matters)		Version		

ET1955	Lab : Advanced Digital Communication	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Ten Experiments based on

1. **BPSK**
2. **QPSK**
3. **MSK**
4. **MIMO**
5. **OFDM**
6. **Channel Estimation**

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1956	Adaptive Signal Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

Advances in Digital Signal Processing involve variable sampling rates, applications in communication systems and signal processing. Linear adaptive filters are studied. It is intended to introduce a course in multirate signal processing, filtering and spectrum estimation.

UNIT-1:Wiener filtering. Optimum linear prediction. Levinson- Durbin algorithm. Prediction error filters.

06 Hrs

UNIT-2:

Adaptive filters. FIR adaptive LMS algorithm. Convergence of adaptive algorithms. Fast algorithms. Applications; Noise canceller, echo canceller and equalizer.

06 Hrs

UNIT-3

Transform domain adaptive filters, The orthogonalization property of orthogonal transforms, The transform domain LMS algorithm.

06 Hrs

UNIT-4:

Recursive least – squares algorithms. Matrix inversion lemma. Convergence analysis of the RLS algorithm.

06 Hrs

UNIT-5

Adaptive beam forming. Kalman filtering.

06 Hrs

UNIT-6:

Fast RLS algorithm, Least square forward prediction, Least square backward prediction, least square lattice, The RLS algorithm, The FTRLS algorithm. Case studies and Industrial Applications.

06 Hrs

Text books:				
1	Adaptive Filters:Theory& Applications		B.FarhangBoroujeny	wiley Publication
2	Adaptive Filter Theory	1996,(3/e),	Simon Haykin	Prentice- Hall

Reference books:				
1	Statistical and Adaptive Signal Processing	2005	D.G.Manolakis	McGraw-Hill,
2	Statistical Digital Signal Processing and Modeling		M.H.Hays,	John-Wiley.

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Dean (Acad. Matters)		Version		

ET1957	Lab : Adaptive Signal Processing	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Ten Experiments based on

1. Random Number generator and finding correlation and autocorrelation
2. Wiener filter
3. LMS and NLMS
4. Adaptive equalizer
5. Linear predictor
6. RLS algorithm and fast algorithm

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1958	Error Control Coding	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

The purpose of the course is to present error correction/detection coding in a modern setting, covering both traditional concepts thoroughly as well as modern developments in soft-decision and iteratively decoded codes and recent decoding algorithms for algebraic codes.

UNIT-1:

Coding for reliable digital transmission and storage. Groups, Rings, Vector Spaces, Galois Fields, Polynomial rings.

06 Hrs.

UNIT-2:

Channel models, Linear Block codes, syndrome and error detection, the minimum distance of block code,standard array and syndrome decoding, Cyclic codes, polynomials , the division algorithm for polynomials,circuit implementation of cyclic codes.

06 Hrs.

UNIT-3

Convolution codes, decoding algorithms for Convolution codes, Viterbi, Stack algorithm, Fano algorithm, Application of Convolution codes.

06 Hrs.

Unit 4:

BCH codes, primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, Reed Solomon Codes, Berlekamp-Massey and Euclid decoding algorithm, Decoding beyond the minimum distance Parameter, Applications of Reed-Solomon codes.

06 Hrs.

UNIT-5

Trellis coded Modulation, Combinatorial description of Block and Convolution codes, mapping by set partitioning ,TCM design rule.

06 Hrs.

UNIT-6:

Soft decision decoding algorithms, Iterative decoding algorithms, Turbo-decoding, Two-way algorithm, LDPC codes, Use of LDPC codes in digital video broadcasting, belief propagation (BP) algorithms, Space-Time codes.

06 Hrs.

Text books:				
1	Error Control Coding: Fundamentals and Applications	2003.	Shu Lin and Danicl J. Costello Jr	Prentice Hall,
2	Error Control Systems for Digital Communication and Storage	1995	S. B Wicker	Prentice- Hall

Reference books:				
1	Theory and Practise of Error Control Codes	2003.	Shu Lin and Danicl J. Costello Jr	Prentice Hall,
2	Error Control Systems for Digital Communication and Storage	1983.	Blahut R. E	Addisson Wesley
3	Algebraic codes for Data transmission	2003	Blahut R.E	Cambridge University Press
4	Fundamentals of Convolutional codes	1999.	Johannesson R and Zigangirov K.S	IEEE press
5	Trellis structure of codes, Chapter 24 of Handbook of Coding Theory.		V. S Pless and W. C Huffman, A. Vardy	
6	Error Correction Coding-Mathematical methods & algorithms		Todd K Moon	Wiley

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1959	Embedded Systems & DSP Processor	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

The course introduces us with the basics of embedded systems, familiarity with the Optimizing Design Metrics, processor technology, IC technology, design technology, hardware, the software, peripherals, memory and interfacing and tradeoffs.

UNIT-1:

Embedded Systems, Introduction, Design Metrics, Processor Technology, IC Technology, Design Technology, Design Productivity Gap, Custom Single purpose Processor Design, RT level design, FSMD, Data-paths, Optimization, Instruction set simulators for simple processors.

06Hrs

UNIT-2:

Architectural Features Of ARM: Processor modes, Register organization, Exceptions and its handling,Memory, Memory-mapped I/Os, ARM and THUMB instruction sets, Addressing modes, DSP extensions, ARM sample codes

06 Hrs

UNIT-3

ARM7/9 Core: H/W architecture, Timing diagrams for Memory access, Co-processor interface, Debug support, Scan chains, Embedded Real Time ICE, Hardware and software breakpoints. Buses: AMBA, ASB, APB, Development tool like Compilers, Debuggers, IDE etc.

06Hrs

UNIT-4:

DSP Architecture: MAC, Modified bus structures and Memory access schemes, Multiple access Memory , Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes, On chip peripherals.

06 Hrs

UNIT-5:

TMS320C3X -32 bit floating point DSP Processor: Introduction, features, Applications, Block diagram, Internal architecture, CPU & data paths, Functional units, Addressing modes, Memory architecture, External memory accesses, Pipeline operation, Peripherals.

06Hrs

UNIT-6:

Assembly language programming. Hardware tools: DSP and other DSP boards Software tools: Assembly language tools.

06Hrs

Text books:				
1	ARM System Developer's Guide: Designing and Optimizing	2004	Sloss Andrew N, Symes Dominic, Wright Chris	Morgan Kaufman Publication
2	Digital signal processors	2002, 1st Edition	B. Venkataramani, M Bhaskar	Tata McGraw Hill

Reference books:				
1	ARM System-on-Chip Architecture	2nd Edition,2002	Steve furber	Pearson Education
2	Embedded System Design	2002, 1st Edition	Frank Vahid and Tony Givargis	Wiely Publication
3	Embedded System Design	2003	Raj Kamal	Tata McGraw Hill ,

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1960	Pattern Recognition	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

To equip with basic mathematical and statistical techniques commonly used in pattern recognition. To introduce to the various pattern recognition algorithms.

UNIT-1:

Introduction ,Applications of Pattern Recognition, Statistical Decision Theory,The Internet Pointers to the Literature, Problems

05Hrs

UNIT-2:

Probability, Probabilities of Events, Random Variables, Joint Distributions and Densities Moments of Random Variables ,Estimation of Parameters from Samples, Minimum Risk Estimators, Problems

06Hrs

UNIT-3

Statistical Decision Making

Introduction, Bayes' Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries ,Unequal Costs of Error ,Estimation of Error Rates ,The Leaving-One-Out Technique, Characteristic Curves, Estimating the Composition of Populations, Problems

07Hrs

UNIT-4:

Nonparametric Decision Making

Introduction , Histograms, Kernel and Window Estimators, Nearest Neighbor Classification Techniques, Adaptive Decision Boundaries, Adaptive Discriminant Functions , Minimum Squared Error Discriminant Functions, Choosing a Decision Making Technique, Problems

07Hrs

UNIT-5

Clustering

Introduction , Hierarchical Clustering, Partitional Clustering, Problems

07Hrs

UNIT-6:

Recent trends in Pattern Recognition

03 Hrs

Text books:				
1	Pattern Recognition and Image Analysis		Earl Gose,Richard Johnsonbaugh	Printice Hall
2	Pattern Classification	2006	Richard O. Duda, Peter E. Hart and David G. Stork	2nd Edition, John Wiley,

Reference books:				
1	Pattern Recognition and Machine Learning	2009	C. M. Bishop	Springer,
2	Pattern Recognition	2009	Theodoridis and K. Koutroumbas	4th Edition, Academic Press

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1961	Advanced Antenna Theory	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
The course aims at basic principles and theory of antennas. It gives the latest developments and advances on antennas and its physical concepts are emphasized.

UNIT-1:
Fundamental Parameters of Antenna, Radiation Integrals & Auxillary Potential Function
06Hrs

UNIT-2:
Planar Antennas Microstrip rectangular and circular patch antennas. Analysis and design, Feeding Methods; Circularly polarized microstrip antennas, Broadbanding techniques. Printed slot antennas.
06Hrs

UNIT-3

Yagi array of linear elements and printed version, Log-periodic dipole array. Frequency Independent Antennas Planar spiral antenna,
06Hrs

UNIT-4:
Array Theory Linear array; Broadside and end fire arrays, Self and mutual impedance of between Linear elements, grating lobe considerations. Planar array Array factor, beamwidth, directivity. Example of microstrip patches arrays and feed networks & analysis**.**
06Hrs

UNIT-5
Aperture Antennas- Field equivalence principle, Babinet's principle. Rectangular waveguide horn antenna, Parabolic reflector antenna. Uniqueness theorem
06Hrs

UNIT-6:
Antennas for mobile communication. Handset antennas: FIFA, Smart antennas, Switch beam system, Adaptive array system, Spatial Division Multiple Access.
06 Hrs

Text books:				
1	Antenna Theory and Design	1997.	C. A. Balanis	John Wiley & Sons

Reference books:				
1	CAD of Microstrip Antennas for Wireless Applications	1996.	R.A. Sainati	Artech House
2	Antenna design Handbook	1988	R. Garg, P. Bharhia, I. Bahl, and A. Ittipiboo	Artech House.
3	Microstrip Antennas: Theory & Design		J. R. James, P.S. Hall and C.Wood, , Peter Peregrinns	UK

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1962	Lab : Advanced Antenna Theory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Sr. No.	Ten Experiments Based on
1.	Microstrip patch antenna
2.	Slot Antenna
3.	Yagi Uda Antenna
4.	Log periodic Antenna
5.	Horn Antenna
6.	Antenna Arrays

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1963	VLSI Signal Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES

The students shall gain proficiency in subjects like the basic design of theory involved in VLSI for signal processing and communication systems , various software tools related to VLSI, Signal Processing and Communication Systems.

UNIT-1:

Introduction to DSP systems – Typical DSP algorithms, Data flow and Dependence graphs - critical path, Loop bound, iteration bound, longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power,

06Hrs

UNIT-2:

Retiming – definitions and properties Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application.

06Hrs

UNIT-3

Folding transformation, Register minimisation techniques Systolic architecture design, FIR systolic arrays, selection of scheduling vector, 2d systolic array design, systolic design for space representations containing delays.

06Hrs

UNIT-4:

Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm

Pipelined and parallel recursive filters – Look-Ahead pipelining in first-order IIR filters, Look-Ahead pipelining with power-of-2 decomposition, Clustered look-ahead pipelining, Parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters.

06 Hrs

UNIT-5

Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using

Horner's rule for precision improvement

06 Hrs

UNIT-6:

Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture

Numerical strength reduction- subexpression elimination, multiple constant multiplication, iterative matching, sub-expression sharing in digital filters, additive and multiplicative number splitting

06 Hrs

Text books:				
1	VLSI Digital Signal Processing Systems, Design and implementation	2007 1st Edition	Keshab K. Parhi	Wiley Interscience,.

Reference books:				
1	"Digital Signal Processing with Field Programmable Gate Arrays".	2nd Edition, 2004	U. Meyer- Bease,	Springer,

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1964	Digital Image Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

Objectives of the course is to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field. Concepts of video and standards are introduced.

UNIT-1:

Digital image fundamentals – image acquisition, representation, visual perception, quality measures, Sampling and quantization, basic relationship between pixels, imaging geometry, color spaces, Image enhancement – point processing, spatial domain filtering.

06 Hrs

UNIT-2:

Image transforms - DFT, DCT, Haar, KL transform, Wavelets and multiresolution processing, Sub-band coding, Multiresolution expansion, One dimensional wavelet transform, Wavelet series expansion, Discrete wavelet transform, Continuous wavelet transform, fast wavelet transform, 2-D wavelet transform, Wavelet packets.

06 Hrs

UNIT-3

Frequency domain filtering, Image restoration/degradation model, Restoration-spatial domain filtering, Periodic Noise Reduction by Frequency Domain filtering, Motion debluring, Estimation the degradation function, Inverse filtering, Minimum Mean Square Error (Wiener Filtering),Constrained Least square filter**.**

06 Hrs

UNIT-4:

Image compression – Data redundancy, lossless and lossy compression techniques, standards for image compression – JPEG, JPEG2000.

06 Hrs

UNIT-5

Image Segmentation-The detection of Discontinuities: Point, Line and Edge Detections :Gradient Operators and Laplacian, Edge linking and Boundary detection : Local Processing and Global Processing Via Hough Transform, Thresholding. Region based segmentation, Clustering technique, Active Contour.

06 Hrs

UNIT-6:

Representation Schemes, Chain Codes, Polygon Approximation, signatures, Skeleton, Boundary Descriptors: Simple Descriptors, Shape Numbers, Fourier Descriptors, Region Descriptor: statistical moments, simple descriptor, Topological descriptor, Texture, Dilation and erosion, opening and closing hit-or-miss transformation, morphological algorithms.

06Hrs

Text books:				
1	Digital Image Processing	2002	R. C. Gonzalez and R E Woods	Pearson Education
2	Digital Image Processing		S. Jayaraman, S. Esakkirajan, T Veerakumar	McGraw-Hill

Reference books:				
1	Fundamentals of Digital Image Processing	1989	A K Jain	Pearson Education
2	Digital Image Processing	2001	W Pratt	Wiley

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1965	Lab : Digital Image Processing	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Sr. No.	Ten Experiments Based on
1.	Image Enhancement & Spatial Domain Filtering
2.	Image Transforms
3.	Frequency Domain Filtering
4.	Image Compression
5.	Image Segmentation
6.	Morphological Operations

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1966	Wireless Communications & Networks	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

This course provides an authoritative treatment of the fundamentals of mobile communications, one of the fastest growing areas of the modern telecommunications industry. It stresses the fundamentals of mobile communications engineering and the networks that are important for the design of any mobile system.

UNIT-1:

Radio Propagation Characteristics: Reflection, diffraction and Scattering, Models for path loss, shadowing and multipath fading (delay Spread, coherence band width, coherence time, Doppler spread), Multipath Fading Models~~: Rayleigh, Rician~~

06 Hrs

UNIT-2:

Diversity**:** Realization of Independent Fading Paths ,Diversity System Model , Selection Combining , Threshold Combining , Maximal Ratio Combining, Equal-Gain Combining ,Moment Generating Functions in Diversity Analysis , Diversity Analysis for MRC , Diversity Analysis for EGC and SC , Diversity Analysis for Noncoherent and Differentially Coherent Modulation , Transmitter Diversity

06 Hrs

UNIT-3

Multicarrier Modulation , Fading across Subcarriers , Frequency Equalization , Precoding , Adaptive Loading ,Coding across Sub channels RAKE receivers ,

06 Hrs

UNIT-4.:

Multiple access techniques for wireless communication: SDMA ,Packet radio protocols: Pure & Slotted ALOHA,CSMA

06 Hrs

UNIT-5:

Wireless Systems and Standards: GSM-GSM services and features, Architecture, Radio Subsystem, GSM channel types, Frame structure and signal processing in GSM, CDMA-Forward CDMA channel, Reverse CDMA channel

06 Hrs

UNIT-6:

3G Overview, 3GPP Network Architecture, 4G features and challenges, Introduction to wireless LANs - IEEE 802.11 WLANs, Blue tooth , Wi-Max, Zigbee

06 Hrs

TEXTBOOK				
1	Wireless communications	2003.	Rappaport. T.S	Pearson Education
2	Wireless Communications	2007.	Andrea Goldsmith	Cambridge University Press

REFERENCES:				
1.	Fixed Broadband Wireless System Design	2003.	HARRY R. ANDERSON	John Wiley –India
2.	3G Wireless Networks	2nd Edition, 2007	Clint Smith. P.E., and Daniel Collins	Tata McGraw Hill
3.	Wireless Communication and Networking	2007	Vijay. K. Garg, Morgan Kaufmann	Publishers, http://books.elsevier.com/9780123735805
4.	Principles of Wireless Networks	2006.	Kaveth Pahlavan,. K. Prashanth Krishnamuorthy	Prentice Hall of India,
5.	Wireless Communications and networks	2nd Ed., 2007.	William Stallings	Pearson / Prentice Hall of India,

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Dean (Acad. Matters)		Version		

ET1967	Selected Topics In Communication Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

This course takes a unified view of the fundamentals of wireless communication and explains the web of concepts underpinning these advances at a level accessible to an audience with a basic background in probability and digital communication. Particular emphasis is placed on the interplay between concepts and their implementation in systems.

UNIT-1:

Physical modeling for wireless channels**:** Free space, fixed transmit and receive antennas, moving antenna , Reflection from wall, Reflection from a ground plane , Power decay with distance and shadowing ,Moving antenna with multiple reflectors Input /output model of the wireless channel: linear time-varying system, Baseband equivalent model, A discrete-time baseband model, Degrees of freedom, Additive white noise Time and frequency coherence **:**Doppler spread and coherence time, Delay spread and coherence bandwidth. Statistical channel models **:**Rayleigh and Rician fading**.**

06Hrs

UNIT-2:

Detection in a Rayleigh fading channel: Non-coherent and Coherent detection Time diversity

Antenna diversity :Receive diversity, Transmit diversity, MIMO. Frequency diversity :Single-carrier with ISI equalization, Direct-sequence spread-spectrum

06 Hrs

UNIT-3

AWGN channel capacity Capacity of Flat: Fading Channels- Channel Distribution Information (CDI), Channel Side Information at Receiver, Channel Side Information at Transmitter and Receiver, Capacity with Receiver Diversity Capacity of Frequency: Selective Fading Channels- Linear time-invariant, Time-Varying Channels

06 Hrs

UNIT-4:

Multiplexing capability of deterministic MIMO channels : Capacity via singular value decomposition, Rank and condition number. Physical modeling of MIMO channels: Line-of-sight SIMO channel ,Line-of-sight MISO channel , Antenna arrays with only a line-of-sight path ,Geographically separated antennas,Line-of-sight plus one reflected path Modeling of MIMO fading channels**.**

06 Hrs

UNIT-5

The V-BLAST architecture Fast fading MIMO channel: Capacity with CSI at receiver and Full CSI. Receiver architectures: Linear decorrelator, Successive cancellation, Linear MMSE receiver D-BLAST**:** an outage-optimal architecture, Coding across transmit antennas: D-BLAST.

06 Hrs

UNIT-6:

Diversity–multiplexing tradeoff: Scalar Rayleigh channel, Parallel Rayleigh channel, MISO Rayleigh channel, 2×2 MIMO Rayleigh channel, nt ×nr MIMO i.i.d. Rayleigh channel Universal code design for optimal diversity: multiplexing tradeoff - Universal code design for scalar channels, parallel channels, MISO channels, MIMO channels Uplink with multiple receive antennas: Space-division multiple access ,SDMA capacity region MIMO uplink:SDMA with multiple transmit antennas Downlink with multiple transmit antennas MIMO downlink.

06 Hrs

Text books:				
1	Fundamentals of Wireless Communications	2005	David Tse, Pramod Viswanath	Cambridge University Press

Reference books:				
1	Coding for Wireless Channels	2007	E. Biglieri,	Springer,
2	MIMO Wireless Communications	2007	E. Biglieri,	Cambridge University Press
3	WIRELESS COMMUNICATIONS	2005	Andrea Goldsmith	Cambridge University Press

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1968	Speech Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES: This course provide with an overview of speech communication in its wide ranging aspects,from a discussion of how humans produce and perceive speech to details of computer based speech processing for diverse communication applications.

UNIT-1:
Speech Production
Human speech production mechanism, acoustic theory of speech production, Digital models for speech production.
06Hrs

UNIT-2:
TIME DOMAIN MODELS FOR SPEECH PROCESSING
Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate ,Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.
06Hrs

UNIT-3
FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 9
Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder, Channel Vocoder -Homomorphic speech analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic Vocoders.
07Hrs

UNIT-4:
LINEAR PREDICTIVE CODING (LPC) ANALYSIS
Basic principles of Linear Predictive Analysis:The Autocorrelation Method, The Covariance Method,Solution of Lpc Equations: Cholesky Decomposition, Solution for Covariance Method, Durbin's Recursive Solution for the AutoCorrelation Equations, Comparision between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.
07Hrs

UNIT-5
Speaker Recognition: Issues in speaker recognition, Speaker verification vs identification, Text-dependent vs text-independent speaker recognition, Vector quantization models applications in speaker recognition, and Gaussian mixture modeling for speaker and speech recognition
06Hrs

UNIT-6:
Discrete and Continuous Hidden Markov modeling for isolated word and continuous speech recognition, DTW.
06Hrs

Text books:				
1	Discrete-time speech signal processing: Principles and Practice	2002	T.F Quatieri	Pearson
2	Digital Processing of Speech Signals	1978.	L R Rabiner,	Pearson
3.	Fundamentals of Speech Recognition	1993	L. Rabiner and B. Juang	Pearson
Reference books:				
1	Speech Communication – Human and Machine	2000	Douglas O'Shaugnessy	IEEE Press

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

ET1969	Detection and Estimation Theory	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
This course provides an introduction to the basic theory and techniques of signal detection and estimation. It provides essential background for engineers and scientists working in a number of fields, including communications, control, signal, and image processing, radar and sonar, radio astronomy, seismology, remote sensing, and instrumentation.

UNIT-1:
Review of Probability Theory; Stochastic Processes; Representation of Stochastic Processes;
06Hrs

UNIT-2:
Classical Detection and Estimation Theory Elementary hypothesis testing, Bayes rule, minimax rule, Neyman-Pearson rule; composite hypothesis testing.
06Hrs

UNIT-3
Detection of deterministic and random signals in Gaussian noise; Detection in non-Gaussian noise; Chernoff bound, asymptotic relative efficiency; sequential and distributed detection;
06Hrs

UNIT-4:
Estimation Theory: estimation of parameters, Random parameters: Bayes Estimates, Estimation of , Nonrandom parameters, Properties of Estimators, LMSE.
06Hrs

UNIT-5
Estimation of Waveforms: Linear MMSE Estimation of waveforms, Estimation of Stationary processes: Wiener filter, Estimation of Non-stationary processes: Kalman filter, Nonlinear estimation
06Hrs

UNIT-6:
Nonparametric detection, Locally optimal detection, Robust detection and estimation.
Applications of detection and estimation Applications in diverse fields such as communications, system identification, adaptive filtering, pattern recognition.
06Hrs

Text books:				
1	Introduction to statistical Signal processing with Applications	1989.	Srinath, Rajasekaran&Viswanathan	Prentice Hall of India, New Delhi
2	An Introduction to Signal Detection and Estimation	1994	H.V. Poor	2nd edition, Springer,
3	Fundamentals of Statistical Signal Processing:Vols.1&2	1993, 1998	S.M. Kay	Prentice Hall,

Reference books:				
1	Detection, Estimation and Modulation Theory	1968.	. E.L. Van Trees	Wiley, New York,
2	Detection of signals in noise and estimation	1985	Shanmugam and Breipohl	John Wiley &Sons, New York
3	Signal processing: Discrete Spectral analysis, Detection and Estimation	1975	Mischa Schwartz and Leonard Shaw	Mc-Graw Hill Book Company

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Dean (Acad. Matters)		Version		

ET1973	Real Time Operating Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Objective

The course objective is to cover the principles of real-time and embedded systems inherent in many hardware platforms and applications being developed for engineering applications. As part of this course, students will learn about real-time and quality of service system principles, understand real-time operating systems and the resource management and quality of service issues that arise, and construct sample applications on representative platforms.

UNIT-1:

Overview Of Commands, File I/O. (Open, Create, Close, Lseek, Read, Write), Process Control (Fork, Vfork, Exit, Wait, Waitpid, Exec), Signals, Inter Process Communication (Pipes, FIFOs, Message Queues, Semaphores, Shared Memory).

06 Hrs

UNIT-2:

Typical Real Time Application, Hard Vs Soft Real Time Systems, a Reference Model of Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

06 Hrs

UNIT-3

Functional Parameters, Resource Parameters of Jobs and Parameters of Resources Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs State Systems, Effective Release Times and Dead Lines, Offline Vs Online Scheduling.

06 Hrs

UNIT-4:

Overview, Time Services and Scheduling Mechanisms, other Basic Operating System Function, Processor Reserves and Resource Kernel. Capabilities of Commercial Real Time Operating Systems.

06 Hrs

UNIT-5

Introduction, Fault Causes, Types, Detection, Fault and Error Containment, Redundancy: Hardware, Software, Time. Integrated Failure Handling.

06 Hrs

UNIT-6:

Memory Managements Task State Transition Diagram, Pre-Emptive Priority, Scheduling, Context Switches – Semaphore – Binary Mutex, Counting: Watch Dogs, I/O System Process Management, Scheduling, Interrupt Management, and Synchronization.

06 Hrs

Text books:				
1	Real Time Systems	1999	Jane W.S. Liu	Pearson
2	Real Time Systems		C.M.Krishna, KANG G. Shin	McGraw.Hill

Reference books:				
1	Advanced Unix Programming		Richard Stevens	

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ET1978	**Seminar**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
			100		**100**	

ET1970	**Multimedia Communications**			**L= 3**	**T = 0**	**P = 0**	**Credits = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Course Objectives

1. To learn the basics of image & graphics data types
2. To understand various Fundamental concepts in video
3. To grasp basics of digital audio
4. To get acquainted with various algorithms used for multimedia data compression
5. To explore various standards used in image, video and audio compression

UNIT-1: Introduction to multimedia , concept of non-temporal and temporal media, Graphics & image data representation: graphics & image data types, computer image processing: Image synthesis, analysis and transmission, popular file formats(GIF, TIFF, JPEG, PNG**)**

06 Hrs

UNIT-2: Fundamental concepts in video Types of video signals: component, composite and s-video, analog video :NTSC, PAL, SECAM video, digital video : chroma sub-sampling, CCIR standards for digital video, HDTV,

06 Hrs

UNIT-3: Basics of digital audio:
digitization of sound, MIDI, quantization and transmission of audio

06 Hrs

UNIT-4:
Multimedia data compression
Lossless compression algorithms: Run length coding, Huffman coding, arithmetic coding
Lossy compression algorithms - DCT, Wavelet- Based Coding
Basic image compression standard- JPEG- **main steps in JPEG Image compression, Image preparation, JPEG modes- Lossy sequential DCT based, Expanded lossy DCT based, Lossless and hierarchical mode**

06 Hrs

UNIT-5: Video compression
Introdction to video compression, video compression based on motion compensation, search for motion vectors, detail study of various video compression standards-MPEG-1, MPEG-2, MPEG-4, MPEG-7

06 Hrs

UNIT-6: Audio compression
basic audio compression techniques, , MPEG audio compression, Applications of multimedia related to image and video processing

06 Hrs

Text books:

1	Fundamentals of Multimedia	2004	Ze-Nian Li , Mark S Drew	PHI/Pearson Education
2	Multimedia Applications	2004	Steinmetz, Nahrst	Springer

Reference books:

1	Multimedia Communications: Applications, Networks, Protocols and Standars	2001	Fred Halsall	Addison-Wesley

Course Outcome:
Students will be able to

1.Graphics/image/video/audio data representations, including color models, HDTV, MIDI, and audio coding
2.Compression formats and standards for data, images, audio, and video, including both lossless and lossy formats
3.Multimedia networks, considering QoS, VoIP, media-on-demand, and multimedia over wireless networks
4.Content-based retrieval in digital libraries

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Dean (Acad. Matters)		Version		

ET1971	Active RF Devices and Circuits	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
Analyze microwave components and circuits in terms of scattering parameters. Determine the electrical characteristics of waveguides and transmission lines through electromagnetic field analysis. Design microwave amplifiers and oscillators based on stability, bandwidth, power, gain and noise figure criteria.

Unit 1
Active RF Component & their Modeling: RF Diodes, Linear & Non linear Diode Models, small & large signal Model of BJT & FET, Active Device Measurements

06 Hrs

UNIT 2
Transistor Amplifiers - Types of amplifiers. S parameter characterization of transistors; Two Port power gain Amplifier Stability , Stability Circle , Test for Unconditional Stability, MOSFETs , Equivalent circuit model.

06 Hrs

UNIT-3:
Single stage amplifier design- unilateral and bilateral cases, Design for Maximum Gain Constant gain, design for Specified Gain , DC bias circuits for amplifiers;

06 Hrs

UNIT-4
Detectors - Point contact and Schottky barrier diodes. Characteristics and equivalent circuit, Theory of microwave detection, Detector circuit design, FM detectors. Low Noise amplifier and Power amplifier : Class A, B, AB, C, D, E, F

06 Hrs

UNIT-5:
Types of mixers. Mixer theory and characteristics. SSB versus DSB mixers. Single-ended mixer and single-balanced mixer. Double balanced and image rejection mixers;

06 Hrs

UNIT-6
Oscillators Oscillator versus amplifier design, Oscillation conditions; Gunn diode Modes of operation, Equivalent circuit. Design of Gunn diode oscillator, FET oscillators. Frequency tuning techniques. Phase Locked Loop (PLL).

06 Hrs

Text books:				
1	Radio Frequency and Microwave Communication Circuits Analysis and Design	2004	D. K. Misra	John Wiley,
2	Microwave Engineering	1998	D. M. Pozar	John Wiley
3.	**RF Circuits Design**		Renhold Ludwig and Pavel Bretchko	Prentice Hall

Reference books:				
1	Microwave Transistor Amplifiers Analysis and Design	1997.	G. Gonzalez	Prentice Hall
2	The Design of CMOS Radio-Frequency Integrated Circuits	Second Edition	Thomas H. Lee	CAMBRIDGE
3	Microwave and Millimeter Wave Phase Shifters, Vol.II- Semiconductor And Delay Line Phase Shifters,	1991	S.K. Koul and B. Bhat	Artech House
4	Microwave Circuit Design using Linear and Nonlinear Techniques,	1990	G.D. Vendelin, A.M. Pavio and U.L. Rhode	

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ET1972	Soft Computing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Objective The objective is to have general understanding of soft computing methodologies including artificial neural networks, genetic algorithms, fuzzy sets and fuzzy logic systems. Develop computational neural network models and fuzzy models for engineering systems.

Unit 1

Genetic algorithms: Population based search techniques, evolutionary strategies, mathematical foundations of genetic algorithms, search operators, genetic algorithms in function and combinational optimization, hybrid algorithms, application to pattern recognition

06 Hrs

Unit 2

Introduction of neural networks, NN Architecture Neural learning and laws, Applications of ANN Evaluation of network,

Supervised Learning:

Single layer network: MP neuron, Perceptron, Perceptron training algorithm, LMS algorithm, ADALINE

06 Hrs

Unit 3

Multiplayer network: Multilevel Discrimination, Backpropogation Algorithm, Setting the parameter values, Accelerating the learning Process, MADALINE, Adaptive Multilayer Networks, Recurrent Network, RBF networks,

06 Hrs

Unit 4

Unsupervised Learning: Winner Take Network, Learning Vector Quantizer, ART Networks, self-organizing feature maps, PCA, Associate Models

06 Hrs

Unit 5

Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conorms Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers

06 Hrs

Unit 6

Fuzzy equations, fuzzy relations , Fuzzy controllers, Defuzzification Methods, Fuzzy Inference Techniques, applications of fuzzy logic

06 Hrs

Text books:				
1	Neural networks	2004	C. Mohan and S. Ranka	Penram publications
2	Fuzzy sets and fuzzy logic, Theory and Applications ,	2009	George J. Klir, Bo Yuan	PHI
3	Neural Networks: A comprehensive foundation	1999	S. Haykin	Pearson

Reference books:				
1	Introduction to artificial neural networks	1997	J. M. Zurada	Jaico publishing
2	Artificial Neural Networks	1999	B. Yejnanarayana	PHI
3	Neural Networks, Fuzzy Logic, and Genetic algorithms, Synthesis and Applications	2006	S.Rajasekaran, G.A.Viayalakshmi Pai	Prentice Hall

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ET1974	High Speed Networks		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

The main purpose of this course is to introduce students the important areas of communication networks, mainly Multistage networks .This will enable the students to acquire a solid understanding of foundations of networks technologies, systems, networks issues as well as economic deployment considerations.
of networks technologies, systems, networks issues as well as economic deployment considerations.

UNIT-1:
Network services, Network Elements, Basic Network Mechanism, High Performance Networks, Traffic Characterization and quality of service, Applications, Layered Architecture.
06 Hrs

UNIT-2:
OSI and IP Models, Frame Relay, Internet Protocol, TCP and UDP, Performance of TCP/IP networks, Internet Success and Limitation
06 Hrs

UNIT-3 :
Wireless Networks: Introduction, The wireless Channel, Link Level Design, Channel Access, Network Design
06 Hrs

UNIT-4:
Control of Networks: Objectives and Methods of Control, Circuit-switched Networks, Datagram Networks, Mathematical Background of Control Networks.
06 Hrs

UNIT-5:
Introduction to Adhoc Wireless Networks, Issues, Routing approaches, Table-Driven of Routing Protocols, On-Demand Routing Protocols, Hierarchical routing Protocols. Ad hoc network security- Requirements, Issues and Challenges
06 Hrs

UNIT-6:
SONET, Optical Links, WDM Systems, Optical Cross-Connects, Optical LANs, Optical Paths and Networks
06 Hrs

Text books:				
1	Computer Networking	2005	J.F.Kurose & K.W. Ross	Pearson
2	High-Performance Communication Networks	2e	Jean Warland Pravin Varaiya	Elsevier

Reference books:				
1	Adhoc Wireless Networks	2005	C.Siva Ram Murthy & B.S.Manoj	Pearson Education, 2005.

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ET1975	Wireless Sensor Network	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:

To expose the students the fundamental concepts of IP based wireless communication systems/networks. To impart students with Wireless/Mobile IP Architecture and Evolution; Performance and Quality of Service; Mobility, Routing, and Signaling; Real-Time Applications.

UNIT-1:

Introduction to sensors- Definition of sensor & its difference from transducer, Classification of sensors, application of sensors in various fields.

Architecture-single node architecture-hardware components, energy consumption of sensor nodes, operating system and execution **environments**

06Hrs

UNIT-2:

Network architecture-optimization goal and figure of merit-design principles for WSN, service interface of WSN, Gateway concept challenges of WSN, comparison with other network.

06Hrs

UNIT-3

Wireless channel and communication fundamental, physical layer and transceiver design consideration in WSN.

06Hrs

UNIT-4:

MAC Protocols-Fundamental of MAC Protocol, low duty cycle protocol and wakeup concepts, schedule based protocols , Link layer protocols, routing protocols ,

06Hrs

UNIT-5

Naming and addressing, Time synchronization, Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement.

06Hrs

UNIT-6:

Data centric routing, Data aggregation, Data centric storage, Topology control-controlling topology in a flat network, Hirarical network by dominating set, Hierarchical network by clustering, combining Hierarchical topologies and power control**.**

06Hrs

Text books:				
1	Protocols and architecture for Wireless Sensor Networks	2007	Holger Karl, Andreas Willig,	Wiley
2	Handbook of Algorithms for Wireless Networking and Mobile Computing	2006	AzzedineBoukerche	Chapman & Hall/CRC, 2006

Reference books:				
1	Wireless Sensor Network Designs,	2003	Anna Hac	Wiley
2	Wireless Sensor Networks : A systems perspective	2005	NirupamaBulusu and Sanjay Jha	Artech House, August 2005.
3	Wireless Sensor Networks : Architecture and Protocols	2003	Jr., Edgar H. Callaway,	Auerbach, 2003.
4	Wireless Sensor Networks	2005	C.S. Raghavendra, Krishna M. Sivalingam and TaiebZnati	Springer,

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ET1979	Micro Electro Mechanical Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
To give detail study of micro electronics circuit and various devices in the manufacturing process of MEMS.
To give brief introduction regarding various processes involved in the manufacturing of MEMS.

UNIT-1:
Intrinsic Characteristic of MEMS :- Energy Domains & Transducers. Sensors & Actuators. Introduction to Micro fabrication- silicon based MEMS processes. New Materials- Review of Electrical and Mechanical concepts in MEMS. Semiconductor devices- Stress & Strain analysis- Flexural beam bending, Torsional deflection
07Hrs

UNIT-2:
Electrostatic sensors- Parallel Plate capacitors, Applications, Interdigital Finger capacitor,Com drive devices, Thermal sensing and Actuation, Thermal Expansion, Thermal couples, Thermal resistors, Applications, Magnetic Actuators, Micro magnetic Components, Case studies of MEMS in magnetic actuators
06Hrs

UNIT-3
Piezoresistive sensors, Piezoresistive sensor materials, Stress analysis of mechanical elements, Applications to Inertia,Pressur, Tactile and Flow sensors, Piezoelectric sensors and actuators, Piezoelectric effects, Piezoelectric materials, Applications to Inertia, Acoustic , Tactile and Flow sensors.
06Hrs

UNIT-4:
Silicon Anisotropic Wet Etching, Dry Etching of Silicon, Plasma Etching, Deep reaction Ion Etching (DRIE), Isotropic Wet Etching, Gas phase Etchants-Case studies, Basic surface micromachining processes, Structural and sacrificial materials, Acceleration of sacrificial Etch, Striction and Anistriction methods, Assembly of 3D MEMS,Foundry process
08Hrs

UNIT-5
Polymers in MEMS , Polimide, SU-8, Liquid Crystal Polymer(LCP), PDMS, PMMA, Parylene,Flurocarbon, Application to acceleration, Pressure, Flow and Tactile sensors
06Hrs

UNIT-6:
Optical MEMS, Lensens and Mirrors, Actuators for Active Optical MEM
06Hrs

Text books:				
1	Foundations of MEMS	2006	Chang Liu,	Pearson Education Inc

Reference books:				
1	An Introduction to Micro electro mechanical system design	2000	Nadim Maluf	Artech House
2	The MEMS Handbook	2000	Mohames Gad-el-Hak	CRDC press Baco Raton
3	MEMS & Micro systems Design and Manufacture	2002	Tai Ran Hsu,	Tata Mcgraw Hill, New Delhi.

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ET1976	PROJECT PHASE - I	L=0	T=0	P=16	Credits=8

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			100		100	

OBJECTIVES

As the project methodology for the batches is decided in the 2nd semester the student shall carry out the project work further 3rd semester. The project work consists of ;

1. Literature survey
2. Study of processes /phenomenon related to project.
3. Design of any equipment its fabrication and testing.

ET1977	PROJECT PHASE - II	L=0	T=0	P=24	Credits=12

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			40	60	100	

1. Review of work done in project phase I and final Design of any equipment, its fabrication and testing.
2. Critical analysis of design or process for optimization
3. Verification by experimentation.
4. In case of industrial project the necessary modifications with the proper design suggested to the industry should be explained. The letter from the industry should be attached in the report related to the performance of the student.

VLSI DESIGN

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE - I	MSE - II	TA	ESE	
I SEMESTER												
1	EE1951	VLSI Signal Processing	3	0	0	3	3	15	15	10	60	3
2	EE1952	Digital IC Design	3	0	0	3	3	15	15	10	60	3
3	EE1953	VLSI Technology	3	0	0	3	3	15	15	10	60	3
4	EE1954	Embedded System & RTOS	3	0	0	3	3	15	15	10	60	3
5	EE1955	Advanced Digital System Design	3	0	0	3	3	15	15	10	60	3
6	EE1956	Lab: Embedded System & RTOS	0	0	2	2	1			40	60	
7	EE1957	Lab: Digital IC Design	0	0	2	2	1			40	60	
8	EE1958	Lab: Advanced Digital System Design	0	0	2	2	1			40	60	
			15	**0**	**6**	**21**	**18**					
II SEMESTER												
1	EE1961	RF Circuit design	3	0	0	3	3	15	15	10	60	3
2	EE1962	Analog IC Design	3	0	0	3	3	15	15	10	60	3
3	EE1963	Sythesis&Optimisation of VLSI Circuits	3	0	0	3	3	15	15	10	60	3
4	**Professional Elective - I**		3	0	0	3	3	15	15	10	60	3
	EE1966	Low Power CMOS VLSI Design										
	EE1967	Hardware Software Codesign										
	EE1968	Nano Scale MOS Transistors										
5	**Professional Elective - II**		3	0	0	3	3	15	15	10	60	3
	EE1969	Verification & Testing of VLSI Circuit										
	EE1970	Digital Image Processing										
	EE1971	Solid State Devices &Modelling										
6	EE1964	Lab: RF Circuit design	0	0	2	2	1			40	60	
7	EE1965	Lab: Analog IC Design	0	0	2	2	1			40	60	
8	EE1972	Seminar	0	0	2	2	1			100		
			15	**0**	**6**	**21**	**18**					

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III SEMESTER

1	**Professional Elective - III**		3	0	0	3	3	15	15	10	60	3
	EE1982	Mixed Signal VLSI Design										
	EE1983	Micro Electro Mechanical Systems										
	EE1984	VLSI for wireless communication										
2	**Professional Elective - IV**		3	0	0	3	3	15	15	10	60	3
	EE1985	ASIC Design										
	EE1986	Semiconductor Memory Design										
	EE1987	Advanced Computer Architecture										
3	EE1981	Project Phase - I	0	0	16	16	8			100		
			6	**0**	**16**	**22**	**14**					

IV SEMESTER

1	EE1991	Project Phase - II	0	0	24	24	12	40	60	
			0	**0**	**24**	**24**	**12**			
Grand Total of Credits							**62**			

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EE1951/EE1920	VLSI Signal Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The students shall gain proficiency in subjects like the basic design of theory involved in VLSI for signal processing and communication systems , various software tools related to VLSI, Signal Processing and Communication Systems.	• Graduates will understand and able to design architectures for DSP algorithms. • Graduates will understand and able to apply the optimisation concept in terms of area, speed and power on DSP systems. • Graduates will understand and able to optimize DSP arithmetic.
Mapped Program Outcomes:	

UNIT I:

Introduction to DSP systems, Data flow and Dependence graphs - critical path, Loop bound, iteration bound, longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, parallel processing, Pipelining and parallel processing for low power.

UNIT II:

Retiming – definitions and properties, solving systems of inequalities, Retiming techniques, Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application

UNIT III:

Folding: folding transformation, Register Minimization Techniques, Register minimization in folded architectures folding of multirate systems.Systolic Architecture Design: Introduction, Systolic Array Design Methodology, FIR systolic Arrays, Selection of scheduling vector, Matrix Multiplication and 2D systolic array Design, Systolic design for space representations containing Delays.

UNIT IV:

Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm, Winograd algorithm, iterated and cyclic convolution, Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture, rank-order filters, Odd-Even merge-sort architecture, parallel rank order filters.

UNIT V:

Pipelined interleaving in digital filters, pipelining in first-order digital filters, Parallel processing of digital filters, combined pipelining and parallel processing of IIR filters, Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement, Distributed Arithmetic.

Unit VI:

Redundant number representation, carry free radix-2 addition and subtraction, hybrid radix 4 addition,radix2 hybrid redundant multiplication architectures, data format conversion, redundant to non redundant converter, Numerical strength reduction – sub-expression elimination, multiple constant multiplication, iterative matching.

Resources:

1. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007.
2. U. Meyer – Baese, " Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004

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VLSI DESIGN

EE1952 / EE1902	Digital IC Design	L=3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The aim of this course is to give knowledge and skills in the area of CAD design of digital circuits, units and systems on currently usable VLSI chips.	• Graduates will able to demonstrate issues related to the development of digital integrated circuits including fabrication, circuit design, implementation methodologies • Graduates will able to Solve complex circuit problems and optimization techniques • Graduates will able to design CMOS combinational, sequential logic design
Mapped Program Outcomes:	

Unit I: CMOS processing technology:

MOS transistors, CMOS logic, NAND gate, combinational logic, NOR gate, Compound gates, Pass transistor and transmission gates, tristates, multiplexers, latches and flip flops, inverter cross section, fabrication process, Layout design rules, CMOS processing technology, CMOS Process enhancements, stick diagram, VLSI design flow ,Euler path in a CMOS gate.

Unit II: MOS transistor theory:

MOS transistor theory, Working of nMOS enhancement transistor & PMOS enhancement transistor, Ideal Current voltage characteristics, threshold voltage , nonideal current voltage effects, velocity saturation, mobility degradation, channel length modulation, Body effect, subthreshold conduction, Junction leakage, Tunneling, Temperature dependence, Geometry dependence, Small signal AC characteristics, CMOS inverter DC transfer characteristics, Beta ratio effects, noise margin, Ratioed inverter transfer function, switch level RC delay models

Unit III: Circuit characterization and performance estimation:

Delay estimation, RC delay models, linear delay model, logical effort, parasitic delay, Delay in a logic gate, delay in a multistage logic networks, power dissipation, interconnect, design margin, Reliability, Scaling

Unit IV: Combinational circuit design:

Circuit families, static CMOS, Ratioed circuits, Cascode voltage switch logic, dynamic circuits, pass transistor circuits, differential circuits, sense amplifier circuits, BiCMOS circuits

Unit V: Sequential Circuit design:

Sequencing static circuits, Sequencing methods, Max-delay constraints, Min-delay constraints, Time borrowing, clock skew, circuit design of latches and Flip flops, static sequencing element methodology, Two phase timing types, characterizing sequencing element delays, sequencing dynamic circuits, Synchronizers.

Unit VI: Array subsystems:

Static Random access memory, Dynamic random access memory, serial access memories, Content addressable memory Programmable logic arrays.

Resources:

1. "CMOS VLSI design: A Circuits and Systems Perspective", Neil H. E. Weste, David F. Harris, A.Banerjee, 3rd Edition, Addison Wesley Publication, 2008
2. "CMOS Digital Integrated Circuits: Analysis and Design", Sung-Mo Kang, Yusuf Lebeleci, 3rd Edition, McGraw-Hill Publications, 2002

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EE1953	VLSI Technology	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The objective of the VLSI Technology is to identify new/hot areas of interest to the Electron Devices and Solid-State Circuits communities.	• Graduates will be able to understand the Fabrication of ICs and purification of Silicon in different technologies. • Graduates will be able to understand impart in-depth knowledge about Etching and deposition of different layers. • Graduates will be able to understand the different packaging techniques of VLSI devices.
Mapped Program Outcomes:	

Unit I

Crystal growth & wafer preparation, Processing considerations: Chemical cleaning, gettering the thermal Stress factors.Epitaxy: Vapors phase Epitaxy, Basic Transport processes & reaction kinetics, doping & auto doping, equipments, safety considerations, buried layers, epitaxial defects, molecular beam epitaxy, equipment used, film characteristics, SOI structure.

Unit II

Oxidation: Growth mechanism & kinetics, Silicon oxidation model, interface considerations, orientation dependence of oxidation rates, thin oxides, Oxides, Oxidation technique & systems dry & wet oxidation. Masking properties of SiO2.Diffusion: Diffusion from a chemical source in vapour form at high temperature, diffusion from doped oxide source, diffusion from an ion implanted layer.

Unit III

Lithography: Optical Lithography: optical resists, contact & proximity printing, projection printing,
electron lithography: resists, mask generation, Electron optics, roster scans & vector scans, variable beam shape.X-ray lithography: resists & printing, X ray sources & masks. Ion lithography.
Etching: Reactive plasma etching, AC & DC plasma excitation, plasma properties, chemistry & surface interactions, feature size control & anisotropic etching, ion enhanced & induced etching, properties of etch processing. Reactive Ion Beam etching, Specific etches processes: poly/polycide. Trench etching,

Unit IV

Dielectric &polysilicon film deposition: Deposition processes, Polysilicon, Silicon dioxide, silicon nitride. Diffusion: Models of diffusion in solids, Ficks one dimensional diffusion equations, atomic diffusion mechanisms, Diffusivities of B,P,As &Sb, Diffusion enhancement & retardations,

Unit V

Ion implantation, range theory, equipment, annealing, Metallization, Metallization Applications, Metallization Choices, Physical vapor Deposition, Patterning, Metallization problems.

Unit VI

VLSI Process integration, Fundamental considerations for IC processing, nMOS IC technology, CMOS IC technology, MOS memory IC technology, Bipolar IC technology, Yield & reliability, mechanism of yield loss in VLSI, modelling of yield loss mechanisms, reliability requirements for VLSI.

Resources:

1. S.M. Sze, " Modern Semiconductor Device Physics", John Wiley & Sons, 2000.
2. . B.G. Streetman, "Solid State Electronics Devices", Prentice Hall, 2002.
3. Chen,"VLSI Technology" Wiley, March 2003

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Dean (Acad. Matters)		Version		

EE1954 / EE1937	Embedded System & RTOS	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To introduce students to the embedded systems, its hardware and software, real time operating systems, inter-task communication and an exemplary case of RTOS.	• Students will be able to understand and learn the concepts, architecture, programming, addressing modes for various embedded systems • Students will be acquainted with the new concepts related to design of embedded systems, introspect themselves for applying their previous knowledge for various parameters, especially, selection of operating systems, processors, controllers, memory, IO devices, etc • Students will be able to establish link for hardware-software interaction for embedded systems, develop build process for signal / data processing through related software and hardware set up • Students will be acquainted with task scheduling, interrupt mechanisms and various managements related to embedded real time operating systems, and will be able to discuss / deliver presentation on contemporary issues related to system on chip and system on slice
Mapped Program Outcomes:	

Unit I:

Introduction to embedded systems, basic concepts, application areas and categories of embedded systems: Stand aloneEmbedded systems, Real Time systems, Requirements, challenges Recent trends and applications of Embedded systems.

Unit II:

New trends in hardware platforms for Embedded system design, Processor selection criteria in Embedded system design, Embedded system design with microprocessors, microcontrollers, and DSP processor.

Unit III:

Issues involved in choosing appropriate development platforms and tools for design of Embedded systems, development environments, operating systems, task scheduling, non real and real time operating systems

Unit IV:

Need for communication Interfaces, RS 232 communication parameters, connector configurations, UART, serial communications, Ethernet, IEEE 802.11, Bluetooth system specifications

Unit V:

Embedded Real Time Operating systems, concepts, architecture of Kernel, tasks, task scheduler, interrupt service routines, semaphores, Mutex, Mailboxes, Message queue management function calls, event register management function calls, signals and timer management function calls, memory management, priority inversion problems in design of Embedded Real Time Operating systems.

Unit VI:

Commonalities of Embedded Real Time Operating systems, Embedded operating systems –LINUX, Real Time Operating systems –RTLINUX, Concept of system on chip and system on Slice.

Resources:

1. ‘Embedded / Real Time Systems – Concepts, design and programming’ Dr.K.V.K.K.Prasad, (DreamTech Press), Reprint Edition, 2006
2. ‘Designing Embedded Hardware’, John Catsoulis, 2nd Edition, O’reilly Publication, 2005
3. ‘Programming for Embedded systems – Cracking the code’ DreamTech Software Team, WileyPublishingInc, 2006
4. “An Embedded Software Primer”, David E. Simon, 1st Edition, Pearson Education,1999
5. “Embedded System Design”, Frank Vahid, Tony Givargis, John Wiley & Sons, Inc,2002
6. “Building Embedded Linux Systems”, Karim Yaghmour,2nd Edition, O’reilly,2008
7. “Programming Embedded Systems”, Michael Barr, 2nd Edition, O’reilly,2006
8. “Real-time systems & software”, Alan C. Shaw,3rd Edition, John Wiley & sons, Inc.2001
9. “Computers as Components”, Wayne Wolf, 1st Edition, Harcourt India Pvt. Ltd., 2002

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Dean (Acad. Matters)		Version		

EE1955 / EE1904	Advanced Digital System Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design	• Graduates will be able to design and analyse combinational and sequential logic circuits. • Graduates will understand hardware description language and able to design and simulate digital systems using different abstraction levels. • Graduates will be able to understand and apply timing issues in multiple contexts and design the circuit. • Graduates will understand programmable devices and able to design digital systems using modern design tools.
Mapped Program Outcomes:	

Unit I

Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs.

Unit II

HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modeling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module.

Unit III

Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog &Testbench, Compilation and synthesis, Timing analysis.

Unit IV

Data Flow Modeling, Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modeling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives.

Unit V

Behavioral Modeling, Initial, Always, Procedural Assignment, Blocking and Non- Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign Deassign, Force Release, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines.

Unit VI

Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Stacks and Queues, Multi bit Adders & Multiplier, Huffman Coding, Processor and Memory Model , CPU, System Tasks and Functions, Design Verification.

Resources:

1. “Verilog Digital System Design” - ZainalabedinNavabi, Second Edition, Tata McGraw Hill, 2009
2. “Verilog HDL: A Guide to Digital Design and Synthesis”, Samir Palnitkar, 2nd Edition, Prentice Hall India, 2003
3. “A Verilog HDL Primer”, J. Bhaskar, 2nd Edition, Star Galaxy Press, 1997

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1956	**Lab: Embedded System & RTOS**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practical based on Syllabus of **Embedded System & RTOS**

EE1957/ EE1907	**Lab : Digital IC Design**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practical based on Syllabus of **Digital IC Design**

EE1958/ EE1908	**Lab: Advanced Digital System Design**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practical based on Syllabus of **Advanced Digital System Design**

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE 1961 / EE1911	**RF Circuit Design**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To study RF component such as resonator, filter, transmission lines, etc, • To learn design of RF amplifiers using transistors	• Graduates will have an ability to demonstrate in-depth knowledge of general RF circuits, components and systems and an understanding of resonant circuits • Graduates will be able to understand and use Smith Chart for developing circuits in RF applications. • Graduates will be able to design impedance matching networks, passive RF filters and RF power amplifiers. • Graduates will be able to use CAD tools for RF circuit design.
Mapped Program Outcomes:	

Unit I

Introduction, Importance of Radio frequency Design, RF Behaviour of Passive Components, Chip Components, Transmission Line Analysis, Equivalent Circuit Representation, Circuit Parameters for a Parallel Plate Transmission Line, Microstrip Transmission Line, Terminated Lossless Transmission Line, Special Termination Conditions, Sourced and Loaded Transmission Line.

Unit II

The Smith Chart, From Reflection Coefficient to Load Impedance, Impedance Transformation, Admittance, Transformation, Parallel and Series Connections, Single- and Multiport Networks, Interconnecting Networks, Network Properties and Applications, Scattering Parameters.

Unit III

An Overview of RF Filter Design, Basic Resonator and Filter Configurations, Special Filter Realizations, Filter Implementation, Coupled Filter.

Unit IV

Matching and Biasing Networks: Impedance Matching Using Discrete Components, Microstrip Line Matching Networks, Amplifier Classes of Operation and Biasing Networks.

Unit V

RF Transistor Amplifier Designs: Characteristics of Amplifiers, Amplifier Power Relations, Stability Considerations, Constant Gain, Noise Figure Circles, Constant VSWR Circles, Broadband, High-Power, and Multistage Amplifiers

Unit VI

Oscillators, Basic Oscillator Model, High-Frequency Oscillator Configuration, Oscillators describing functions, Colpitt's oscillators Resonators, Tuned Oscillators, Negative resistance oscillators, Phase noise Basic Characteristics of Mixers. Non-linear based mixers, Quadratic mixers, Multiplier based mixers,Single balanced and double balanced mixers, sub sampling mixers.

Resources:

1. "RF Circuit Design – Theory and Applications", Reinhold Luduig and PavelBretchko, 2nd Edition, Pearson Education, 2000.
2. T.Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004.
3. B.Razavi, "RF Microelectronics", Pearson Education, 1997.
4. B.Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1962/EE1916	Analog IC Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To understand the functions of various digital and analog IC's and their applications in the design of electronic circuits	• Graduates will able to demonstrate behaviour of single, multiple transistor amplifier • Graduates will able to Solve complex circuit problems • Graduates will able to model integrated circuit devices • Graduates will be able to design nonlinear analog circuits
Mapped Program Outcomes:	

Unit I: Models for integrated circuit active devices:

Depletion region of a p-n junction, Small Signal & large signal behavior of MOS & BJT transistor, short channel effects in MOS transistors, weak inversion in MOS transistor, substrate current in MOS transistor

Unit II: Single transistor and multiple transistor amplifiers:

Basic Single transistor Amplifiers stages: Common Emitter, Common base, Common Collector, Common Drain, Common Gate & Common Source Amplifiers, Multiple Transistor Amplifier stages: CC-CE, CC-CC, & Darlington configuration, Cascode configuration, Active Cascode, Super source follower, Differential pairs, DC transfer characteristics.

Unit III: Current Mirrors, Active Loads & References:

Current Mirrors: Simple current mirror, Cascode current mirrors, Widlar current mirror, Wilson Current mirror, Active loads, Voltage & current references, supply and temperature independent biasing techniques

Unit IV: Operational Amplifier with single ended outputs:

Deviations from ideality in real operational amplifiers, Basic two stage op amp, two stage MOS Operational Amplifier with cascodes, MOS telescopic-cascode operational amplifiers, MOS Folded-cascode operational amplifiers, MOS active cascade operational amplifiers, Bipolar operational amplifiers

Unit V: Frequency response of integrated circuits:

Single stage amplifiers & miller effect, MOS differential amplifier differential mode gain, frequency response of the common mode gain for a differential amplifier, frequency response of voltage buffers, frequency response of current buffers, Multistage amplifier frequency response, frequency response of a current mirror loading a differential pair.

Unit VI: Nonlinear Analog Circuits:

Analysis of four quadrants, Gilbert cell as an analog multiplier, Phase Locked Loops, Integrated circuit phase locked loops, Voltage controlled oscillators, Switched Capacitor Circuits and Switched Capacitor Filters.

Resources:

1. "Analysis and Design of Analog Integrated Circuits", Paul B Gray ,hurst ,Lewis, Meyer ,fifth edition, John Wiley & sons, reprint 2010.
2. "CMOS Analog Circuit Design"P.E.Allen,D.R.Holdberg,secondedition,Oxforduniv. press.2010
3. "CMOS circuit design, Layout, and simulation" R.Jacob Baker, second edition, Wiley student edition, reprint 2009

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1963	Synthesis & Optimization of VLSI Circuits	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The objective of this course is to acquaint concept of Optimization of Very Large Scale Integration (VLSI) circuit and. systems design	At the end of this course, students will • Understand basic Boolean functions, their representations and different CAD based synthesis and optimization issues. • Understand, able to analyze and solve the algorithms which underpin behavioral synthesis including scheduling, allocation and binding. • Understand and able to analyze high level synthesis issues, two level logic optimization, multilevel logic optimization, and sequential logic optimization. • Understand and able to apply the Satisfiability (SAT) concept.
Mapped Program Outcomes:	

Unit I

Microelectronics, Semiconductor technologies and circuit taxonomy, Microelectronic design styles, Computer aided synthesis and optimization. Graphs Notation, Undirected graphs, Directed graphs, Combinatorial optimization, Algorithms, Tractable and intractable problems Graph optimization problems and algorithms, Boolean algebra and Applications.

Unit II

Hardware Modeling Languages, Distinctive features, Structural hardware language, Behavioral hardware language, HDLs used in synthesis, Abstract models, Structures logic networks, State diagrams, Data flow and sequencing graphs, Compilation and optimization techniques.

Unit III

Logic optimization, principles, Operation on two level logic covers, Algorithms for logic minimization, Symbolic minimization and encoding property, Minimization of Boolean relations. Multiple level combinational optimizations, Models and transformations

Unit IV

Combinational networks, Algebraic model, Synthesis of testable network, Algorithm for delay evaluation and optimization, Rule based system for logic optimization. Sequential circuit optimization, Sequential circuit optimization using state based models, Sequential circuit optimization using network models.

Unit V

A model for scheduling problems, Scheduling with resource and without resource constraints, Scheduling algorithms for extended sequencing models, Scheduling Pipe lined circuits. Cell library binding, Problem formulation and analysis, Algorithms for library binding, Specific problems and algorithms for library binding (lookup table F.P.G.As and Antifuse based F.P.G.As), Rule based library binding.

Unit VI

Ongoing work in logic Synthesis, Speedup Algorithms Design Reuse, Domain Specific Synthesis, Testability, Future role of Logic Synthesis

Resources:

1 “Synthesis and Optimization of Digital Circuits" ,Giovanni De Micheli, 1st Edition, Tata McGraw-Hill, 2003.
2. “Logic Synthesis” SrinivasDevadas, AbhijitGhosh, and Kurt Keutzer,1st Edition, McGraw-Hill, USA, 1994.
3. ”Principles of CMOS VLSI Design: A System Perspective”,NeilWeste and K. Eshragian, 2nd edition,Pearson Education,2000.
4. “VHDL for Programmable Logic,” Kevin Skahill, 1st Edition, Pearson Education, 2000.

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VLSI DESIGN

EE1966 / EE1918	Low Power CMOS VLSI Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To acquaint students with principles of design , analysis , modelling and optimization of low power VLSI , as well as to promote an interest in VLSI design	• Graduates will understand the concepts of sources of power dissipation and basics of CMOS Physics. • Graduates will understand the concepts of levels of abstraction and its power dissipation. • Graduates will understand the Power Optimization methods at Behaviour, Logic and Circuit Level design. • Graduates will understand the challenges in deep submicron technology. • Graduates will understand the principles for low power designs, and have the capabilities to analyze power consumption and develop low power strategies for a given system.
Mapped Program Outcomes:	

Unit I

Need for low power VLSI chips, Sources of power dissipation: Short circuit dissipation, dynamic dissipation, designing Techniques for low power. Physics of power dissipation in MOSFET devices, MOS Capacitance analysis, low power figure of merits, brief overview of low power VLSI design limits.

Unit II

Probabilistic power analysis: random logic signals, probability and frequency, probabilistic power analysis techniques, signal entropy, Low power circuits: transistor and gate sizing, equivalent pin ordering, network reconstruction and reorganization, Glitching Power, special latches and flip-flops.

Unit III

Behavioural, Logic and circuit level approaches. Algorithm level transforms. Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre-computation, Logic: gate reorganization, signal gating, logic encoding, state machine encoding.

Unit IV

Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect. Low voltage design techniques using reverse Vgs. Steep sub threshold swing and multiple threshold voltages. Multiple threshold CMOS based on path critically, multiple supply voltages.

Unit V

Low energy computing, Energy dissipation in transistor channel. Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and IO Buffer, supply clock generation.

Unit VI

Introduction, sources of software power dissipation, power estimation and optimization. Co-design for low power**.**

Resources:

1. "Solid State Electronic Devices", 6th Edition, Ben Streetman, Sanjay Benerjee.
2. "Low-Power CMOS VLSI Circuit Design", Kaushik Roy, Sharat C. Prasad, 1st Edition, Wiley India,2009
3. "Practical Low Power Digital VLSI Design", Gary K. Yeap, Kluwer Academic Publisher, 2002
4. "Low-Power CMOS Circuits-Technology, Logic Design and CAD Tools" Christian Piguet, 2006 by Taylor & Francis Group, LLC
5. "Energy Efficient Microprocessor Design", T. D. Burd and R. A. Brodersen, Boston: Springer, 2002.
6. "Low-Power Digital CMOS Design", A. Chandrakasan and R. Brodersen, Boston: Springer, 1995.
7. "Digital Integrated Circuits: A Design Perspective", 2nd ed., J. Rabaey, A. Chandrakasan, B. Nikolic.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1967	Hardware Software Codesign	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To educate the hardware, software, and system designer on the fundamentals of hardware/software codesign in a manner that will assist him/her in understanding and employing cooperative hardware/software design techniques for the construction of complex systems, particularly embedded systems.	• Graduates will understand the Models for describing hardware and software components (specification) • Graduates will understand the System design (hardware-software partitioning and design space exploration) • Graduates will understand Performance analysis and estimation techniques
Mapped Program Outcomes:	

Unit I

Introducing Hardware/Software Codesign, The Quest for Energy Efficiency, The Driving Factors in Hardware/Software Codesign, The Hardware-Software Codesign Space, The Dualism of Hardware Design and Software Design, Modeling Abstraction Level, Concurrency and Parallelism, Introducing Data Flow Graphs, Analyzing Synchronous Data Flow Graphs, Control Flow Modeling and the Limitations of Data Flow Models, Adding Time and Resources, Transformations

Unit II

Software and Hardware Implementation of Data Flow, Hardware/Software Implementation of Data Flow, Data and Control Edges of a C Program, Implementing Data and Control Edges, Construction of the Control Flow Graph, Construction of the Data Flow Graph, Application: Translating C to Hardware, Single-Assignment Programs

Unit III

Finite State Machine with Datapath, Hardware Modules, Finite State Machines, Finite State Machines with Datapath, FSMD Design Example: A Median Processor, Proper FSMD,Language Mapping for FSMD by Example, Limitations of Finite State Machines, Microprogrammed Control, Micro-instruction Encoding, The Micro-programmed Datapath, Implementing a Micro-programmed Machine, Micro-program Interpreters, Micro-program Pipelining

Unit IV

General-Purpose Embedded Cores: Processors, The RISC Pipeline, Program Organization, Compiler Tools, Low-Level Program Analysis, Processor Simulation, The System-on-Chip Concept, Four Design Principles in SoC Architecture, Example: Portable Multimedia System, SoC Modeling in GEZEL

Unit V

Connecting Hardware and Software, Synchronization Schemes, Communication-Constrained Versus Computation-Constrained, Tight and Loose Coupling, On-Chip Bus Systems, Bus Transfers, Multi-master Bus Systems, Bus Topologies

Unit VI

Microprocessor Interfaces: Memory-Mapped Interfaces, Coprocessor Interfaces, Custom-Instruction Interfaces, Hardware Interfaces: The Coprocessor Hardware Interface, Data Design, Control Design, Programmer's Model = Control Design + Data Design

Resources:

1. "A Practical Introduction to Hardware/Software Codesign" By Patrick R. Schaumont , Second Edition, Springer New York Heidelberg Dordrecht London,2013
2. "Readings in Hardware/software Co-design"**By Giovanni De Micheli,**Morgan Kaufmann, 2002
3. "The Co-design of Embedded Systems: A Unified Hardware Software Representation", Sanjaya Kumar, James H. Ayler , Kluwer Academic Publisher, 2002
4. "Co-synthesis of Hardware and Software for Embedded Systems",R.Gupta, Kluwer Publications, 1995.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1968	Nano Scale MOS Transistors	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To understand the necessary of scaling of MOS transistor. • To introduce the concepts of nano scale MOS transistor concepts and their performance characteristics. • To study the various nano scaled MOS transistors.	• Graduates will be able to apply knowledge from undergraduate engineering and other disciplines to identify, formulate and present solutions to technical problems in various engineering fields related to VLSI design and technology. • Graduates will be able to learn advanced technologies in the fields of VLSI design along with the fundamental concepts. • Graduates will be to understand multigate CMOS in detail
Mapped Program Outcomes:	

UNIT I: Basics of MOSFETs:
MOSFET scaling, Short channel effects, Channel engineering , Source/Drain Engineering, High k dielectric, Copper interconnects, Strain engineering ,SOI MOSFET Physics, Classical Physics, Quantum Effects

UNIT II: Multigate Technology:
Active Area, Gate Stack, Source/ Drain Resistance and Capacitance, Mobility and Strain Engineering, Contacts to Fins

UNIT III: Compact Models for Multi-Gate Transistors:
Framework for multigate FET Modelling, Multigate Models: BSIM-CMG and BSIM-IMG, Core Models, Modelling Physical Effects of Real Devices

UNIT-IV: Physics of Multigate MOS System:
Device electrostatics, Double Gate MOS System, Double Gate MOSFETs and FinFETs, Silicon Multiple Gate Nanowires

UNIT V: Radiation Effects in MOSFETs:
Brief history of radiation effects in SOI, Total Ionizing Dose Effects, Single Event Effects, Scaling Effects

UNIT-VI: Multigate MOSFET Circuit Design:
Impact of Device Performance on Digital Circuit Design, Analog Circuit Design, Device Figure of Merit, Mixed Signal Aspects, RF Circuit Design Aspects.

Resources:
1. J P Colinge, FINFETs and other multi-gate transistors, Springer – Series on integrated circuits and systems, 2008
2. Mark Lundstrom Jing Guo, Nanoscale Transistors: Device Physics, Modeling and Simulation, Springer, 2006.
3. M S Lundstorm, Fundamentals of Carrier Transport, 2nd Ed., Cambridge University Press, Cambridge UK, 2000

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1969/ EE1921	**Verification & Testing of VLSI Circuits**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To gain knowledge from the area of applying diagnostic principles in the design of modern Electronic systems.	• Students develop an understanding of VLSI design verification and testing issues. • Students learn how to generate test patterns for faults in a system and how to design a system for testability. • Ability to model different faults and carry out fault simulation in digital circuits. • Ability to know about importance of testing and its types in VLSI circuits.
Mapped Program Outcomes:	

Unit – I

Overview Of Testing**:** Design Process, Verification, Faults & Their Detection, Test Pattern Generation, Fault Coverage, Types Of Tests, Test Application, Testing Economics. Defects, Failures, and Faults: Physical Defects, Failures Modes, Faults, Fault Equivalence and Dominance, Fault Collapsing

Unit – II

Design Representation: Graphical representation, Graphs, Binary Decision diagrams, Netlists, VLSI Design Flow: CAD tools, Design Methodologies, Semicustom Design

Unit - III

Simulation: Logic Simulation, Approaches to Simulation, Fault Simulation & Their Results. Automatic Test Pattern Generation: D-Algorithm, Critical Path Extensions to D-Algorithm PODEM, FAN

Unit - IV

Ad Hoc Techniques, Scan–Path Design, Test pattern generation, Test Pattern Application, Scan architectures, multiple scan chains, Partial Scan Testing

Unit - V

Boundary-Scan Testing: Boundary Scans Architecture, Test Access Port, Registers, Tap Controller, Modes of Operation. Built In Self Test: Pseudorandom Test Pattern Generation, Response Compaction, BIST Architectures

Unit - VI

Memory Testing: Types of Memory Testing, Functional Testing Schemes, Testing FPGAs and Microprocessors: Testability Of FPGAs, Testing RAM- Based FPGAs, Testing Microprocessors, Synthesis For Testability.

Resources:

1. “Principles of Testing Electronic Systems”, 2nd edition SamihaMourad, YervantZorian
2. “Essentials of Electronic Testing for Digital, Memory, and Mixed-Signal VLSI Circuits”,Michael L. Bushnell and Vishwani D. Agrawal, B.S.Publications, 2000
3. "Digital Systems Testing and Testable Design" ,MironAbramovici, Melvin Breuer and Arthur Friedman, IEEE press,
4. “A Guide to VHDL" by Stanley Mazor,2nd Edition, Kluwer Academic Press, 2007
5. "HDL Chip Design" by Douglas Smith, 3rd Edition, Doone Publications, 2008
6. "Rapid Prototyping of Digital Systems", by J. O. Hamblen and M. Furman, Kluwer Academic Publishers.2001

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1970/EE1913	Digital Image Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• Provide deeper knowledge of theoretically demanding methods of image data processing and of their applications.	Upon successfully completing the course, the student should: • Demonstrate the understanding of fundamentals of Digital image processing wrt to enhancement, filtering, segmentation, restoration & representation • Able to understand the mathematical implementation & interpretation of image transforms • Be able to formulate solutions to general image processing problems • Develop skill base necessary to further explore advanced topics of Digital Image Processing for research
Mapped Program Outcomes:	

Unit I

An image model – sampling & quantization – basic relation between pixels: imaging geometry, Properties of 2-D Fourier transforms, FFT algorithm and other separable image transforms, Walsh transforms, Hadamard, Cosine, Haar, Slant Transforms, KL Transforms and their properties, Wavelets.

Unit II

Spatial domain methods, Frequency domain methods, Histogram Modification technique, Neighbourhood averaging, Median filtering, Low pass filtering, Averaging of Multiple Images, Image sharpening by differentiation, High pass Filtering,

Unit III

Degradation model for Continuous functions, Discrete Formulation, Diagonalization of Circulant and Block – Circulant Matrices, Effects of Diagonalization, Constrained and unconstrained Restorations Inverse filtering, Wiener Filter, Constrained least Square Restoration.

Unit IV

Fundamentals, Image compression models, error free compression, lossy compression, image compression standards Objective an subjective Fidelity Criteria, the encoding process, the Mapping, the Quantizer and the Coder, Contour Encoding, Run length Encoding, Image Encoding relative to a Fidelity Criterion, Differential Pulse Code Modulation, Transform Encoding.

Unit V

The detection of Discontinuities, Point Line and Edge Detections, Gradient Operators, Combined Detection, Image segmentation Thresholding. Region oriented segmentation Representation Schemes, Chain Codes, Polygon Approximation, Boundary Descriptors, Simple Descriptors, Shape Numbers, Fourier Descriptors Dilation and erosion, opening and closing hit-or-miss transformation, morphological algorithms, extension to gray scale images.

Unit VI

Color Image Processing: Color Fundamentals, color models, Pseudocolor image processing, Basics of full color image processing, Color transformations, Smoothing and sharpening, Color segmentation, Noise in color images,

Resources:

1. "Digital Image Processing", Gonzalez RC & Woods RE, 2nd Edition ,Addison Wesley Publishing Company,2002
2. "Fundamentals of Digital Image Processing" ,3rd Edition, Jain AK, Printice Hall of India, 1989
3. "Digital Image Processing", Pratt William K., 4thEdition,John Wiley & Sons 2000.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1971	Solid State Devices &Modelling	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To have fundamental knowledge about structure of devices, VI characteristics of devices like PN Junction diode, Zener diode, MOSFET, BJT and Opto electronic.	• Graduates will be able to learn advanced technologies in the fields of VLSI design along with the fundamental concepts. • Graduates will be able to understand and design advanced VLSI based system • Graduates will be able to understand the use of diodes and FET in VLSI field • Graduates will be able to understand the use of Lasers in VLSI field
Mapped Program Outcomes:	

Unit I:

Semi-conductor materials- Crystal lattices, bulk crystal growth, epitaxial growth, Physical models-bohr model, quantum mechanics, atomic structure, energy bands & charge carriers in semiconductors, carrier concentration, drift of carriers in electric and magnetic fields, diffusion of carriers.

Unit II:

Fabrication of P-N junctions, equilibrium conditions, forward and reverse biased junctions, steady state conditions, reverse bias breakdown, transient and a.c. condition, deviation from simple theory, metal semi-conductor junction, heterojunction

Unit III:

P-N junction diodes, tunnel diode, photo diode, light emitting diodes and lasers. BJTs: amplification & switching: Fundamental of BJT operation, BJT fabrication, minority carrier distribution & terminal currents, generalized biasing, switching, frequency limitation of transistors, heterojuction bipolar transistor. Modeling of Diode and BJT and study their parameters.

Unit IV:

FETs: Junction FET-metal semi-conductor FET-Metal insulator semiconductor FET, Integrated circuits: fabrication of monolithic circuits, monolithic device elements. MOS Devices Modeling and study the MOS devices parameters. Study of various MOSFET model levels from level 1 to BSIM and other advance technologies.

Unit V:

Charge transfers devices, very large scale integration, testing, bonding and packaging.

Unit VI:

Lasers: stimulated emission: ruby lasers, semi-conductor lasers, other lasers, p-n-p-n switching devices, switching mechanism: semiconductor controller rectifier, negative conductance, Microwave devices: Transit time devices: Gunn effect and related devices.

Resources:

1. “Solid State Electronic Devices”, Ben G Steetman , 6th Edition, Prentice Hall of India, 2008
2. “Physics of semiconductor Devices”,S M Sze, 2nd Edition, Willey Publications,2007
3. “Introduction to Solid State Physics”, Kittel C, 8th Edition,Willey Publications, 2008
4. ”YannisTisividi s (Oxford), The MOS Transistor (2nd edition)
5. “MOSFET MODELING FOR VLSI SIMULATION: Theory and Practice, World Scientific, 01-Jan-2007

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Dean (Acad. Matters)		Version		

EE1964	**Lab: RF Circuit design**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

OBJECTIVES

Practical based on RF Circuit Design

EE1965	**Lab: Analog IC Design**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

OBJECTIVES

Practical based on **Analog IC Design**

EE1972	**Seminar**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	100		100	

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1982/EE1934	Mixed Signal VLSI Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To study different types of mixed signal VLSI design and their procedures with methods applied in different stages of design.	• Graduates will understand the basic building blocks of Data converter systems. • Graduates will understand the basics of different data converters that are used in different Mixed signal systems. • Graduates will understand the physical layout representation and the alternative layout solutions of data converter systems. • Graduates will understand the design of various CMOS Op-Amps used in Mixed signal system. • Graduates will understand the design of various analog filers used in data converter systems.
Mapped Program Outcomes:	

Unit - I

Introduction to Mixed Signal VLSI System, Signal and Filters, digital comb filter, the z-plane, simple digital filters, Sampling and Aliasing: Impulse Sampling, Sample and Hold. Quantization noise.Spectral density of quantization noise.

Unit - II

Data Converter SNR: Effective number of bits Clock jitter, Using averaging to improve SNR, Decimating filters for ADCs, Interpolating filters for DACs, Band pass and High pass Sync filters, Using feedback to improve SNR.

Unit - III

Sub-Micron CMOS circuit design : Process flow, capacitors and resistors, MOSFET Switch, Delay and Adder elements, Analog circuits – MOSFET Biasing, Op-Amp design, Circuit noise.

Unit - IV

Implementing Data converters: Current mode and voltage mode R-2R DAC, Using Op-Amps in data converters, Implementing ADCs, Cyclic ADC, Introduction to Sigma Delta ADC and Line Drivers.

Unit - V

Integrator Based CMOS Filters: Integrator Building Blocks, Low pass and Active R-C filters, MOSFET-C integrators,gm-C Integrators, Discrete time integrators

Unit - VI

Bilinear and Bi-quadratic transfer functions – Active R-C Transconductor-C and Switched Capacitor implementations both transfer functions, Canonic form of a digital filter.

Resources:

1. "CMOS – Mixed signal circuit design, layout and simulation",R.Jacob Baker, "2nd Edition
   a. IEEE Press and Wiley Interscience, 2002.
2. "CMOS Circuit Design, Layout, and Simulation", Third Edition, R. Jacob Baker
3. "Design of Analog CMOS Integrated circuits", B. Razavi, 1st Edition, McGraw Hill, 2001.
4. "CMOS Analog Circuit Design", P.E. Allen and D.R. Holberg, 2nd Edition, Oxford University Press, 2002.

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Dean (Acad. Matters)		Version		

EE1983	Micro-Electro-Mechanical Systems	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The goals of this course are to go beyond the introduction stage in Micro-Electro-Mechanical Systems (MEMS) and Nano-Electro-Mechanical Systems (NEMS) to provide students with a strong background in design and characterization of micro and nano scale sensors and actuators with a broad range of applications in CNT-based sensors, actuators and devices, biomedical systems, micro- and nanoscale manipulation, adaptive optics, and microfluidics.	• Graduates will be able to gain the knowledge of basic approaches for micro/nanosystems design • Graduates will be able to Understand state-of-the-art micromachining and packaging technologies • Graduates will be able to Learn new materials for micro/nanosystems applications • Graduates will be able to Develop experience on micro/nanosystems applications
Mapped Program Outcomes:	

Unit -I

Smart Materials, Smart Structures, Integrated Microsystems, Micro Sensors, Actuators, Systems and Smart Materials

Unit -II

Silicon Micromachining Technologies, Thin Film Deposition, Lithography, Etching, Specialized Materials for micromachining, advanced processes for Micromachining.

Unit -III

Deformable Elements, Energy Methods for Elastic Bodies, Residual Stresses, Poisson Effects, Electrostatics, Coupled Electromechanics

Unit -IV

Semiconductor Devices, Electronic Amplifiers, Practical Signal Conditioning, Circuits for Conditioning sensed signals, Control theory, Implementation of Controllers.

Unit -V

Integration of Microsystems, Microsyststem Packaging, Case studies of Integrated Microsystems, Smart Structures in Vibration Control.

Unit – VI

Scaling in Mechanical Domain, Electrostatic Domain, Magnetic Domain, Thermal Domain, Diffusion Domain, Fluid Domain, Optical Domain, and Biochemical Phenomenon.

Text Book:

G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre , “Micro and Smart Systems, ” Wiley India Publication, First Edition, 2010.

Resources:

1. “Between Technology &Science : Exploring an emerging field knowledge flows & networking on the nanoscale “, Martin S. Meyer,1st Edition, Universal Publisher ,2005
2. “Nanoscience& Technology: Novel structure and phenomea“ Ping Sheng ,CRC Press, 2003
3. ” Nano Engineering in Science & Technology : An introduction to the world of nano design “, Michael Rieth, CRC Press,
4. “Enabling Technology for MEMS and nano devices “, Balles, Brand, Fedder, Hierold.
5. “Optimal Synthesis Methods for MEMS”, G. K. Ananthasuresh, Kluwer Academic Publishers, 2003
6. “MEMS & MOEMS Technology and Applications” P. RaiChoudhury, SPIE Press, 2000

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1984	VLSI for Wireless Communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
To study the design concepts of low noise amplifiers. To study the various types of mixers designed for wireless communication. To study and design PLL and VCO. To understand the concepts of CDMA in wireless communication.	• Graduates will able to apply knowledge from basic engineering and other disciplines to identify, formulate and present solutions to technical problems in a variety of specialty areas related to telecommunications engineering technology. • Graduates will able to learn new related technologies in the fields of telecommunication and wireless networks along with the concepts of that require advanced knowledge within the field. • Graduates will able to apply advanced technical knowledge in multiple contexts.
Mapped Program Outcomes:	

Unit I : Communication Concepts

Overview of wired Systems, Standards, Access methods, Modulation Schemes, Classical channels, wireless channel , Multipath fading.,

Unit II:Receiver Architecture

Receiver frond end, Filter design, nonidealities and design parameters, deviation of Noise Figures.

Unit III:Low Noise Amplifiers (LNA)

Matching networks, Wideband LNA Design, Narrowband LNA Design, Narrowband LNA Core Amplifiers.

Unit IV:Active & Passive Mixers

Balancing, Qualitative description of Gilbert Mixer, Conversion gain, noise, switching mixer, Distortions in Mixers.

Unit V:Analog to Digital Converters

Demodulators, A/D conversion in Receiver, Implementation of Sigma Delta Modulators.

Unit VI:Frequency Synthesizers

PLL Based Frequency Synthesizer, Phase detector and charge pump, Loop Filters, Dividers, VCOs

Resources:

Bosco Leung, “VLSI For Wireless Communication, ” Springer Publication, Second Edition,

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version		

EE1985	ASIC Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The course is designed to teach students about Higher Methodology for ASICI design and includes various testing techniques, fault models, algorithmes.	• Graduates will able to explain types of ASICs, technology involved for sequential, combinational and datapath logic cells • Graduates will able to explain Programmable ASICs and its Logic cells and I/O cells of different vendors. • Graduates will able to explain ASICs Interconnect and software • Graduates will able to explain Logic Synthesis, Simulation and testing. • Graduates will able to explain ASIC construction , floor planning ,placement and routing
Mapped Program Outcomes:	

Unit - I

Introduction to ASICs, Types of Asics, Design Flow, Economics of Asics, ASIC Cell Libraries, ASIC library design

Unit – II

Programmable ASICs: Antifuse, SRAM, EPROM, EEPROM, Shannons expansion theorem, multiplexer logic as function generator.

Unit – III

Physical design flow, System Partition, FPGA Partitioning, Partitioning Methods.

Unit – IV

Floor planning: Goals & Objectives, Measurement of Delay, Channel Definition, I/O & power planning. Placement: Goals & objective, placement algorithms.

Unit - V

Routing: Goals & objectives of global & detailed routing, measurement of channel density, Routing algorithms, special routing, circuit extraction & DRC.

Unit – VI

Issues in chip Design: Requirements of successful design, Soc, Power consumption issues, Power network, power optimization, chip power usage analysis, clock distribution, chip reliability, Analog integration in digital environment, crosstalk delay**.**

Resources:

1. "Application - Specific Integrated Circuits", M.J.S .Smith, 1st Edition, Addison -Wesley Longman Inc., 1997.
2. "VLSI Design", K.LalKishor,V.S.V.Prabhakar.
3. VLSI Circuits and Systems in Silicon", Andrew Brown, McGraw Hill, 1991.
4. Field Programmable Gate Arrays" S.D. Brown, R.J. Francis, J. Rox, Z.G. Uranesic-Kluever Academic Publishers, 1992.

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EE1986	Semiconductor Memory Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• Memory is an important part in many digital circuits and microcontrollers. This course discusses implementation methods and problems in designing and making semiconductor memories.	• Graduates will be able to apply knowledge from undergraduate engineering and other disciplines to identify, formulate, solve novel advanced electronics engineering along with design coding that require advanced knowledge within the field. • Graduates will be able to apply advanced technical knowledge in multiple contexts • Graduates will be able to understand and design advanced memory systems
Mapped Program Outcomes:	

Unit I

Study of semiconductor devices such as BJT and MOSFET etc. as a memory element. Masked Read-Only Memories (ROMs)-High Density ROMs-Programmable Read-Only Memories (PROMs)-Bipolar PROMs-CMOS PROMs-Erasable (UV) - Programmable Road-Only Memories (EPROMs)-Floating-Gate EPROM Cell-One-Time Programmable (OTP) Eproms-Electrically Erasable PROMs (EEPROMs)- EEPROM Technology And Architecture-Nonvolatile SRAM-Flash Memories (EPROMs or EEPROM)- Advanced Flash Memory Architecture.

Unit II

SRAM Cell Structures-MOS SRAM Architecture-MOS SRAM Cell and Peripheral Circuit Operation-Bipolar SRAM Technologies-Silicon On Insulator (SOI) Technology-Advanced SRAM Architectures and Technologies- Application Specific SRAMs.

DRAM Technology Development-CMOS DRAMs - DRAMs Cell Theory and Advanced Cell Strucutures - BiCMOS, DRAMs - Soft Error Failures in DRAMs - Advanced DRAM Designs and Architecture-Application Specific DRAMs.

Unit III

Masked Read-Only Memories (ROMs)-High Density ROMs-Programmable Read-Only Memories (PROMs)-Bipolar PROMs-CMOS PROMs-Erasable (UV) - Programmable Road-Only Memories (EPROMs)-Floating-Gate EPROM Cell-One-Time Programmable (OTP) Eproms-Electrically Erasable PROMs (EEPROMs)-EEPROM Technology And Architecture-Nonvolatile SRAM-Flash Memories (EPROMs or EEPROM)-Advanced Flash Memory Architecture.

Unit IV

RAM FaultModelling, Electrical Testing, Peusdo Random Testing-Megabit DRAM Testing-Non-volatile, Memory Modelling and Testing-IDDQ Fault Modelling and Testing-Application Specific Memory Testing

Unit V

General Reliability Issues-RAM Failure Modes and Mechanism-Non-volatile Memory Reliability-Reliability Modelling and Failure Rate Prediction-Design for Reliability-Reliability Test Structures-Reliability Screening and Qualification. RAM Fault Modelling, Electrical Testing, Pseudo Random Testing-Megabit DRAM Testing- Non-volatile Memory Modelling and Testing-IDDQ Fault Modelling and Testing-Application Specific Memory Testing.

Unit VI

Radiation Effects-Single Event Phenomenon (SEP)-Radiation Hardening Techniques-Radiation Hardening Process and Design Issues-Radiation Hardened Memory Characteristics-Radiation Hardness Assurance and Testing - Radiation Dosimetry-Water Level Radiation Testing and Test Structures.

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Ferroelectric Random Access Memories (FRAMs)-Gallium Arsenide (GaAs) FRAMs - Analog Memories-Magneto-resistive Random Access Memories (MRAMs)-Experimental Memory Devices. Memory Hybrids and MCMs (2D)-Memory Stacks and MCMs (3D)-Memory MCM Testing and Reliability Issues-Memory Cards-High Density Memory Packaging Future Directions.

Resources:

1. "Semiconductor Memories", Ashok K. Sharma, Two-Volume Set, Wiley-IEEE Press, 2003
2. "DRAM Circuit Design: A Tutorial", Brent Keeth, R. Jacob Baker Wiley-IEEE Press, 2000
3. "High Performance Memories: New Architecture DRAMs and SRAMs - Evolution and Function", Betty Prince, Wiley, 1999
4. Nonvolatile Memory Technologies with Emphasis on Flash, IEEE Press series on Microelectronics by Joe E Brewer and Manzur Gill 2008.

EE1987/EE1938	**Advanced Computer Architecture**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The objective of this course is to introduce the fundamental techniques on which high-performance computing is based, to develop the foundations for analyzing the benefits of design options in computer architecture, and to give some experience of the application of these techniques.	• Understand and evaluate the hardware components of advanced architectures Understand and analyze architectures performance and select among different ones for particular use scenarios • Understand and analyze the most important parallel architectures in order to distinguish their main difference. • Understand the levels of software and hardware comprising the Instruction Set Architecture (ISA) of a computer • Make design decisions based on performance data
Mapped Program Outcomes:	

Unit I

The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers. Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit II

Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Unit III

Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Unit IV

Linear pipeline processor, nonlinear pipeline processor, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Unit V

Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Unit VI

Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization,

Resources:

1. "Advanced computer architecture", Kai Hwang, Tata McGraw Hill,1993
2. "Computer organization and design" ,D. A. Patterson and J. L. Hennessey, 2nd Edition, Morgan Kaufmann,
3. "Computer Architecture and organization", J.P.Hayes, 3rd Edition, McGraw Hill,1998
4. "Memory System and Pipelined processors" Harvey G.Cragon , NarosaPublication,1998
5. "Parallel computer";V.Rajaranam&C.S.R.Murthy, Printice Hall of India,2002
6. "Foundation of Parallel Processing", K.Ghose, RajanMoona&Phalguni Gupta, Narosa Publications,2002

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EE1981	**Project Phase – I**	L= 0	T = 0	P = 16	Credits = 8

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	100		100	

EE1991	**Project Phase - II**	L= 0	T = 0	P = 24	Credits = 12

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

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YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

M. Tech. SoE and Syllabus 2014-15

Computer Science Engineering

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE - I	MSE - II	TA	ESE	
I SEMESTER												
1	CSE1901	High Performance Computer Architecture	3	0	0	3	3	15	15	10	60	3
2	CSE1902	Real Time Systems	3	0	0	3	3	15	15	10	60	3
3	CSE1903	Network Security & Cryptography	3	0	0	3	3	15	15	10	60	3
4	CSE1904	Lab: Network Security & Cryptography	0	0	2	2	1			40	60	2
5	CSE1905	Algorithm Design Techniques	3	0	0	3	3	15	15	10	60	3
6	CSE1906	Lab: Algorithm Design Techniques	0	0	2	2	1			40	60	2
7	**Professional Elective-I**		3	0	0	3	3	15	15	10	60	3
	CSE1907	Advanced Digital Image Processing										
	CSE1908	Ethical Hacking										
	CSE1909	Machine Learning										
	CSE1910	Grid and Cloud Computing										
Total			**15**	**0**	**4**	**19**	**17**					
II SEMESTER												
1	CSE1911	Data Mining	3	0	0	3	3	15	15	10	60	3
2	CSE1912	Distributed Systems	3	0	0	3	3	15	15	10	60	3
3	CSE1913	Optimizing Compilers	3	0	0	3	3	15	15	10	60	3
4	CSE1914	Lab: Optimizing Compilers	0	0	2	2	1			40	60	2
5	CSE1915	Software Architecture	3	0	0	3	3	15	15	10	60	3
6	CSE1916	Lab: Software Architecture	0	0	2	2	1			40	60	2
7	CSE1917	Seminar	0	0	2	2	1			100		1
8	**Professional Elective-II**		3	0	0	3	3	15	15	10	60	3
	CSE1918	Soft Computing Techniques										
	CSE1919	Data Warehousing										
	CSE1920	Wireless Sensor Network										
	CSE1921	Information Retrieval Systems										
Total			**15**	**0**	**6**	**21**	**18**					

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III SEMESTER

1	**Professional Elective- III**		3	0	0	3	3	15	15	10	60	3
	CSE1923	Computer Vision										
	CSE1924	Natural Language Processing										
	CSE1925	Optimization Techniques										
	CSE1926	Database Security										
2	**Professional Elective-IV**		3	0	0	3	3	15	15	10	60	3
	CSE1927	Cyber Forensics										
	CSE1928	Pattern Recognition										
	CSE1929	Algorithms for Bioinformatics										
	CSE1930	Semantic Web and Social Networks										
3	CSE1922	Project Phase – I	0	0	16	16	8			100		
Total			**6**	**0**	**16**	**22**	**14**					

IV SEMESTER

1	CSE1931	Project Phase - II	0	0	24	24	12		40	60	
			0	**0**	**24**	**24**	**12**				
Grand Total of credits							**61**				

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SEMESTER- I

CSE1901	High Performance Computer Architectures	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I : The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers.

Unit II : Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus dataflow, Dataflow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit III : Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Unit IV : Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, cache coherence protocols, memory based directory protocols, cache based directory protocols.

Unit V : Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors.

Unit VI: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency. Multicore and Many core computing, GPU programming: OpenCL , CUDA

Text Books:

1. Kai Hwang, “Advanced computer architecture”, TMH publications
2. D. A. Patterson and, J. L. Hennessey, “Computer organization and design”, Morgan Kaufmann

Reference Books:

1. J. P. Hayes, “Computer Architecture and organization”, MGH
2. Ryojitsuchiyama, Takashi Nakamura, Takurolizuka, Akihiro Asahara, satoshi Miki “OpenCL Programming Book”, Kindle Edition
3. Edward Kandrot, Jason Sanders, “CUDA by Example, An Introduction to General-Purpose GPU Programming” Prentice Hall Publications.
4. V. Rajaranam & C. S. R. Murthy, “Parallel computer”, PHI
5. R. K. Ghose, Rajan Moona & Phalguni Gupta, “Foundation of Parallel Processing”, Narosa Publications
6. Kai Hwang and Zu, “Scalable Parallel Computers Architecture”, MGH.
7. M. J. Flynn, “Computer Architecture, Pipelined and Parallel Processor Design”, Narosa Publishing.
8. D. A. Patterson, J. L. Hennessy, “Computer Architecture: Aquantitative approach”, Morgan Kauffmann
9. Cuda toolkit documentation from NVIDIA and developer.nvidia.com/cuda-zone

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CSE1902	Real Time Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction to real-time systems, Example real-time applications, Hard vs. soft real time, Reference model, Classic uniprocessor scheduling, Static scheduling, Dynamic scheduling, Cyclic executives

Unit II: Dynamic-priority scheduling: Optimality of EDF and LLF, Utilization-based schedulability test for EDF, Non preemptive EDF, Static-priority scheduling: Optimality of RM and DM, Utilization-based schedulability test for RM, Demand-based scheduling: conditions for static-priority systems. Dealing with complexities arising in real systems: Practical considerations, Timing analysis, Intractibility results

Unit III: Preemptive systems: Dynamic-priority systems, Static-priority systems, Non preemptive systems, Dynamic-priority systems, Static-priority systems

Unit IV: Independent Task Models, Resource sharing, Priority inheritance and priority ceiling protocols, stack resource protocol, Lock-free approach Global multiprocessor schedulability analysis, Hard real-time analysis for global EDF, Soft real-time analysis for global EDF.

Unit V: Synchronization in multiprocessors and distributed systems, Multiprocessor locking protocols, End-to-end scheduling. Mixing real-time and non-real-time, Deferrable servers, Sporadic servers, Constant utilization and total bandwidth servers, fair queuing, Fairness, Proportional-share scheduling,

Unit VI: A look at some real systems, Basic operating-system functions needed for real-time computing, Survey of commercial real-time and non-real-time operating systems.

Text Books:

1. Hermann Kopetz, Real-Time Systems: Design Principles for Distributed Embedded Applications, Springer
2. Jane W. S. Liu: Real-Time Systems, Prentice Hall,

Reference Books:

1. Philip A. Laplante, Seppo J. Ovaska: Real-Time Systems Design and Analysis: Tools for Practitioner
2. C.M. Krishna, Kang G. Shin, “Real Time Systems”, McGraw – Hill International Edition
3. Raymond J.A.Bhur, Donald L.Bailey, “An Introduction to Real Time Systems”, PHI

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CSE1903	Network Security & Cryptography	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction: Security Trends, Security Goals, Security Attacks, Security Services, Security Mechanisms, Relation between Services and Mechanisms, Network Security model, Techniques.

Unit II: Encryption Techniques: Traditional Symmetric Key Ciphers: Substitution, Transposition, Stream and Block Ciphers, Modern Symmetric Key Ciphers: Introduction, Data Encryption Standard (DES), AES. Symmetric Key Cryptography: RSA, Rabin, ElGamal Cryptosystem.

Unit III: Integrity, Authentication: Message Integrity, Message Authentication, Cryptographic Hash Functions, Digital signature, Entity Authentication.

Unit IV: Key Management: KDC, Kerberos, symmetric Key Management: Diffie–Hellman key management, Public Key Distribution: Trusted Center, Certification Authority, X.509, Public Key Infrastructure (PKI).

Unit V: Security at Application Layer: Pretty Good Privacy (PGP), S/MIME.
Security at Transport Layer: Secure Socket Layer (SSL), Transport Layer Security (TLS).
Security at Network Layer: IPsec.

Unit VI: System Security: Intruders, Intrusion detection, Password Management, Malicious Software, Viruses and related threats, Virus Counter measures, Distributed Denial of Service Attacks, Firewalls, Firewall design principles, Trusted systems.

Text Books:

1. Behrouz A. Forouzan, “Cryptography and Network Security”, Tata McGraw-Hill
2. William Stalling, “Cryptography and Network Security”, Fourth Ed., Prentice Hall
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill

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CSE1904	**Lab : Network Security and Cryptography**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

List of Practical's

1. Study of various types of network security attacks, attack detection and defense mechanism.
2. Use of different network attacking, traffic monitoring, detection and defense tools in Linux/ Window
3. Report on YCCE Campus wide networking and its performance monitoring.
4. Installation and configuration of Apache Web Server on Linux/Windows Platform.
5. Installation and configuration of Apache Tomcat Application Server on Linux/Windows Platform.

CSE1905	Algorithm Design Techniques	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Algorithmic analysis: Analyzing control structures, Solving recurrences, Review of data structures. **Greedy algorithms**: General characteristics, Graphs algorithms, Scheduling.

Unit II: Divide and conquer algorithms: General template, Searching, Sorting, Matrix multiplication, Exponentiation and its application in cryptography. **Dynamic programming**: Principle of optimality, Shortest paths, Chained matrix multiplication, Approaches using recursion, Memory functions.

Unit III: Linear programming: Formulating problems as linear programs, The simplex algorithm, Duality.

Unit IV: Probabilistic algorithms: Introduction, Pseudorandom generation, Numerical probabilistic algorithms, Monte Carlo algorithms, Las Vegas algorithms. **Heuristic algorithms and Approximate algorithms**: Heuristic algorithms, NP-hard approximation problems

Unit V: Parallel algorithms: Basic techniques, Parallel evaluation of expressions, Parallel sorting networks, parallel sorting, Distributed computation.
Unit VI: Computational complexity: Introduction, Linear reductions, Introduction to NP-completeness.

Text Books:
1. T. H. Cormen, C. E. Leiserson, R.L. Rivest, C. Stein, “Introduction to Algorithms”, PHI.

Reference Books:
1. G. Brassard, P. Bratley, “Fundamentals of Algorithmics”, PHI
2. A.V. Aho, J. E. Hopcroft, J.D. Ulman, “The Design & Analysis of Computer Algorithms”, Addison Wesley.
3. Horowitz E., Sahni S, Rajasekharan S., “Fundamentals of computer algorithms”, University press

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CSE1906	**Lab : Algorithm Design Techniques**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

List of Practical's

1. Write an algorithm and program for fractional knapsack problem using greedy strategy.
2. Implement Strassen's algorithm using divide and conquer strategy.
3. Write an algorithm and program for 0-1 knapsack problem using dynamic programming strategy
4. Write an algorithm and program to demonstrate the Simplex Method.
5. Write an algorithm and program to implement randomized quicksort algorithm.
6. Study of NESL: A Parallel Programming Language
7. Study of Heuristic algorithm for TSP
8. Study of Approximation algorithm for TSP

CSE1907	Advanced Digital Image Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Overview of Digital Image Processing and Image Enhancement: A Simple Image Model, Sampling and Quantization, Basic Relationship Between Pixel, Basic gray level Transformation, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filtering, Sharpening Spatial Filters, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, Inverse Fourier Transform, Filtering in Frequency Domain**,** Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homographic Filtering.

Unit II: Image Segmentation: Fundamentals, Point, line and edge detection, thresholding, Region Oriented Segmentation, Motion Based Segmentation.

Unit III: Morphing, Representation and Description: Introduction, Basic Morphological Algorithm, Chain Code, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of a region, Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors.

Unit IV: Model of the Image Degradation/Restoration Process: Noise Models, Restoration in the presence of Noise only-Spatial Filtering, Periodic Noise reduction by frequency domain filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse Filtering, Wiener Filtering, Constrained Least Square Filtering.

Unit V: Wavelets: Image Pyramids, Haar Transform, Multiresolution Expansions, Wavelet Transforms in1D, Fast wavelet Transform, wavelet packets.

Unit VI: Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Fidelity criteria, Image compression models, compression standards, Basic compression methods, Huffman coding, colomb coding, arithmetic coding, LZW coding, runlength coding, Symbol based coding, Block transform coding, predictive coding.

Text Books:

1. Rafael C. Gonzalez & Richard E. Woods, “Digital Image Processing”, Pearson Education.
2. A. K. Jain, “Fundamental of Digital Image Processing”, PHI.

Reference Books:

1. Rosefield Kak, “Digital Image Processing”.
2. W. K. Pratt, “Digital Image Processing”.

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CSE1908	**Ethical Hacking**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I: Introduction to Ethical Hacking, Ethics, and Legality: Ethical Hacking Terminology, Types, Phases and Stages of Ethical Hacking: Passive and Active Reconnaissance, Scanning, Gaining Access, Maintaining Access, Covering Tracks, Hacktivism, Hacker Classes, Skills Required to Become an Ethical Hacker, Vulnerability Research, Ways to Conduct Ethical Hacking, Creating a Security Evaluation Plan, Types of Ethical Hacks, Testing Types, Ethical Hacking Report

Footprinting and Social Engineering: Footprinting, Information Gathering Methodology, Competitive Intelligence, DNS Enumeration, Who is and ARIN Lookups, Types of DNS Records, Traceroute, E-Mail Tracking , Web Spiders, Social Engineering, Types of Attacks: Insider Attacks, Identity Theft, Phishing Attacks, Online Scams, URL Obfuscation, Social-Engineering Countermeasures.

Unit II: Scanning and Enumeration: Types of Scanning , CEH Scanning Methodology ,Ping Sweep Techniques, Nmap Command Switches, SYN, Stealth, XMAS, NULL, IDLE, and FIN Scans, TCP Communication Flag Types, War-Dialing Techniques, Banner Grabbing and OS Fingerprinting Techniques, Proxy Servers, Anonymizers, HTTP Tunneling Techniques, IP Spoofing Techniques, Enumeration, Null Sessions, SNMP Enumeration & Steps Involved

Unit III: System Hacking: Password-Cracking Techniques, LAN Manager Hash Cracking Windows 2000 Passwords, Redirecting the SMB Logon to the Attacker SMB Redirection, SMB Relay MITM Attacks and Countermeasures, NetBIOS, DoS Attacks, Password-Cracking Countermeasures, Types of Passwords Passive Online Attacks, Active Online Attacks, Offline Attacks, Non electronic Attacks, Keyloggers and Spyware Technologies Escalating Privileges, Buffer Overflows, Planting Root kits on XP Machines, Rootkit Embedded TCP/IP Stack Rootkit Countermeasures, Hiding Files, NTFS File Streaming NTFS Stream Countermeasures, Steganography Technologies, How to Cover Your Tracks and Erase Evidence, Disabling Auditing, Clearing the Event Log

Unit IV: Trojans, Backdoors, Viruses, and Worms: Trojans and Backdoors, Overt and Covert Channels, Types of Trojans, Reverse-Connecting Trojans, Netcat Trojan ,Wrapping, Trojan Construction Kit and Trojan Makers , Countermeasure Techniques, Trojan-Evading Techniques, System File Verification, Viruses and Worms, Types of Viruses, Antivirus Evasion Techniques, Virus Detection Methods Sniffers: Protocols Susceptible to Sniffing, Active and Passive Sniffing, ARP Poisoning, Ethereal Capture and Display Filters, MAC Flooding, DNS Spoofing Techniques, Sniffing Countermeasures

Denial of Service and Session Hijacking: Denial of Service, Types of DoS Attacks, DDoS Attacks DoS/DDoS Countermeasures, Session Hijacking, Spoofing vs. Hijacking, Session Hijacking, Sequence Prediction, Prevention of Session Hijacking

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Unit V : Hacking Web Servers, Web Application Vulnerabilities, and Web-Based Password Cracking: Web Server Vulnerabilities, Attacks against Web Servers, IIS Unicode Exploits, Patch Management Techniques, Web Server Hardening Methods, Web Application Vulnerabilities, Objectives, Anatomy of an Attack, Web Application Threats, Google Hacking, Web Application Countermeasures, Web-Based Password Cracking Techniques, Authentication Types, Password Cracker, Password Attacks, Password-Cracking Countermeasures

SQL Injection and Buffer Overflows: SQL Injection, SQL Server, Vulnerabilities, SQL Injection Countermeasures, Buffer Overflows, Types and Methods of Detection, Stack-Based Buffer Overflows, Mutation Techniques

Unit VI: Linux Hacking: Linux Basics, Compile a Linux Kernel, GCC Compilation Commands, Install Linux Kernel Modules, Linux Hardening Methods

Penetration Testing Methodologies: Security Assessments, Penetration Testing Methodologies, Penetration Testing Steps, Pen-Test Legal Framework, Automated Penetration Testing Tools, Pen-Test Deliverables

Text Books:

1. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition

Reference Books:

1. Rich Annings, Himanshu Dwivedi, Zane Lackey, “Hacking Exposed Web 2.0”, Tata McGraw Hill
2. Michael T, “Ethical Hacking & Network Defense”, Simpson
3. Joel Scambray, cissp, Stuart Mcclure, Cissp, “Hacking Exposed Windows”, 3rd Edition, Tata McGraw Hill
4. Joel Scambray Stuart Mcclure, “Hacking Exposed Window server 2003”, Tata McGraw Hill

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CSE1909	Machine Learning	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

Unit II: Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search indecision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks

Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms

Unit III: Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, NaïveBayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm

Unit IV: Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning

Instance-Based Learning- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning

Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

Unit V: Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution

Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

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Unit VI: Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators,

Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

Text Books:

1. Tom M. Mitchell, “Machine Learning”, MGH
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, Taylor & Francis (CRC)

Reference Books:

1. William W Hsieh, “Machine Learning Methods in the Environmental Sciences, Neural Networks”, Cambridge Univ Press.
2. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, John Wiley & Sons

CSE1910	Grid and Cloud Computing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: System models for advanced computing –clusters of cooperative computing, grid computing and cloud computing; software systems for advanced computing-service oriented software and parallel and distributed programming models with introductory details, Features of grid and cloud platform.

Unit II: Cloud Computing services models and features in Saas, Paas and Iaas. Service oriented architecture and web services; Features of cloud computing architectures and simple case studies.

Unit III: Virtualization- Characteristic features, Taxonomy Hypervisor, Virtualization and Cloud Computing, Pros and Cons of Cloud Computing, Technology Examples/Case Studies.

Unit IV: Cloud programming Environmental- Map Reduce Hadoop Library from Apache, Open Source Cloud Software Systems –Eucalyptus.

Unit V: Grid Architecture and Service modeling, Grid resource management, Grid Application trends.

Unit VI: Case Studies

Text Books:

1. Kaittwang Geoffrey C.Fox and Jack J Dongrra, “Distributed and Cloud Computing, Elsevier India
2. Raj Kumar Buyya, Christian Vecchiola and S.TanuraiSelvi, “Mastering Cloud Computing”,TMH,

Reference Books:

1. John W. Ritting House and James F Ramsome, “Cloud Computing”, CRC Press
2. Gautam Shroff, “Enterprise Cloud Computing”, Cambridge University Press

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SEMESTER- II

CSE1911	**Data Mining**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I:
Introduction to data mining, Process of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task primitives, Major issues in Data Mining, Applications of Data Mining

Unit II: Classification and Clustering Classification: Introduction, decision tree, building a decision tree- the tree induction algorithm, split algorithm based on information theory, gini index, over fitting and pruning, decision tree rules, naïve Bayes method.

Clustering: Types of data in cluster analysis, Categorization of major clustering methods: Partitioning methods, Hierarchical methods, Applications of clustering.

Unit III: Mining Frequent Patterns and Association Rules: Market Basket Analysis, Frequent Item sets and Association rules, A Priori Algorithm, Improving the efficiency of A priori, FP- growth Algorithm.

Unit IV: Social Media Analytics: Social network analysis, Representation of social data, Social media analysis, Tools to collect and analyze data of social media based on NODEXL.

Unit V: Visualization and Prediction Visualization: Motivation for visualization, General concepts, Techniques
Prediction: Linear regression (Least Square method), Analyzing regression error, Analyzing goodness of fit

Unit VI: Statistical Mining: Logistic Regression, Multivariate regression, ANOVA, PCA, Factor analysis, Graph Mining

Text Books:
1 Jiawei Han & Micheline Kamber, “Data Mining – Concepts and Techniques”, Harcourt India.
2. Arun K Pujari, “Data Mining Techniques”, University Press.
3. Pang-ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data mining”

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CSE1912	Distributed Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and The Web, Challenges, System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

Unit II: Interprocess Communication: Introduction, The API for the Internet Protocols- The Characteristics of Interprocess communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast.

Unit III: Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; RPC, Events and Notifications, Case Study: JAVA RMI

Unit IV: Operating System Support: Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

Unit V: Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

Unit VI: Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication. Transactions& Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication- Introduction, Passive (Primary) Replication, Active Replication.

Text Books:

1. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems- Concepts and Design”, Fourth Edition, Pearson Publication
2. Ajay D Kshemkalyani, Mukesh Sighal, “Distributed Computing, Principles, Algorithms and Systems”, Cambridge
3. Andrew S Tanenbaum, Maarten Van Steen: “Distributed Systems- Principles and Paradigms”, Pearson Publication

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CSE1913	Optimizing Compilers	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Overview Lexical analyzer, Syntax analyzer, Semantic analysis
Unit II: Intermediate code generation, Compiler Challenges for High-Performance Architectures, Dependence and its Properties, Parallelization and Vectorization
Unit III: Loop optimization, Data flow analysis, Enhancing Fine-Grained Parallelism
Unit IV: Creating Coarse-Grained Parallelism, Cache management.
Unit V: Scheduling, Register allocation & Assignment
Unit VI: Case studies of compilers.

Text Books:
1. Randy Allen and Ken Kennedy, “Optimizing compilers for modern architectures”, Morgan Kaufmann Publishers
2. Steven S. Muchnick, “Advanced Compiler Design and implementation”.
3. A. V. Aho, R. Sethi, & J. D. Ullman, “Compilers: Principles, Techniques &Tools”, Pearson Edu.

Reference Books:
1. C. Fischer and R. LeBlanc, “Crafting a Compiler”, Pearson Education.
2. A. C. Holub, “Compiler Design in C”, Pearson Education.
3. Appel Modern Compiler Implementation in Java: Basic Design, Cambridge Press.
4. Fraser and Hanson, “A Retargetable C Compiler: Design and Implementation, Pearson Education.

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CSE1914	Lab : Optimizing Compilers	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

List of Practical's

1. a. Write a flex programs that simulate Desktop calculator to calculate the expression with basic operator.
   b. Write a flex program to count the number of characters, words, and lines present in a multiple input files.

2. Write a flex program to evaluate a postfix notation.

3. Write a YACC program that reads input file (where c program will be the content of a input file) to check and identify all valid C identifiers.

4. Write a Flex and YACC program for the following
   a. Write a flex grammar file for evaluating the postfix formula below and check if it works correctly. 5 24 8 - * 9 4 + 8 - *
   b. Write a YACC grammar file for evaluating the postfix formula above and check if it works correctly.
   c. Write a YACC grammar file for evaluating the infix formula below and check if it works correctly. 12 – 4 * 5 + 11 * 3
   d. Write a Flex and YACC grammar file for evaluating infix formulas and check if it works correctly using the infix formula above.

CSE1915	Software Architecture	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction and Overview of Software Architecture, Architectural Models: Models for characterizing and reasoning about architectures, Tools for architectural modeling

Unit II: Typical software system structures (Architectural styles), Techniques for Designing and Implementing these structures,

Unit III: Role of architecture in Software engineering; Enterprise Architectures, Zachman's Framework, Software Product Lines and Configurable Software

Unit IV: Architectural Styles, Design Patterns, Product-line architectures, Component based development

Unit V: Architectural Description Languages

Unit VI: Self-Adaptive Software, Feature Modeling, Architecture and Model-Based Testing, Detailed Case study on contemporary Software Architecture**.**

Text Books:

1. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, MiachelStal, Douglas Schmidt, "*Pattern Oriented Software Architecture",* Volumes 1 &2, Wiley Publications.
2. Len Bass, Paul Clements, Rick Katzman, Ken Bass, "*Software Architecture in Practice",* Pearson Edu.
3. George T. Heineman, William T. Councill, "C*omponent Based Software Engineering",* Addison-Wesley
4. Kurt Wallnau, Scott Hissam and Robert Seacord, "*Building Systems from Commercial Components",* Addison-Wesley

CSE1916	Lab: Software Architecture	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

List of Practical's

1. Creation of software architecture document
2. Identify appropriate architectural style for B.E. project
3. Implementation of simple connectors or client server using middleware
4. Identify & familiarize tools and techniques for architectural modelling
5. Architectural analysis of B.E. project
6. Implementation of framework
7. Study of non-functional properties of an operating system
8. Web service implementation
9. Study typical industry cases for design pattern
10. Creation of domain model in a known domain

CSE1917	**Seminar**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**Continuous Evaluation**	**CA**	**ESE**	**Total**	**ESE Duration**
		100		**100**	

CSE1918	Soft Computing Techniques	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Unit II: Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. **Operations on Fuzzy Sets:** Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

Unit III: Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Unit IV: Introduction of Neuro Fuzzy Systems, Architecture of Neuro Fuzzy Networks.

Unit V: Application of Fuzzy Logic: Engineering, Economics, etc.

Unit VI: Computational Learning Theory: - Instance-Based Learning: k-Nearest-neighbor algorithm, Learning first-order rules etc.

Text Books:

1. R. A. Aliev, R. R. Aliev, “Soft Computing and Its Applications”
2. Bar Kosko, “Neural Networks and Fuzzy Systems”, Prentice-Hall
3. Melanie Mitchell, “An Introduction to Genetic Algorithms (Complex Adaptive Systems)”, MIT Press

CSE1919	Data Warehousing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction to data warehousing, real time applications, scope of mining and warehousing for various applications. Data warehousing- Various schema, three-tier architecture, design issues, multidimensional model. Data warehouse development life cycle Data Warehouse Design **-** Massive denormalisation, STAR schema design, Data ware house Architecture, OLAP, ROLAP and MOLAP , concepts of Fact and dimension table.

Unity II: ETL process, ETL tools, Concept of various data transforms

Unit III: Data warehouse analysis and statistical queries, CUBE, ROLL UP and STAR queries.

Unit IV: Space Management in Data warehouse - Schemas for storing data in warehouse using different storage structures, B-tree index, hash index, clusters, Bitmap index functional index, domain index, Data partitions.

Unit V: Performance and Tuning- Query optimization, memory management, process management. I/o management for Data warehouse.

Unit VI: Handling BIG data, NO sql database, Columnar database

Text Books:

1. Paul Raj Poonia, “Fundamentals of Data Warehousing”, John Wiley & Sons
2. Sam Anahony, “Data Warehousing in the real world: A practical guide for building decision support systems”, John Wiley
3. W. H. Inmon, “Building the Data Warehouse”, 3rd Ed., John Wiley & Sons.
4. W. H. Inmon, C. Kelly, Developing the Data Warehouse”, John Wiley & Sons.
5. Thomas Connoly, Carolyn Begg, “Database Systems-A practical approach to Design, Implementation and management” 3rd Edition, Pearson Education

Reference Books:

1. W. H. Inmon, “Building the operational data store”, 2nd Ed., John Wiley
2. Kamber and Han, “Data Mining Concepts and Techniques”, Hartcourt India

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CSE1920	Wireless Sensor Network	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Overview of Sensor Network Protocols, Architecture and Applications, Simulation and Experimental platforms, Main features of WSNs, Research issues and trends. **Enabling technologies**: Fundamentals of 802.15.4, Bluetooth, and UWB, Physical and MAC layers

Unit II: Sensor Node Hardware and Software: **Hardware**: mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT. **Software** (OS): tinyOS, MANTIS, Contiki, and RetOS. Programming tools: C, nesC, Mate

Unit III: Localization, Connectivity, and Topology: Sensor deployment mechanisms, Coverage issues, Node Discovery Protocols.

Unit IV: Network layer protocols: Data dissemination and processing, multi-hop and cluster based protocols, routing.

Unit V: Middleware and Application Layers: Data dissemination, Data storage, Query processing, Sensor Web, Sensor Grid

Unit VI: Open issues for future research: Energy preservation and efficiency, Security challenges, Fault-tolerance

Text Books:

1. H. Karland, A.Willig, “Protocols & Architectures for Wireless Sensor Networks”, John Wiley
2. K. Sohraby, D. Minoli, and T. Znati, “Wireless Sensor Networks: Technology, Protocols, and Applications, John Wiley
3. C.S. Raghavendra, K.M. Sivalingam, and T.Znati, “Wireless Sensor Networks”, Springer Verlag
4. E .H. Callaway, Jr. Auerbach, “Wireless Sensor Networks: Architectures and Protocols
5. B. Krishnamachari, “Networking Wireless Sensors”, Cambridge University Press
6. F. ZhaoandL. Guibas, “Wireless Sensor Networks: An Information Processing Approach. Morgan Kaufmann
7. S. N. P. Mahalik, “Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications, Springer Verlag
8. N. Bulusuand, S. Jha, “Wireless Sensor Networks: A Systems Perspective”, Artech House

CSE1921	Information Retrieval Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Boolean Retrieval, Vocabulary and postings lists, Dictionaries and tolerant retrieval, Index construction, Index compression

Unit II: Scoring, Weighting and the vector space model, Computing scores in a complete search system, Evaluation in information retrieval, Relevance feedback and query expansion

Unit III: XML retrieval, Probabilistic information retrieval, Language models for information retrieval, Text, Classification, Vector space classification

Unit IV: Support Vector Machines and Machine Learning on documents, Flat clustering, Hierarchical clustering, Matrix decompositions and Latent Semantic Indexing.

Unit V: Web search basics, Web Crawling and Indexes, Link analysis

Unit VI: Case studies

Text Books:

1. Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, “Introduction to Information Retrieval”, Cambridge University Press

Reference Books:

1. Kowalski, Gerald, Mark T Maybury, “Information Storage and Retrieval Systems: Theory and Implementation”, Springer.
2. Ricardo Baeza-Yates, “Modern Information Retrieval”, Pearson Education
3. David A Grossman and Ophir Frieder, “Information Retrieval: Algorithms and Heuristics”, 2nd Edition, Springer
4. William B Frakes, Ricardo Baeza-Yates, “Information Retrieval Data Structures and Algorithms”, Pearson Education
5. Robert Korfhage, “Information Storage & Retieval”, John Wiley & Sons.

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SEMESTER- III

CSE1923	**Computer Vision**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESEDuration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I: Introduction to Human and Computer Vision, Image Representation (boundary, region and moment) and Modeling. Line and Edge detection, labeling, Image Registration algorithm

Unit II: Pattern Recognition Techniques, Statistical, Structural, Neural and Hybrid Techniques. Feature Extraction Techniques, Training and Classification

Unit III: Sensing 3D Shapes, How the 3rd dimension changes the problem, Stereo 3D description,3D Model, Matching

Unit IV: Direct 3D Sensing-Structured Light, Range finders, Range image segmentation

Unit V: Emerging IT applications, Recognition of characters, Fingerprint, Iris and Face

Unit VI: Scene and activity interpretation. Texture, color, stereo, and motion descriptors, Disambiguation and the achievement of invariances, Robotic Vision

Text Books:

1. Shapiro and G. Stockman, “Computer Vision”, Prentice Hall
2. David A. Forsyth, Jean Ponce, “Computer Vision”, Prentice Hall

Reference Books:

1. A. K. Jain, “Fundamentals of Digital Image Processing”
2. Milan Sonka,Vaclav Hlavae, “Image Processing and Machine Vision”
3. J.T. Tou and R. C. Gonzalez , “Pattern Recognition Principles”
4. King Sun Fun, “Syntactic Pattern Recognition and Applications”
5. Fairhurst, “Computer Vision”, Prentice Hall

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CT1924	Natural Language Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: Introduction to NLP: Computational Models of Language, Organization of NLP Systems, Natural Language Generation; Techniques of Machine Translation

Unit II: Syntax: Linguistic Background, Elements of Simple Sentences, Parsing Techniques, Features and Augmented Grammars, Deterministic Parsing.

Unit III: Semantic: Logical Form, Case Relations, Semantic Networks, Basic Operations for Semantic Interpretation, Strategic and Issues.

Unit IV: Context & World Knowledge: Knowledge Representation, Question, Answering Systems: Natural Language Generation, Typical NLP Systems and their Architectures, Cognitive Aspects of Natural Languages

Unit V: Indian Language Processing: Approach to Machine Translation, Typical Case Studies

Unit VI: Introduction to Speech Processing: Word level Morphology and Computational Phonology; Basic Text to Speech; Introduction to HMMs and Speech Recognition, Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning; Semantic Analysis; Lexical Semantics; Word Sense; Disambiguation; Discourse understanding; Indian language case studies

Text Book:

1. James Allen, “Natural Language Understanding”, Pearson Education.
2. Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, Prentice-Hall

Reference Books:

1. Christopher Manning “Foundations of Statistical Natural Language Processing”, MIT Press, Cambridge.
2. Akshar Bharathi, Vineet Chaitanya, Rajeev Sangal, “Natural Language Processing – A Paninian Perspective”, Prentice Hall
3. Tom Mitchell, “Machine Learning”, McGraw Hill
4. Ronald Hausser, “Foundations of Computational Linguistics”, Springer-Verlog,
5. Winograd, “Language as a cognitive process- syntax”, Addison Wesley.
6. Popov, “Talking with computer in Natural language”, Springer Verlog,

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CSE1925	**Optimization Techniques**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit-I: Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.

Unit-II: Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn –Tucker Sufficient Conditions.

Unit-III: Optimization: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg- Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP),

Unit-IV: Non-Liner Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming,

Unit-V: Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation,

Unit-VI: Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods.

Text Books.

1. Winston W L, “Operations Research: Applications and Algorithms”,
2. Rao S.S., “Optimization: Theory and Applications”.
3. Walsh G R., “M methods of Optimization”.
4. Williams H.P., “Model Building in Mathematics Programming”.
5. Williams H.P., “Model Solving in Mathematics Programming”.
6. G.L. Nemhauser and L.A. Wolsey., “Intger and Combinational Optimization”.
7. R.G. Parker and R.L. Rardin., “Discrete Optimization”.

CSE1926	Database Security	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: Introduction: Introduction to Databases Security Problems in Databases Security Controls Conclusions **Security Models -1:** Introduction Access Matrix Model Take-Grant Model Acten Model PN Model Hartson and Hsiao's, Model Fernandez's Model Bussolati and Martella's Model for Distributed databases

Unit II: Security Models -2: Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu's, Model The Lattice Model for the Flow Control conclusion.

Security Mechanisms: Introduction User Identification/Authentication Memory Protection Resource Protection Control Flow, Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria

Unit III: Security Software Design: Introduction, A Methodological Approach to Security Software Design Secure Operating System, Design Secure DBMS Design Security Packages Database Security Design

Unit IV: Statistical Database Protection &Intrusion Detection Systems: Introduction Statistics Concepts and Definitions Types of Attacks Inference Controls evaluation, Criteria for Control Comparison .Introduction IDES System RETISS System ASES System Discovery

Unit V: Models for the Protection of New Generation Database Systems -I: Introduction A Model for the Protection of Frame Based Systems A Model for the Protection of Object- Oriented Systems SORION Model for the Protection of Object-Oriented Databases

Unit VI: Models for the Protection of New Generation Database Systems -II: A Model for the Protection of New Generation Database Systems: the Orion Model Jajodia and Kogan's Model, A Model for the Protection of Active Databases Conclusions

Text Books:

1. Hassan A. Afyouni, “Database Security and Auditing”, India Edition, Cenage Learning
2. Castano, “Database Security”, Second edition, Pearson Education.

Reference Books:

1. Alfred Basta, Melissa Zgola, “Database security”, Cengage learning

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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CSE1927	Cyber Forensics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction: Review of TCP/IP and TCP, IP Header analysis, Introduction to Cyber World, Cyber attacks and cyber security

Unit II: Information warfare and cyber terrorism, Types of cyber attacks, Cyber Crime and Digital Fraud, Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations).

Unit III: Live Data collection and investigating windows environment: windows Registry analysis, Gathering Tools to create a response tool kit, obtaining volatile Data, Computer forensics in windows environment, Log analysis and event viewer, File auditing, identifying rogue machines, hidden files and unauthorized access points.

Unit IV: Live Data collection and investigating Linux environment: Proc file system overview, Gathering Tools to create response toolkit.

Unit V: Handling Investigations: Log Analysis (Network, host, user logging details), Recording incident time/date stamps, Identifying rogue processes, unauthorized access points, unauthorized user/group accounts

Unit VI: Forensic tools and report generation: Recovery of Deleted files, Analyzing network traffic, sniffers, Ethical Hacking, Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), Mobile forensic tools and analysis of called data record Template for computer for ensic reports.

Text Books:

1. Mandia, K., Prosise, C., Pepe, M., “Incident Response & Computer Forensics”, 2nd edition, Tata-McGraw Hill,
2. Bill Nelson, Amelia Phillips**,** Frank Enfinger, and Chris Steuart, “Guide to Computer Forensics and Investigations”, 2nd Edition, Thomson Learning

Reference Books:

1. Eoghan Casey, “Digital Evidence and Computer Crime”, 2nd Edition, Academic Press File System
2. Brian Carrier, “Forensic Analysis”, Wesley
3. Harlan Carvey, “Windows Forensic Analysis” DVD Toolkit, Syngress Publication
4. Steve Bunting, “EnCE: The Official En Case Certified Examiner Study Guide, 2nd Edition, Sybex Publication

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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CSE1928	Pattern Recognition	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: Introduction and classifiers based on Bayesian Decision

Unit II: Linear classifiers and non linear classifiers

Unit III: Feature selection and feature generation

Unit IV: Template matching and context dependent classification

Unit V: Clustering algorithms: Sequential and Hierarchical Algorithms

Unit VI: Clustering algorithms based on function optimization and cluster validity

Text Books:

1. Sergios Theodoridis and Konstantinos Koutroumbas, "Pattern Recognition", 4th Edition , Academic Press.
2. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley
3. John Hertz, Andres Krogh & Richard G. Palmer, "Introduction to the theory of Neural Computation", Addison Wesley
4. Theodoridis & Koutroumbas, "Pattern Recognition", 4th Edition

Chairperson		Date of Release	May2014	Applicable for AY 2014-15 Onwards
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CSE1929	Algorithms for Bioinformatics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: Introduction and Information Retrieval: Introduction, Historical overview, Bioinformatics Applications, major databases, data management, data analysis, molecular biology, Tools for Web Search, Data Retrieval tools, Data mining of biological databases.

Unit II: Molecular Biology and Bioinformatics: Introduction to Genes and Proteins Genome Sequences Genome rearrangement, bock allignmeny, global sequence alignment, ORFs, Genes, Intones, Exons, Splice Variants DNA/RNA Secondary Structure, Triplet Coding Protein Sequences, bioinformatics algorithms.

Unit III: Information molecule and information flow: Central dogma of molecular biology, Problem in molecular and bioinformatics approach, Basic component, Chemistry of DNA and RNA, Basics of DNA replication

Unit IV: Introduction to protein, Amino acid and Protein Structure: Secondary, Tertiary, Quaternary, protein Folding protein function, protein purification and characterization, Data integration and Data Analysis, Multiplicity of Data and redundancy

Unit V: Genome Analysis and Gene Mapping: Pairwise Sequence Alignment, Database Similarity Searching: BLAST, FASTA, Multiple Sequence Alignment, Profiles and Hidden Markov Models Structure prediction methods for gene, Gene expression and Microarray. Protein classification and Structure Visualization, Protein structure Prediction, Proteomics, Protein folding

Unit VI: Applications: Drug Discovery**:** Introduction, Technology, Cell Cycle, G-Protein coupled Receptor as drug target.

Text Books:

1. S. C. Rastogi, Namita Mendirata, Parag Rastogi„ "Bioinformatics concepts Skills and application", CBS publisher
2. S. C. Rastogi, Namita Mendirata, Parag Rastogi„ "Bioinformatics Methods and application", PHI
3. D. Baxevanis and F. Oulette, "Bioinformatics: A practical guide to the analysis of genes and proteins", Wiley
4. Arthur M. Lesk, "Introduction to Bioinformatics", Oxford University

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CSE1930	Semantic Web and Social Networks	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Web Intelligence: An Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

Unit II: Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontology Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language (OWL), UML, XML/XML Schema.

Unit III: Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

Unit IV: Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

Unit V: Social Network Analysis and Semantic web: Social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

Unit VI: Case Studies

Text Books:

1. Berners Lee, Godel and Turing, "Thinking on the Web", Wiley Interscience
2. Peter Mika, "Social Networks and the Semantic Web", Springer

Reference Books:

1. J. Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies, Trends and Research in Ontology Based Systems", John Wiley & Sons.
2. Liyang Lu, Chapman and Hall, "Semantic Web and Semantic Web Services", CRC Publishers,(Taylor & Francis Group)
3. Heiner Stuckenschmidt, Frank Van Harmelen, "Information Sharing on the semantic Web", Springer Publications.
4. T. Segaran, C. Evans, J. Taylor, O. Reilly, "Programming the Semantic Web", SPD.

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CSE1922	**Project Phase –I**	**T=0**	**P=16**	**Credits=8**

Evaluation Scheme	**Continuous Evaluation**	**CA**	**ESE**	**Total**	**ESE Duration**
		100		**100**	

SEMESTER- IV

CSE1931	**Project Phase –II**	**T=0**	**P=24**	**Credits=12**

Evaluation Scheme	**Continuous Evaluation**	**CA**	**ESE**	**Total**	**ESE Duration**
		40	**60**	**100**	

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Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE - I	MSE - II	TA	ESE	
I SEMESTER												
1	IT1901	Advanced Database Systems	3	0	0	3	3	15	15	10	60	3
2	IT1902	Lab: Advanced Database Systems	0	0	2	2	1			40	60	
3	IT1903	Advances in Algorithms	3	0	0	3	3	15	15	10	60	3
4	IT1904	Lab: Advances in Algorithms	0	0	2	2	1			40	60	
5	IT1905	Soft Computing	3	0	0	3	3	15	15	10	60	3
6	IT1906	Lab: Soft Computing	0	0	2	2	1			40	60	
7	IT1907	Advanced Computer Architecture	3	0	0	3	3	15	15	10	60	3
8	**Professional Elective-I**		3	0	0	3	3	15	15	10	60	3
	IT1908	Geographical Information Systems										
	IT1909	Artificial Intelligence										
	IT1910	Internet Technology										
	IT1911	High Performance Computer Networks										
Total			**15**	**0**	**6**	**21**	**18**					
II SEMESTER												
1	IT1912	Parallel Computing	3	0	0	3	3	15	15	10	60	3
2	IT1913	Lab: Parallel Computing	0	0	2	2	1			40	60	
3	IT1914	Object Oriented Systems	3	0	0	3	3	15	15	10	60	3
4	IT1915	Lab: Object Oriented Systems	0	0	2	2	1			40	60	
5	IT1916	Business Intelligence & Analytics	3	0	0	3	3	15	15	10	60	3
6	IT1917	Lab:Business Intelligence & Analytics	0	0	2	2	1			40	60	
7	IT1918	Computer System Secutity	3	0	0	3	3	15	15	10	60	3
8	**Professional Elective-II**		3	0	0	3	3	15	15	10	60	3
	IT1919	Advanced Digital Image Processing										
	IT1920	Advanced Compiler Design										
	IT1921	Bioinformatics										
	IT1922	Mobile Communication Systems										
9	IT1923	Seminar	0	0	2	2	1			100		
Total			**15**	**0**	**8**	**23**	**19**					

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III SEMESTER

1	**Professional Elective-III**		3	0	0	3	3	15	15	10	60	3
	IT1924	Distributed Systems										
	IT1925	Operation Research Techniques										
	IT1926	Pattern Recognition										
	IT1927	Wireless Sensor Networks										
	IT1928	Software Architecture										
2	**Professional Elective-IV**		3	0	0	3	3	15	15	10	60	3
	IT1929	Cloud Computing										
	IT1930	Computer Vision										
	IT1931	Cyber Forensics										
	IT1932	Internet Routing Design										
	IT1933	Embedded Systems Design										
	IT1934	Management Information Systems										
3	IT1935	Project Phase- I	0	0	16	16	8			100		
Total			**6**	**0**	**16**	**22**	**14**					

IV SEMESTER

1	IT1936	Project Phase - II	0	0	24	24	12		40	60	
Total			**0**	**0**	**24**	**24**	**12**				
Grand Total Of Credits							**63**				

I Semester

IT1901	**Advanced Database Systems**	**L=3**	**T=0**	**P=0**	**Credits=6**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

Unit 1:

Introduction to DBMS, SQL Overview, Anatomy of DBMS, process, memory and disk structure.

[07 Hrs]

Unit 2:

ACID properties Implementation , Concurrency control and Isolation level, implementation of commit, Log based Recovery, Read consistency, write consistency, implementation of Read consistency, write consistency using time stamped based protocol and log based protocol.

[06 Hrs]

Unit3:

Logical and Physical storage: table storage, index organized table, clusters, partitions, Query optimization: Generation of query execution plan, representation, cost based and rule based optimization, Access path optimization, join optimization.

[07 Hrs]

Unit 4:

Security and auditing , Introduction to Database Security Issues, Types of Security, Database Security and DBA,Access Protection, User Accounts, and Database Audits, Materialized Views , Query rewriting.

[06 Hrs]

Unit 5:

Distributed databases: homogeneous and heterogeneous, distributed data storage, distributed transactions, ACID properties in distributed database.

[06 Hrs]

Unit 6:

Introduction to Parallel database architecture, Hadoop file system, columnar databases.

[08 Hrs]

Text books :

- Database System Concepts *Sixth Edition*. Avi Silberschatz · Henry F.*Korth* · S. Sudarshan. McGraw-Hill ISBN 0-07-352332-1
- Fundamentals of Database Systems *5th Edition*. Textbook authors: Shamkant B. *Navathe*, Ramez Elmasri Addison-Wesley ISBN: 9780321369574////978-81-317-1625-0
- *Distributed Databases*. Author, Stefano CERI. Publisher, McGraw-Hill, 1988. ISBN, 0070265119, 9780070265110.

Reference Books:

- Principles of Distributed Database Systems 3rd Edition Author Özsu, M. Tamer, Valduriez, Patrick Springer
- Readings in Database Systems, Third Edition (The Morgan Kaufmann Series in Data Management Systems) [Paperback]
- Michael Stonebraker (Author), Joseph Hellerstein (Author)
- Oracle 11g Concepts guide
- Oracle 11g Administration Guide
- Oracle 11g Performance and Tuning

Lab Experiments based on above syllabus

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IT1903	Advanced Algorithms	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Prerequisites: Data Structures, Elementary algorithmic, efficiency of algorithms, Asymptotic Notations

Unit I: Algorithmic analysis: Analyzing control structures, Solving recurrences, Review of data structures. Amortized Analysis **Greedy algorithms**: General characteristics, Graphs algorithms, Scheduling. Mininmum spaning tree

[06 Hrs]

Unit II: Divide and conquer algorithms: General template, Searching, Sorting, Matrix multiplication,. **Dynamic programming**: Principle of optimality, shortest paths, Chained matrix multiplication, Approaches using recursion, Memory functions, Knapsack Problems Multistage graphs.

[08 Hrs]

Unit III: Linear programming: Formulating problems as linear programs, The simplex algorithm, Duality.Algorithms on Arrays, String matching Algorithms

[06 Hrs]

Unit IV: Probabilistic algorithms: Introduction, Pseudorandom generation, Numerical probabilistic algorithms, Monte Carlo algorithms, Las Vegas algorithms.

[08 Hrs]

Unit V: Parallel algorithms: Basic techniques, Parallel evaluation of expressions, Parallel sorting networks, parallel sorting and distributed computation.

[06 Hrs]

Unit VI: Computational complexity: Introduction, Linear reductions, Introduction to NP-completeness. **Heuristic algorithms and Approximate algorithms**: Heuristic algorithms, NP-hard approximation problems.

[06 Hrs]

Text Books:

1. T. H. Cormen, C. E. Leiserson, Rivest, C. Stein, “Introduction to Algorithms”, PHI.

Reference Books:

1. G. Brassard, P. Bratley, “Fundamentals of Algorithmics”, PHI
2. A.V. Aho, J. E. Hopcroft, J.D. Ulman, “The Design & Analysis of Computer Algorithms”, Addison Wesley.3. Horowitz E., Sahni S, Rajasekharan S., “Fundamentals of computer algorithms”, University press

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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IT905	Soft Computing	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Course Objectives:-

1. To understand the Soft Computing and how it is different from Hard Computing.
2. To comprehend the basics of each of the three Soft Computing methodologies and to understand their advantages and limitations.
3. To analyze and design a given system using Soft Computing methodologies.
4. To understand the basic principles of hybrid systems and their applications.

Unit I : [7 Hrs]
Introduction to soft Computing**,** History of Neural Networks**,** overview of biological Neural system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, Neural Network Learning Rules.

UNIT-II: [7 Hrs]
ANN training Algorithms, Multilayer Perceptron Model, Back Propagation Algorithm, Hopfield Networks, Self Organizing map, Associative Memories, ART networks, Applications of Artificial Neural Networks.

Unit III: [6 Hrs]
Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Operations on Fuzzy Sets**:** Compliment, Intersections, Unions, fuzzy relations, Cylindrical extension, projection, and composition.

Unit IV: [6 Hrs]
Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Fuzzy inference, design of a fuzzy controller, Extension principal, Fuzzy Inference Systems, Fuzzy Information Retrieval.

Unit V: [7 Hrs]
Introduction to genetic algorithms (GA):overview of GA, operators in GA- selection, crossover, mutation, GA cycle, GA in problem solving.

Unit VI:[7 Hrs]
Introduction to Hybrid Systems:- types of hybrid systems:- Sequential, Auxiliary and Embedded hybrid systems, Neuro-fuzzy, Neuro-Genetic and Fuzzy-Genetic hybrid systems, Applications of Soft Computing and case studies.

Course Outcomes:-
At the end of the course student will be able to:-

1. define soft computing and differentiate between hard and soft problems.
2. understand the basic principles of working of each of the soft computing methodologies (neural networks, fuzzy logic and genetic algorithms).
3. select appropriate soft computing methodology for the given problem and analyze and design an effective system for solving the problem using the methodology selected.
4. to comprehend the basics of hybrid systems and their applications.

Text Books:

1. Karray and Silva, Soft Computing and Intelligent System Design, Pearson education (LPE), 2009
2. Introduction to Artificial Neural Systems,J. M. Zurada,Second Ed. (1994),Jaico Publishing House
3. Fuzzy Logic With Engineering Applications, T. J. Ross, 2004, McGraw Hill
4. An Introduction to Genetic Algorithms (Complex Adaptive Systems), Melanie Mitchell, MIT Press.

Reference Books

1. Neuro-fuzzy and Soft Computing, JangSun and E. Mizutani, 1996, Prentice Hall.
2. Real life applications of Soft Computing, AnupamShukla, RituTiwari, Rahul Kala, 2010,CRC Press

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IT1907	Advanced Computer Architecture	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: [05 Hrs.]
Classification of parallel computers, Multiprocessors and multicomputer, Multi vector and SIMD computers.

Unit II: [07 Hrs.]
Conditions of parallelism, Data and resource Dependencies, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit III: [08 Hrs.]
Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Unit IV: [06 Hrs.]
Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Unit V: [06 Hrs.]
Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors.

Unit VI: [08 Hrs.]
Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Text Books:
1. Kai Hwang, “Advanced Computer Architecture”; TMH.

Reference Books:
1. Harvey G.Cragon, ”Memory System and Pipelined processors”; Narosa Publication.
2. V.Rajaranam & C.S.R.Murthy, “Parallel computer”; PHI
3. R.K.Ghose, Rajan Moon & Phalguni Gupta, “Foundation of Parallel Processing”, Narosa Publications
4. Kai Hwang and Zu, “Scalable Parallel Computers Architecture”, MGH.
5. D.Sima, T.Fountain, P.Kasuk, “Advanced Computer Architecture-A Design space Approach,”Addison Wesley,
6. M.J Flynn, “Computer Architecture, Pipelined and Parallel Processor Design”; Narosa Publishing.
7. Hwan and Briggs, “Computer Architecture and Parallel Processing”; MGH

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IT1908	Geographical Information Systems	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Course Objectives:

1. Introduction to the concepts, principles, and theories behind Geographic Information Systems and Science (GIS), with emphasis on the nature of geographic information, data models and structures for storing geographic information, geographic data input, data manipulation, and simple spatial analysis and modeling techniques.
2. Identify the applications in GIS

UNIT I: [7 Hrs]
Fundamentals of GIS and Cartography : Roots of GIS, Four M's, Definition, GIS Architecture, Models of GIS, Framework for GIS, GIS Categories, Map as a Model, Spatial Referencing System, Map Projections, Commonly Used Map Projections, Grid Systems, Cartographic Symbolization, Types of Maps, Typography, Map Design, Map Productions, Map Applications.

UNIT II: [7 Hrs]
Data Management, Models and Quality Issues : Conceptual Models, Geographical Data Models, Data Primitives, Data Types - Raster and Vector Approach, Data Modeling and Spatial Analysis, Sources of Geographical Data, Data Collectors and Providers, Creating Digital Data Sets, Data Presentation, Data Updating, Data Storage, Spatial Data Costs, Quality of GIS Output, Sources of Errors in Spatial Data, Factors affecting Reliability of Spatial Data, Faults from Assumptions.

UNIT III: [8 Hrs]
Remote Sensing Fundamentals : Remote Sensing - Basic Principles, Electromagnetic Remote Sensing,Energy Sources, Energy Interactions with Earth's Surface Materials,Microwave Remote Sensing, The Radar Principle, Factors Affecting Microwave Measurements, Radar Wavebands, SLAR Systems, Sar, , Interpreting Sar Images, Geometrical Characteristics, Remote Sensing , Platform and Sensors, Satellite System Parameters, Sensor Parameters,Imaging Sensor Systems, Earth Resources Satellites, Meteorological Satellites.

UNIT IV: [7 Hrs]
Image Processing : Digital Image Processing, Basic Character of Digital Images, Preprocessing, Registration, Enhancement, Spatial Filtering, Transformations, Classification, Image Classification and GIS, Visual Image Interpretation, Types of Pictorial Data Products, Image Interpretation Strategy, Image Interpretation Process, Overview of Image Interpretation Equipments.

UNIT V: [6 Hrs]
Terrain Mapping, Geocoding and Segmentation : Interpolation, Visualization of Continuous Surfaces, Data Sources forInterpolations, Methods for Interpolations, Global Interpolation, LocalDeterministic Methods, Comparison of Global and Local Method, Optimal
Interpolation Using Geo Statistics – Kriging, Variogram, Geocoding,Applications of Geocoding, Dynamic Segmentation, Applications of DynamicSegmenation.

UNIT VI:[6 Hrs]
Issues and Applications in GIS :
Changes in Technology, Data Supply and Users, Role of Satellite Imagery and Data Sets, Urban and Municipal Applications, Other Applications.

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Course Outcomes : At the end of the course students will be able to :

1. Describe what GIS is; name the major GIS software available; know where to find more Information.
2. Explain the components and functionality of a GIS and the differences between GIS and Other information systems.
3. Understand the nature of geographic information and explain how it is stored in computer(including map projection) and the two types of GIS data structure.
4. Enlist the issues and applications in GIS.

Books:

1. Peter A Burrough and McDonell, “Principles of Geographical InformationSystems”, Oxford University Press, 1998.
2. M. AnjiReddi, “Remote Sensing and Geographical Information Systems”, B.S. Publications, Second Edition, 2001.
3. George B Korte, “The GIS Book”, Onword press, Thomson Learning, 5thEdition, 2003.
4. Kang-tsung Chang, “Introduction to Geographical Information Systems”, TataMcGraw Hill, Third Edition, 2003.

IT1909	Artificial Intelligence	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Objectives:-

1. Describe the key components of the artificial intelligence (AI) field
2. Describe search strategies and solve problems by applying a suitable search method
3. Describe minimax search and alpha-beta pruning in game playing.
4. Describe and apply knowledge representation
5. Describe and list the key aspects of planning
6. Describe the key aspects of intelligent agents
7. Describe the key aspects of Evolutionary computation, including genetic algorithms and natural language ..
8. Describe the key aspects of Machine learning and expert system.

UNIT I : **[7 Hrs]**
INTRODUCTION : Intelligent Agents – Agents and environments - Good behavior – The nature of environments – structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.

UNIT II : **[7 Hrs]**
SEARCHING TECHNIQUES :Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments - Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems - Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.

UNIT III: **[7 Hrs]**
KNOWLEDGE REPRESENTATION :First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation - Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects

UNIT IV : **[7 Hrs]**
LEARNING :Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods - Learning with complete data - Learning with hidden variable - EM algorithm - Instance based learning - Neural networks - Reinforcement learning – Passive and active reinforcement learning ,Generalization in reinforcement learning.

UNIT V: **[6 Hrs]**
Design and development of Expert Systems

UNIT VI : **[6 Hrs]**
Natural Language Understanding :Communication, Formal grammar for a fragment of English – Syntactic analysis – Augmented grammars – Semantic interpretation – Ambiguity and disambiguation – Discourse understanding – Grammar induction - Probabilistic language processing - Probabilistic language models – Information retrieval and Extraction – Machine translation.

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Outcomes :-
Students are able to:

1. Apply artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning.
2. To design and implement appropriate solutions for search problems (such as playing two-person games) and for planning problems (such as determining a sequence of actions for a robot).
3. To analyse problem specifications and derive appropriate solution techniques for them.
4. To design expert system .

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, 2nd Edition, Pearson Education / Prentice Hall of India, 2004.
2. George F. Luger, “Artificial Intelligence-Structures And Strategies For Complex Problem Solving”, Pearson Education / PHI, 2002.

REFERENC BOOKS:

1. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Harcourt Asia Pvt. Ltd., 2000.
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, 2nd Edition, Tata McGraw-Hill, 2003.

IT1910	Internet Technology	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Course Objectives:
At the end of the course, the students will be able to:
1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
4. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

UNIT I: [7 Hrs]
The OSI Model and The TCP/IP Protocol Suite:
Protocol Layers ,The OSI Model , TCP/IP Protocol Suite , Addressing ,**Underlying Technologies :** Wired Local Area Networks , Wireless LANs , IEEE 802.11, Point-to-Point WANs, Connecting devices

UNIT II: [7Hrs]
Network Layer : Introduction to Network Layer , Switching, Packet Switching at Network Layer, Network Layer Services , Other Network Layer Issues,IPv4 Addresses , Classful Addressing , Classless Addressing , Special Addresses , NAT ,Delivery and Forwarding of IP Packets.

UNIT III: [6 Hrs]
Internet Protocols: Introduction , Datagrams , Fragmentation , Options ,Checksum , IP over ATM, Security , IP Package , **Address Resolution Protocol (ARP) :** Address Mapping , ARP Protocol , ATMARP , ARP Package , Internet Control Message Protocol ICMPv4 and ICMPv6, **Mobile IP :** Addressing , Agents , Three Phases , Inefficiency in Mobile IP .

UNIT IV: [6 Hrs]
Transport Layer : Introduction to the Transport Layer , Transport-Layer Services , Transport-Layer Protocols ,User Datagram Protocol (UDP) , Transmission Control Protocol (TCP) , SCTP

UNITV: [7 Hrs]
Application Layer: Introduction to the Application Layer ,Client-Server Paradigm , Peer-to-Peer Paradigm , **Host Configuration:** BOOTP**,** DHCP ,Domain Name System (DNS) , **Remote Login:** TELNET and SSH , **File Transfer:** FTP and TFTP

UNIT VI: [7 Hrs]
World Wide Web and HTTP, **Electronic Mail:** SMTP, POP, IMAP, MIME , **Network Management:** SNMP , **Multimedia:** Streaming Stored and Live Audio/Video, RTP , RTCP, Voice Over IP (VOIP), SIP, VPN.

Learning Outcomes:
After completing this course the student must demonstrate the knowledge and ability to:
1. Independently understand basic computer network technology.
2. Understand and explain Data Communications System and its components.
3. Identify the different types of network topologies and protocols.
4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
5. Identify the different types of network devices and their functions within a network
6. Understand and building the skills of subnetting and routing mechanisms.
7. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

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Text Book:

1. TCP/IP Protocol Suite - Behrouz A. Forouzan , Fourth Edition , McGraw-Hill .

Reference Books:

1 Communication Networks, 2/e - Alberto Leon-GarciaIndraWidjaja, McGraw-Hill.
2 Internetworking with TCP / IP - Douglas E .Comer; PE.
3 Computer Networks - Andrew S. Tannenbaum; PHI.
4 Computer Networks and Internets - Douglas E. Comer; PE.
5 Data and Computer Communication - William Stallings; PHI.

IT1911	High Performance Computer Networks	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives:
Understanding of how modern networks provide high performance and advanced classes of service, with a focus on topics such as high-performance networks like ATM, performance factors and performance modeling, quality of service protocols in IP networks, and investigate voice-over-IP, mobile IP networks.

UNIT I: [7 Hrs]
BACKGROUND: A Brief Networking History, The Need For Speed And Quality Of Service, Advanced TCP/IP and ATM Networks, Protocols and The TCP/IP Suite, TCP and IP, IPv6.

UNIT II: [6 Hrs]
HIGH-SPEED NETWORKS: Frame Relay, Asynchronous Transfer Mode, High-Speed LANs.

UNIT III: [6 Hrs]
PERFORMANCE MODELING AND ESTIMATION: Overview of Probability and Stochastic Process, Queuing Analysis, Self-Similar Traffic.

UNIT IV: [7 Hrs]
CONGESTION AND TRAFFIC MANAGEMENT: Congestion Control in Data Networks, Link-Level Flow and Error Control, TCP Traffic Control, Traffic and Congestion Control in ATM Networks.

UNIT V: [7 Hrs]
INTERNET ROUTING: Overview of Graph Theory and Least-Cost, Interior Routing Protocols, Exterior Routing Protocols and Multicast.

UNIT VI: [7Hrs]
QUALITY OF SERVICE IN IP NETWORKS: Integrated and Differentiated Services: Protocols for QoS Support.

Learning Outcomes:
At the completion of the subject, students should be able to:
1. Define the various high-speed networking technologies and their design issues.
2. Perform the Queuing Analysis theory to estimate the performance parameter for network traffic volume.
3. Compare and contrast the congestion control mechanism and traffic management used in high-speed network environment.
4. Conclude the Quality of Service (QoS) in IP Networks and evaluate their performances

Text Book :
1. William Stallings: High Speed Networks and Internets, performance and quality of service, second edition, Pearson Education

Reference Books:
1. Communication Networks, 2/e - Alberto Leon-GarciaIndraWidjaja, McGraw-Hill.
2. M Shwartz: Telecommunication Network Protocol Modeling and Analysis:Addison Wesley
3. Fred Halsall: Data Communication Computer Networks, And Open Systems: Addison Wesley
4. Kershanbaum : Telecommunication Network Design Algorithms: McGraw-Hill
5. Computer Networks & Internet: Comer

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II Semester

IT1912	Parallel Computing	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit-1 : **[6Hrs]**

Introduction to parallel computing: need of ever increasing performance, building parallel systems, need to write parallel programs, Parallel hardware: SIMD systems, MIMD systems, Interconnection networks,. Cache coherence, Shared-memory versus distributed-memory,Parallel Software: Caveats, Coordinating the processes/threads, Shared-memory, Distributed-memory, Programming hybrid systems.

Unit-2: **[7Hrs]**

Parallel Programming Platforms: implicit parallelism, Limitation of Memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, communication cost in parallel machines.

Unit-3:

Dependence Concepts : Basic introduction of dependence in single loop and double loop, index and iteration spaces and perfect loop nest, test for dependences, GCD test, Bound test.

Unit-4: **[8Hrs]**

Shared-Memory Programming with OpenMP: What is OpenMP, creating team of threads, OpenMP Memory model, thread synchronization, Directives, Sharing the Work among Threads in an OpenMP Program : Loop Construct, The Sections Construct , The Single Construct , Workshare Construct, Combined Parallel Work-Sharing Constructs ,Clauses to Control Parallel and Work-Sharing Constructs, OpenMP Synchronization Constructs ,Interaction with the Execution Environment, OpenMP Clauses : If Clause , Num threads Clause, Ordered Clause, Reduction Clause, Copyin Clause ,Copyprivate Clause ,Advanced OpenMP Constructs: Nested Parallelism , Flush Directive , Threadprivate Directive.

Unit-5: **[7Hrs]**

Distributed-Memory Programming with MPI :

Compilation and execution,MPI programs ,MPI_Init and MPI_Finalize, Communicators: MPI_Comm_ size and MPI_ Comm_rank, MPI_Send ,MPI_Recv, Message matching, Semantics of MPI_Send and MPI_Recv, Dealing with I/O,Collective communication,MPI derived data types.

Unit-6: **[6Hrs]**

Compute Unified Device Architecture (CUDA):

CUDA Architecture, Introduction to CUDA C, Kernel Call, Passing parameters, Querying Devices, Thread Cooperation: Splitting blocks, Shared Memory and Synchronization.

Text and Reference Books:

1. Introduction to Parallel Computing by AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, Addison Wesley, Second edition.
2. Dependence Concept by Utpal Banerjee (Intel Corporation) Kluwer Academic Publishers
3. CUDA by Example:An IntroductIon to General- Purpose GPU Programming by Jason Sanders,Edward Kandrot (Addison Wesley)
4. Using OpenMP by Barbara Chapman, Gabriele Jost, Ruud van der Pas (MIT Press)
5. An Introduction to Parallel Programming by Peter S. Pacheco , Morgan Kaufmann.

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IT1914	Object Oriented Systems	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES: -

- Learn what the **object-oriented (OO) approach** to software development is, through OO principles and design patterns.
- Practice the application of principles of object-oriented software development through the course
- Learn the concepts such as reuse, quality, iterative development, and risk management.

Unit I: [06 Hrs]

Introduction: Software Engineering, object orientation and reusable technology

Unit II: [06 Hrs]

Developing requirements: Domain analysis, types of requirements.
Modeling with classes: UML, essentials of UML class diagrams, associations and multiplicity, generalization, instance diagrams

Unit III: [08 Hrs]

Design patterns: Abstraction-occurrence pattern, general hierarchical pattern, play-role pattern, singleton pattern, observer pattern, delegation pattern, adaptor pattern, facade pattern, immutable pattern, read-only interface pattern and proxy pattern
Focusing on users and their tasks: User-centered design, characteristics of users, developing use case models of systems, the basics of user interface design, usability principles, evaluating user interfaces

Unit IV: [06 Hrs]

Modeling interactions and behavior: Interaction diagrams, state diagrams, activity diagrams, **Designing and testing software**: The process of design, principles leading to good design, techniques for making good design decisions, software architecture, writing a good design document

Unit V: [08 Hrs]

Testing and inspecting: Basic definitions of defect, error and failure, effective and efficient testing, defects in ordinary and numerical algorithms, defects in timing and coordination, defects in handling stress and unusual situations, documentation defects, writing formal test cases and test plans, strategies for testing large software, inspections, quality assurance in general. **Managing the software process**: Project management, software process model, cost estimation, building software engineering teams, project scheduling and tracking, contents of a project plan

Unit VI: [06 Hrs]
Case studies on the analysis and design of object oriented systems

OUTCOMES : -

1) Analyse and model requirements and develop software using object-oriented analysis and design,
2) 2)Express object models in UML
3) Design basic object-oriented software systems that meet requirements by applying OO software development principles and design/architectural patterns.
4) Work as a member of a software development team

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Text Book:

1. Timothy Lethbridge, Robert Langaniere, "Object-Oriented Software Engineering Practical software development using UML and Java", Mcgraw-Hill

Reference Books:

1. Roger S. Pressman, "Software Engineering A Practitioner's Approach", 5th Ed. Tata McGraw Hill.
2. Grady Booch, James Rumbaugh, Ivar Jacobson "The Unified Modeling Language User Guide", Addison-Wesley.
3. Edwards Yourdon, Carl Argila, "Case Studies in Object Oriented Analysis and Design", Prentice Hall.
4. Booch, Rumbaugh & Jacobson, "The Unified Modeling Language User Guide", Addison-Wesley.
5. Bernd Bruegge, Allen H. Dutoit "Object Oriented Software Engineering: Using UML, Patterns and Java", Pearson Education

IT1916	Business Intelligence & Analytics	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit 1: Introduction to Business intelligence and Multidimensional Modeling:
Introduction to OLTP, OLAP, BI definition and concepts, Business applications of BI, BI roles and responsibilities, Multidimensional data model, ER- modeling Vs. multidimensional modeling, concepts of dimension, facts, cubes, concept hierarchies, star, snowflake and Fact constellation ,Schemas for multidimensional database, OLAP operations in Multidimensional data model.

[07 Hrs]

Unit 2: ETL- Data source categorization, data transformation: Basic Tasks, Major Transformation Types, Data Integration and Consolidation, Loading data from multiple sources, loading data in stages.

[06 Hrs]

Unit 3: Social Media Analytics:
Social network analysis, representation of social data, social media analysis, using Open source tools to collect and analyze data of social media.

[06 Hrs]

Unit 4 : Mining Frequent Patterns and Association Rules:
Market Basket Analysis, Frequent Itemsets and Association rules, Apriori Algorithm, improving the efficiency of Apriori, FP- growth Algorithm.

[07 Hrs]

Unit 5: Classification and Clustering:
Classification : Introduction, decision tree, building a decision tree- the tree induction algorithm, split algorithm based on information theory, gini index, overfitting and pruning, decision tree rules, naïve Bayes method.
Clustering : Types of data in cluster analysis, categorization of major clustering methods: Partitioning methods, Hierarchical methods. Applications of clustering.

[08 Hrs]

Unit 6: Visualization and Prediction:
Visualization : Motivation for visualization, general concepts, techniques
Prediction: Linear regression (least square method), analyzing regression error, analyzing goodness of fit.

[06 Hrs]

Text books:

1. Introduction to data mining ,Pang-Ning Tan, Michael Steinbach, vipin kumar, Addison- Wesley 2005 ISBN: 0321321367.
2. Data mining Techniques 2nd edition(2006) , Jiawei Han and Micheline Kamber, Elsevier.
3. Business Intelligence, David Loshin.

Reference books:

1. Data Warehousing ETL toolkit, Indian edition.
2. Data mining methods and models, second reprint 2007, Daniel Larose Wile interscience.

Practicals based on the syllabus using various open source tools.

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IT1918	Computer System Security	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Course Objectives:
At the end of the course, the students will be able to:
1. Build an understanding of basic components of computer security.
2. A knowledge of security policies for integrity and confidentiality.
3. Understand and explain design principles for security.
4. A knowledge of a set of security attacks and the safeguards to prevent them.

UNIT I: (7 hr)
Introduction , security attacks, security services, security mechanisms, a model for network security, encryption model, steganography, classical encryption techniques, modern techniques - block cipher principles, data encryption standard, differential and linear cryptanalysis, block cipher modes of operation, algorithm – triple DES, international data encryption algorithm.

UNIT II: (6 hr)
Confidentiality using conventional encryption: Placement of encryption function, traffic confidentiality, Public key cryptography: Principles, RSA algorithm, Symmetric Key Management: Diffie – Hellman key exchange, Public Key Distribution: Certification authority, X.509, public key infrastructure.

UNIT III: (7 hr)
Integrity, Authentication: Message integrity, message authentication, cryptographic hash functions, digital signature.

UNIT IV: (7 hr)
Web security: Requirements, secure socket layer, secure electronic transaction.
Database Security: Integrity of database, element integrity, auditability, access control, user authentication, direct attack, indirect attack, aggregation, SQL Injection, defending against SQL injection.

UNIT V:(6 hr)
Program/System Security: Intruders, password management, viruses and related threats, virus countermeasures, worms, distributed denial of service attacks, trojan horses, firewall design principles, trusted systems.

UNIT VI:(7 hr)
Network security: Threats in networks, firewalls and proxies, honeypots,
Networks management security: Basic concepts of SNMP.
Security at Application Layer: Pretty Good Privacy (PGP), S/MIME, data compression using ZIP Radix-64 conversion,

Learning outcomes
After completing this course the student must demonstrate the knowledge and ability to:
1. Critically analyse and describe elements of Computer System Security.
2. Critically analyse and describe a selection of hardware and physical layer security solutions.
3. analyse network security issues and solutions from the LAN and WAN (Internet) perspectives.
4. evaluate platform specific operating systems and application security issues and solutions.
5. Analyse a given case study with a view to determining and evaluating possible security solutions

TEXT BOOKS:
1. Behrouz A. Forouzan “Cryptography and Network Security” The McGraw-Hill.
2. William Stallings “cryptography and networks security” (Pearson Education Prentice Hall).
3. C.P. Pfleeger and S.L.Pfleeger, “Security in Computing”, Pearson Education.

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REFERENCE BOOKS:

1. Atul Kahate, “Cryptography and Network Security”, Tata Mc Graw Hill
2. Scott Mann, Ellen L, Mitchell Krell:”Linux System security: An Administrator Guide to Open Source security Tools “Pearson Education.
3. Brian hatch, James Lee, George Kurtz:”hacking Linux Exposed: Linux Security Secrets & Solutions”, Tata McGraw-Hill
4. Matt Bishop, “Computer Security: Art and Science”, Pearson Education

IT1919	Advanced Digital Image Processing	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Course Objectives:-

1. To analyse the techniques of image enhancement in the frequency and spatial domain.
2. To appreciate the significance of 2-D DFT as an important image processing tool.
3. To understand the problem of image segmentation, its need and study different techniques of it.
4. To understand internal and external representation of an image region and to select appropriate representation for the given problem.
5. To understand the Model of the Image Degradation/ Restoration Process and to apply the principles and techniques of image restoration on the degraded images.
6. To comprehend the basics of color image processing techniques .
7. To understand the basics of image compression and various techniques of compressing images and their performance analysis.

Unit I: [08 Hrs.]
Image Enhancement and Spatial Filtering: A Simple Image Model, Sampling and Quantization, Basic Relationship Between Pixel, Basic gray level Transformations, mathematical tools used in DIP, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filtering, Sharpening Spatial Filters,

Unit II: [07 Hrs.]
Frequency Domain Processing: Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2D FT, Inverse Fourier Transform, Filtering in Frequency Domain**,** Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homographic Filtering.

Unit III: [06 Hrs.]
Image Segmentation: Fundamentals, Point, line and edge detection, thresholding, Region Oriented Segmentation, Other Segmentation methods.
Morphing, Representation and Description: Introduction, Basics of morphological operations on images, Chain Code, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of a region, Boundary Descriptors: Simple Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors: Simple Descriptors, Topological Descriptors, Texture.

UNIT IV: [06 Hrs.]
Image Degradation and Restoration: Noise Models, Restoration in the presence of Noise only - Spatial Filtering, Periodic Noise reduction by frequency domain filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse Filtering, Wiener Filtering, Constrained Least Square Filtering.

UNIT V: [06 Hrs]
Color Image Processing: Color fundamentals and color models, pseudo-color image processing, basics of full color image processing, color transformations, smoothing and sharpening, color image segmentation

Unit VI: [07 Hrs.]
Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Fidelity criteria, Image compression models, compression standards, Basic compression methods, Huffman coding, Arithmetic coding, LZW coding, run length coding, digital image watermarking

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Course Outcomes:-

At the end of the course student will be able to:-

1. to perform the basic image processing operations in the spatial domain and to differentiate between frequency domain and spatial domain.
2. understand the significance of 2-D DFT as an image processing tool and apply it to perform image processing tasks.
3. define image segmentation and explain different techniques of it.
4. differentiate between the internal and external representation of an image region and will be able to choose appropriate representation for the given problem.
5. to understand the basic principles of image degradation and image restoration.
6. to extend the image processing tasks to the domain of color images
7. explain the need for image compression, different techniques for it and the performance parameters to measure the effectiveness of image compression algorithms.

Text Books:

1. Rafael C. Gonzalez & Richard E. Woods, “Digital Image Processing”, Third Edition, 2008, Pearson Education.
2. Tinku Acharya and A. K. Ray, Image Processing Principles and Applications, Wiley Interscience,2005.

Reference Books:

1. A.K.Jain, “Fundamental of Digital Image Processing”, PHI.

IT1920	Advanced Compiler Design	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Prerequisite: Basics of Theoretical Computer Science, Basics of Compilers.

Unit 1: Introduction (6 Hrs)
Review of Compiler Structure, Lexical Analyzer: Implementation and Role, Parsing: Top down and Bottom UP Parsing, Parser Development Tool: YACC, Importance of Code Optimization, Structure of Optimizing Compilers.

Unit 2: Context –Sensitive Analysis & Intermediate Representation (6 Hrs)
Semantic Analysis: Type checking, type conversion, Intermediate code generation (Looping statement, array references in arithmetic expression, procedure call), The Attribute –grammar framework, Adhoc Syntax directed translation, Issues in designing an intermediate languages, Graphical & Linear IR, Static-single Assignment form, Mapping values to names & symbol tables.

Unit 3: Code Optimization (8 Hrs)
Introduction, Redundant expressions, Scope of optimization, Procedural and interprocedural optimization, loop optimization, Global redundancy elimination, Cloning to increase context, Inline substitution, Introduction to control flow analysis, Approaches to control flow analysis, Interval analysis and control trees, Structural analysis, Reaching definitions.

Unit 4: Data Flow Analysis (8 Hrs)
Basic concepts: Lattices, flow functions and fixed points, Lattice of flow functions, defining Use Chains, Data Flow Analysis: Dead Code Elimination, Constant Propagation, Static Single- Assignment Form, Induction Variable Exposure, Iterative data flow analysis, Control –tree based data flow analysis, Structural analysis and interval analysis, Advanced topics: Structures data-flow algorithms and reducibility, Inter procedural analysis (Control flow, data flow, constant propagation, alias).

Unit 5: Instruction Selection & Scheduling (8 Hrs)
Introduction, Instruction selection and code generation, Instruction selection via tree-pattern matching, Instruction selection via peephole optimization, Learning peephole patterns, Generating instruction sequences, Introduction to instruction scheduling, The instruction scheduling problem, List scheduling, Regional scheduling.

Unit 6: Register Allocation (6 Hrs)
Introduction, Issues in register allocation, Local register allocation and assignment, moving beyond single block, Global register allocation and assignment, Variations on Graph Coloring Allocation, Harder problems in register allocation, CASE Study of GCC compiler.

Text Books:

1. Steven S. Muchnick, Advanced Compiler Design Implementation, Elsevier-Morgan Kaufmann Publishers, 2003.
2. Kennedy, Optimizing Compiler for Modern Architecture.
3. Keith D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier-Morgan Kaufmann Publishers, 2004.
4. A.V. Aho, J.D. Ullman, Sethi, Compiler: Principles, Techniques and Tools, Pearson Education
5. Uday Khedker, Amitabha Sanyal, Bageshri Karkare , Data Flow Analysis: Theory and Practice, CRC Press, 2009

Reference Books:

1. Andrew Appel, Modern Compiler Implementation in C: Basic Techniques, Cambridge University Press, 1997.
2. Y.N. Srikant, Priti Shankar, The Compiler Design Handbook: Optimizations and Machine Code Generation, CRC Press, 2nd Edition, 2002.
3. David R. Hanson , Christopher W. Fraser, A Retargetable C Compiler: Design and Implementation, Addison-Wesley, 1995
4. Morgan, Robert, Building an Optimizing Compiler, Digital Press Newton, 1998.

IT1921	Bioinformatics	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Objectives: This course provides an introduction to the analysis of biological data using computational methods, as well as investigating problems in molecular and biology from a computational perspective. It is expected that, upon completion of this course, the students will achieve the following objectives:

- Develop an understanding of the basic principles of molecular and cell biology.
- Become familiar with existing tools and resources for computational analysis of biological data, including sequences, phylogenies, microarrays, ontology's, and bio-molecular interactions.
- Develop an awareness of the computational problems that arise in the modelling and analysis of living systems.
- Understand basic abstractions and computational approaches used to formulate and address these problems.
- Be able to use and extend existing computational infrastructure for analyzing biological data.

UNIT I: [06 Hrs.]
Introduction and Information Retrieval : Introduction, Historical overview, Bioinformatics Applications, major databases, data management, data analysis, molecular biology, Tools for Web Search, Data Retrieval tools, Data mining of biological databases.

UNIT II: [07 Hrs.]
Molecular Biology and Bioinformatcis : Introduction to Genes and Proteins Genome Sequences Genome rearrangement, bock allignmeny, global sequence alignment, ORFs, Genes, Intones, Exons, Splice Variants DNA/ RNASecondary Structure, Triplet Coding Protein
Sequences, bioinformatics algorithms.

UNIT III: [07 Hrs.]
Information molecule and information flow : Central dogma of molecular biology, Problem in molecular and bioinformatics approach, Basic component, Chemistry of DNA and RNA, Basics of DNA replication , Introduction to protein ,Amino acid and Protein Structure: Secondary, Tertiary, Quaternary , protein Folding protein function , protein purification and
characterization, Data integration and Data Analysis, Multiplicity of Data and redundancy.

UNIT IV: [07 Hrs.]
Genome Analysis and Gene Mapping : Pairwise Sequence Alignment, Database Similarity Searching :- BLAST,FASTA, Multiple Sequence Alignment, Profiles and Hidden Markov Models, Structure prediction methods for gene, Gene expression and Microarray.

UNIT V: [07 Hrs.]
Protein classification and Structure Visualization, Protein structure Prediction, Proteomics, Protein folding

UNIT VI: [06 Hrs.]
Drug Discovery: Introduction, Technology, Cell Cycle, G-Protein coupled Receptor as drug target, applications.

Course Outcome:
At the end of the course, the students would have learnt about

- Sequencing Alignment and Dynamic Programming
- Sequence Databases
- Evolutionary Trees and Phylogeny

Text Books :

1. S.C. Rastogi, Namita Mendirata, Parag Rastogi ''Bioinformatics concepts Skills and application, CBS publisher
2. S.C. Rastogi, Namita Mendirata, Parag Rastogi ''Bioinformatics Methods and application, PHI
3. D. Baxevanis and F. Oulette, (2002), "Bioinformatics: A practical guide to the analysis of genes and proteins", Wiley
4. Arthur M. Lesk, (2002), "Introduction to Bioinformatics" Oxford University

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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IT1922	Mobile Communication Systems	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

COURSE OBJECTIVES:

1. To Study of role of different devices in mobile communication with modern technics .
2. To Study evolution of wireless telecom system
3. To Learn about the diff. networks used in wireless mobile communications.

UNIT-I: [07HRS]
Review of radio transmission, antennas, modulation & demodulation, Radio propagation. Concept of cellular working, Multiplexing in space, frequency time, Code division multiplexing, Spread spectrum medium access methods.

UNIT-II: [08HRS]
Wireless telecom Systems: Evolution, study of 2G system GSM. Network architecture, radio interface, System's internal interfaces, role of VLRs & HLRs. Handover algorithms, security, Operation Maintenance systems.

UNIT-III: [07HRS]
3G Systems & beyond : Evolution towards 3G systems based on GSM & CDMA networks. Radio interface, system internal functioning, handover scenarios, security.

UNIT-IV: [06HRS]
Wireless LAN systems : Medium access control mechanism in 802.11 networks. Radio interface, protocol architecture.

UNIT-V: [07HRS]
Mobile adhoc networks. Algorithms for routing & overall network function. Mobile satellite networks.

UNIT-VI: [06 HRS]
Support for mobility : Mobile IP, TCP for mobile hosts. Other developments in the TCP/IP stack for mobility support.

COURSE OUTCOMES:
After Completion of this course students will be able to:

1. Analyze basic structure of mobile communication
2. Demonstrate different wireless mobile architecture
3. Prove the basic of 2G,3G,GSM architecture.
4. State and explain support for mobility.

Books :

1. Mobile Communications(2ed- J.Schiller – Pearson Education)
2. Mobile and Personal Communication Systems & Services– Raj Pandya. Prentice Hall.

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IT1923	**Seminar**	**L=0**	**T=0**	**P=2**	**Credits=2**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
		100	**100**	

The student is expected to study at least four research papers from IEEE/ACM transactions based on any theory course studied in Semester-I and II and deliver a seminar on topic of current research interest that area.

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III-Semester

IT1924	Distributed Systems	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES: -

1. To study the different design issues of Distributed Operating Systems
2. Create an awareness of the major technical challenges in distributed systems design and implementation;
3. Expose students to current technology and distributed infrastructure software;
4. Expose students to past and current research issues in the field of distributed systems;
5. Provide experience in the implementation of typical algorithms used in distributed systems.

Unit-I **Architecture of Distributed Systems : [6 Hrs]**

Characteristics of Distributed System, Motivation, challenges /Issues in the design & development of Distributed System. Architecture Model, System Architecture, Types of Architectural Model: Client server model, Search engine, Proxy server & caches, Variation on client server model: mobile code, mobile agents. Fundamental Models: Interaction model, failure model, Security model, Inter-process communication, Sockets, middleware, Group communication, and Remote procedure calls.

Unit-II **Distributed Objects & Distributed file system : [6 Hrs]**

RPC,CORBA,RMI ,Distributed file system, Name services, Directory services
File Service types, download/upload model
File sharing semantics, session semantics, Server design : stateless & stateful server, Cache update policies. Case studies on Distributed file system : NFS,AFS.

Unit -III **Theoretical Foundations : [7 Hrs]**

Inherent limitations of distributed systems, Timing issues, clock synchronization, Network time protocol, Lamport's logical clocks, Vector clocks, Casual ordering of messages, Global state, Cuts of Distributed computation, Termination detection.

Unit-IV **Distributed Mutual Exclusion : [8 Hrs]**

Classification of mutual exclusion algorithms, Requirements and performance measures of mutual exclusion algorithms, Leader election, Chang Robert : Ring based leader election algorithm, Bully algorithm. Non Token Based Algorithms : Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm.Token Based Algorithms : Suzuki-Kasami's Algorithm, Raymond's Algorithm, Comparative performance analysis.

Unit-V **Distributed Deadlock Detection & Agreement Protocols: [8 Hrs]**

Resource vs Communication deadlocks, graph theoretic model, deadlock prevention, avoidance, detection, Issues in deadlock detection, Centralized deadlock detection algorithms, distributed deadlock detection algorithms

Agreement Protocols

Synchronous vs. asynchronous computations, model of process failures, authenticated vs. non-authenticated messages. A classification of Agreement problems, Solutions to Byzantine Agreement problem, LSP.

Unit-VI **Failure recovery and Fault Tolerance: [6 Hrs]**

Classification of failures. Backward and forward error recovery, Basic approaches of backward error recovery, recovery in concurrent systems, consistent set of checkpoints, synchronous checkpointing and recovery, asynchronous checkpointing and recovery.
Atomic actions and committing, commit protocols, non-blocking commit protocols, Voting protocols, Dynamic voting protocols, Autonomous vote reassignment.

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Course Outcomes : After completing this course, students will be able to

1. Analyze and design distributed algorithms for reliable distributed systems.
2. Know how to specify the properties of distributed algorithms, so called liveness and safety properties.
3. Explain the different models of distributed systems, including failure and timing models
4. Master basic algorithms for failure detection, leader elections, broadcast and multicast, basic shared memory in distributed systems, agreement protocols, and group communication
5. Practice in design and implementation of selected distributed algorithms in middleware designed for group communication.

Text Books:

1. Singhal M. & Shivratri N.; *Advanced concepts in operating systems*; McGraw Hill
2. George Coulouris, Jean Dollimore & Tim Kindberg Distributed Operating Systems Concepts and Design 2nd Edition, 2000. Pearson (LPE)

Reference Books:

1. Lynch N., Morgan Kaufman; *Distributed Algorithms*
2. A. Tanenbaum; *Modern Operating Systems*; PHI EEE

IT1925	Operational Research	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

UNIT 1: Problem Solving with Mathematical Models

Application Stories, Optimization and the Operations Research Process, System Boundaries, Sensitivity Analysis, Tractability and Validity, Descriptive Models and Simulation, Numerical Search and Exact versus Heuristic Solutions, Deterministic versus Stochastic Models,Perspectives.

[06 Hrs]

UNIT 2: Deterministic Optimization Models in Operations

Research ,Decision Variables, Constraints, and Objective Functions. Graphic Solution and Optimization Outcomes, Large-Scale Optimization Models and Indexing, Linear and Nonlinear Programs. Discrete or Integer Programs. Multi objective, Optimization Models. Classification,Summary.

[06 Hrs]

UNIT 3: Improving Search

Improving Search, Local and Global Optima. Search with Improving and Feasible Directions. Algebraic Conditions for Improving and Feasible Directions. Unimodal and Convex Model Forms Tractable for Improving Search. Searching for Starting Feasible Solutions.

[06 Hrs]

UNIT 4: Linear Programming Models

Allocation Model, Blending Models, Operations Planning Models. Shift Scheduling and Staff Planning Models .Time-Phased Models, Models with Linearizable Nonlinear Objectives.

[06 Hrs]

UNIT 5: **Simplex Search for Linear Programming** LP Optimal Solutions and Standard Form.Extreme-Point Search and Basic Solutions The Simplex Algorithm. Dictionary and Tableau Representations of Simplex, Two Phase Simplex, Degeneracy and Zero-Length Simplex Steps. Convergence and Cycling with Simplex, Doing It Efficiently: Revised Simplex, Simplex with Simple Upper and Lower Bounds, Interior Point Methods for Linear Programming, Searching through the Interior, Scaling with the Current Solution, Affine Scaling Search, Log Barrier Methods for Interior Point Search, Dual -Dual Extensions.

[08 Hrs]

UNIT 6: Duality and Sensitivity in Linear Programming

Generic Activities versus Resources Perspective. Qualitative Sensitivity to Changes in Model Coefficients, Quantifying Sensitivity to Changes in LP Model Coefficients: A Dual Formulation, Formulating Linear Programming Duals. Primal-to-Dual Relationships.. Computer Outputs and What If Changes of Single Parameters. Bigger Model Changes, Reoptimization and Parametric Programming. Multiobjective Optimization and Goal Programming, Multiobjective Optimization Models. Efficient Points a nd the Efficient Frontier. Preemptive Optimization and Weighted Sums of Objectives , Goal Programming.

[08 Hrs]

Text Books:

1. T. Rardin, Ronald L.,, **"Optimization in operations research**",
Upper Saddle River, N.J.Prentice Hall, c1998

Reference Books:

1. G. Brassard, P. Bratley, "Fundamentals of Algorithmics", PHI
2. A.V. Aho, J. E. Hopcroft, J.D. Ulman, "The Design & Analysis of Computer Algorithms", Addison Wesley.3. Horowitz E., Sahni S, Rajasekharan S., "Fundamentals of computer algorithms", University press

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IT1926	Pattern Recognition	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

OBJECTIVES:

The subject gives a review of the pattern classification and recognition from the mathematical point of view and at the same time, applies the methods to several areas of signal processing. The structure of the general problem of pattern recognition (i.e., pre-processing, feature extraction and classification), can be applied to different areas, such as quality control, biomedical applications and diagnosis, communication systems, image processing, and speech recognition.

UNIT I [05 Hrs.]

Machine perception, Components of Pattern recognition systems, the design cycle, learning and adaptation, Statistical Decision Theory.

UNIT II [08 Hrs.]

Probability-probabilities of events, random variables, joint distribution & densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.

UNIT III [06 Hrs.]

Statistical Decision Making, Baye's Theorem, Decision boundaries, estimation of error rates.

UNIT IV [08 Hrs.]

Non parametric decision Making-Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, squared error, estimation functions, choosing a decision making technique.

UNIT V [07 Hrs.]

Clustering-Introduction, hierarchical clustering, partition clustering, fuzzy c-means clustering.

UNIT VI [07 Hrs.]

Problem of dimensionality, Principal component analysis, Hidden Markov models, Support vector machines Applications of Pattern Recognition.

Course Outcomes:

1. To understand the basic principles of pattern recognition system.
2. To understand the probabilistic distributions and to estimate the parameters of the density from the data available in the training samples.
3. To understand the parametric classification/ decision making concept and to determine the optimal boundary between two classes.
4. To comprehend the non-parametric classification/ decision making concept and to choose an appropriate decision making technique for solving the classification given problem.
5. To understand basic principles of different clustering methods and to select appropriate method for solving the given classification problem.
6. To understand the problem of feature dimensionality, Principal Component Analysis and Hidden Markov Models to design efficient and cost effective Pattern Recognition Systems.

Text books:

1	Pattern recognition & Image processing	2003	EarlGose, Richard Johnsonbaugh & Steve Jost	Pearson ducation.

Reference books:

1	Pattern Classification	2006, 2nd Ed.	RichardDuda, Peter Hart and David G. Stork	Wiley

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IT1927	Wireless Sensor Networks	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Course Objectives:

1. Introduce wireless sensor network architectures and communications protocols
2. Provide an understanding of mutual relationships and dependencies between different protocols and architectural decisions by offering an in-depth investigation of relevant protocol mechanisms.
3. Introduce sensor network platforms, operating systems and programming tools for sensor networks.
4. Introduce design spaces for sensor networks

UNIT I : [06 Hrs.]
Introduction and overview; key definitions, overview of sensor network protocols, architecture, and applications; simulation and experimental platforms; main features of WSNs; research issues and trends. Comparison of ad hoc and sensor network

UNIT II: [06 Hrs.]
Enabling technologies : Fundamentals of 802.15.4, Bluetooth, and UWB; Physical and MAC layers. Issues in designing MAC protocols, classifications of MAC protocols

UNIT III: [07 Hrs.]
Sensor node hardware and software: mica2, micaZ, telosB, Imote2, tmote, btnode, and Sun SPOT. Software (OS): tinyOS, MANTIS, Contiki, and RetOS. Introduction to Programming tools: C, nesC, Mate.

UNIT IV: [07 Hrs.]
Localization, connectivity, and topology: Sensor deployment mechanisms; coverage issues; node discovery protocols.

UNIT V: [07 Hrs.]
Network layer protocols :issues in designing routing protocols, classifications of routing protocols, Data dissemination and processing; multi-hop and cluster based protocols; routing. Middleware and application layer, Data dissemination; data storage; query processing; sensor Web; sensor Grid.

UNIT VI: [07 Hrs.]
Transport layer and security protocols, Open issues for future research : Energy preservation and efficiency; security challenges; fault-tolerance

Outcomes:
On completion of this course students will able to: ,
1.Know the wireless sensor network architectures
2.Get an overview of the various network level protocols for MAC, classification of MAC
3. Students will learn to program sensor network platforms using TinyOS, C, nesC, Mate .
4. Students will understand what research problems sensor networks pose

Text books:				
1	Protocols and Architectures for Wireless Sensor Networks.	June 2005	H. Karl and A. Willig. John	Wiley & Sons
2	Wireless Sensor Networks: Technology, Protocols, and Applications	March 2007	K. Sohraby, D. Minoli, and T. Znati. John	Wiley & Sons
3	Wireless Sensor Networks	Sept. 2006	C. S. Raghavendra, K. M. Sivalingam, and T. Znati	Springer Verlag
4	Wireless Sensor Networks: Architectures and Protocols	Aug. 2003	E. H. Callaway, Jr. AUERBACH	
5	Networking Wireless Sensors	Dec. 2005	B. Krishnamachari	Cambridge University Press

Reference books:				
1	Ad Hoc Wireless Networks: Architectures and Protocols	2004	C. Siva Ram Murthy and B. S. Manoj	Prentice Hall

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IT1928	Software Architecture	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES: -

- Introduction to the fundamentals of software architecture.
- Software architecture and quality requirements of a software system
- Fundamental principles and guidelines for software architecture design, architectural styles, patterns, and frameworks.

UNIT I: [07HRS]
Software process and the role of modeling and analysis, software architecture, and software design. Software Modeling and Analysis: Analysis modeling and best practices, traditional best practice diagrams such as DFDs and ERDs,

UNIT II: [07HRS]
Software Architecture: architectural styles, architectural patterns, analysis of architectures, formal descriptions of software architectures, architectural description languages and tools, scalability and interoperability issues, web application architectures, case studies.

UNIT III: [06 HRS]
Software Design: design best practices, design patterns, design case studies, component technology, object oriented frameworks, distributed objects, interoperability standards, case studies., software quality

UNIT IV: [07 HRS]
UML diagrams and UML analysis modeling, analysis case studies, analysis tools, analysis patterns, documenting software architecture, reconstructing software architecture.

UNIT V: [06HRS]
Middleware components, programming models, implementation, systems qualities Moving from qualities to architecture and views Components and COTS.

UNIT VI: [06HRS]
Economics- Driven Architecture, Software product line, Software architecture future, case studies.

OUTCOMES : -

1. Design and understand software architecture for large scale software systems.
2. Recognize major software architectural styles, design patterns, and frameworks.
3. Describe a software architecture using various documentation approaches and architectural description languages.
4. Develop architectural alternatives for a problem and select among them.
5. Use well-understood paradigms for designing new systems.

Text Books:

1. M. Shaw; *Software Architecture Perspectives on an Emerging Discipline*, Prentice-Hall.
2. Len Bass, Paul Clements, Rick Kazman: *Software Architecture in Practice,* Pearson Education Asia.
3. Jan Bosch; *Design and Use of Software Architectures*, Addision-Wesley-Pearson Education
4. Christine Hofmeister, Robert Nord, Dilip Soni; *Aoolied Software Architecture,* Addision-Wesley-Pearson Education
5. Dikel, D.Met Al*; Software Architecture: Organizational Principles and Patterns*, Prentice Hall

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IT1929	Cloud Computing	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Course Objectives:-

1. To understand cloud computing and to study existing cloud computing platforms like Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, etc.
2. To understand the data intensive computing and the map reduce model.
3. To understand the Cloud computing security architecture and security issues and challenges.
4. To understand the performance parameters of cloud computing platforms.

Unit I: [7 Hrs]
Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS, HAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS,HAAS.
Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

Unit II: [7 Hrs]
Introduction to Cloud Technologies, Study of Hypervisors, Compare SOAP and REST **Webservices, AJAX and mashups**-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services **Virtualization Technology**: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization

Multitenant software: Multi-entity support, Multi-schema approach, Multi-tenance using cloud data stores, Data access control for enterprise applications.

Unit III: [7 Hrs]
Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of MapReduce, Features and comparisons among GFS,HDFS etc, Map-Reduce model

Unit IV: [6 Hrs]
Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud
Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security
Cloud computing security challenges: Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques,
Secure Execution Environments and Communications in cloud.

Unit V: [7 Hrs]
Issues in cloud computing, Implementing real time application over cloud platform
Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.
Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Unit VI: [6 Hrs]
Cloud computing platforms, Installing cloud platforms and performance evaluation
Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform,

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Course Outcomes:-

At the end of the course student will be able to:-

1. explain the cloud computing concept and their advantages and applications.
2. explain the concept of data intensive computing and understand the map reduce model.
3. comprehend the Cloud computing security architecture and will have awareness about the security issues and challenges in the cloud environment.
4. To understand the performance parameters of cloud computing platforms.

Text Book:

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
2. Enterprise Cloud Computing by GautamShroff,Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

Reference Book:

1. Google Apps by Scott Granneman,Pearson
2. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY)
3. Cloud Computing: A Practical Approach, Antohy T Velte, et.al McGraw Hill,
4. Cloud Computing Bible, Barrie Sosinsky, Wiley India
5. QoS–aware Clouds,Stefano Ferrettiet.al., 2010 IEEE 3rd International Conference on Cloud Computing

IT1930	Computer Vision	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Prerequisite:
Any course on Digital Image Processing and knowledge of any programming language. Exposure to MATLAB Image Processing Toolbox is desirable.

UNIT-I:
Introduction to Computer Vision, Image formation, geometric primitives and transformations, 2-D and 3-D transformations, photometric image formation, the digital camera

UNIT-II
Review of image segmentation, image representation and description, principal components for description, Texture and shape analysis, feature detection and matching

UNIT-III
Introduction to Video Processing, Dynamic scene analysis, Moving object detection and tracking

UNIT-IV
Recognition of image patterns, object recognition, face recognition, instance recognition, context and scene understanding

UNIT-V
Recent advancements in computer vision, additional applications

UNIT-VI
Study of MATLAB Computer Vision Toolbox, Implementing Computer Vision systems.

Books:
1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2010
2. Tinku Acharya and A. K. Ray, Image Processing Principles and Applications, Wiley Interscience,2005.
3. Rafael C. Gonzalez & Richard E. Woods, “Digital Image Processing”, Third Edition, 2008, Pearson Education.

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IT1931	Cyber Forensics	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Objectives:-
1. Understand cyber world.
2. Enabling knowledge on attack profiles, investigation tools(windows &linux environment) and techniques
3. Critical analysis i.e. analysis of data to identify evidence recording timestamp,Identifying rogue processes.
4. Understand various Forensic tools and how to generate report .

Unit I : Introduction : [06 HRS]
Review of TCP/IP and TCP, IP Header analysis, Introduction to Cyber World, Cyber attacks and cyber security

Unit II : [07HRS]
Information warfare and cyber terrorism, Types of cyber attacks, Cyber Crime and Digital Fraud ,Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations).

Unit III : [07HRS]
Live Data collection and investigating windows environment: windows Registry analysis, Gathering Tools to create a response toolkit, Obtaining volatile Data, Computer forensics in windows environment, Log analysis and event viewer, File auditing, identifying rogue machines, hidden files and unauthorized access points.

Unit IV : [06HRS]
Live Data collection and investigating Linux environment : /Proc file system overview , Gathering Tools to create a response toolkit.

Unit V : [07HRS]
Handling Investigations: Log Analysis (Network, host, user logging details), Recording incident time/date stamps, Identifying rogue processes, unauthorized access points, unauthorized user/group accounts,

Unit VI : [07HRS]
Forensic tools and report generation: Recovery of Deleted files, Analyzing network traffic, sniffers, Ethical Hacking , Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap , Netscan etc . Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), Mobile forensic tools and analysis of called data record Template for computer forensic reports.

Outcomes:-
On completion of this course students will able to:
- Apply the knowledge and understanding of computer security to identify security weaknesses and propose solutions;
- correctly isolate computer systems for investigation and use of various investigation tools.
- Document and present gathered information for follow-up.

Text Books:
1. Mandia, K., Prosise, C., Pepe, M., *Incident Response & Computer Forensics.* 2nd edition. Tata-McGraw Hill,
2. Bill Nelson, Amelia Phillips**,** Frank Enfinger, and Chris Steuart , Guide to Computer Forensics and Investigations, 2nd edition, , Thomson Learning.

Reference Books:
1. Eoghan Casey ,Digital Evidence and Computer Crime, 2nd Edition , academic Press File System Forensic Analysis by Brian Carrier , addition Wesley
2. Harlan Carvey Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Syngress Publication
3. Steve Bunting , EnCE: The Official EnCase Certified Examiner Study Guide, 2nd Edition , Sybex Publication

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IT1932	Internet Routing Design	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

COURSE OBJECTIVES:

1. To Study of different routing protocol and routing algorithms.
2. To Study router architecture and analysis of network algorithms.
3. To Learn about the quality of service and various routing and traffic engineering.

UNIT I: [07HRS]
Networking and Network Routing: An Introduction : Addressing and Internet Service: An Overview, Network Routing, IP Addressing, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology, Architecture, Network Management Architecture, Public Switched Telephone Network.

UNIT II: [08HRS]
Routing Algorithms : Shortest Path and Widest Path**:** Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra's Algorithm, Widest Path Algorithm, Dijkstra- Based Approach, Bellman–Ford-Based Approach, *k*-Shortest Paths Algorithm. OSPF and Integrated IS-IS **:** OSPF: Protocol Features, OSPF Packet Format, Integrated IS-IS, Key Features, comparison
BGP **:** Features ,Operations, Configuration Initialization, phases, Message Format. IP Routing and Distance Vector Protocol Family **:**RIPv1 and RIPv2

UNIT III: [07HRS]
Routing Protocols: Framework and Principles : Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing, Protocol, Link Cost.
Internet Routing and Router Architectures : Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability. Router Architectures**:** Functions, Types, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures

UNIT IV: [07HRS]
Analysis of Network Algorithms : Network Bottleneck, Network Algorithmics, Strawman solutions, Thinking Algorithmically, Refining the Algorithm, Cleaning up, Characteristics of Network Algorithms. IP Address Lookup Algorithms : Impact, Address Aggregation , Naïve Algorithms, Binary , IP Packet Filtering and Classification : Classification, Classification Algorithms, Naïve Solutions

UNIT V: [07HRS]
Quality of Service Routing : QoS Attributes, Adapting Routing: A Basic Framework. Update Frequency, Information Inaccuracy, and Impact on Routing, Dynamic Call Routing in the PSTN, Routing Protocols for QoS Routing, QOSPF: Extension to OSPF for QoS Routing, ATM PNNI.

UNIT VI: [07HRS]
Routing and Traffic Engineering : Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Problem Illustration: Layer 3 VPN, LSP Path Determination: Constrained Shortest Path Approach, Layer 2 VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS.

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COURSE OUTCOMES:
After Completion of this course students will be able to:

1. Analyze and design network architecture.
2. Demonstrate different network topology with diff. algorithms
3. Prove the basic of MPLS /VPN network engineering.
4. State and explain Quality of service routing

Books :

1. Network Routing: Algorithms, Protocols, and Architectures Deepankar Medhi and Karthikeyan Ramasamy (Morgan Kaufmann Series in Networking)

2. Network Algorithmics: An Interdisciplinary Approach to Designing Fast Networked Devices George Varghese (Morgan Kaufmann Series in Networking)

IT1933	Embedded Systems Design	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES: -

- Define processes involved in design of an embedded system
- Partition the hardware and software for a given specification of an embedded system
- Provide an overview about technologies, products and applications relevant for ARM-based embedded systems design

UNIT – 1: [07HRS]

Embedded Design Life Cycle: Introduction, Product Specification, Hardware/software partitioning, Iteration and Implementation, Detailed hardware and software design, Hardware/Software integration, Product Testing and Release, Maintaining and upgrading existing products. Selection Process: Packaging the Silicon, Adequate Performance, RTOS Availability, Tool chain Availability, Other issues in the Selection process, partitioning decision: Hardware/Software Duality, Hardware Trends, Asics and Revision Costs**.**

UNIT - 2: [07HRS]

Embedded Processor And Computing Platform : ARM processor- processor and memory organization, Data operations, Flow of Control, SHARC processor- Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock.

UNIT- 3: [07HRS]

Programming Embedded Systems :Program Design: Design Patterns for Embedded Systems , Models of Program, Control and Data flow Graph, Programming Languages: Desired Language Characteristics, Introduction to Object Oriented Programming, Data Typing, Overloading and Polymorphism, Control, Multi-tasking and Task Scheduling, Timing Specifications Run-time Exception handling .

UNIT 4: [07HRS]

Development Environment: The Execution Environment, Memory Organization, System Startup. Special Software Techniques: Manipulating the Hardware, Interrupts and Interrupt service Routines (ISRs), Watchdog Times, Flash Memory, Design Methodology. Basic Tool Set: Host – Based Debugging, Remote Debuggers and Debug Kernels, ROM Emulator, Logic Analyzer.

UNIT 5: [07HRS]

Buffers and testing of embedded systems: Testing: Why Test? When to Test? Which Test? When to Stop? Choosing Test cases, Testing Embedded Software, Performance Testing Maintenance and Testing, Buffering and Other Data Structures: What is a buffer? Linear Buffers, Directional Buffers, Double Buffering, Buffer Exchange, Linked Lists, FIFOs, Circular Buffers, Buffer Under run and Overrun, Allocating Buffer Memory, Memory Leakage. Memory and Performance Trade-offs.

UNIT 6: [07HRS]

Networks : Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link ports, Ethernet, Myrinet, Internet, Network-Based design-Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

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OUTCOMES : -

1. Complete design of an embedded system with functional requirements for hardware and software components including processor, networking components, and sensors, along with applications, subsystem interfaces, networking, and middleware.
2. Appreciate engineering issues in the development of embedded software, such as the importance of addressing the user's concerns, working with limited resources, maintainability, and dependability.
3. Identification and synthesis of solutions for embedded system problems
4. Analysis, design and testing of systems that include both hardware and software.

BOOKS

1. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.
2. Vahid and Tony Givargi, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons, 2000.Networking)
3. Embedded System Design – Introduction to Processes, Tools, Techniques, Arnold S Burger, CMP Books
4. Embedded Systems Design by Steve Heath, Newnes

IT1934	Managing Information Systems	L=3	T=0	P=0	Credits=6

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit-I: [7 Hrs]
Introduction to Information systems, the information system strategy triangle, business strategy frameworks, overview of organizational strategies, information systems strategy, strategic use of information resources, evolution of information resources, information resources as strategic tools, strategic alliances, risks, case studies.

Unit-II: [6 Hrs]
Organizational Impacts of Information Systems Use, information age organizations, IT and organizational design, IT and management control systems, virtual organizations, virtual teams, IT and the design of work, job design framework, gaining acceptance for IT-induced change, case studies.

Unit-III: [7 Hrs]
IT and changing business processes, silo perspective vs. business process perspective, the tools for change, integrated supply chains, enterprise systems, IT architecture and infrastructure, from vision to implementation, the leap from strategy to architecture to infrastructure, other managerial considerations, case studies.

Unit-IV: [7 Hrs]
Doing business on the internet, overview of internet, framework of E-commerce, threats on internet, E-learning, Web blogs, using information ethically, control of information, normative theories of business ethics, emerging issues in the ethical governance of information systems, security and controls, ethics and internet, case studies.

UNIT-V: [7 Hrs]
Understanding MIS organization, information system organization processes, manager's expectations from IS department, organizing and controlling IS processes, Funding IT department, cost of IT, IT portfolio management, valuing IT investments, monitoring IT investments, option pricing, case studies.

UNIT-VI: [7 Hrs]
Project and project management, IT project management, project measurement, project elements, IT project development methodologies, managerial influences, managing project risks, open sourcing, knowledge management, types of knowledge management projects, caveats for managing knowledge, Intellectual Property Rights (IPR) - Copyrights, Patents, Trade Secrets, Piracy, Cyber Law - IT Bill, Relevance of The Companies Act, The Consumer Protection Act, Indian Copyright Act, digital millennium copyright act, case studies.

Text Books:
1. Managing and Using Information Systems by Keri Pearson and Carol Saunders, Wiley India, 2006.
2. IT Project Management by Joseph Phillips, Tata McGraw-Hill 2003, Edition.

Reference Books:

1. Resisting Intellectual Property - Halbert, Taylor & Francis Ltd, 2007.
2. Cyber Law Simplified by VivekSood, Tata McGraw Hill.
3. Information Technology Project Management - S. A. Kelkar, PHI, 2005

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IT1935	**Project Phase – I**	**L= 0**	**T = 0**	**P = 14**	**Credits = 14**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

SEMESTER IV

IT1936	**Project Phase – II**	**L= 0**	**T = 0**	**P = 20**	**Credits = 20**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

UG SoE & Syllabus 2014

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

B.E. SoE and Syllabus 2014-15

First Year (1st Semester & 2nd Semester)

Sl. No.	CODE NO.	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE - I	MSE - II	TA	ESE	
SEMESTER I Group A												
1	GE1101	Engineering Mathematics I	3	1	0	4	4	15	15	10	60	3
2	GE1105	Engineering Physics	4	0	0	4	4	15	15	10	60	3
3	GE1106	Engineering Physics Lab	0	0	2	2	1			40	60	
4	GE1107	Communications Skills	3	0	0	3	3	15	15	10	60	3
5	CV1101	Engineering Mechanics	3	1	0	4	4	15	15	10	60	3
6	CV1102	Engineering Mechanics Lab	0	0	2	2	1			40	60	
7	EE1101	Basic Electronics	3	1	0	4	4	15	15	10	60	3
8	IT1101	Introduction to Computer Programing	3	1	0	4	4	15	15	10	60	3
9	IT1102	Introduction to Computer Programing Lab	0	0	2	2	1			40	60	1
Total			**19**	**4**	**6**	**29**	**26**					
SEMESTER I Group B												
1	GE1102	Engineering Mathematics II	3	1	0	4	4	15	15	10	60	3
2	GE1103	Engineering Chemistry	4	0	0	4	4	15	15	10	60	3
3	GE1104	Engineering Chemistry Lab	0	0	2	2	1			40	60	
4	GE1108	Social Sciences	3	0	0	3	3	15	15	10	60	3
5	EL1101	Electrical Engineering	3	1	0	4	4	15	15	10	60	3
6	EL1102	Electrical Engineering Lab	0	0	2	2	1			40	60	
7	ME1101	Engineering Graphics	1	0	0	1	1	15	15	10	60	3
8	ME1102	Engineering Graphics Lab	0	0	4	4	2			40	60	
9	ME1103	Workshop Practice	0	0	2	2	1			40	60	
Total			**14**	**2**	**10**	**26**	**21**					

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YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING

B.E. SoE and Syllabus 2014-15

First Year (1st Semester & 2nd Semester)

Sl. No.	CODE NO.	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE - I	MSE - II	TA	ESE	
SEMESTER II Group A												
1	GE1102	Engineering Mathematics II	3	1	0	4	4	15	15	10	60	3
2	GE1103	Engineering Chemistry	4	0	0	4	4	15	15	10	60	3
3	GE1104	Engineering Chemistry Lab	0	0	2	2	1			40	60	
4	GE1108	Social Sciences	3	0	0	3	3	15	15	10	60	3
5	EL1101	Electrical Engineering	3	1	0	4	4	15	15	10	60	3
6	EL1102	Electrical Engineering Lab	0	0	2	2	1			40	60	
7	ME1101	Engineering Graphics	1	0	0	1	1	15	15	10	60	3
8	ME1102	Engineering Graphics Lab	0	0	4	4	2			40	60	
9	ME1103	Workshop Practice	0	0	2	2	1			40	60	
Total			**14**	**2**	**10**	**26**	**21**					

SEMESTER II Group B												
1	GE1101	Engineering Mathematics I	3	1	0	4	4	15	15	10	60	3
2	GE1105	Engineering Physics	4	0	0	4	4	15	15	10	60	3
3	GE1106	Engineering Physics Lab	0	0	2	2	1			40	60	
4	GE1107	Communications Skills	3	0	0	3	3	15	15	10	60	3
5	CV1101	Engineering Mechanics	3	1	0	4	4	15	15	10	60	3
6	CV1102	Engineering Mechanics Lab	0	0	2	2	1			40	60	
7	EE1101	Basic Electronics	3	1	0	4	4	15	15	10	60	3
8	IT1101	Introduction to Computer Programing	3	1	0	4	4	15	15	10	60	3
9	IT1102	Introduction to Computer Programing Lab	0	0	2	2	1			40	60	1
Total			**19**	**4**	**6**	**29**	**26**					

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GE1101	Engineering Mathematics-I				L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3 Hrs		

Objective	Outcome
• The goal of this paper is to introduce fundamental concepts of calculus, vector calculus and multiple integrals.	• With the completion of this syllabus students will be familiar with differential equations and their methods of solutions and vector calculus with simple applications and essential concepts of multiple integrals and use these mathematical techniques in variety of technical, business, industry optimization problems.

Unit I: Differential Calculus (a,e)

Successive differentiation; Taylor's and Maclaurin's series for one variable; Indeterminate forms; Curvature and radius of curvature of plane curves (excluding Newton's Method), Circle of curvature.

(7 hours)

Unit II: Partial Differentiation (a,k)

Functions of several variables; First and higher order derivatives; Euler's theorem; Chain rule and total differential coefficient; Implicit functions; Jacobians; Taylor's and Maclaurin's series for two variables; Maxima and minima of functions of two variables; Lagrange's method of undetermined multipliers.

(8 hours)

Unit III: Integral Calculus (a,h,k)

Beta and gamma functions; Differentiation of a definite integral; Tracing of curves (Cartesian and Polar Curves); Rectifications of simple curves; Quadrature: volume and surface of solids of revolution (Cartesian, polar and parametric forms);

(7 hours)

Unit IV: Multiple integrals and their Applications (a,e,h)

Elementary double integrals; Change of variable (simple transformations) and Jacobian of transformations; Change of order of integration (Cartesian and polar); Applications to find mass, area, volume and centre of gravity (Cartesian and polar forms); Elementary triple integrals.

(7 hours)

Unit V: Vector Calculus (a,e,h)

Scalar point functions; Vector point functions; Quadruple product of vectors.
Vector differentiation;Gradient, Divergence and Curl; Directional derivatives with their physical interpretation; Solenoidal and irrotational motions; vector fields.

(8 hours)

Unit VI : Vector Integration & Application

Vector integration: Line, surface and volume integrals; Statement without proof of Stokes' theorem, Gauss' divergence theorem and Green's theorem; Simple applications of these theorems.

(8 hours)

Text Books

1. Engineering Mathematics - by H.K. Dass, 11th revised edition, 2003, S.Chand, Delhi.
2. Advanced Engineering Mathematics - by H.K. Dass, 8th Ed, 2007, S.Chand, Delhi.
3. Engineering Mathematics by Dr. B.S. Grewal

Reference Books

1.G B Thomas and R L Finney: Calculus and Analytical Geometry, 9th ed, Addison-Wesley, 1999.
2.Calculus-by Michael Spivak and Tom Apostol (Vols I and II)

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GE1102	Engineering Mathematics-II	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The objective of this paper is to study differential equations and their methods of solution and complex variables with simple applications and to introduce the essential concepts of probability and statistics.	• With the completion of this syllabus students will be in positions to solve the differential equations and their methods of solutions and complex variables with simple applications and essential concepts of probability and statistics and use these mathematical techniques in variety of technical, business, industry optimization problems.

Unit I: Differential Equations – I [a,e]

First order first degree differential equations: Linear, reducible to linear and exact differential equations (excluding the case of integrating factor); Higher order differential equations with constant coefficients up to method of variation of parameters.

(7 hours)

Unit II: Differential Equations – II [a,e]

Cauchy's and Legendre's homogeneous differential equations; Simultaneous differential equations; Differential equations of the type d2y/dx2 = f (x) and d2y/dx2 = f (y); Applications of differential equations to electrical circuits, kinematics and vibrations (only up to second order).

(8 hours)

Unit III: Complex Numbers [a,e]

Cartesian and polar forms of complex numbers; Separation or real and imaginary part. Geometrical representation of fundamental operations on complex numbers; De Moivre's theorem; Hyperbolic functions and their inverse; Logarithm of a complex number.

(8 hours)

UNIT IV: Complex Variables [a,e]

Analytic function, Cauchy-Riemann conditions, conjugate functions, singularities, Cauchy's integral theorem & integral formula (statement only), Power series, Taylor's and Laurent's Theorem (statement only) Residue theorem, contour integration.

(8 hours)

UNIT V: Probability [a,k]

Theory of probability: Axioms and Models, Conditional probability, Baye's Rule with examples, Random variables expectation & variance, Binomial, Poisson, normal distributions skewness & kurtosis.

(7 hours)

Unit VI: Statistics [a,e]

Fitting of straight line, y = a + bx, a parabola y = a + bx + cx2 and exponential curves by method of least squares; Lines of regression and correlation ; Rank correlation.

(7 hours)

Text Books

1. Engineering Mathematics - by H.K. Dass, 11th revised edition, 2003, S.Chand, Delhi.
2. Advanced Engineering Mathematics - by H.K. Dass, 8th Ed, 2007, S.Chand, Delhi.

Reference Books

1. A First course in probability by Sheldon Ross, Sixth Edition, Pearson Education.
2. Probability and Statistics – By Murray R.Spiegel, Schaum's Outline Series, 3rd Edition, TATA Mc-Graw - Hills.

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GE1103	Engineering Chemistry			L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

Objectives	Outcomes
• To impart intensive and extensive knowledge of the subject enriching students to understand the role of Chemistry in the field of engineering. • To develop analytical capabilities of students in characterizing, transforming and using materials in engineering. • To inculcate habit of scientific reasoning to do the task rationally.	• the significance of quality of water for industry and drinking and the techniques like membrane technology ; social awareness about conservation and proper utilization of natural resources like water, fuel and use of cleaner technology. • fascinating developments in battery technology which has opened new vistas in engineering field • technological applications of engineering. Materials.

Unit I Water Conditioning (10 hrs)

Industrial

Specifications of water for industries (paper, textile, beverages and power generation), types of hardness; softening of water by lime-soda process, Zeolite process, De-mineralization process (principle, advantages and limitations). Numerical based on lime-soda and Zeolite process.

Boiler troubles, sequestration (carbonate, phosphate and calgon)

Domestic

Domestic water-as per IS 10500 (14 parameters) ; Effect of nitrate, fluoride, arsenic and lead in drinking water, sterilization of drinking water by chlorination, UV and ozonisation.

Membrane process (Reverse osmosis) used in water and waste water treatment.

Unit-II Electrochemistry, Battery Technology and Green Chemistry (8 hrs.)

Electrochemistry

Basic electrochemistry, half cell potentials, Nernst's equation, Faraday's laws for electrodeposition,.

Battery Technology:

Classification of batteries: Primary, Secondary- Electricity storage density, power density, energy efficiency, cycle life, shelf life

Rechargeable alkaline storage batteries, Ni-Cd, Ni-metal hydride.

Lithium ion batteries and H_2-O_2 Fuel cell.

Green chemistry

Introduction, goals, significance, industrial applications, carbon credits.

Unit III Corrosion (8 hrs)

Introduction to corrosion, electrochemical and galvanic series,

Types of corrosion:- Chemical and electrochemical corrosion. Mechanisms of electrochemical corrosion, Factors influencing corrosion. Differential aeration theory of corrosion,

Forms of corrosion: Pitting corrosion, Intergranular corrosion, Stress corrosion, Waterline and Microbial corrosion.

Corrosion prevention: Design and material selection, Cathodic and anodic protection, Modifying the environment; Protective surface coatings- tinning, galvanizing and powder coating, metal cladding and electroplating.

Unit IV Lubricants & Cement (8 hrs.)

Lubricants

Introduction, mechanism, Classification of lubricants: Solid,liquid,semisolid ,gaseous and synthetic; Solid lubricant-Graphite

Liquid lubricants, properties of liquid lubricants & significance–Viscosity and viscosity index., Flash and fire point, Cloud and pour point, Aniline point, acid value, saponification number, Steam Emulsion Number.

Greases as Semisolid lubricants - Consistency test and drop point test.

Criteria for selection of lubricants : IC engines, gears, refrigeration, transformer, steam turbines, delicate instruments.
Synthetic lubricants-dibasic acid esters, silicate esters, silicones

Cement

Portland cement: Manufacture, role of microscopic constituents.
Properties-setting and hardening, heat of hydration and soundness
Types of cement -Rapid hardening, High alumina, Blended cement-Portland Pozzolana cement; Ready-mix concrete, Grading of cement, Ferro-cement

Unit V Fuels (10 hrs)

Calorific value, HCV, LCV, Determination of calorific value of fuels by Bomb and Boy's calorimeter.
Solid fuels: Significance of Proximate and Ultimate analysis
Liquid fuels: Fractional distillation of crude oil, Catalytic cracking and its advantages, Knocking in Internal combustion petrol and diesel engines, Octane and Cetane number, Knocking and its relationship with structure of fuels, Doping agents, Aviation fuel, Rocket propellants, Bio-diesel.
Gaseous fuels: CNG.
Simple numericals on combustion calculations.

Unit VI Introduction to Advanced Materials (8 hrs)

New materials

Nanomaterials: Definition of nanomaterials, nano scale. Carbon nano tubes: Different Types of CNT ; applications of nanomaterials in medicine, environment and electronics. Threats of Nanomaterials.

Shape memory alloys: Definition, Properties, general applications. Specific properties and applications of Nitinol.

Composite materials: Introduction , Classification and their industrial applications.

Advanced Polymeric materials

Biodegradable polymers. Conducting polymers- types of doping, Polyacetylene and Polyaniline, Liquid crystals and liquid crystal polymers (thermotropic and lyotropic),phases of thermotropic polymers: nematic,smectic,cholesteric; advantages, disadvantages and applications.

Books recommended

Text Books

1. A Text book of Engineering Chemistry by S S. Dara; S.Chand & Co New Delhi. Eleventh Edition.
2. Engineering Chemistry by Jain & Jain; Dhanpat Rai & sons New Delhi. Sixteenth Edition.

Practical book

1. A text book on experiments and calculations in engineering Chemistry by S.S .Dara ; S. Chand & Co.

Reference Books

1) Water treatment for industrial and other use by Eskel Nordell, Rein hold Publishing Corporation, New York
2) Chemistry in Engineering by Lloyd A.Munro, Prentice-hall, Inc Nj
3) Applied chemistry for engineers by T.S.Gyngell
4) Water treatment by F.I. Bilane , Mir publisher
5) Fundamentals of corrosion by Michael Henthorne, Chemical Engineering
6) Corrosion Engineering by Mars G. Fontana and Norbert D. Green Mc Graw Hill Book Co. Tokyo
7) Engineering Chemistry B.K.Sharma Krishna Prakashan media private LTD.
8) Chemistry of Advanced Materials CNR Rao RSC Publications
9) Engineering Chemistry(Vol. 1&2) by Rajaram and Kuriakose
10) Engineering Chemistry by R.V.Gadag, A.Nityananda Shetty ; I K International Publishing House New Delhi First Edition
11) A Text book of Engineering Chemistry by Shashi Chawla; Dhanpat Rai & sons, New Delhi
12) A textbook of polymer science Fred. Billmeyer Jr. Wiley India Third edition
13) Chemistry of Engineering Materials, by Rober B Leigeou Mc Graw-Hill Book Company, Inc New York
14) Fuels and Combustion by Amir Circar, Orient Longmans Publication
15) Laboratory manual by Dr. Sudha Rani Dhanpat Rai publication New Delhi.

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GE1104	Engineering Chemistry Lab	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

Total 10 experiments are to be performed (4 each from Phase I and Phase II and two demonstration experiments)

Objectives	Outcomes
• To develop analytical ability • To integrate chemistry fundamentals with practical applications.	• By the end of the course students should be able to carry out chemical analysis of water, assess the quality of water and to carry out the estimation of various metal ions. • Budding engineers should be able to carry out and understand the significance of material testing.

List of Experiments-Phase I

- Determination of total hardness of water sample.
- Determination of alkalinity present in the water sample.
- Determination of available chlorine in bleaching powder
- Determination of copper by iodometric titration
- Estimation of Nickel.
- Determination of COD of water sample.
- Estimation of metal ions by colorimeter / spectrophotometer

List of Experiments-Phase II

1) Determination of viscosity by Redwood Viscometer I or II
2) Determination of cation exchange capacity of an ion exchange resin
3) Determination of molecular weight of a polymer.
4) Oil Testing for Flash Point / Cloud Point/Pour Point/Aniline Point
5) Proximate analysis of coal.

Demonstration:

1) Determination of pH of water sample by pH meter
2) Determination of conductivity of water sample by conductometer.
3) Synthesis of urea formaldehyde resin.

GE1105	Engineering Physics	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
• To understand fundamental principles of engineering physics specifically concern to quantum physics, Ultrasonics, wave optics, electron ballistics, semiconductor, Laser, optical fiber and their engineering applications. • To provide problem solving experience and learning of concepts through it in engineering physics, in both the classroom and the laboratory learning environment.	• Acquire fundamental understanding of concepts specifically concern to quantum physics, wave optics, electron ballistics and ultrasonics, semiconductors, Laser, Fiber Optics and their engineering applications. • Develop the ability to recognize the appropriate physics that applies to experiments based on the Engineering Physics. • To develop a systematic, logical approach to problem – solving that can be applied to problems in physics and to problems in general. • the significance of material testing.

Unit-I : Quantum Physics (08)

Matter waves , Application to Bohrs orbits, Wave packet , Heisenberg Uncertainty Principle , Wave function . Schrodinger Equation(Time dependent and time independent), Applications in Engineering : Particle in an infinite potential well, .(Numericals on matter waves , U .P, Infinite pot well Eigen fn(all) and Eigen values,wavelengths).

Unit-II : Semiconductor Physics (08)

Formation of energy bands ; Classification of solids based on EB ,EB diagram of Si andGe. ; Intrinsic semiconductor ,P, N type semiconductor and their EB diagram , Brief idea of direct and indirect semiconductor materials ; law of mass action ; Fermi function , Fermi level , Graph of f(E) Vs E at different temperatures ; Symmetric nature of f (E) , Derivation E_F= Eg/2 in pure semiconductor and , Expression n/N = exp-Eg/kT ; Dependence of fermi level in pure, P and N type semiconductor on temperature and concentration of impurity diagrametically .Drift velocity, mobility , current density ,conductivity and expressions in pure, N,P type semiconductor , diffusion current , drift current ; Hall effect . (Numericals on n/N = exp-Eg/2kT, law of mass action, Conductivity(pure,N, P semiconductor ,Hall effect)

Unit-III : Ultrasonics and Wave optics (04+05)

Ultrasonic waves ; Generation of ultrasonic waves by Piezoelectric and Magnetostriction method ; Detection of ultrasonic waves, by thermal, Piezoelectric and Kunds tube method. Applications of piezoelectric materials ,; Propertiesof ultrasonic waves , Few engineering applications of ultrasonic waves as detection of flaws and cavities in metals ,depth of the sea, SONAR ; Determination of velocity of Ultrasonic waves (acoustic grating).

Interferencein thin films : Background of Interference in parallel sided thin film ,Wedge shaped film , derivation of β and applications as thickness of thin sheet or diameter, of thin wire testing of optical flatness . Newtons rings, Derivation of expression of diameters of dark and bright rings , applications as determination of λ of light , and refractive index of transparent liquids; Antireflecting coating and its application. (Numeicals on freq. and velocity of ultrasonic waves ,wedge shaped film, Newtons rings, antireflecting coating)

Unit-IV: Laser (07)

Temporal and spatial coherence ,Derivation of Lc = $\lambda^2/\Delta\lambda$. ,Laser, comparison with conventional light, Three process . Obtaining conditions to get laser light , Population Inversion and Optical resonance cavity , Physical components of laser , Pumping schemes in laser, Ruby laser, He-Ne laser . semiconductor laser , Characteristics of laser , Few engineering applications of laser / Applications of laser in Industry .(Numericals on Lc . τ ,Lc = $\lambda^2/\Delta\lambda$, dυ= c/2μL, N_2/N_1 exp- hυ/kT)

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Unit-V : Electron Ballastics (08)

Motion in electric and magnetic field ,Cross field configuration; Bethes law ; Electrostatic lens , CRO, CRT ,Block diagram, Synchronisation, Display of waveforms ,Application of CRO as amplitude ,frequency by calibration and lissajous method and phase determination . Expression of resultant lissajous pattern and discusion of special cases .(Numericals on Electric, Magnetic field , Bethes law . CRO:Amp, Freq and Phase), Different display Devices .

Unit-VI: Fiber optics (08)

Optical Fiber ,. Structure , Propogation of light through fiber, Derivation of expression of acceptance angle and NA, fractional refractive index change and relation with NA ,Classification of fiber based on material , modes and R I profile , Expression V number and number of modes , Attenuation(and Dispersion(three types) .Application of O F as a temperature sensor , pollution detector, liquid level detector **.**(Numericals on , θo, NA, **Φ**c,∆, V number, Number of modes , Attenuation), fiber optic communication

Text books and Reference Books Recommended :

1. A concise book of Engineering Physics by S A Band and S A Fadnavis
2. A text Book of Engineering Physics by Avadhanulu and kshirsagar
3. Electronic devices and Circuits by John Allison
4. Introduction to Modern optics by Ajoy Ghatak
5. Physics Part I & II by Resnick and Haliday
6. Concepts of Modern Physics by Arthur Beiser
7. Solid state physics by Pillai
8. Solid State Physics by Palanswamy

GE1106	Engineering Physics Lab	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

Objectives	Outcomes
• To understand and strengthen the theoretical concepts by thorough experimentation. • To learn the proper methods and techniques utilized in gathering experimental data. • To become familiar with the proper use of some basic measuring instruments commonly found in physics laboratories. • To learn how to analyze data and then reach scientific conclusions based on this analysis. • To learn how effectively communicate experimental results in standard scientific way.	By the end of course students will be able to • Perform experiments based on syllabus adopting the proper methodology. • Derive a scientific conclusion on the basis of experimental data. •

Minimum ten experiments to be performed from the list as given below. [a,b]

1. A study of cubic space lattices and atomic packing in solids.
2. Determination of amplitude and frequency of sinusoidal signal using C.R.O.
3. Determination of phase angle between sinusoidal signals using C.R.O.
4. Determination of wavelength of sodium light using Fresnel's Biprism
5. Determination of principle refractive indices of a birefringent crystal.
6. Determination of radius of curvature of Plano convex lens using Newton's rings.
7. Determination of R.I. of liquid using Newton's rings.
8. Determination of thickness of thin paper using air wedge
9. Illustration of quantum tunneling using tunnel diode.
10. Demonstration of wave nature of electron.
11. Determination of Band gap in a semiconductor by four probe method.
12. Determination of Band gap in a semiconductor using reverse biased p-n diode .
13. Determination of activation energy of a thermister.
14. Determination of Hall coefficient and density of charge carriers using Hall effect.
15. Dependence of Hall coefficient on temperature.
16. Determination of wavelength of laser light using plane transmission grating.
17. To measure the divergence of laser beam or beam spot size.
18. Determination of Numerical aperture and Acceptance angle of an optical fiber.
19. Measurement of attenuation in optical fiber.
20. Effect of temperature on conductivity of various materials.
21. Verification of Joule's Law

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GE1107	Communication Skills	L=3	T=0	P=0	CREDITS = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
• The objective of the syllabus is to enrich lives of student's across various verticals in their career. • To introduce the basic concepts of language, different strategies of technical communication skills and four fold skills. • To prepare students to stretch beyond their comfort zones in order to become leaders in the industry. • To develop student's new management skills, express themselves with confidence and clarity , contribute more productively and above all become a good team members.	• By the end of this course students will be able to face challenges in communication, primarily in technical and will achieve commendable style in writing and speaking. • Student will be able to eliminate road blocks that hinder their ability to communicate effectively. • It will also help them to express with more clarity and Confidence. • Will be able to communicate effectively using simple, concise and direct language.

Unit I :- (g ,i,f)

- Basics of technical communication – process, language as a tool, levels , flows , networks of communication and importance of communication.
- Barriers to communication – definition of noise , five steps to evoke the desire response and classification of barriers(intrapersonal , interpersonal and organizational barriers)

(8 Hrs.)

Unit II:- (g ,i,f)

- Effective Presentations – defining purpose, analyzing audience and locale, organizing contents ,preparing outline, visual aids ,understanding nuances of delivery (Kinesics, Proxemics, Paralinguistics & Chronemics)
- Listening skills – introduction, types traits of good listening, active verses passive listening and implications of effective listening.

(8 Hrs.)

Unit III :- (g , i)

- Interview Skills – Introduction ,objectives and different types on bases on objective & nature and on the bases of contribution
- Job Interviews – Expectations , preparation, answering and questioning techniques ,overcoming nervousness ,Process of interview , follow- up and ten Success and failure factors.
- Telephonic interview - Types , preparation and guidelines.
- Reading skills – introduction , purposes , reading rates, reasons for poor comprehension ,improving skills, and techniques for good reading comprehension

(8 Hrs.)

Unit IV :- (g ,i ,f,d,j)

- Group Communication – Purposes ,types and difference between group and team
- Group discussion – Organizational and GD as a part of selection process
- Meetings – Purposes , preparation and procedure
- Conferences – significance ,planning & preparation and procedure

(8 Hrs.)

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Unit V:- (g ,i,b ,f)

- Report – Objectives, characteristics ,types, importance ,formats and different prewriting aspects
- Memos – Definition, classification, purpose, style and structure and layout.

(7 Hrs.)

Unit VI:- (g ,i ,f)

- Technical proposals – Definition, purposes, types, characteristics style & appearance and elements of structure.
- Business letters – significance , purpose , structure , standard element , additional element, layout , writing resume and principles of letters.

(7 Hrs.)

Text Books:-

1) Raman &Sharma, "Technical Communication", Oxford University Press.

Reference Books :-

1) Kaul Asha, "Effective Business Communications", Prentice Hall India.
2) Kerry Patterson, Josph Grenny, Ron McMillan & Al Switzler Crucial conversation
3) Barbara & Allan Pease, Body Language
4) Mark Goulston,. Just Listen

GE1108	**Social Science**		L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	**Outcome**
The objective of the syllabus is to meet some of the basic requirement pertaining towards the awareness of social science, as well as to make them aware of the political, economical and social causes and consequences of industrialization and urbanization during the late 19th and early 20th centuries. The syllabus also aims to broaden up the intellectual outlook, understanding of moral, ethical and social values and an improved ability to communicate.	With the completion of this syllabus students will be familiar with political, economical and social causes and consequences of industrialization and urbanization during the 20th and early 21th centuries as well as, well known about our/world culture and civilization. Similarly, broaden up the intellectual outlook, understanding of moral, ethical & social values and improved ability to communicate.

Unit I: (d,e,f) : Basic Social Sciences
- Meaning, Scope and General Utility of Social Sciences to Engineers.
- Applied Humanities and Social Engineering.
- Society, its type, characteristics.

(8 Hrs.)

Unit II: (d,j,h) : Civilization
- Development of human Civilization with specific reference to monumental studies of engineering skill
- Ancient Indian Civilization.-
  a) Indus Valley Civilization.
  b) Vedic Civilization.
  c) Indian Art & architecture.

(8 Hrs.)

Unit III: (e,f,i) : Applied Social Sciences
- Industrial Psychology- Meaning, Scope& Importance
- Industrial Sociology – Meaning, Scope, Importance. & Impact of Industrialization on society.
- Industrial Fatigue of Workers.
- Selection, Training & Motivation of Workers.

(8 Hrs.)

Unit IV: (f,j) : Sociology & Culture
- Social structure and Social system & its problems.
- Socialization and Social Stratification
- Social Control and Social Change
- Culture – Types, Characteristic, Merits, Demerits & some related terms of culture.

(8 Hrs.)

Unit V: (d,e,f) : Industrial Engineering And Management
- Concept of Industrial democracy.
- Work Organization. : Power, Authority and Status System, Formal and Informal Organization.
- Relationship between Engineering & environment.

(7 Hrs.)

Unit VI: (e,j) : Industrial Management
- Health and Safety of Workers.
- Industrial Peace and Industrial Unrest.
- Labour Turn Over.
- Union Labour Organization.
- Discipline in Industry.

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(7 Hrs.)

Text Books:-

1) S. Shabbir, A.M. Sheikh, Jaya, Dwadashiwar, A New Look into Social Science, S. Chand & Company Ltd. New Delhi.
2) Khanna OP, Industrial Engineering & Management, Dhanpat Rai Publication, New Delhi.

Reference Book :

- Sociology : Principal of Sociology with an introduction to social thought.
  By C.M.Shankar Rao, Publication : S Chand, New Delhi.
- Social problems in India ; Chronical Publication, New Delhi

CV1101	Engineering Mechanics			L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 hours		

COURSE OBJECTIVE	COURSE OUTCOMES
• To provide a fundamental understanding of static concepts commonly used in analysis and design of engineered structures and prepare for advanced education in related fields. • To develop the skills for analyses of simple statically determinate structures such as beam and pinned jointed trusses subjected to various loading and support conditions. • To understand the engineering properties of surface area of composite figure like centroid, moment of inertia, product of inertia, etc. • To understand the equilibrium of a particle and a rigid body by applying the principle of virtual work. • To determine simple dynamic variables and solve simple dynamic problems involving kinetics, energy and momentum.	• An ability to identify, formulate, and solve engineering problems by applying principles of equilibrium and free-body diagrams • An ability to utilize knowledge and skill in analysis and modelling of simple, statically determinate structures. • An ability to determine the centroid, center of gravity and moments of inertia of simple geometric shapes and understand the physical applications of these properties. • An ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
Mapped Program Outcomes: a, b, e, k, l, m	

Unit I: Plane Force System

Resultant: Fundamental concepts, system of forces, laws of mechanics, principle of transmissibility of forces, Resolution and Resultant of a 2 Dimensional force system, Moment of force,Principle of moment, Couple, Equivalent force couple system.

Equilibrium: Free body diagrams, Conditions of equilibrium, types of supports, types of beams, types of loads, Application to 2D force system.

Unit II: Spatial Force System

Resultant: Vector Algebra, Resolution and Resultant of a 3 Dimensional force system, Moment of force (about point and about an axis),Couple, Equivalent force couple system.

Equilibrium: Conditions of equilibrium,Application to 3D force system.

Unit III: Friction and Trusses

Friction: Definitions of friction, Coulomb's laws of friction, plane friction, belt friction.

Trusses: Definitions, assumptions, types, condition of determinacy of Truss, Analysis of truss by method of joints

Unit IV: Properties of Surfaces

Centroid: Introduction, First Moment of Area, Problem on Centroid of composite sections.

Area Moment of Inertia: Introduction, Second Moment of Area, Radius of Gyration, Transfer Theorem, Polar Moment of Inertia. Product of Inertia, Moment of Inertia and Product ofInertia with respect to inclined axes, Principal Momentsof Inertia.

Unit V: Virtual Work Method andKinetics of Particle

Virtual Work Method: Introduction, Principle of virtual work, Application to beam and frame.

Kinetics of Particle: D' Alembert's principle, Force Inertia Method, Translation of bodies and interconnected particles.

Unit VI: Work Energy and Impulse Momentum Method

Work Energy Method: Introduction, Work Energy principle, Conservation of energy and problems on connected bodies.

Impulse Momentum Method: Definitions, Principle of conservation of momentum, elastic impact of two bodies, coefficient of restitution, application of impulse momentum method.

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Text Books:-

1. Beer F.P. and Johnston E.R; Vector Mechanics for Engineers, 9th edition Tata McGraw Hill Publication, New Delhi. 2007
2. Nelson A., Engineering Mechanics (Statics and Dynamics), ed 2009, Tata Mc-Grew Hill Education Pvt Ltd, New Delhi, 2009
3. Dubey N.H., Engineering Mechanics (Statics and Dynamics) first edition 2013,Tata Mc-Graw Hill Education Pvt Ltd, New Delhi, 2013

Reference Books:-

1. Timoshenko S,Young D.H and Rao J.V, Engineering Mechanics, McGraw Hill Publication, New Delhi, 2007
2. Bhattacharyya B., Engineering Mechanics, Oxford University Press, New Delhi, 2008
3. Hibbeler R.C, Engineering Mechanics (Statics and Dynamics), Pearson Publication, Singapore, 2000
4. Shames I.H. and Rao J.V., Engineering Mechanics (Statics and Dynamics), First Edition, Pearson Publication, New Delhi, 2003
5. Singer F.L, Engineering Mechanics (Statics and Dynamics), Harper and Rowe publication, New Delhi, 1994

CV1102	Engineering Mechanics Lab	L=0	T=0	P=2	CREDITS = 1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
• Ability to utilize scalar and vector analytical techniques for analyzing forces in statically determinate structures. • Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems. • Ability to solve Equations of motion, work and energy for rigid bodies; impulse and momentum for rigid bodies; • To understand the principles and functions of various practical mechanisms and devices, such as Single purchase crab, differential axel and wheel, fly wheel • Ability to do analysis of the dynamics of the given machine components and determine their behaviors accordingly. • Ability to Successfully enter a profession that involves Engineering Mechanics skills or pursue graduate/professional education.	• Knowledge of science and engineering fundamentals • In-depth technical competence in at least one engineering discipline: Statics and Dynamics • Ability to use appropriate techniques and resources • Ability to undertake problem identification, formulation and solution • Ability to communicate effectively with the engineering team and with the community at large • Ability to manage information and documentation • Understanding of professional and ethical responsibilities and commitment to them • Capacity for creativity and innovation • Capacity for lifelong learning and professional development • Professional attitudes • General knowledge about the place of engineering in society
Mapped Program Outcomes: a,b,d,f,g	

Minimum Ten practicals to be performed from the list as below:

1. To determine support reactions for a Simply Supported Beam experimentally, analytically and graphically.
2. To determine the coefficient of Coil friction
3. To determine the forces in the members of a Jib Crane.
4. To determine acceleration due to gravity using Compound Pendulum.
5. To determine the moment of inertia of a Fly Wheel.
6. To determine Law of machine & efficiency of Differential axel &Wheel.
7. To determine the forces in members of a Shear Leg apparatus.
8. To determine Law of machine & efficiency of Single Purchase Crab.
9. To determine the coefficient of friction between two surface.
10. To determine Law of machine & efficiency of Double Purchase Crab.
11. To verify the Law of motion using Fletcher's Trolley.
12. To determine forces in the members of a truss and compare the same graphically.
13. To find Moment of Inertia and Product of Inertia by Mohr's circle method.
14. To verify law of Polygon of forces.

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EE1101	Basic Electronics	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
• To expose all the engineering students to basic principles of Electronics. • To bridge different branches of engineering enabling new inter-disciplinary areas to grow. • To enlightened students to experiment with basic electronic circuits to enable them to understand its basic application of electronics in day to day life.	• Students will be familiar with all number systems and codes and will able to solve numericals on same. • Students will understand the concepts of combinational & sequential circuits and will able to design the same. • Students will understand the functions & characteristics of Semiconductor Devices. • Students will understand the types of amplifier & their mathematical equations.
Mapped Program Outcomes: a, b, c, d, e, i	

Unit I:
Number Systems and Codes

Number System & their conversions, Codes- BCD code, Excess-3 Code, Gray Code & ASCII Code, BCD arithmetic, Binary Arithmetic operations. **{a,b,e,i}**

(7 Hours)

Unit II:
Digital Principles

Binary Number representation- Sign-magnitude Numbers, 1's & 2's Complement, 2's Complement Arithmetic. The Basic Gates, Universal Logic Gates, Exclusive Gates, Boolean Laws & Algebras, Demorgans theorem, Sum of Product & Product of Sum. **{ a,b,e,i}**

(7 Hours)

Unit III : Logic Design

Combinational Logic- Introduction to logic minimization using K-map (limited upto 3-variable only), Half & Full Adder, Half & Full Subtractor, Data Processing units- Multiplexer, Demultiplexer, Decoders & Encoders. Sequential Circuits – Introduction to Flip flops, register & counters**.** **{a,b,e,i}**

(7 Hours)

Unit IV:

Diodes & its applications

Characteristics of materials based on Energy band theory, Intrinsic and extrinsic semiconductors, P-N junction diodes, Biasing & Characteristics of diodes. Diode Circuits - Half wave rectifier, full wave rectifier, bridge rectifier, clippers & clampers, filter Circuit. Special Purpose Diodes - Zener diode, LED. **{a,b,c,d,e,i}**

(7 Hours)

Unit V : BJT & its application

Introduction to BJT- NPN and PNP, biasing, Configuration & modes of operation, Characteristics & Applications of BJT. Concepts of amplifiers, Introduction to SCR, Introduction to MOSFET. **{a,b,c,e,i}**

(7 Hours)

Unit VI: Operational Amplifiers

Introduction to feedback, gain equation for feedback, Introduction to Op-Amp, Inverting and Non-Inverting Amplifier, Linear Op-Amp Circuits, Differential Amplifiers, Summing Amplifier, Difference amplifier, Integrator, Differentiator. **a,b,c,e,i}**

(7 Hours)

1. "Basic Electronics",by Soumitra Kumar Mandal ,1st edition ,Tata McGraw Hill Education Private Limited, Publised in 2013.
2. "A textbook of Electronics", by S.L. Kakani, K.C. Bhandari. 3rd edition, New Age International Publishers, 2008.

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Dean (Acad. Matters)		Version	1.00	

EL1101	Electrical Engineering	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
• To impart knowledge of basics in Electrical Engineering. • To understand the applications of Electrical Engineering.	• Students will be able to understand the basic concepts of Electrical engineering & their applications in the field of engineering.
Mapped Program Outcomes a,b,d,e,i PEO- 1,2	

Unit I : D. C. Circuits
Brief Introduction and concept of Electrical Circuits, Active and Passive Elements, Equivalent Resistance, Series/Parallel, star/delta and delta/star transformation, power in dc circuits.
Electrical energy sources, Kirchoff's Laws, mesh and nodal analysis, Superposition Principle.

Magnetic Circuits : Concept of magnetic flux, magnetomotive force, magnetic field intensity, magnetic circuit, permeability of free space, relative permeability, reluctance, permeance, laws governing magnetic circuits, comparison between electric and magnetic circuits, B-H curve, leakage flux, core losses.

Unit II : Single Phase a.c. Circuits :_Generation of an alternating voltage, emf equation, concept of phase and phase difference, instantaneous, average and effective values by analytical method, form factor, peak factor for sinusoidal waveform, phasor diagram, Solution of R. L, C Series, Parallel, Series/Parallel circuits with phasor diagrams, power factor, active power, reactive power and apparent power in a.c. circuit, concept of resonance in series and parallel a.c. circuits.

Unit III : Three Phase a.c. Circuits :_ Single phase and poly phase system, advantages of three phase system, Three phase AC generation, phase sequence, Delta and Star Connections, Line and Phase Quantities, Phasor Diagram, Solution of Three Phase Balanced Circuits, active, reactive, and apparent power.
Measuring Instruments :Introduction to Electrical Measuring Instruments (indicating, recording, integrating instrument, principle of operation of instrument moving coil, moving iron, electrodynamometer, induction)

Unit IV : Single Phase Transformer: Concept of Mutual Inductance, Construction, Theory and operation of Single Phase Transformer, emf equation, equivalent circuits, voltage regulation, losses in transformer, efficiency, classification of transformers, Concept of open and short circuit tests, Elementary problems on efficiency and regulation, Introduction of CT & PT.

Unit V : D. C. Machines:_Principle of DC generator, construction, emf equation, types of generators and elementary discussion on their characteristics.
Principle of DC Motor, comparison of motor and generator, significance of back emf, voltage equation and torque equation of motor, type of motors and their characteristics, application of motors, need of starter, speed control of D.C. motor, losses and efficiency (only theoretical treatment is expected).

Unit VI : Three Phase Induction Motor : Classification of a.c. motors, general principle of induction motor and its construction, Basic idea of revolving field, starting torque, condition for maximum starting torque, torque under running conditions, maximum torque under running conditions, torque slip characteristics. (Only qualitative treatment)
Single Phase Induction Motor :_Magnetic field produced by single phase and two phase a.c. supply, double field revolving theory, making single phase motor self starting, types of single phase induction motor, principle of working of capacitor start induction motor.
Application of Electrical Motors in domestic sector (e.g. mixer, ceiling fan, water pump motor etc.).

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Text Books:-

1) " Basic Electrical Engineering", T. K. Nagsarkar and M. S. Sukhija, Oxford Higher Education, 1st Edition, 2005.
2) " Basic Electrical Engineering" , V. N. Mittle and A. K. Mittal , The McGraw Hill Companies, New Delhi, 2nd Edition,2006.

Reference Books:-

1. "Basic Electrical Engineering ", I J Nagrath and D. P. Kothari , McGraw Hill, New Delhi, 2nd Edition, 2002.
2. " Electrical Engineering Fundamentals" Vincent Del Toro, Prentice Hall India, New Delhi, 2nd Ed, 2001

EL1102	Electrical Engineering Lab	L=0	T=0	P=2	CREDITS = 1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

Minimum Ten Nos of experiments to be done from the following list

LIST OF EXPERIMENTS :

1. To verify Kirchoff's laws.
2. To verify Superposition Theorem
3. To determine Self and Mutual Inductances of a coupled circuit
4. To plot magnetization curve for a magnetic material
5. To study R-L-C series circuit
6. To study R-L-C parallel circuit.
7. To study balanced three phase star connected load
8. To study balanced three phase delta connected load
9. To calculate Transformation Ratio, Efficiency and Regulation of single phase Transformer by direct loading
10. To study starting and reversal of three phase squirrel cage induction motor.
11. To draw single line diagram of power flow in electrical system.
12. To study protective devices(Fuse, MCB, ELCB).
13. To study electrical earthing

Reference Book:

" A text Book of Laboratory Courses in Electrical Engineering", S. G. Tarnekar, P. K. Kharbanda and S. B. Bodkhe, S. Chand , New Delhi, .

IT1101	INTRODUCTION TO COMPUTER PROGRAMMING	L=3	T=1	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
• To facilitate the students in using Computer effectively as a programmable device. • To provide basic knowledge of programming language to the students for developing software projects related to the applications/research in the respective disciplines	• Understand the basics of computers and its various components. • Understand the basic building blocks of programming languages. • Differentiate between an algorithm and a program. • Develop programs using different control statements. • To apply the concepts of functions to write programs based on structure and union and Files
MAPPING OF COs WITH POs & PSOs: **a, b, c,e,k,l**	

Unit I: Introduction to Computers

Fundamentals of Computers: Basic Structure of a Computer, Input /Output Devices, Memories, Hardware, Software, System Software, Application Software, Applications of Computers, Types of Computers, Programming Languages, Types of Errors in Programming, Algorithms and Flowcharts.

(06)

Unit II: C language preliminaries and decision control structures

Character set, variables and identifiers, built in data types, Arithmetic operators and expressions, constants and literals, simple assignment statements, library functions, basic input/output statements, relational and logical operators, precedence of operators, logical expressions, pointer variables, Compilation, linking and loading concept, write straight line programs, Decision control structures: if, if - else and nested if-else statements, goto statement, conditional operator, switch-case control structure Statement, simple C programs based on these control structures

(08)

Unit III: Loop control structures

While, do while and for loops, break and continue statement. Simple C programs based on these loop structures. Identifying test cases and performing test runs, good programming practices – indentation, comments, writing time and space efficient programs.

(06)

Unit IV: Concepts of Functions , Pointer and Modular Programming

Concept of functions, function prototypes, formal parameters, actual parameters, return types, function call: call by value and call by reference, C programs using functions, Recursive functions, comparing recursion against iteration, Concepts of pointers, C programs using recursive functions, Modular programming.

(07)

Unit V: One and Two dimensional arrays, strings

Concept of array as a data structure. One dimensional array: array manipulation, insertion, deletion of an element searching techniques: Linear and binary search, sorting techniques: Bubble, insertion and selection sort. C Programs based on different applications of arrays.

Two dimensional array: programs for basic matrix operations-addition, multiplication and transpose, Array as function arguments, Arrays and pointers.

Introduction to strings, string handling functions. Programs based on Strings.

(08)

Unit VI: Structures, Concept of files, File handling and preprocessor directives

Introduction to structures and Union, Array of Structures, Programs based on Structures Concept of files, Different types of files, file opening in various modes, Command Line Arguments, Program based on Files.

Concept of preprocessor directives and macros, testing and debugging a program, program documentation.

(07)

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Text Books:

1. J.B.W.Kernighan & D.M.Ritchie," The C Programming Language", Prentice Hall
2. E. Balguruswamy ,"Programming in ANSI C"
3. K.R.Venugopal & S.R. Prasad, "Mastering C", TMH,2007.

Reference Books:

1. Jeri R. Hanly, Elliot B. Koffman, "Problem Solving And Program Design In C" , 5th Edition, Pearson Education
2. Byron Gottfried," Programming with C", Schaum;s Outline Series
3. R. G. Dromey," How to solve it by computers", Prentice Hall India

IT1102	Introduction to Computer Programming Lab	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

List of Practical

Sr. No.	Topic	No of practical
1.	Introduction to operating system and editor	02
2.	Writing simple C programs	01
3.	Writing programs based on control structures	02
4.	Writing programs based on loops	02
5.	One dimensional arrays and pointers	02
6.	Two dimensional arrays	01
7.	Program on user defined data types using structures and type def statement	01
8.	Functions	02
9.	String handling using functions	01
10.	File Handling	01

ME1101	Engineering Graphics	L=1	T=0	P=0	CREDITS=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
The objective of learning Engineering Graphics is to make the students aware of how an industry communicates technical information. An engineer need to have three skills, he must be able to imagine, draw clearly and rapidly and to read the drawings drawn by others. Engineering Graphics aims in teaching the principles of accuracy and clarity while presenting the information necessary to produced products. It also develops the imagination skills that are essential while creation of successful design.	• The imagination skills of students are being developed. • Students are able to read, write and communicate engineering drawings. • Students are aware about the standards followed in industry. • Students are able to draw the projections of points, lines, planes, solids, section of solids and development of lateral surfaces, orthographic, isometric, missing lines, missing views and intersection of solids.

Unit I:
Introduction to AutoCAD [a, b, f]
Basic Commands.

Unit II:
Theory of Projections [a, b, f]
Theory of orthographic projection, techniques, first and third angle projections and multi view drawing from pictorial views. Theory of isometric projection, oblique drawing and its construction. Need of primary and secondary auxiliary views. Identification and drawing of missing line(s), views in orthographic projections.

Unit III:
Spatial Geometry [a, c, e]
Projection of points, lines, application of lines, true lengths, inclinations, shortest distance and planes.

Unit IV:
Geometrical Solids and Sections [a, e, g]
Construction of right, regular and oblique solids. Section planes and its sectional views.

Unit V:
Development of Surfaces [a, c, d]
Radial line, parallel line and reverse development.

Unit VI:
Intersection of Surfaces [a, e, f]
Intersection between line - plane, plane - plane, line - solid and solid - solid.

Text Books:
1. D.M. Kulkarni and A. Sarkar, Engineering Graphics with AutoCAD, Prentice Hall India, New Delhi, 2009.

Reference Books:
1) N.D. Bhatt and V. M. Panchal, Elementary Engineering Drawing, 49th Edition, Charotar Publisher, 2011.
2) Dhananjay Jolhe, Engineering Drawing, TMH, New Delhi, 2008.
3) N.D. Bhatt and V. M. Panchal, Machine Drawing, 43rd Edition, Charotar Publisher, 2001.

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ME1102	Engineering Graphics Lab	L=0	T=0	P=4	Credits=2

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

Unit	Learning Objectives	Topics to be covered	Practical Classes
1	**Introduction to AutoCAD**	Basic commands	8
2	Theory of Projections	Theory, techniques, first and third angle projections, Multi view drawing from pictorial views. Theory of isometric and oblique drawing, construction of isometric and oblique from orthographic. Need, primary and secondary auxiliary views, true shapes. Identification and drawing of missing line(s) and view in orthographic projections	20
3	Spatial geometry	Projection of points; lines, true lengths, inclinations, shortest distance; planes	8
4	Geometrical solids and sections	Construction of right, regular, oblique solids; section planes and sectional view.	8
5	Development of surfaces	Radial line, parallel line; reverse development.	6
6	Intersection of surfaces	Intersections between: line-plane, plane-plane, line-solid, solid-solid	6

Text Book:

1) D.M. Kulkarni and A. Sarkar., Engineering Graphics with AutoCAD, Prentice Hall India, New Delhi, 2009.

Reference Book:

1) N. D. Bhatt & V. M. Panchal., Engineering Drawing, Charotar Publisher, 2007.
2) Dhanjay A Jolhe, Engineering Drawing, Tata-Mcgarw hill, 2008.

Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
Dean (Acad. Matters)		Version	1.00	

ME1103	Workshop Practice	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

Objectives:

This course is an entry level course for all B.E. students. The course will provide an overview of the techniques and applications of basic manufacturing processes required to produce a finished product from raw materials.

1. **Carpentry:** [a b i] [2 Jobs]

   Identifying some common types of timber and their engineering applications, Names and uses of carpenters tools, various types of wood working joints and their applications.

2. **Smithy:** [a b i] [1 Job]

   Use of various tools and equipments in smithy shops. Demonstration of various operations and their applications. Operations of the smithy hearth and various other hand and power forging equipments.

3. **Fitting:** [a b i] [1 Job]

   Use of Fitting tools, equipments and measuring instruments, Practice in the method of marking and the use of measuring instruments, Chipping , filling , drilling ,
   Tapping, scraping operations.

4. **Welding:** [a b i] [1 Job]

   Name and uses of gas and electric welding, tools and equipments gas and electric welding, operation practice.

Hand Tools: Use and handling of common hand tools.

Text Books Recommended

1. Workshop Technology Volume I by S K Hajra Choudhary and A K Chaoudhary. Media Promoters and Publishers, Mumbai.

Reference Books

1. Sero Kalpakjian and Steven Schmid, “Manufcaturing Processes for Engineering Materials”, Pearson Education, 2004.
2. E.Paul Degarmo et al., “Materials and Processes in Manufacturing”, PHI, Eighth Edition, 2004.

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
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Y.C. COLLEGE OF ENGINEERING
AN AUTONOMOUS INSTITUTION
SEAL
NAGPUR

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Chairperson		Date of Release	May 2014	Applicable for AY 2014-15 Onwards
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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2014

3 to 8 Semester

Civil Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Civil Engineering

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE-I	MSE-II	TA	ESE	
THIRD SEMESTER												
1	GE1201	Engineering Mathematics-III	3	1	0	4	4	15	15	10	60	3
2	GE1202	Engineering Geology	4	0	0	4	4	15	15	10	60	3
3	GE1203	**Lab:** Engineering Geology	0	0	2	2	1			40	60	
4	CV1201	Strength of Materials	3	1	0	4	4	15	15	10	60	3
5	CV1202	**Lab:** Strength of Materials	0	0	2	2	1			40	60	
6	CV1203	Geotechnical Engineering-I	3	1	0	4	4	15	15	10	60	3
7	CV1204	**Lab:** Geotechnical Engineering-I	0	0	2	2	1			40	60	
8	CV1205	Fluid Mechanics-I	3	1	0	4	4	15	15	10	60	3
9	CV1206	**Lab:** Fluid Mechanics-I	0	0	2	2	1			40	60	
Total			**16**	**4**	**8**	**28**	**24**					

FOURTH SEMESTER

1	**GE1204**	Advanced Mathematical Techniques	4	0	0	4	4	15	15	10	60	3
2	CV1208	Concrete Technology	4	0	0	4	4	15	15	10	60	3
3	CV1209	**Lab:** Concrete Technology	0	0	2	2	1			40	60	
4	CV1210	Surveying-I	3	1	0	4	4	15	15	10	60	3
5	CV1211	**Lab:** Surveying-I	0	0	2	2	1			40	60	
6	CV1212	Environmental Engineering-I	3	1	0	4	4	15	15	10	60	3
7	CV1213	**Lab:** Environmental Engineering-I	0	0	2	2	1			40	60	
8	CV1214	Building Construction and Building Drawing	4	0	0	4	4	15	15	10	60	4
9	CV1215	**Lab:** Computer Aided Building Drawing	0	0	2	2	1			40	60	
10	CV1216	Engineering Hydrology	4	0	0	4	4	15	15	10	60	3
Total			**22**	**2**	**8**	**32**	**28**					

Chairperson	**Dean (Acad. Matters)**	**1.00**	**May 2015**	**Applicable for AY 2015-16 Onwards**
		Version	**Date of Release**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Civil Engineering

Sno	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total		MSE-I	MSE-II	TA	ESE	
FIFTH SEMESTER												
1	GE1311	Fundamental of Management	3	0	0	3	3	15	15	10	60	3
2	CV1301	Surveying -II	4	0	0	4	4	15	15	10	60	3
3	CV1302	**Lab:** Surveying -II	0	0	2	2	1			40	60	
4	CV1307	Structural Analysis-I	3	1	0	4	4	15	15	10	60	3
5	CV1308	**Lab:** Structural Analysis-I	0	0	2	2	1			40	60	
6	CV1304	Transportation Engineering –I	4	0	0	4	4	15	15	10	60	3
7	CV1305	**Lab:** Transportation Engineering –I	0	0	2	2	1			40	60	
8	**Open Elective I**		3	0	0	3	3	15	15	10	60	3
	CV1325	OE I : Environmental Management										
	CV1327	OE I : Building Services Engineering										
	CV1329	OE I : Construction Techniques										
	CV1330	OE I : Transportation Engineering Basic										
9	CV1331	Reinforced Concrete Structures	3	1	0	4	4	15	15	10	60	4
		Total	**20**	**2**	**6**	**28**	**25**					
SIXTH SEMESTER												
1	GE1312	Fundamental of Economics	3	0	0	3	3	15	15	10	60	3
2	CV1310	Fluid Mechanics –II	3	1	0	4	4	15	15	10	60	3
3	CV1311	**Lab:** Fluid Mechanics –II	0	0	2	2	1			40	60	--
4	CV1332	Steel Structures	3	1	0	4	4	15	15	10	60	4
5	CV1333	Geotechnical Engineering II	4	0	0	4	4	15	15	10	60	3
6	**Professional Elective I**		3	0	0	3	3	15	15	10	60	3
	CV1315	PE I : Water Treatment										
	CV1316	PE I :Prestressed Concrete										
	CV1317	PE I :Building Services										
	CV1323	PE I :Pavement Design										
	CV1324	PE I :Geotechnical Investigation & Ground Improvement Techniques										
7	**Open Elective II**		3	0	0	3	3	15	15	10	60	3
	CV1341	OE II: Elements of Earthquake Engineering										
	CV1342	OE II: Air Pollution and Solid Waste Management										
	CV1343	OE II: Introduction to Finite Element Method										
	CV1344	OE II: Disaster Management										
	CV1345	OE II: Environmental Impact Assessment										
8	CV1314	Seminar	0	0	2	2	1			100		--
		Total	**19**	**2**	**4**	**25**	**23**					

Chairperson	**Version**	**1.00**	**Applicable for AY 2016-17 Onwards**
Dean (Acad. Matters)	**Date of Release**	**May 2016**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Civil Engineering

Sno	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total		MSE-I	MSE-II	TA	ESE	
SEVENTH SEMESTER												
1	CV1401	Water Resource Engineering	3	1	0	4	4	15	15	10	60	3
2	CV1402	Structural Analysis-II	3	1	0	4	4	15	15	10	60	3
3	CV1403	**Lab:** Structural Analysis-II	0	0	2	2	1			40	60	--
4	CV1422	Transportation Engineering –II	4	0	0	4	4	15	15	10	60	3
5	CV1441	Environmental Engineering -II	4	0	0	4	4	15	15	10	60	3
6	CV1442	**Lab :** Computer Applications in Civil Engineering	0	0	2	2	1			40	60	--
7	**Professional Elective II**		3	0	0	3	3	15	15	10	60	3
	CV1410	PE II: Traffic Engineering										
	CV1411	PE II: Advanced Hydraulics										
	CV1413	PE II: Natural Resources Management										
	CV1443	PE II: Optimization Techniques										
	CV1444	PE II: Structural Dynamics										
	CV1445	PE II: Soil Dynamics										
	CV1459	PE II: Computer Applications in Civil Engineering										
	CV1406	Industrial Training/ CRT	0	0	0	0	2			100		
8	CV1407	Project- Phase I	0	0	4	4	4			40	60	--
Total			**17**	**2**	**8**	**27**	**27**					
EIGHTH SEMESTER												
1	CV1421	Estimating & Costing	3	1	0	4	4	15	15	10	60	4
2	**Professional Elective III**		3	0	0	3	3	15	15	10	60	3
	CV1446	PE III: New Engineering Materials										
	CV1447	PE III: Advanced RCC										
	CV1448	PE III: Remote Sensing and GIS										
	CV1449	PE III: Earth and Earth Retaining Structures										
	CV1450	PE III: Watershed Management										
	CV1451	PE III: Urban Transportation Planning										
3	**Professional Elective IV**		3	0	0	3	3	15	15	10	60	3
	CV1427	PE IV: Wastewater Treatment										
	CV1428	PE IV: Earthquake Engineering										
	CV1429	PE IV: Matrix Analysis of Structures										
	CV1452	PE IV: Advanced Surveying										
	CV1453	PE IV: Foundation Engineering										
	CV1454	PE IV: Water Power Engineering										
4	**Professional Elective V**		3	0	0	3	3	15	15	10	60	3
	CV1432	PE V: Water Transmission and Distribution Systems										
	CV1433	PE V: Advanced Steel Design										
	CV1434	PE V: Maintenance and Rehabilitation Engineering										
	CV1455	PE V: Finite Element Method										
	CV1456	PE V: Advanced Geotechnical Engineering										
	CV1457	PE V: Design of Bridge Structures										
	CV1458	PE V: Advanced Foundation Engineering										
5	CV1424	Comprehensive Viva-voce	0	0	0	0	3				100	
6	CV1425	Project- Phase II	0	0	8	8	8			40	60	
7	CV1426	Extra / Co-curricular / Competitive Examination	0	0	0	0	2			100		
Total			**12**	**1**	**8**	**21**	**26**					

Add. Sub : 7-CV1459 PE: CAICE

Chairperso	**Version**	**1.02**	**Applicable for AY 2018-19 Onwards**
Dean (Acad. Matters)	**Date of Release**	**April 2018**	

III Semester

GE 1201	Engineering Mathematics-III			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Objective	Outcome
The aim of this paper is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	• With the completion of this syllabus students will be familiar with Laplace ,Z-transform and their methods of solutions and partial differential equation with simple applications and essential concepts of optimization techniques and use these mathematical techniques in variety of technical, business, industry optimization problems.

UNIT-1: : Finite Differences (a,e) [8 hrs]
Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform (a,e) [7 hrs]
Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform (a,e) [8 hrs]
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 :Matrices (a,e) [9 hrs]
Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigenvectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation (a,e,h) [8 hrs]
Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.
Partial Differential Equations – PDE of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

UNIT-6 : Fourier Transform (a,h) [6 hrs]
Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.

Text books:

1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference books:

1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John wiley& Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John wiley& Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill.
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune VidyarthiGrihaPrakashan

III Semester

GE 1202	Engineering Geology	L=4	T=0	P=0	Credits = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the origin, development and ultimate fate of various surface features of the earth 2. To understand the basic building units of which the solid crust of the earth 3. To understand the nature of geographic distribution of rocks and engineering properties of rock on the earth 4. To understand the nature of geological structures and their importance on the civil engineering structures 5. To know the importance of geology in civil engineering practices	**1.** An ability to understand various aspects of geological science and its application to engineering for the purpose of assuring that the geological factors affecting the location, design, construction, operation and maintenance of engineering works are recognized and adequately provided for. **2.** An ability to perform studies and opinions regarding geological hazards, erosion, flooding, dewatering and seismic investigations etc.
Mapped Program Outcomes: b,h,k	

UNIT-I:
Indian Geology: Principles of stratigraphy &eological time scale, Physiographic and tectonic divisions of India, Introduction to the stratigraphy of India.
Geomorphology: Geomorphologic processes and their external and internal agents, Geological action of wind, glaciers, running water and oceans and their resulting landforms, Geomorphic forms and their consideration in engineering structures.

UNIT-II:
Structural Geology: Deformation of rocks, folds, parts of fold, its classification and nomenclature, Identification joints, its definition, nomenclature and classification, Definition, nomenclature and classification of fault, Recognition of fault and fold in the field and its effect on outcrops, Outliner and inliers, Problems on dip, strikes, thickness and depth of rock strata.

UNIT-III
Mineralogy: Definition and classification of minerals, Isomorphism, polymorphism and pseudo orphism, General chemical and physical characters of the following mineral groups, Silica, Feldspar, olivine, Pyroxene, Amphibole, Mica, Feldpathoid and clay.
Petrology: Rock cycle, Magma and its composition, Igneous rocks: Formation of igneous rocks, Forms, textures and structures, Tabular classification of igneous rocks. Sedimentary rocks: Weathering, Erosion, Transportation and Deposition of sediments, Sedimentary Environments, Classification of sedimentary rocks. Metamorphic rocks: Definitions and agents of metamorphism, Types of metamorphism, Zones and grades of metamorphism, Ana taxis, Soils: soil profile and soil types.

UNIT-IV:
Engineering Geology: Applications of geology to Civil Engineering projects, Engineering properties of rocks. Engineering considerations of structures of rocks.Rock as a construction material, Building stone, Road metal and Ballast.Surface and sub-surface geotechnical investigation, Geological mapping, sampling, drilling, photogeology, geophysical methods. Application of geology for location, design and construction of dams, hydraulic structures, bridges and tunnels.

UNIT-V
General Geology: Definition and scopes of geology, Earth in relation to the Universe, Internal structures of the earth. Continental drift and plate tectonics.Isostasy and diastrophism, Volcanoes and their products.
Earthquake Engineering: Earthquake waves, causes and effects, magnitude and intensity. Tectonic zones of India. Landslides: causes of landslides and their prevention.

UNIT-VI:
Geohydrology: Hydrologic cycle, Occurrence and distribution of ground water, Water table and water table maps. Aquiclude, Acqifuge and aquifers, confined and unconfined aquifers, Springs and geysers, Importance of ground water studies in Civil Engineering Works.

III Semester

GE 1202	Engineering Geology	L=4	T=0	P=0	Credits = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

Text books:
1. Singh Parbin, “Engineering and General Geology”, 2009,S. K. Kataria& Sons
2. Kesavulu, “Textbook of Engineering Geology”,2009,Macmillan India Ltd

Reference books:
1. SenguptaSupriya, “Introduction to Sedimentology” 1994, A. A. Balkema
2. Park R. G., “Foundation of Structural Geology,” 2004 Routledge Publishing House

III Semester

GE 1203	Lab:- Engineering Geology	L=0	T=0	P=2	CREDITS = 1

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand different types of minerals through megascopic study 2. To understand different types and species of rock through megascopic study. 3. To understand importance of geological mapping and its use to civil engineering.	1. An ability to identify different types of minerals. 2. An ability to identify different types of rocks 3. An ability to draw geological maps.
Mapped Program Outcomes: a ,d, h	

LABORATORY WORK

Practical work will include the following:

- **Megascopic study of the following minerals:**

Quartz, Orthoclase, Microcline and Plaqioclase feldspar, nepheline, galena, olivine, augite, hornblende muscovite biotite, serpentine, asbestos, chlorite, talc, zeolite, gypsum, calcite, dolomite, fluorite, apatite, topaz, corrundum, beryl, tourmaline garnet, epidote, braunzite, laterite, clay, coal, magnatite, hematite, limonite, ochre, , sphalerite, chalcopyrite, pyrite, Malachite, azurite, pyrrolucite, psilomelene.

- **Megascopic study of the following rocks:**

Igneous rocks: Granite, granodiorite, diorite, syenite, gabbro, anorthositeperiodotite, dunite pegmatite, aplite, rhyolite, andesite, basalt, pumice, obsidian.

- **Sedimentary rocks:** Conglomerate, brecceia, grit, arkose, sandstone, greywacks, shales, limestone.

- **Metamorphic rocks:** slate, phyllite, Schist, Gneiss, Granulite, eclogite, hornblende schist, Amphibolite, marble, quartzite.Microscopic studies of Igneous, Sedimentary and Metamorphic rocks.

- **Geological map reading:** strike, dip, outcrop, Construction or cross section of simple geological maps depicting structures like Unconformity, intrusive, folds, faults etc. and some maps with engineering problems – About 10 maps.

Field Work:
Use of clinometer – compass in geological mapping.
Local geological fieldwork to identify and interpret geomorphic and geological features.
Visits to site of engineering structures to study the bearing of geological features in them.

Excursion be conducted under the guidance and supervision of the teaching staff and preliminary report on geological excursion shall be submitted by the students.
The report shall be valued and the marks shall be included in the sessional marks for practicals.

III Semester

CV1201		Strength of Materials	L=3	T=1	P=0	CREDITS =4
EVALUATION SCHEME						
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION	
15	15	10	60	100	3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To determine the deflections in beams by various methods which is an important criteria in design 2. To analyze the structural elements and find stresses. 3. To investigate state of stress in three dimensions and various theories of failure in designing the structural members 4. To interpret failure pattern of metal under different action 5. 5. To compute quantities of S.F. and B.M. and principle stresses.	1. An ability to understand basic concepts and mechanical properties of materials. 2. An ability to analyze behavior of material under various types of loading pattern. 3. An ability to draw variation of shear force, bending moment and stresses.
Mapped Program Outcomes: a ,c, e, g	

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UNIT – I

Mechanical properties and uniaxial problems: Types of force distribution, concept of stress and strain, stress strain behavior of ductile and brittle material in uniaxial state of stress. Elastic, plastic and strain hardening zones.stress – strain relations, elastic constants, relation between elastic constants. Uniaxial loading and deformation of simple cases of statically indeterminate problems under axial loading. Stress due to variation of temperature.

UNIT - II

Shear force and bending moment diagram: Axial force, shear force and bending moment diagram. Concept of free body diagram, types of loads, determination of axial force, shear force and bending moment at a section. Axial force, shear force and bending moment diagram in beams and simple frames, differential relation between shear force, bending moment and load

UNIT- III

Stresses in beam: Bending stresses in simple beam. Assumptions and derivation of simple bending. Theory relation between bending moment bending stress and curvature. Homogeneous and composite beams. Shear stresses in simple beams and shear stress distribution, Shear stress in composite beams. Combined effect of BM and axial force.

UNIT – IV

Torsion of Shaft: Torsion of circular sections, assumptions and derivation of relation between torsional moment, shear stress and angle of twist. Torsional stress in solid and hollow circular sections.

UNIT – V

Deflection of Beams: Derivation of differential equation of moment curvature relation, Differential Equation relating deflection and moment shear and load. Deflection of simple beams by integration.

UNIT – VI

Compound stresses: State of stress in two dimensions, differential equation of equilibrium, transformation of stresses, principal stresses, maximum shear stresses, Mohr's circle, combined bending and torsion, combinedeffect of Torsion and Shear. Thin walled pressure vessel, cylindrical and spherical pressure vessel subjected to internal pressure.

Text Books:

1. Bhavikatti S. S., Strength of Materials, 3rd Edition, Vikas Publication House Pvt. Ltd., Noida, UP, 2008.
2. Timoshenko S. P., Strength of Materials (Vol. 1 & 2), 2nd Edition, D Van Nostrand Company, Inc, New York.

Reference Books:

1. Chakraborti, M., Strength of Materials, S. K. Kataria& Sons.
2. Pytel A., Kivsalaas J. Mechenics of Material, CENGAGE LEARNING, (INDIAN EDITION),2010.
3. Shah V.L., Ogale R.A., Strength of Materials and Machine Element, 2nd Edition, Jain Book Agency, New Delhi.
4. Popov E.P., Engineering Mechanics of Solids, 4th Edition, Printice Hall, 2002.
5. Junnarkar S.B., Shah H., J., Mechanics of Structures VoL–I (Strength of Materials), 27th Edition, Charotar Publishing House, Anand, Gujrat, 2008.

III Semester

CV1202	Lab:- Strength of Materials	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study suitability of various materials for civil engineering construction. 2. To study the resistance offered by various materials against the external forces	1. An ability to understand basic concepts & mechanical properties of material. 2. An Ability to understand behavior of various materials.
Mapped Program Outcomes: a,b,k	

PRACTICALS:

Minimum **Ten** practical's to be performed from the list as below:-

1. To study the universal testing machine.
2. To study the extensometer.
3. To perform tension test on metal.
4. To determine compressive strength of brick.
5. To determine flexural strength of timber.
6. To determine modulus of rigidity of M.S. bar by torsion test.
7. To determine impact value of metal by Charpy Impact Test and Izod Impact Test.
8. To determine Rockwell hardness number for M.S. and Aluminium bar.
9. To determine Brinell hardness number for M.S. and Aluminium bar.
10. To determine the stiffness of spring and modulus of rigidity.
11. To determine percentage variation in dimension of brick.
12. To determine the percentage water absorption of brick, roofing tile and flooring tile.
13. To perform flexural test on flooring tile and roofing tile.
14. To perform shear test on metals.
15. To determine the compressive strength of metal.

III Semester

CV 1203	Geotechnical Engineering – I	L=3	T=1	P=0	CREDIT S = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To Provide the description, formation, classification and identification of soil and analysis of stresses in soils under different loading conditions. 2. To describe various index properties and their correlation with soil characterization and classification 3. To develop an understanding of the principles of effective stress in saturated soils, and its application to one dimensional compression and consolidation 4. Familiarize the students an understanding of permeability and seepage of soils	1. An ability to develop an appreciation soil as a vital construction material, and of soil mechanics in the engineering of civil infrastructure. 2. An ability to develop an understanding of the relationships between physical characteristics and mechanical properties of soils. 3. An ability to understand and experience experimental measurement of the physical and mechanical soil properties commonly used in engineering practice. 4. An ability to understand and can apply the modeling and analysis techniques used in soil mechanics (a) Darcy's Law and flow-nets for seepage; (b) consolidation models for load-time-deformation responses of soils; (c) Mohr-Coulomb models for shear strength behavior of soils. 5. An ability to develop good technical reporting and data presentation skills
Mapped Program Outcomes: a, b,e,h,i,j	

UNIT – I
Introduction: Formation of soil, residual & transported soil, soils generally used in practice such as sand, gravel, organic silt, clay, Bentonite, Hard pan, Celiche, Peat, Loess, Black cotton soil etc. Fields of Geotechnical engineering, Role of Geotechnical engineer in construction industry.
Phases of Soil: Soil as three-phase system. Various soil weight & volume inter–relationship.Density indices, methods of determining in situ density.

UNIT - II
Index Properties & Their Determination: Water content, specific gravity, sieve analysis, particle size distribution curve, sedimentation analysis, Differential and free-swell value. Consistency of soil – Attenberg'slimits, determination, significance of consistency limits and related indices.
Classification of Soil: Criteria of classification, particle size classification, Textural classification, Unified & I.S. classification system, field identification of soils, Expansive soil, their identification and related problems.

UNIT – III
Permeability: Darcy's law & its validity, Discharge & seepage velocity, factors affecting Permeability, Determination of coefficient of permeability by Laboratory and field methods, permeability of stratified soil.
Seepage: Seepage pressure, quick sand condition, flow nets, Laplace equation, method to draw flow nets, characteristics & uses of flow nets, preliminary problems of discharge estimation in homogeneous soils, Effective, neutral and total stresses in soil mass.

UNIT – IV
Stress Distribution: Stress distribution in soil mass, Boussinesq's point load theory, uniformly loaded rectangular & circular areas, Equivalent point load method, Newmark's charts.

UNIT - V
Consolidation: Consolidation of laterally confined soil, Terzaghi's 1–D consolidation theory, various terms associated with consolidation, Determination of pre-consolidation pressure, determination of coefficient of consolidation, degree of consolidation, settlement rate.
Compaction: Mechanics of compaction, factors affecting compaction, Standard & Modified Proctor Tests, Optimum Moisture Content, field compaction methods, Quality control

III Semester

CV 1203	Geotechnical Engineering – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

UNIT – VI

Shear Strength: Introduction, Mohr's diagram, Mohr-Coulomb's failure theory, Measurement of Shear strength by Direct shear test, Triaxial test, Unconfined compression test, Vane shear test, sensitivity. Shear test under different drainage conditions. Shear characteristics of sands and clays.

Text Books:

1. Punmia B. C., Jain A.K., Jain A.K., Soil Mechanics & Foundations., 16th edition, Laxmi Publications, New Delhi, 2005.
2. Murthy V.N.S., Geotechnical Engineering – Principles and Practices of Soil Mechanics and Foundation Engineering, CRC Press, 2003.
3. Gopal R., Rao A.S.R., Basic and Applied Soil Mechanics, 2nd edition, New Age International Publishers, New Delhi.

Reference Books:

1. Purushothama Raj P., "Soil Mechanics and Foundation Engineering, 1st edition, Pearson Education India, 2008.
2. Datta M, Gulhati S. K., Geotechenical Engineering, 5th edition, Tata McGraw Hills Publications, New Delhi, 2005.
3. ShamsherPrakash, GopalRanjan, Problems in Soil Engineering, SaritaPrakashan Publishers, Meerut, U.P., 1976.

III Semester

CV 1204	Lab:- Geotechnical Engineering - I	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various Index properties of soil 2. To perform various test to determine engineering properties of soil 3. To perform the test for determination of compactness soil	1. An ability to understand the Index properties of soil 2. An ability to understand the Engineering properties of soil 3. An ability to test the compactness of soil
Mapped Program Outcomes: a, b, e, j, k	

PRACTICALS

Minimum **Ten** practicals out of following will be performed

1. To determine Moisture content of given soil sample.
2. To determine Specific gravity of soil.
3. To perform Grain size Analysis – (Dry Sieve Analysis)
4. To determine Attenberg's Limits.
5. To determine coefficient of Permeability by (i) Constant head, and (ii) Falling head.
6. To perform Standard Proctor compaction Test and to determine OMC.
7. Field Density determination by sand replacement method.
8. Field Density determination by core cutter method.
9. To perform Unconfined compression test.
10. To perform Direct shear Test.
11. To perform Triaxial Compression test (Demonstration)
12. To find F.S.W. and D.F.S. of soil. Identification of swelling Soil.
13. To study the Consolidation characteristics of soil.

Reference Books:

1. Mittal S., Shukla J.P., Soil Testing for Engineers, Khanna Publishers, New Delhi, 2006.
2. Head K. H., Manual of Soil Laboratory Testing, 3rd edition, Whittles Publishing, 2008.

III Semester

CV 1205	Fluid Mechanics – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the importance, application and inter-relationship of various properties of fluid. 2. To study the various pressure measuring devices. 3. To study theories those explain the behavior and performance of fluid at rest. 4. To study Lagrangian and Eularian approach to understand the behavior of fluid in motion without reference of force. 5. To study motion fluid with reference of force. 6. To study the various flow measuring devices in pipe, channel and tanks. 7. To understand the utilization of dimensional analysis as a tool in solving problems in the field of fluid mechanics.	1 An ability to understand various properties of fluid and its behavior when is at rest. 2. An ability to apply various flow measuring device in pipes and tanks 3. An ability tounderstand the different approaches of study of fluid flow by considering &without considering the forces causing the flow. 4. An ability to understand the utilization of dimensional analysis as a tool in solving problems in the field of fluid mechanics.
Mapped Program Outcomes: a, b, e,k	

UNIT – I

Fluids and Their Properties: Definition of fluid, Differences between solids, liquids and gases , fluid properties, mass density, specific weight and specific gravity, viscosity, Newton's equation, coefficients of dynamic and kinematic viscosity, Rheological Diagram, Ideal and real fluids. Compressibility and bulk modulus.Surface tension, capillarity, pressure inside a bubble and cylindrical jet, vapor pressure and cavitation.Effect of pressure and temperature on fluid properties.

UNIT – II

Fluids Pressure and its Measurement: Fluid pressure, law of fluid pressure, variation of fluid pressure with depth, pressure and head, Atmospheric pressure and vacuum. Gauge and absolute pressures.Pressure measurement by open and differential manometers.

Hydrostatics: Total pressure & center of pressure, Forces on a Horizontal, Vertical, Inclined, Curved, submerged surfaces.

UNIT – III

Kinematics of Flow: Lagrangian and Eularian approaches in fluid flow description. Velocity and its variation with space and time.Acceleration of fluid particles, Normal and tangential acceleration. Steady, unsteady, uniform, Non–uniform flow. One, two and three dimensional flow, Rotational &Irrotational flow.

Streamline, path line, streak line, Equation of continuity in Cartesian co-ordinates, stream functions, velocity potential function .Relationship between stream function and velocity potential, flow net

UNIT – IV

Kinetics of Flow: Forces influencing motion, Euler's equations of motion for one dimensional flow, Bernoulli's equation for ideal fluids, Assumptions, derivation, limitation and application, Kinetic energy correction factor.Momentum equation, forces on pipe bends and closed conduits, Momentum correction factor

Flow Measurement-I: Velocity measurement by Pitot tube, Pitot–static tube and Prandtl'sPitot tube. Discharge measurement by venturimeter, orifice meter and flow nozzles.

UNIT – V

Flow Measurement-II: Flow through Orifices and mouthpieces: Definition, types, hydraulic coefficients, factors affecting them and their experimental determination, time for emptying tank by orifices. Discharge through large and submerged orifices, external and internal mouth pieces, running free and running full, pressure at vena contracta, Discharge through a convergent- divergent mouthpiece

UNIT – VI

Dimensional analysis and theory of models: Dimensional analysis: Definition and use, fundaments and derived dimensions, dimensional analysis by Raleigh and Buckingham's Pi methods. Similitude,geometric, kinematic and

III Semester

CV 1205	Fluid Mechanics – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

dynamic similarities. Predominant force, force ratio, dimensionless numbers and their significance, Introduction to hydraulic models.

Text Books:

1. Asawa, G.L., Fluid Flow in Pipes and Channels, 1st edition, CBS Publishers and Distributers, 2009.
2. Gupta V., Gupta S.K., Fluid Mechanics and Its Applications, John Wiley & Sons, 1984.
3. Modi P.N., Seth S.M., Hydraulics and Fluid Mechanics Including Hydraulics Machines, 14th edition, Standard Book House Publishers, New Delhi, 2009.

Reference Books:

1. White F.M., Fluid Mechanics, 6th Edition, McGraw-Hill, 2007.
2. Fox R.W., McDonald A.T., Introduction to Fluid Mechanics, 6th Edition, John Wiley & Sons, 2003.

III Semester

CV 1206	Lab:- Fluid Mechanics – I	L=0	T=0	P=2	CREDITS = 1

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOME
1. To understand concept of equilibrium of floating bodies & position of metacenter. 2. To understand various forms of energy of flowing fluid. 3. To understand various flow measuring devices in pipe, tank, channel.	1. An ability to determine Metacentric height of ship model 2. An ability to verify Bernoulli's theorem 3. An ability to measure velocity or discharge in pipe, tank & channel & also determine hydraulic coefficients of devices.
Mapped Program Outcomes : a,b,k	

PRACTICALS

Minimum of **Ten** practicals from the list given below shall be performed.

1. Determination of metacentric height of a given ship models.
2. Verification Bernoulli's theorem
3. Velocity measurement by Pitot tube.
4. Discharge measurement by Venturimeter- determination of meter coefficient
5. Discharge measurement by pipe orifice, determination of Cd
6. Determination of hydraulic coefficient of a sharp edged circular orifice.
7. Determination of hydraulic coefficient of a rectangular orifice.
8. Determination of Cd of an external cylindrical mouth piece
9. Determination of Cd of a convergent-divergent mouth piece.
10. Flow over a rectangular notch: Determination of Cd
11. Calibration of triangular notch.
12. Determination of diameter of sharp edge Circular orifice at vena contracta by using micrometer contraction gauge.

Reference Books:

1. Asawa, G.L., Laboratory work in Hydraulic Engineering, New Age International Publishers,

IV Semester

GE 1204	Advanced Mathematical Techniques	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
The objective of this paper is to study numerical methods and their methods of solution and statistics and probability with simple applications and to introduced fuzzy sets and logics	With the completion of this syllabus students will be familiar with study numerical methods and their methods of solutions and fuzzy sets and logics with simple applications and essential concepts of probability and statistics and use these mathematical techniques to provide the solution to variety of technical, business, industry optimization problems.

UNIT-1: (a,e) **[9 hrs]**

NUMERICAL METHODS FOR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Errors in numerical calculation, Errors in series approximation. Rounding of error solutions of algebraic and transcendental equations. Iteration method, Bisection method, False position method, Newton Rapphson method and their convergence

NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss -Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2: (a,e) **[8 hrs]**

NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4th order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. Numerical methods of solving 1st order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques (a,h) **[6 hrs]**

Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 (a,h,k) **[7 hrs]**

Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

UNIT-5: (a,h,k) **[8 hrs]**

Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 (a,h,k) **[6 hrs]**

FUZZY SETS AND FUZZY LOGIC ; Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

Text books:

1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition(2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference books:

1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers

IV Semester

CV 1208	Concrete technology	L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1.To develop systematic knowledge of concrete constituents 2.To familiarize with the fundamentals of concrete 3.Principles involved for high performance concrete 4.To understand the basic concepts of special concretes 5. To introduce fundamentals of concreting methods	1. An ability to understand the properties of the constituent materials of concrete. 2. An ability to understand the properties of fresh concrete 3. An ability to understand the properties of hardened concrete and tests to determine them 4. An ability to design concrete mixes and apply statistical quality control techniques 5. An ability to understand admixtures and their role in concrete properties 6. An ability to understand the durability of concrete
Mapped Program Outcomes a ,c, e, f, j, k, m	

UNIT-1:
Constituents of cements, Hydration of cement. Water requirement, Physical properties and testing of cement. Effect of fineness, Initial, final and false setting of cement, Soundness test. Hardening and compressive strength, Grades and different types of cement,
Aggregates: Coarse and fine aggregate, normal, light and heavy weight aggregates. aggregate characteristics and their significance in properties of concrete. Sampling, Particle shape and texture, Bond of aggregate, size & grading of aggregate, strength of aggregate. Mechanical properties and tests as per IS, bulking of sand. Crushed sand.Alkali aggregate reaction. Introduction of IS: 383, water quality for mixing and curing, Acceptable water, pH value, Seawater chlorides content. Provisions in IS: 456.

UNIT-2:
Fresh Concrete: Batching, Mechanical mixers, automatic batching and mixing plants. Efficiency of mixing, Workability and its Measurement, Factor affecting workability, setting time, Significance of w/c ratio, cohesiveness of concrete, Segregation, bleeding, voids, permeability. Hot weather concreting, Conveyance of concrete, placing of concrete, compaction, vibrators, curing of concrete, significance and methods, temperature effects on curing and strength gain, IS provisions, Maturity of concrete, Formwork for concrete- IS provisions . Introduction to Ready mix, pumped and self-compacting concrete

UNIT-3
Strength of concrete: Strength gain, factors affecting compressive strength, Tensile and flexural strengths, relation between compressive and tensile strength. Failure modes in concrete, cracking in compression.Impact strength, fatigue strength, shear, elasticity, Poisson's ratio.
Testing of hardened concrete: Compression test, cube strength and cylinder strength and their relation, effect of aspect ratio on strength.Flexural strength of concrete, determination of tensile strength, indirect tension test, splitting test, abrasion resistance, accelerated curing test.
Non Destructive test: Significance, rebound hammer, ultra sonic pulse velocity test, Advanced concrete testing equipment.

UNIT-4:
Mix Design: Process, statistical relation between main and characteristic strength, variance, standard deviation, factors affecting mix properties, grading of aggregates, aggregate/cement ratio etc. Degree of quality control, design of mix by IS method, introduction to road Note No. 4 (BS) and ACI method.

UNIT-5
Additives and admixtures: Types of admixtures, natural products, diatomaceous earth, calcined clays of shales, volcanic glasses, byproducts–pozzolona, fly ash, silica fume, rice husk ash, metakaoline, G.G. blast furnace slag, admixtures- air entraining, water reducing, accelerators, retarders, plasticizers and superplasticizers, permeability reducing, grouting agents, surface hardeners.

IV Semester

CV 1208	Concrete technology	L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

Shrinkage: Early volume changes, drying shrinkage, mechanism and factors affecting shrinkage, influence of curing conditions, differential shrinkage, carbonation, creep- factors influencing, relation between creep and time, nature of creep, effect of creep.

UNIT-6:
Durability of concrete: Significance, water as an agent of deterioration, permeability of concrete, sulphate attack and its control, sea water attack, acid attack, efflorescence, resistance to corrosion, abrasion and cavitation, process of rusting of steel.

Text books:
1. M.S. Shetty, “Concrete Technology”: S Chand & Co., 6thedition, S.Chand& Company, Limited, 2008
2. Gambhir M.L., “Concrete Technology”

Reference books:
1. PK Mehta and PJ Monterio, “Concrete Microstrucutres: Properties and materials.”
2. AM Neville, “Properties of concrete” ELBS, London
3. DF Orchard, “Concrete Technology”, Applied Sciences Publications

IV Semester

CV 1209	Lab:- Concrete Technology	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the properties of various grades cement. 2. To study the behavior of concrete at its fresh and hardened state 3. To study about the concrete design mix 4. To know about the procedures in concreting 5. To understand special concrete and their use	1. An ability to outline the importance of testing of cement and its properties. 2. An ability to assess the different properties of aggregate 3. An ability to summarize the concept of workability and testing of concrete 4. An ability to describe the properties of fresh and hardened concrete 5. An ability to Ensure quality control while testing/ sampling and acceptance criteria
Mapped Program Outcomes: a, b, h, k	

LIST OF EXPERIMENT

Minimum **Ten** experiments out of following shall be conducted in the laboratory.

1. To determine the normal consistency and initial setting time and final setting time by Vicat's apparatus.
2. To determine the fineness of cement.
3. To perform soundness test of cement.
4. To determine fineness modulus for coarse and fine aggregates .
5. To determine the bulking of sand & plotting bulking curve.
6. To determine the compressive strength of cement.
7. To design the concrete mix of required characteristic strength according to I.S .method vide SP23
8. To determine the workability of concrete by slump cone, Vee bee apparatus,compaction factor and flow test.
9. To prepare and test the concrete cubes for compressive strength by Indian standard method.
10. Study of various Non-Destructive testing methods (NDT) in concrete Technology
11. To determine workability of cement mortar.
12. To determine the permeability of concrete.
13. To determine the permeability of mortar.

IV Semester

CV 1210	Surveying – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOME
1. To know the importance, application, division, classification & principle of survey in all kinds of Engineering field. ***2.*** To know the different land Surveying Equipment's Such as Chain, Compass, Theodolite, Plane table, Level etc. . ***3.*** To know the different kinds of Survey such as hydrographic Survey and underground Survey.	1. An ability to understand the basic concepts of surveying 2. An ability to understand the basic principles, operation, handling & uses of various surveying equipment. 3. An ability to draw the location of maps, contour map using various surveying equipment **4.** An ability to understand the basic method and equipment use for hydrographic and underground surveying.
Mapped Program Outcomes: a,b,d,e, ,j, k	

UNIT – I

Introduction, Chain and Compass Traversing

Introduction: - Classification, division of survey, Principle of survey,

Chain Traversing: - Basics, tape correction

Compass Surveying: Prismatic and Surveyor's Compass, true and magnetic bearing, local attraction, dip and magnetic declination, compass traversing.

UNIT – II

Leveling and Adjustment of Dumpy Level

Leveling: Definitions, Different types of Levels, Study of Dumpy Level, temporary adjustments, principles of leveling, reduction of levels, classification of leveling, Reciprocal leveling, Corrections for Curvature and Refraction, distance to visible horizon.

Permanent adjustment of Dumpy Level: Principle axes of Dumpy level, relationship, testing and adjustment of bubble axis and line of collimation.

UNIT – III

Contouring and Trignometrical Leveling

Contouring: Definitions, Characteristics, uses, and methods of locating contours, interpolation of contours

Trignometrical Leveling: Indirect leveling, elevation of a point with base of an object accessible and inaccessible (with instrument station in/not in the same vertical plane as the elevated object)

UNIT – IV

Theodolite Surveying

Theodolite: Introduction, Type of theodolite, temporary adjustment, Principle Axes and relationship, measurement of horizontal and vertical angles, magnetic bearings, prolonging a line, lining in.

Traverse Computation: Consecutive and independent co-ordinates, adjustment of closed traverse, Gale's traverse table, area calculation by co-ordinate.

UNIT – V

Plane Table Surveying & Computation of Area & Volume

Plane Table Survey: Equipments, advantages and disadvantages, orientation, methods of plane tabling, two point and three point problems in plane tabling.

Computation of Area and Volume: Trapezoidal and Simpsons Rule,

UNIT – VI

Hydrographic Surveying, Underground Surveying and Surveying Equipment:

Hydrographic Surveying: Shore line survey, River survey, Soundings, Equipments, Methods of locating soundings, three point problems.

Underground Surveying: Correlation of underground and surface survey, transferring the levels underground.

IV Semester

CV 1210	Surveying – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION
15	15	10	60	100	3 hours

Surveying Equipments: Box Sextant, Abney level, Optical theodolite.Planimeter, its use, theory.

Text books:

1. Kanitkar T.P., Kulkarni S.V., Surveying and Leveling (Vol-I), Pune VidyarthiGrihaPrakashan, Pune.
2. Punmia B.C., Jain A.K., Jain A.K., Surveying and Leveling (Vol–I & II), 15th Edition, LaxmiPublication(P) Ltd. New Delhi, 2005.

Reference books:

1. Basak N. N., Surveying and Leveling, 1st Edition, Tat McGraw–Hill Publishing company Ltd. New Delhi.

IV Semester

CV 1211	Lab:- Surveying – I	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand the operation, principle, handling and uses of surveying equipment such as chain, compass, theodolite, level. 2. To recognize the role of the professional surveyor, and modern developments in surveying 3. To study map interpretation and public land systems 4. To determine the Distance between two inaccessible point by using trigonometric leveling.	1. An ability to work in a team to carry out a survey of a small area using appropriate methods 2. An ability to describe the observation, computation and adjustment of a Traverse to carry out basic survey computation and adjustment **3.** An ability to understand the angle and distance measurement; and differential, profile, cross-section, and topographic leveling procedures and apply them to field conditions
Mapped Program Outcomes: a,b,d,e,j,k,l	

PRACTICALS

Minimum **Ten** Practical's should be performed out of the following

1. Measurement of distance by ranging and chaining.
2. Locating various objects by chain and cross staff survey.
3. Determination of area of a given polygon by chain and cross staff survey.
4. Measurement of bearing of sides of traverse with prismatic compass and computation of correct included angles.
5. Locating given building by chain and compass traversing (1 full size drawing sheet)
6. Determination of elevation of various points with dumpy level by collimation plane method and rise and fall method.
7. Fixing the bench mark with respect to temporary bench mark with dumpy level by fly leveling and check leveling.
8. Measurement of horizontal angle with theodolite by method of repetition.
9. Measurement of vertical angle with theodolite.
10. Determination of horizontal distance between two inaccessible point with theodolite.
11. Locating given building by theodolite traversing. (One full size drawing sheet also showing Gale's traverse table)
12. Determination of elevation of point by trigonometric leveling.
13. Study of planimeter and Measurement of area by Digital Planimeter
14. Study of Box Sextant, Abney Level, optical theodolite.
15. To give layout for given plan of building.

IV Semester

CV 1212	Environmental Engineering – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To study step by step method of designing a water supply scheme for a town. 2. To study characteristics of water and objectives of treatment of water. 3. To study working of various water treatments units and a few concept of design of these units. 4. 4. To study importance of solid waste management and methods of collection, treatment, disposal and reuse of solid waste.	1. An ability to understand significance of community water supply scheme and concept of design of water supply scheme. 2. An ability to design certain components of water supply system 3. An ability to understand significance of good quality of water and methods of treatment to achieve required quality of water. 4. An ability to understand methods of distribution of water. 5. An ability to understand the significance and concept of solid waste management.
Mapped Program Outcomes: a,b,c,d,e,h,j	

UNIT – I
Introduction, Importance and necessity of water supply scheme.
Water demand: Types of demand, empirical formulae, factors affecting per Capita demand, variation in demand, design period and methods of population forecasting.
Intake structures: Location types – river, lake, canal reservoir etc.

UNIT – II
Conveyance of water: Types of pipes, joints in pipes, valves and fittings.
Rising mains and pumps: Hydraulic design of rising mains, Classification, working, merits, demerits & selection of pumps.

UNIT – III
Water quality: General idea of water borne diseases, Physical, Chemical, and bacteriological characteristics of water, Standards of drinking water.
Water treatment: Objective of treatment, unit operations and processes, Flow sheet of conventional water treatment plant.
Aeration: Purpose, types of aerators.
Coagulation and Flocculation: Definition, Principles, types of coagulants and reactions , coagulant doses, types of mixing and flocculation devices.

UNIT – IV
Sedimentation: Principles types of settling basins, inlet and outlet arrangements.
Clariflocculators: Principles and operation.
Filtration: Mechanism of filtration, types of filters RSF, SSF, pressure filters, elements of filters UDS, design aspects filter sand specification, operational problems in filtration.

UNIT – V
Disinfection: Purpose, Mechanism, criteria for good disinfectant , various disinfectants and their characteristics, disinfection by chlorination using different forms of chlorine.
Distribution systems: Requirements for a good distribution system, methods of distribution, systems and their layouts, appurtenance in water distribution system. Leakage and leakdetector. Storage reservoirs for treated water: Types, capacity of reservoir, mass curve.

IV Semester

CV 1212	Environmental Engineering – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION
15	15	10	60	100	3 hours

UNIT – VI

Municipal solid waste management: Generation sources, composition, Quality, Methods of Collection, transportation, treatment and disposal, 3 R's of solid waste management.

Text Books

1. Modi P.N., Water Supply Engineering (Vol – I & II), 2nd Edition, Standard Book House / Rajsons Publication, New Delhi.
2. Punmia B. C., Wastewater Engineering, 2nd Edition, Laxmi Publication, New Delhi
3. Birdie G.S., Birdie J.S., Water Supply and Sanitary Engineering, 4th Edition, DhanpatRai Publication, New Delhi.

References:

1. Metcalf, Eddy, Wastewater Engineering Treatment & Reuse, 4th Edition, Metcalf & Eddy Inc.

IV Semester

CV 1213	Lab:- Environmental Engineering – I	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To study the water quality criteria & permissible standards 2. To study the characteristics of water and experimental procedure 3. To study the analysis of various parameters related to water quality	1. An ability to understand water quality criteria standards. 2. An ability to understand physical, chemical & biological characteristics of water. 3. An ability to understand the acceptable & permissible limits of drinking water.
Mapped Program Outcomes: a,b	

PRACTICALS

Any **TEN** of following practicals will be conducted:

1. Determination of pH.
2. Determination of turbidity.
3. To perform Jar test.
4. Determination of available chlorine.
5. Determination of residual chlorine.
6. Determination of dissolved oxygen.
7. Determination of Hardness.
8. Determination of acidity
9. Determination of alkalinity
10. M.P.N. Test.
11. Plate count test.
12. B.O.D. test
13. C.O.D. test

IV Semester

CV 1214	Building Construction and Building Drawing	L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	4 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To build awareness about the type of masonry, floors and roofs. 2. To understand types of doors and stairs and its uses. 3. Read, interpret and draw the building drawings. 4. Prepare submission drawings for the building. 5. Prepare working drawings for the building. 6. Plan various types of buildings considering the functional requirements. 7. Apply the building rules, regulations and byelaws.	1. An ability to understand various aspects related to foundation of structures such as types of foundation, bearing capacities and foundation lay outs. 2. An ability to understand various aspects of masonry constructions such as brick and stone masonry and damp proofing of masonry structures. 3. An ability to understand in details various building components like roof trusses, doors, windows, plastering, pointing, timbering, and painting. 4. An ability to understand and develop techniques of drawings of various structural components, detailed drawings, as per site requirements and drawings such as perspective drawing.
Mapped Program Outcomes: a,f,g,h,**i,j,**l	

UNIT – I

Foundation: Necessity and types of foundations, details of shallow foundations, bearing capacity of soils and its assessment. Presumptive bearing capacity values from codes. Loads on foundation, Causes of failures of foundation and remedial measures, Foundation on black cotton soils, setting out layout for foundation trenches, excavation and timbering of foundation trenches. Load bearing and framed structures.

UNIT – II

Brick Masonry: Qualities of good bricks, classification of bricks, tests on bricks as per IS codes.
Terms used in brickwork, commonly used types of bonds in brickwork, principles of construction.
Parapets, coping, sills and corbels, cavity walls, load bearing and partition walls. Masonry construction using cement concrete blocks and light weight blocks.
Stone Masonry: Stone, cutting and dressing, selection of stones, types of stone masonry, principles of construction, joints in masonry. Common building stones in India.
Damp Proofing: Causes and effects of dampness .Various methods of damp proofing and water proofing.

UNIT – III

Roofs and Trusses: Different types of flat and pitched roofs, different types of trusses.
Stairs: Types of stairs, functional design of stairs.
Doors and Windows: Purpose, materials and types.
Plastering and Pointing: Necessity, types and methods.
Temporary Timbering: Centering and formwork, shoring, underpinning and scaffolding.
Painting: White washing, colour washing and distempering, new materials & techniques.
Concept of Green Building, Mass housing practices.

UNIT – IV

Introduction: Importance of Building drawing as Engineers language in construction & costing.
Method of Drawing: Selection of scales for various drawings. Thickness of line Dimensioning, first angle and third angle method of projection, Abbreviations and conventional representations as per IS 1962. Free hand dimensioned sketches. Developing working drawings to scale as per IS 1962 from the givens sketch design and general specifications for terraced and pitched roofs. Developing submission drawings to scale with location and site plan.

UNIT – V

Site requirements: **R**equirements of owner and building byelaws. Climate and design consideration, recommendations of CBRI, Roorkee and general principles of planning with emphasis on functional planning. Graph paper design (line plans) based on various requirements for residential, public, education and industrial buildings.

IV Semester

CV 1214	Building Construction and Building Drawing	L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION
15	15	10	60	100	4 hours

UNIT – VI

Perspective drawing, principles and uses, two point perspective of residential building neglecting small elements of building such as plinth offset,chajja projections etc.

Text Books:

1. Shah M.G., Kale C.M., Patki S. Y., Building Drawing, 4th Edition, Tata McGraw-Hill, New Delhi, 2002.
2. Sushil Kumar, Building Construction, 19th Edition, Standard Publisher Distributors 2001, New Delhi, 2001.

Reference Books:

1. National Building Code of India 1983, Bureau of Indian Standards, India, 2001

IV Semester

CV 1215	Lab:- Computer Aided Building Drawing	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1 To be able to identify various building elements, and their requirements at necessary places. **2** To be able to develop line plans in to developed/ submission drawings using bye laws. **3** To be able to understand latest computational techniques and software used for building drawing. **4** To be able to understand the use of perspective drawing in field.	1. An ability to advice/ apply the various building elements as per the need 2. An ability to draw various building drawings. 3. An ability to understand the requirement of application of different norms and local bye laws for sanctioning of plan from governing authority. 4. An ability to understand latest computational techniques and software used for building drawing. 5. An ability to understand the representation of the object as it appears to the observer.
Mapped Programme Outcomes:- a,f,g,h,i,j,k,l	

PRACTICALS

I] Practical submission work:

A] Sketch book:

1. Minimum 30 free hand sketches of various building elements should be drawn on the sketch book.

The sketch book will be submitted for evaluation.

B] Drawing sheets on AUTOCAD:

Following drawing sheets should be drawn with the help of AutoCAD (A1 size).

1. Submission drawing for residential building including its planning and with area and parking statements and all other details as per the norms and local bye-laws by using AutoCAD. (Minimum two storied framed structure on A1 size sheet).
2. Submission drawing of multistoried Public / Educational / Health / Community building including its planning with area and parking statements and all other details as per norms and local bye laws, by using AutoCAD. (Framed structure. on A1 size sheet)..

All these drawings will be printed and submitted for evaluation.

II] Manual drawing:

1. Line Plans of Various types of buildings. (**Five** Assignments should be done on A4 size graph paper)
2. Developed plan for residential building (**One** assignment on A1 size sheet for single storied load bearing structure)
3. Developed plan for residential building (**One** assignment on A1 size sheet for two storied framed structure.)
4. Line plan for a public building on graph sheet. (**One** assignment on A1 size sheet)
5. Two point perspective of the single Residential building neglecting small building elements. (**One** assignment on A1 size sheet)

All these drawings will be drawn and submitted for evaluation

IV Semester

CV 1216	ENGINEERING HYDROLOGY	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

Course Objectives	Course Outcome
1. To understand the atmospheric changes and hydrological cycle. 2. To understand details of various hydrological processes like Evaporation, Precipitation, Transpiration, etc. 3. To understand the cumulative accumulation of runoff and its analysis. 4. To understand occurrence of floods. 5. To understand probability of flood distribution and frequency analysis. 6. To understand concept of geo hydrology and ground water recharge.	1. An ability to understand the concept of hydrology. 2. An ability to interpret and analyze the hydrological processes. 3. An ability to understand need of water recharge and rain water harvesting. 4. An ability to understand different issues related with natural water resources.
Mapped Program Outcomes: **a, b, e, f, g, h, i, j**	

UNIT-1:
Introduction: Engineering hydrology, hydrological cycle, hydrological equation, Importance of temperature, wind and humidity in hydrological studies.
Precipitation: Definition, types and forms of precipitation, factors affecting precipitation, measurement of precipitation (using rainguages& analytical methods), optimum number of rain gauge stations, radar measurement of rainfall, mass curves, data missing records. Intensity-Duration-Frequency and Depth-Area- Duration analysis.
[07Hrs]

UNIT-2:
Infiltration: Definition, mechanism, factors affecting Infiltration, Infiltration indices,
Evaporation: Definition, mechanism, **f**actors affecting evaporation, estimation of evaporation (instrumental & analytical), evaporation control.
Transpiration: Definition, mechanism, **f**actors affecting transpiration, its measurement and control. Evapotranspiration & Its measurement.
[07Hrs]

UNIT-3
Runoff: Runoff, sources and component, classification of streams, factors affecting runoff, Estimation Methods. Measurement of discharge of a stream by Area-slope and Area-velocity methods.
Hydrograph: Flood hydrographs and its components, Base flow & Base flow separation, S-Curve technique, unit hydrograph, synthetic hydrograph. Instantaneous Unit hydrograph.
[07Hrs]

UNIT-4:
Statistical Methods: Statistics in hydrological analysis, probability and probability distribution.
Floods: Causes and effects, Factors affecting peak flows and its estimation, Flood routing and Flood forecasting. Frequency analysis. Economic planning for flood control.
[07Hrs]

UNIT-5
Geohydrology: Introduction, occurrence and distribution of groundwater, aquifers, specific yield, specific retention, porosity, permeability, water table, types and properties of aquifer, Darcy's law. Introduction to hydraulics of wells, Open wells safe yield test, Pumping Tests.
Groundwater quality, geomorphic and geological control on ground storage and movement. [07Hrs]

IV Semester

CV 1216	ENGINEERING HYDROLOGY	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

UNIT-6:

Ground water recharge: Introduction, selection of recharge sites, recharging methods, spreading method, Induced recharge method, Recharge well method, sub-surface dams, waste water recharge, recharge by urban storm runoff, recharge through rain water harvesting.

Project planning for water resources: Multipurpose projects, Inter basin water transfer and Inter state water disputes, Water resources planning through watershed management, Economic planning for domestic and industrial water supply.

[07Hrs]

Text books:

1] Ojha, C.S.P., Berndtsson, R., and Bhunya, P., Engineering Hydrology, Oxford University Press
2] Raghunath H.M., Hydrology, New Age International Publishers.
3] Reddy R., Hydrology, Tata McGraw-Hill New Delhi.

Reference books:

1] Linsley, R.K., Kohler, M.A. and Paulhas **,**Hydrology for Engineers **,** Tata McGraw-Hill Publishing Company Limited.
2] Todd, D.K., Ground Water Hydrology **,** John Wiley & Sons **.**
3] Subramnaya, K., Engineering Hydrology **,**Tata McGraw-Hill Publishing Company Limited **.**
4] Sharma R.K., Sharma T.K., Hydrology & Water Resources Engineering, DhanpatRai Publications.

V SEMESTER

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
Principle of Management	To familiarize the students with the basic concepts and principles of management. The students should clearly understand the definitions of different areas of management. This course will facilitate students to understand and describe specific theories related to perception, motivation, leadership. This will help the students to demonstrate effective management skill by knowing the various functions of management like planning, organising, directing, coordinating and controlling.
Legal Aspects of Management	The present course aims at familiarizing the students with various legal aspects of business, contract, partnership and companies. It aims at providing a rich fund of contemporary knowledge, time tested principles, basic concepts, emerging ideas and practices in the field of law in a comprehensive way.
Human Resource Management	The objective of this course is to endow the student with a broad perspective on themes and issues of Human Resource Management, Human Resource Development, Training and Development activities, Job Analysis, Performance Appraisal, disciplinary and grievance procedure. It will help the students to build up and refine decision making skills so that they can help organizations effectively manage employee relations.
Project Management	The course is intended to develop the knowledge of the students in the management of projects, special emphasis will be provided on project formulation as also on various tools and techniques for project appraisal and control so that they are able to draft the project proposal in any area of management and evaluate the projects.
Marketing Management	This course intends to provide an experienced-based approach to marketing concept and its practical application. The course is designed to enable the students to learn the basic of marketing, customer behaviour, marketing research & sales promotion. Topics of the syllabus shall be addressed and discussed from an application oriented perspective
Financial Management	The present course aims at familiarizing the participants with the skills related to basic principles, tools and techniques of financial management. This will help the students to demonstrate their skill in understanding the budgets and budgetary control, balance sheet, and profit and loss statement.

Mapped Program Outcomes:

UNIT-1: Principles of Management

Evolution of Management Thought : Scientific, Classical, Neo Classical and Modern Theory of Management, Defintion Meaning and Concept of Management, Functions of Managment : Planning, Organizing, Directing Coordinating and Controlling. Motivation Theory, Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, Types of Partners, Right and Duties of Partners, Registration and Dissolution of firm, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Directors : Powers and duties, Winding up of the Company

V SEMESTER

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-3: Human Resource Management

Human Resource Management-Meaning, Nature and Scope, Principles of HRD, Human Resource Planning, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Discipline and Grievance Procedure**.**

UNIT-4 Project management

Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Project Management, Tools and Techniques of Project Management, SWOT Analysis, Project Risk Analysis, Project cost, Project Planning, Project Control, Network techniques - Introduction and Use of CPM &PERT for planning.

UNIT-5 Marketing Management:-

Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Rural Marketing, Marketing Environment, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

UNIT-6 Financial Management:-

Definition & Functions of Finance department, Sources of finance , Financing organizations, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

TEXT BOOKS:

1. S.C.Saxena, Business Management and Administration, Sahitya Bhawan Publication
2. P. Subba Rao, Management -- Theory and Practice (Text and Cases) (Himalaya Publication)
3. Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
4. P.S Rao , Essentials of Human Resource Managemen & IR, Himalaya , Mumbai
5. Avraham Shtub and Jonathan F. Bard, Project Management: Processes, Methodologies, and Economics (2nd Edition)
6. Kotler, Keller, Koshy & Jha, Marketing Management, Pearson, New Delhi
7. R.K. Sharma, Shashi K Gupta, Management Accounting,. Kalyani Publishers.

TEXT BOOKS FOR REFERENCE:

1) **Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills**
2) **Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law**
3) **Dr. V.S.P.Rao - Human Resource Management - Text and Cases**
4) **C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,**

5) Lock, Gower - Project Management Handbook
6) Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7) Rajan Saxena: Marketing Management, Tata McGraw Hill.
8) Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9) Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10) Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11) Khan M Y - Financial Services (Tata Mc Graw Hill, 1998)

V SEMESTER

CV1301	Surveying – II			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To know the basic principle and operation of tachometric surveying 2. To Design different types horizontal and vertical curve. 3. To know the basic principle and application of different types survey such as geodetic, photographic and astronomical surveying. 4. To know the advance technique of surveying such as GIS, GPS and Remote sensing	1. An ability understands the modern technique of surveying. 2. An ability to understand and operate the modern Surveying equipment's 3. An ability to understand basic concepts of GIS, GPS & Remote sensing
Mapped Program Outcomes:a,b,d,k,	

UNIT – 1 :
Tachometric Surveying
Classification, Principle of stadia method, Theory of analytic lens, Distance and elevation formulae, tangential method, Errors in stadia surveying.

[08 Hrs.]

UNIT – 2 :
Simple and Compound Curves
a) **Simple Curves**: Elements of simple curves, Methods of Curve ranging, Obstacles in setting out curves.
b) **Compound Curves**: Elements of compound Curves, setting out the curve.

[09 Hrs.]

UNIT – 3 :
Transition and vertical curve
a) Transition Curves: Elements of transition curves, Super elevation, Length of transition curve, Ideal transition curve, characteristics of transition curve, Setting out the transition curve.
b) Vertical Curves: Elements of vertical curves, Types, Tangent Correction, Location of highest or lowest point.

[09 Hrs.]

UNIT – 4 :
Geodetic Surveying and Triangulation Adjustment
a) Geodetic Surveying: Classification of triangulation survey, Inter visibility of stations, Field work, reduction to centre.
b) Triangulation Adjustment: Definitions, Weighted observations, Laws of weights, Station adjustment.

[09 Hrs.]

UNIT – 5 :
Advanced surveying techniques
Photographic Surveying: Basic definitions, Terrestrial and aerial photography, Tilt and height displacements, Heights from parallax measurements, Flight planning, study of photo theodolite and stereoscope.

[09 Hrs.]

UNIT – 6 :
Remote Sensing: Introduction, definitions, Introduction to GIS, GPS and Total Station.
Astronomy Astronomy: Elements of spherical trigonometry, Napier's rule of circular parts, Celestial sphere, astronomical terms.

[08 Hrs.]

Text Books:
1. Punmia B.C., Jain A.K., Jain A.K, Surveying, (Vol. 2 & Vol. 3), Laxmi Publication, New Delhi. 1, 15th Edition.
2. Kanetkar T.P. & Kulkarni S. V, Surveying & Levelling (Vol.2 & Vol. 3), Pune Vidhyarthi Gruha Prakashan, Pune.
3. Reddy M. A., Remote sensing & GIS, B. S. Publication, Hyderabad.
4. Dr. A.M. Chandra, Higher Surveying, New age international publishers , New Delhi
Reference Books:
1. Thomas M. L., Ralph W. K., Jonathan W., Remote Sensing and Image Interpretation, Chipman Wiley & Sons, 5th Edition (2010).

V SEMESTER

CV1302	Lab : Surveying – II			L=0	T=0	P=2	CREDITS = 1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	--	40	60		100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand the operation ,handling and principle of tachometry 2. To measure the RL of floor w.r.to BM 3. To Design basic horizontal alignment of a curve. 4. To use latest instruments like total station	1. An ability to measure distance by using tachometry 2. An ability to plot Horizontal curve by using theodolite 3. An ability to understand the rectangular coordinate system **4.** An ability to Understand (introductory level) geographic information systems and Global positioning system (GIS ,GPS)
Mapped Program Outcomes: a,b, d, k,l	

PRACTICALS

Any Eight Experiments out of the following in addition to one day Survey Camp at campsite:

1. Determination of constants of Tacheometer.
2. Determination of elevation of points by Tacheometric surveying.
3. Determination of elevation of points and horizontal distance between them by Tacheometrical survey.
4. Determination of gradient of given length of road by Tacheometric survey.
5. Setting out of simple circular curve by offsets from chord produced method
6. Setting out of simple circular curve by Rankine method of tangential angle.
7. Setting out of simple transition curve by tangential angle method.
8. Study of stereoscope
9. Study of Handling, Operation and Basic Concept of Total Station.(Compulsory)
10. Contour plan of given area. (One full size drawing sheet)
11. Locating given building by Plane table traversing. (One full size drawing sheet)
12. Three point problem in plane table surveying.
13. L-section and cross section of road (One full size drawing sheet each for L-section and cross section) for the survey work carried out in survey camp.
14. Study and application of GIS, GPS and Remote Sensing.
15. Setting out simple circular curve by offset from long chord.
16. To determine height of the building using total station.
17. To determine the location of various point using total station.

V SEMESTER

CV1307	Structural Analysis-I			L= 3	T= 1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the student knowledge of rolling loads and its characteristics in structures 2. To provide the student knowledge of influence line diagrams for statically determinate structures 3. To provide the student knowledge about analysis of indeterminate structures (beams, frames and trusses) for internal forces, deflections etc. using energy methods. 4. To provide the student knowledge of Slope deflection method. 5. To provide the student knowledge of Moment distribution method.	1. An ability to understand the basic concept of structural analysis 2. An ability to understand the behavior of structural components subjected to various loadings. 3. An ability to understand various methods of analysis of structural elements.
Mapped Program Outcomes: a, e, l, m	

UNIT – 1 :
Analysis of strain, strain gauges, strain rosette, strain transformation.
Analysis of fixed and continuous beams by theorem of three moments, effect of sinking of support.
[09 Hrs.]

UNIT – 2 :
Analysis of continuous beams and simple portals (Non sway) using Moment Distribution method
[08 Hrs.]

UNIT – 3 :
Influence lines for reactions, bending moments and shear forces in simply supported beams, cantilevers, beams with overhangs and simple trusses subjected to different types of loadings.
[09 Hrs.]

UNIT – 4 :
Slope deflection method as applied to indeterminate beams & continuous beams, portal frames.
[08 Hrs.]

UNIT – 5 :
Buckling of Columns and beam-columns, Euler's and Rankine's formula. Analysis of Two and Three Hinged parabolic arches, shear force and normal thrust.
[09 Hrs.]

UNIT – 6 :
Strain energy method as applied to the analysis of redundant frames and redundant trusses up to two degrees. Determination of deflection of trusses, Willot Mohr's diagram, Castigliano's theorems, Maxwell's reciprocal theorem, Betti's theorem, Muller Breslauw Principle
[09 Hrs.]

Text Books:
1. Pandit G.S and Gupta S.P., Structural Analysis, Tata McGraw-Hill Publishing company LTD, New Delhi, 1997.
2. Timoshenko S.P. and D.H. Young; Theory of Structure, Tata Mc Graw Hill Publication, Delhi.
3. Sadhu Singh: Experimental Stress Analysis, khanna Publishers, Delhi,2009.

Reference Books:
1. Ramamruthum S.S. and Narayan R., Theory of structures, Dhanpat Rai and Sons, New Delhi,2010
2. Vazirani V.N and Ratwani M.M, Analysis of structures, Khanna Publishers, New Delhi, 1994.
3. Bhavikatti S.S, Structural Analysis (volume II) , Vikas publishing House LTD, Delhi,2011
4. Kinney J.S, Intermediate structural analysis, Oxford and IBH Publishing Co.PVT.LTD, New Delhi.

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V SEMESTER

CV1308	Lab : Structural Analysis-I			L=0	T=0	P= 2	CREDITS = 1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	----	----	40	60		100	----

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the basic concept of strain measurements. 2. To study the various methods for finding deflection in truss analytically and graphically. 3. To study the analysis of the aches 4. To study various properties of beam like flexural rigidity, slope, deflection, bending moment etc. 5. To study the behavior of column, curved member and portal frame.	1. An ability to understand various types of strain gauges and to measure the strain in beam. 2. An ability to find the defections in truss analytically and graphically. 3. An ability to determine the horizontal thrust of different types of arches. 4. An ability to understand the various properties of beam. 5. An ability to understand the behavior of the column, curved member and portal frame.
Mapped Program Outcomes: a, b, e, m.	

Any TEN experiments from the following are required to be conducted:

1. To study various types of electrical resistance strain gauges.
2. To measure the strain in the cantilever beam subjected to point load at tip and to check this value with theoretical value.
3. To determine slope and deflection at center of each span for a two span continuous beam subjected to point load W at center of each span and to check these values with theoretical values.
4. To verify Maxwell's Reciprocal Theorem for simply supported beam.
5. To determine the value of flexural rigidity of given beam and to compare it with theoretical value.
6. To determine the elastic displacements of the curved members experimentally and to check these values with theoretical values.
7. To study the behavior of different types of struts and to calculate the Euler's buckling load for each case.
8. To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of two hinged parabolic arch.
9. To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of three hinged parabolic arch.
10. To determine deflection of cantilever end of cantilever truss by Willot Mohr's diagram and to check this value with theoretical value.
11. To study the behavior of a portal frame under different end conditions.
12. To find the deflection of a pin-connected truss experimentally and to verify the result theoretically.
13. To obtain the influence line for bending moment of prismatic fixed beam for cases (a) one end hinged (b) both ends fixed.
14. To determine experimentally and analytically the reactions in the three suspension rods supporting an elastic beam with a concentrated load hung midway between two of the suspension rods when the suspension rods are attached at their upper end to rigid support.

V SEMESTER

CV1304	Transportation Engineering – I			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To know about importance of transportation in Indian context. 2. To know about various transportation systems and their inter relations. 3. To know about highway, planning of highways, road materials and geometric design of roads. 4. To know about pavement types and pavement materials. 5. To know about bridge and its various components including bridge hydrology.	1. An ability to understand concept of Geometric design of roads and various aspects of traffic engineering. 2. An ability to understand various types of bridges and their design aspects. 3. An ability to understand various traffic characteristics and analysis and use the data for road design. 4. An ability to understand various Highway materials and their suitability under different conditions.
Mapped Program Outcomes : a, b, c, d, e, h, j, k	

UNIT – 1 :
Introduction and importance of transportation, History of transportation, interrelations of various modes of transportation.
Development & Planning: Road transport characteristics, Classification of roads, development plans, network patterns, data collection & Surveys, Principles of alignment.
Traffic Engineering: 3E's of traffic engineering, Various Traffic Surveys, Intersection-types, layouts, design principles, parking, lighting, Introduction to Traffic control Devices, marking, Signs, Signals, and Regulations.
[08 Hrs.]

UNIT – 2 :
Geometric Design: Road user & road vehicle characteristics, Factors affecting design standards. Cross Section elements, Stopping & overtaking sight distance overtaking zones. Horizontal alignment, Curves, design of super elevation, extra widening, transition curves, vertical alignments, I.R.C. Standards for geometric Design.
[09 Hrs.]

UNIT – 3 :
Introduction to pavement materials
Aggregates: physical & Mechanical properties, tests on aggregates, Bituminous materials; classification, sources, properties and tests. Cutback bitumen & Emulsions, IRC/IS standards, Introduction to Geotextiles.
Construction & Maintenance: IRC, MOST specifications for quality & quantity of materials, techniques, tools and plant for the Earthwork, sub base, base and wearing/ surface course of flexible pavements with gravel, WBM, stabilized Bitumen & Concrete as Construction materials, Drainage, shoulders, arboriculture maintenance & repairs, Choice of construction.
[09 Hrs.]

UNIT – 4 :
Bridges: Introduction, Components, classification and identification, Data Collection, site selection, Economic Span, Estimation of flood discharge, waterway, scours depth, depth of foundation, Afflux, clearance and free board.
[08 Hrs.]

UNIT – 5 :
Bridge Super Structure: Different structural forms-culverts, causeways, minor and major bridges, suitability and choice, precast, post-tensioned and segmental construction.Girder Launching operation systems, Bridge Bearings, and Bridge Architecture.
[09 Hrs.]

UNIT – 6 :
Loads, Forces and Stresses for Bridges: IRC Specification & codes of practice, Critical combinations.
Rating and Maintenance of Bridges: Methods & Techniques of rating for existing bridges- inspection, repairs, maintenance, corrosion-causes and prevention, Aesthetics.
[09 Hrs.]

V SEMESTER

CV1304	Transportation Engineering – I			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Khanna& Justo, Highway engineering,Nem Chand & Bros.
2. K. L.Bhanot, Highway Engineering, S. Chand &Company (P) Ltd. New Delhi.
3. T. D.Ahuja, Highway Engineering, Standard Book House Delhi
4. S.P.Bindra, Bridge Enginnring, DhanpatRai Publication
5. J. Garber and L. A. Hoel, Traffic and Highway Engineering, Thomson Learning, Inc., 2002.

Reference Books:

1. Indian Road Congress, IRC handbooks ,International Code Council International Code Council
2. Ministry of surface/road transportation, MOST.

V SEMESTER

CV1305	Lab : Transportation Engineering – I			L=0	T=0	P=2	CREDITS= 1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	--	40	60		100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To determine various properties of aggregates. 2. To determine various properties of bitumen. 3. To perform the CBR test on soil. 4. To determine the Marshall stability of bituminous mixture. 5. To conduct traffic volume survey. 6. To know about bridges and its various components.	1. An ability to conduct various tests on aggregates and study its desirable properties. 2. An ability to conduct various tests on bitumen and understand its properties. 3. An ability to perform the CBR value. 4. An ability to perform Marshall stability of bituminous mixture. 5. An ability to conduct traffic volume survey. 6. An ability to understand about bridges and various components.
Mapped Program Outcomes: a, b, e, f, h, j, k	

PRACTICALS

Any TEN experiments from the following are required to be conducted:

1. To determine specific gravity of aggregates.
2. To determine impact value of given aggregate sample.
3. To determine crushing value of given aggregate sample.
4. To determine flakiness index of given aggregate sample.
5. To determine abrasion value by Los Angeles test.
6. To perform water absorption test on given aggregate sample.
7. To find softening point of given bitumen sample.
8. To perform penetration test for given bitumen sample.
9. To perform flash and fire point for given bitumen sample.
10. To perform ductility test on given bitumen sample.
11. To perform viscosity test on bitumen.
12. To perform CBR test on given soil sample.
13. To perform Marshall Stability Test on bituminous concrete.
14. To conduct traffic Volume survey for select stretch of road.
15. Bridge site visit.

V SEMESTER

CV1325	OE I : Environmental Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To understand the various organisation impacts on the environment. 2. To evaluate environmental problem define from natural and resource management. 3. To understand the principles and benefits of effective resources.	1. An ability to Identify the scientific and social aspects of environmental issues. 2. An ability to understand the procedure of environmental protection by legislation. 3. An ability to understand the role of environmental management system in protecting the resources.
Mapped Program Outcomes: a,c,d,e,f,g,h,j	

UNIT – 1 :
Sustainable development -carrying capacity based development planning process, assimilative and supportive capacity, Environmental Management in India. Concept of EIA, environmental attributes, nature of impact – directly & indirectly measurable impacts

[06 Hrs.]

UNIT – 2 :
Screening and scoping in EIA, terms of reference for conducting EIA, methodologies of EIA-checklists, matrices, overlays, cost benefit analysis & adaptive environment and management, networks.
Framework of EIA - baseline data collection, prediction of impacts, evaluation of impacts, Battelle environmental evaluation system, environmental quality monitoring budgetary provisions for implementing control measures.

[07 Hrs.]

UNIT – 3 :
Environmental appraisal of projects, MoEF questionnaire for environmental clearance, element of public participation & hearing, case studies on EIA, critical environmental issues and formulation of strategies of EMP, environmental management plan, development of action plans for critical environmental education programmes.

[07 Hrs.]

UNIT – 4 :
Environmental legislation – basic concepts, critical issues, civil liability, various enactment and their provisions –, Environmental Protection Act 1986, environmental tribunal & its functions. Implementation mechanism of environmental legislation, Role of State & Central boards of pollution control, local government social action groups, and environmental policies.

[07 Hrs.]

UNIT – 5 :
Environmental Audit- Concept of EA, environmental statement, procedural aspects of conducting environmental audit, pre-audit phase, on-site audit phase & post-audit phase, water audit, health & safety audit.

[06 Hrs.]

UNIT – 6 :
Resource Management: Biotic & Abiotic resources, renewable and non-renewable resources, bio-energy resource, depletion of resources – causes & effects, resource utilization, , optimal use of resources,.
Human Resources – importance of socio-economic studies in development projects.

[06 Hrs.]

Text Books :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.
2. John Rau & Wooten, Environmental Impact Assessment, Mc Graw Hill.
3. W.F. Canter, Environmental Impact Assessment, McGraw Hill.
4. Harry W. Gehm, Jacob I. Bregman, Handbook on pollution Control Acts, Central Pollution Control Board, New Delhi.
5. R.K. Sapra, S.Bhardwaj, The New Environmental Age, Ashish Pub. House, New Delhi.

References Books :

1. Rosencrannz, S. Divan, M.L. Nobal, Environmental Law and Policy in india, Cases, Materials And Statutes, Tripathi Pvt. Ltd. Bombay.

V SEMESTER

CV1327	OE I: Building Services Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
At the end of the course the student will be able to 1. Understand basic concepts of various building services. 2. Understand various aspects of natural light and ventilation. 3. Understand various methods of acoustics and sound insulation. 4. Understand various equipments and installations used in building services.	1.An ability to understand relevance of services related to lighting, ventilation & acoustics & understand the methodologies, materials & equipment in this regards. 2.An ability to understand special installations in buildings such as electrical, air conditioning, heating & mechanical ventilation & related practices. 3.An ability to understand specifications & usage of mechanical installations like lifts, security systems etc. & special features required as per need. 4.An ability to understand causes of fires in buildings & their preventive and protective strategies
Mapped Program Outcomes:a ,c, f ,h, i, j, k	

UNIT – 1 :

Lighting: Day lighting, Fenestration, Daylight Factor.
Ventilation: Functions of ventilation, supply of fresh air, convective cooling, Stack effect, physiological cooling, provision for air movement; wind effect, Air flow through buildings, cross-ventilation, position and size of openings, air flow around buildings, humidity control.

[07 Hrs.]

UNIT – 2 :
Acoustics, Sound Insulation and Noise Control: Basic terminology and definitions, Physics of sound. Behaviour of sound in an enclosed space. Requisites for acoustic environment, Acoustic design approaches for different building types, with reference to applicable standards. Selection of acoustic materials. Noise and its control, control of structure borne sound and noise from different mechanical equipment.

[06 Hrs.]

UNIT – 3 :
Electrical and Allied Installations: Different types of wiring need of earthing, comparison between fuse and MCB, substation, types of lightening fixtures, electricity distribution in multistoried building. Building protection against lightening, Planning and layout of electrical installations within a building complex.

[07 Hrs.]

UNIT – 4 :
Air Conditioning, Heating and Mechanical Ventilation: Requirement of air conditioning, air conditioning system, elements of air conditioning, Working and Pressure-Enthalpy (heat) diagram of vapour compression cycle, refrigeration effect, Thermodynamics of human body.

[06 Hrs.]

UNIT – 5 :
Mechanical Equipment & Installation: Installation of lifts and escalators, different types of Security and alarm systems. Hot Water Provision (Solar and Electrical), Special features required for physically handicapped and elderly, Conveyors, Vibrators, Concrete mixers.

[07 Hrs.]

UNIT-6
Causes of fire in buildings: Planning considerations in buildings using non-combustible materials, staircases and lift lobbies, fire escapes, A.C. systems, Fire detection and fire fighting systems. Heat and smoke detectors, Fire alarm system, Automatic sprinklers.

[06 Hrs.]

V SEMESTER

CV1327	OE I – Building Services Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Building services, B.S. Patil, Orient Longman.
2. Building Services Engineering, Fred Hall, Roger Greeno, Butterworth-heinemann, 2007.
3. Building Services Engineering, David V. Chadderton, Taylor & Francis Group, 2007.

Reference Books:

1. E.R. Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G. Hopkinson and J.D.Kay, “The Lighting of buildings”, Faber and Faber, London, 1969.
4. William H. Severns and Julian R. Fellows, “Air-conditioning and Refrigeration”, John Wiley and Sons, London, 1988.
5. A.F.C. Sherratt, “Air-conditioning and Energy Conservation”, the Architectural Press, London, 1980.
6. National Building Code.

V SEMESTER

CV1329	OE I: Construction Techniques			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To study and understand the construction techniques applied to engineering construction for sub structure, super structure. 2. To study and understand the Safety in Construction Operations. 3. To study and understand the construction Equipment used in Engineering	1. An ability to understand the construction techniques to be used in the construction of building and 2. An ability to understand the demolition techniques, Importance of rehabilitation, Strengthening etc.
Mapped Program Outcomes: a, d , i ,k	

UNIT – I :

Introduction to Cement and Concrete: Introduction to types of cement, grade of cement, mortar, concrete mix design, mix proportion and specification. Ready mix concrete, transit mixer, pumped concrete, self-compacting concrete, porous concrete, light weight concrete, asphalt etc., use of ecofriendly materials in construction.

[07 Hrs.]

UNIT – II :

Construction Equipment: Introduction To Various Construction Equipment Earth moving Machinery, Concreting Equipment, Compacting Equipment, Material Handling Equipment And Transportation Equipment.

[06 Hrs.]

UNIT – III :

Type of structure: load bearing, Frame & Composite. Components of structure.

Sub Structure Construction: - Types Of Foundation and Footings, Foundation in Black Cotton Soil,Underground and Underwater Construction, Dewatering In Shallow and Deep Excavations Using Different Methods, Introduction to Shuttering and Scaffolding and Types.

[07 Hrs.]

UNIT – IV :

Super structure construction: Stone Masonary: Uses & Types, Brick Masonary: Uses & Types, Partitions, arches, lintels, stairs, introduction to formwork for various components of structure, pointing and plastering, roofs, painting, varnishing and distempering etc.

[06 Hrs.]

UNIT – V :

Importance of rehabilitation repairs and retrofitting as a part of construction engineering. Difference between the terms.

Strengthening of existing structures - repairs to overcome low member strength, deflection, cracking,chemical disruption, weathering, wear, fire, leakage, marine exposure, use of nondestructive testing techniques for evaluation, load testing of structure.

[07 Hrs.]

UNIT – VI :

Safety in Construction Operations– Types of hazard, safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety of scaffolding and working platforms. Safety while using electrical appliances. Explosives used.

[06 Hrs.]

Text Books.

1. M.S. Shetty, " Concrete Technology": S Chand & Co., 6th edition, S. Chand & Company, Limited, 2008
2. Rangwala, Building Construction, 32nd Edition,Charotar Publishing House Pvt. Ltd.2014

References Books :

Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication
1. Sankar, S.K. and Saraswati,S., Construction Technology, Oxford University Press, New Delhi, 2008
2. Sushil Kumar, Building Construction, 19th Edition, Standard Publisher Distributors 2001, New Delhi, 2001.
3. Elements of Civil Engineering: By S. S. Bhavikatti, Vikas Publishing House Pvt Limited, 2004
4. Basic Civil Engineering: By Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Firewall Media, 2003
5. SP 70 (2001): Handbook on Construction Safety Practices

V SEMESTER

CV1330	OE I: Transportation Engineering Basic			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose the students to various modes of transportation systems and their interrelation, planning aspects, design, construction and maintenance 2. To Understand purposes, location and planning of various facilities.	1. On completing the course, the students will have the ability to Plan and Design various civil Engineering aspects of Railways, Airports and Harbour.
Mapped Program Outcomes: a, b, c, e,h,l	

UNIT – 1 :
Railway transportation and its development, Various organizations, Long term operative plans for Indian Railways. Classification of Railway lines and their track standards, Railway terminology, Traction and tractive Resistance, different Types of Tractions.

[06 Hrs.]

UNIT – 2 :
Permanent Way: Alignment Surveys, Requirement, gauges, track section, Coning of wheels, Stresses in railway track, high speed track. Geometric design of railway track, Gauge, Gradient, speed, super elevation, cant deficiency, Negative super elevation, curves.

[07 Hrs.]

UNIT – 3 :
Airports development of Air Transportation in India: Airport site selection. Modern aircraft's. Airport obstructions: Zoning Laws, Imaginary surfaces, Approach and Turning zone, clear zone, Windrose diagram, cross wind component.

[06 Hrs.]

UNIT – 4 :
Runway Orientation and configuration. Basic runway length and corrections, runway geometric design standards. Taxiway Layout and geometric design standards. Taxiway and other areas. Air traffic control: Need, Network, control aids, Instrumental landing systems.

[07 Hrs.]

UNIT – 5 :
Definition of Terms - Harbours, Ports, Docks, Tides and Waves, Littoral Drift, Sounding, Area, Depth, Satellite Ports - Requirements and Classification of Harbours - Site Selection & Selection Investigation – Speed of water, Dredging, Range of Tides, Waves and Tidal Currents, Littoral Transport with Erosion and Deposition,

[06 Hrs.]

UNIT – 6 :
Winds & Storms, Position and Size of Shoals - Shore Considerations- Proximity to Towns/Cities, Utilities, Construction Materials, Coast Lines - Dry and Wet Docks, Planning and Layouts - Entrance, Position of Light Houses, Navigating - Terminal Facilities – Port Buildings, Warehouse, Transit Sheds, Inter-modal Transfer Facilities, Mooring Accessories.

[07 Hrs.]

Text Books:
1. Railway Engineering, Saxena;, Dhanpat Rai Publication.
2. Airport Planning & Design, Goyal & Praveen Kumar, Galgotia Publication
3. Harbour, Dock And Tunnel Engineering, R. Srinivasan, Charotar publishing house.
4. Rangwala, Railway Engineering, Charotar Publishing House, 1995.
5. Rangwala, Airport Engineering, Charotar Publishing House, 1996.
6. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013.

Reference Books:
1. Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi
2. Planning and Design of Airports, Robert Horonjeff, Francis Mckelvey, William Sproule, Seth Young, Fifth Edition 2010, McGraw Hill Professionals

V SEMESTER

CV1331	Reinforced Concrete Structures			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To impart comprehensive knowledge on the design of reinforced concrete structural elements such as beams, columns, slabs and footings. 2. To bring about an understanding of the behavior of reinforced concrete. 3. To bring about an understanding of the design philosophies of RCC structures. 4. To introduce the Prestressed concrete.	1. An ability to understand the structural properties of steel and concrete and their applications in structural planning and design of various components of buildings. 2. An ability to understand the basic methods of structural design of RCC. 3. An ability to understand design and detailing of RCC structural elements required for building. 4. An ability to understand the concept and application of prestressed concrete
Mapped Program Outcomes a, b, c, e, k, l, m	

UNIT – 1 :
Properties of different grades of concrete and steel, Permissible stresses, load factors, Structural planning & understanding the behavior of R.C.C. members. Load distribution of frame structure for beam, Slabs, Column, and footing. Methods of frame analysis (brief introduction). Introduction to IS 456-2000, SP: 34, SP: 16 and specification for beam, slab, column.
Drawing in sketchbook about structural planning of building.

[09 Hrs.]

UNIT – 2 :
Working stress method: Behavior of beam under flexure, Stress distribution diagram, Basic concept in design for flexure, assumptions, design constant, analysis of rectangular sections, balanced, under reinforced section & over reinforced sections.
Limit state method : Characteristic values, partial safety factor, stress strain relationship, stress block parameters, failure criteria. Limit state of collapse in flexure, basic assumptions.
Drawing in sketchbook about stress-strain curve of steel and concrete, stress diagram and stress block

[09 Hrs.]

UNIT – 3 :
Analysis and design of singly reinforced rectangular section, under reinforced section & balanced section. Analysis and design of doubly reinforced rectangular section, Analysis and design of T & L beam for flexure.
Drawing in sketchbook about structural detailing of different types of beam.

[08 Hrs.]

UNIT – 4 :
Limit state of serviceability, deflection control of beam and slab.
Design for Shear and Bond.
Design of one way, two way, cantilever & staircase slabs.
Drawing in sketchbook about stirrups, zoning and detailing about one way, two way and cantilever slab.

[09 Hrs.]

UNIT – 5 :
Limit state of collapse in compression; basic assumptions.
Analysis and design of columns subjected to axial load, and uni-axial & biaxial moments.
Design of isolated footing for column subjected to axial loads.
Drawing in sketchbook about columns and footing.

[09 Hrs.]

UNIT – 6 :
Design of rectangular combined footing.
Introduction to under-reamed pile foundation.
Introduction to Prestressed Concrete(Basic Concept, Types of Prestressing, Advantages and limitations of Prestressing, Pre-tensioning Systems and Devices. Prestressing Steel, Forms of Prestressing Steel, Types and properties of Prestressing Steel, Codal Provisions.)
Drawing in sketchbook about combined footing, piles and prestressed concrete.

[08 Hrs.]

V SEMESTER

CV1331	Reinforced Concrete Structures			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 Hours**

Text Books:

1. P.C. Vergese, Limit State Design of Reinforced Concrete, Prentice Hall Publishers, 2nd edition, 2008
2. Shah and Karve, Reinforced Concrete Structures, Structures Publishers, Pune, 5th edition, 2015.
3. Sinha S.N, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007
4. Ashok K. Jain, Reinforced Concrete – Limit State Design, Nem chand and Brothers, 7th edition,2012

Reference Books:

1. P.C. Varghese, Advanced Design of Structures, Prentice Hall Publishers,2009
2. Punmia B.C., Jain A.K., Jain A.K, Reinforced Concrete Structures (Vol-I), Laxmi Publications Pvt Ltd, New Delhi, 2007
3. N. Krishana Raju, Prestressed Concrete, Tata McGraw Hill Publishing Company Limited, New Delhi, 5th edition 2012

VI SEMESTER

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1:Introduction to Economics and Consumers' Behaviors:

Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs

Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price

Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

UNIT-4: National income accounting:

Concepts of GDP and GNP,Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

UNIT-5: Money, Banking and Public Finance

Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

VI SEMESTER

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher,2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

VI SEMESTER

CV1310	Fluid Mechanics – II			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1.To understand the concept of boundary layer theory and shear stress and velocity distribution in a pipe flow. 2. To understand the concept pipe flow and water distribution network analysis. 3. To understand the design of economical section of various channels, concept of uniform flow and critical flow in an open channel. 4. To understand the concept of various water surface profiles in non-uniform flows. 5. To understand the hydraulic jump and its importance in the field. 6. To understand the concept of model and variousmodel laws.	1.An ability to understand boundary layer theory and fluid flow around immersed bodies. An ability to understand different concepts in pipe flow, water distribution network analysis in field. 2.An ability to understand different concepts in pipe flow, water distribution network analysis in field 3.An ability to understand uniform flow and carry out design of economical section of channels for practical or field problems 4.An ability to understand the GVF profile in open channel flow. 5.An ability to understand the practical application of hydraulic jump. 6.An ability to understand model laws and apply in design of model and prototype
Mapped Program Outcomes: a,c,e, k	

UNIT – 1 :
Boundary layer theory: Laminar, Transition and Turbulent flows, Reynolds experiment, Critical Reynolds number, flow of viscous fluid in circular pipes, Velocity and shear stress distribution, maximum velocity, average velocity, Drop of pressure, Hagen – Poiseuille equation.

[09 Hrs.]

UNIT – 2 :
Flow Through Pipes: Hydrodynamically smooth and rough surfaces, Frictional resistance to flow of fluid, loss of energy in pipe, Darcy-Weisbach & Hazen William's equation for frictional head loss, Hydraulic gradient and energy gradient lines: Pipes in series and parallel, equivalent pipe, Siphon , Branched pipes, Hardy – Cross method for pipe networks, Water hammer pressure.

[08 Hrs.]

UNIT – 3 :
Flow Through Open Channel: Types of channel and their geometrical properties, Types of flow in open channel. Chezy's and Manning's equations for computations of normal depth of flow, conveyance of channel, section factor for uniform flow, Hydraulically most efficient rectangular, triangular, trapezoidal and circular sections.

[09 Hrs.]

UNIT – 4 :
Critical Flow and Rapidly Varied Flow: Specific energy and specific energy diagram, alternate depths, Computations of critical depth, section factor for critical flow, Conditions of critical flow, Definition of hydraulic jump, Classifications of jump, Belanger's equation for classical hydraulic jump, Expression for depth of hydraulic jump in terms of upstream Froude number, Length and height of jump, Energy loss in hydraulic jump.

[08 Hrs.]

UNIT – 5 :
Gradually Varied Flow: Mild, Steep, critical, Horizontal and Adverse slopes, Dynamic equation for GVF, Classification and characteristics of surface profiles, Direct Step method of computing profile length.

[09 Hrs.]

UNIT – 6 :
Hydraulic similitude and model investigation : Dimensionless numbers and their significance, Model investigation, similitude-types of similarities i.e. Geometric, Kinematics and Dynamic, Force ratio, model laws, types of model, merits and limitations of distorted and undistorted model, scale effect in models, application of dynamic similarity to specific model investigations: submerged objects, partial submerged objects. Introduction to hydraulic Machines.

[09 Hrs.]

VI SEMESTER

CV1310	Fluid Mechanics – II			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	**15**	**10**	**60**	**100**		**3 Hours**

Text Books:

1. Asawa, G.L, Fluid Flow in Pipes and Channels, CBS Publishers and Distributers.
2. Gupta, Vijay & Gupta, S.K., Fluid Mechanics, New Age International Publishers.
3. Modi & Seth, Fluid mechanics and Machineries, Standard Book House, Delhi.
4. Subramanya K., Theory and application of Fluid mechanics including Hydraulic machines, Tata McGraw-Hill publishing company ltd. New Delhi.
5. Van Te Chow, Open Channel Hydraulics, The Blackburn Press.
6. Streeter V.L., Wylie E.B., and Bedford K.W, Fluid mechanics, McGraw-Hill.
7. Flow through open channels by Ranga Raju K.G.Tata McGraw Hill.

Reference Books:

1. White, F.M, Fluid Mechanics, McGraw-Hill.
2. Fox R.W., McDonald A.T, Introduction to Fluid Mechanics, John Wiley & Sons.
3. Ramamrutham S, Hydraulics fluid mechanics & Fluid machines, Dhanpat Rai publishing company (P) ltd. New Delhi.
4. B. S. Massey, Mechanics of Fluids, Springer 6th edition.
5. Richard H. French, Open Channel Hydraulics, Water Resources Publication.

VI SEMESTER

CV1311	Lab: Fluid Mechanics – II			L=0	T=0	P=2	CREDITS = 1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	--	40	60		100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand the flow around immersed bodies. 2. To study the various types of flow, major and minor losses in pipes. 3. To understand the analysis of water distribution pipe network 4. To study the various flows in channel 5. To study the various hydraulic machines.	1. An ability to determine the forces around the submerged bodies. 2. An ability to carry out the head loss in pipes for design of pipe network. 3. An ability to carry out analysis of water distribution network. 4. An ability to determine velocity and sketch various profiles, back water length, hydraulic jump, roughness, concept of specific energy in open channels. 5. An ability to determine the performance of hydraulic machines.
Mapped Program Outcomes: a, b, c, e ,g,h	

Practicals:

Minimum **TEN** Experiments from the following will be performed:

1. Study of flow around immersed bodies.
2. Determination of Darcy – Weisbach friction factor for given pipes.
3. Study of status of flow using Reynolds Apparatus.
4. Determination of Manning's or Chezy's constant for uniform flow in an open channel.
5. Study of hydraulic jump in a horizontal rectangular channel.
6. Development of specific energy diagram for rectangular channel.
7. Study of flow over horizontal contraction.
8. Determination of minor losses in pipes.
9. Determination of velocity in open channels flow by using current meter.
10. Design problems of pipe network analysis.
11. Sketch the various standard profiles in open channels flow
12. Sketch the various profiles in open channels flow by considering break in grade.
13. Computation of water surface length in open channel by using direct step method.
14. Study of performance of centrifugal pump.
15. Study of performance of pelton wheel turbine

Reference Books:

1. Laboratory work in Hydraulic Engineering, 2006, Asawa, G.L., New Age International Publishers.

VI SEMESTER

CV1332	Steel Structures			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the behavior and design of Structural steel components. 2. To study the fundamental design philosophies of steel structures. 3. To study the codal provision for design of steel structure. 4. To study the design of built-up section and column bases.	1. 1.An ability to understand effect of forces and its impact on structure 2. An ability to identify the type of structure and its design methodology 3. An ability to utilize the application of Indian Standard code for design purpose. 4. An ability to design the simple, built up section and column bases.
Mapped Program Outcomes: **a, c, e, i, k, l, m**	

UNIT – 1 :
Steel as a Structural Material: Physical and mechanical properties of Structural Steel, Merits and Demerits of Steel as a Structural Material, Grades of Structural Steel, Structural Steel Sections, Introduction to Indian Standards: IS 800:1984, IS 800:2007, Method of Design: Introduction to Working Stress Method, Introduction to Limit State Method. Drawing in sketchbook about different sections used.

[08 Hrs.]

UNIT – 2 :
Connection: Types and Failure of Connections, Simple Riveted Connection, Bolted Connection, Simple Welded Connection, Strength and Efficiency of Joint. Drawing in sketchbook about various connections

[09 Hrs.]

UNIT – 3 :
Tension Member: Types of Tension Member, Stresses , Design of axially loaded Tension Member
Compression Member: Effective length, Slenderness ratio, Built-up sections, Design of axially loaded Compression Member

[09 Hrs.]

UNIT – 4 :
Design of Beam: Types of Beams, Lateral Stability of beams, Types of section, Stresses on Beam, Design of Laterally Supported Beam, Design of Laterally Unsupported Beam, Built-up Beams. Drawing in sketchbook about built-up beam.

[08 Hrs.]

UNIT – 5 :
Column: Design of Axially loaded columns, Design of Laced and Battened Columns (Design of Built-up Columns) with Bolted and Welded End Connection. Drawing in sketchbook about built-up column

[09 Hrs.]

UNIT – 6 :
Column Bases and Footing: Types of Column Bases, Slab Base, Gusset Base, Foundation Bolt, Grillage Footing, Design of Slab Base and Gusseted Base. Drawing in sketchbook about column bases and footing.

[09 Hrs.]

Text Books:
1. Fundamentals of Structural Steel Design, By M. L. Gambhir, Mc Graw Hill Education, 2013
2. Design of Steel Structures, By N. Subramanian, OXFORD University Press, First Edition, 2008
3. Limit State Design of Steel Structures, By S. K. Duggal, Mc Graw Hill Education Private Limited, 2011

Reference Books:
1. Design of Steel Structures, LSM, By S. S. Bhavikatti, I. K. International Publication House Pvt. Ltd. 2009
2. Structural Steel Design, By Jack C. McCormac), Stephen F. Csernak, 5th Edition Pearson Education Limited, 2013

VI SEMESTER

CV1333	Geotechnical Engineering –II			L= 4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students with basic understanding of geotechnical site investigation. 2. To understand the bearing capacity of soil & factors governing choice of foundation. 3. To understand the lateral earth pressure. 4. To study stability of sloyes. 5. To familiarize different methods of ground improvement.	1. An ability to understand & apply the fundamentals of earth pressure to earth retaining structure. 2. An ability to understand & apply knowledge of stability of slopes and ground improvement techniques 3. An ability to comprehend and utilize the geotechnical literature to establish the framework for foundation design. 4. An ability to plan and implement a site investigation including collection of soil sample for testing and observation of soil behavior and obtain necessary design parameter. 5. An ability to develop good technical reporting and data presentation skills
Mapped Program Outcomes: a, b, c, d, e, f, k	

UNIT – 1 :

GEOTECHNICAL EXPLORATION : Importance and objectives of field exploration, principal methods of subsurface exploration, open pits & shafts, types of boring, number, spacing and depth of boring for different structures, type of soil samples & samplers, collection & shipment of samples, bore logs and sampling record,

[08 Hrs.]

UNIT – 2 :

SHALLOW FOUNDATIONS:

Bearing capacity of soils (IS: 6403), types of shear failure in foundation soil, Terzaghi's theory, its validity and limitations, bearing capacity factors, effect of water table on bearing capacity, effect of water table on bearing capacity, correction factors for shape and depth of footings, Standard Penetration Test, corrections to N –values & correlation for obtaining design soil parameters, bearing capacity estimation from N-values.

Settlement Analysis of footings and Rafts: Causes of settlement, computation of elastic and consolidation settlement (IS-8009: Part I), differential settlement, control of excessive settlement, proportioning the footing for equal settlement, plate load test: procedure, interpretation for bearing capacity and settlement prediction.

[09 Hrs.]

UNIT – 3 :

PILE FOUNDATION: Classification and types of piles, constructional features of cast–in–situ &pre-cast concrete piles, pile driving methods, effect of pile driving on ground, load transfer mechanism of axially loaded piles. Pile capacity by Static formula & Dynamic formula, pile load test and interpretation of data, group action in piles, spacing of piles in groups, group efficiency, overlapping of stresses, settlement of pile group by simple approach, negative skin friction and its effect on pile capacity, general feature of under reamed piles, Introduction to well foundations, caissons and coffer dams.

[08 Hrs.]

UNIT – 4 :

LATERAL EARTH PRESSURE :Fundamentals of earth pressure at-rest, active & passive pressures, general & local states of plastic equilibrium in soil, Rankine's and Coulomb's theories of earth pressure, effects of soil type, surcharge, submergence, graphical solutions of Rebhan and Culmann for active case.

[09 Hrs.]

UNIT – 5 :

STABILITY OF SLOPES : Causes and types of slope failure, stability analysis of infinite slopes and finite slopes, effect of seepage, location of critical slip circle, method of slices for cohesive and C - Ø soil slopes, pore pressure considerations, Taylor's stability numbers & stability charts, methods of improving stability of slopes.

[09 Hrs.]

UNIT – 6 :

GROUND IMPROVEMENT : Method of soil stabilization – mechanical stabilization & chemical stabilization, use of admixtures (lime, cement, flyash) in stabilization, basic concepts of reinforced earth - use of geosynthetic materials-salient features, function and applications of various geosynthetic materials, deep compaction by impact, vibroflotation, pre-consolidation techniques by band drain installation, pre-loading and surcharging.

[09 Hrs.]

VI SEMESTER

CV1333	Geotechnical Engineering –II			L= 4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering,1988, Kaniraj R.,McGraw Hills, New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan, Meerut.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C, Prentice Hall & Co., New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian Standards.

VI SEMESTER

CV1315	PE I : Water Treatment			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand the layout of water treatment plant and its various units. 2. Understand the principle of working of each unit and its design. 3. Understand various water treatment processes for different quality requirements	1. An ability to understand importance of water treatment 2. An ability to analyse available data and design a water treatment unit.
Mapped Program Outcomes: b, c, e, h	

UNIT – 1 :
Introduction: Water treatment objectives, Water quality standards and regulations, Health and aesthetic aspects of water quality. Unit processes and unit operations. Site selection, synthesis of treatment flow sheet.
Aeration: Objectives, Principles, Various methods, Design of aerators.
[06 Hrs.]

UNIT – 2 :
Coagulation: History, need of coagulation, chemistry of coagulation, various coagulants used in the process, factors affecting efficiency of coagulation process. Operation of feeders. Type of rapid mixing devices, design of flash mixer
Flocculation: Theory of flocculation, slow mixing devices.
[07 Hrs.]

UNIT – 3 :
Sedimentation: Principle, Stoke's law, working of ideal sedimentation tank, Types of sedimentation tanks, design of rectangular sedimentation tank, working and design of clariflocculator. Operational problems in sedimentation tanks.
[06 Hrs.]

UNIT – 4 :
Filtration: Theory of filtration, Types of filters, Slow and rapid sand filters, Operation of rapid sand filters, Operational difficulties, Design of rapid sand filter.
[07 Hrs.]

UNIT – 5 :
Disinfection: History, Various methods of disinfection, Chemical disinfections, Kinetics of chemical disinfection, Chlorination, Chemistry of chlorination, Methods of chlorination.
[06 Hrs.]

UNIT – 6 :
Adsorption: Theory, Granular and powder activated carbon, Performance and reactivation. Adsorption of organic compounds. Deflouridation, Ion Exchange, Materials and reactions, Kinetics, Applications.
[07 Hrs.]

Text Books :
1. P.N. Modi, Water Supply and treatment, Standard Book House.
2. CPHEEO Manual on Water Supply and Treatment.

Reference Books :
1. Fair, Geyer and Okun, Water and wastewater engineering Vol. 2, John Wiley and Sons, New York
2. Franklin Burton, Stensel, Waste Water Engineering, Tata Mc Graw Hill.
3. Dr. B.C. Punmia, Waste Water Engineering, Firewall Media.

VI SEMESTER

CV1316	PE I : Prestressed Concrete			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the basic concepts of Prestressed concrete. 2. To understand the various devices used for prestressing. 3. To understand methods of analysis of Prestressed concrete structural element.	1.An ability to understand the basic concepts of prestressed concrete structures. 2.An ability to analyse the presstressed concrete structural elements. 3.An ability to design theprestressed concrete structural elements. 4.An ability to exercise the limit state of serviceability to prestressed concrete members.
Mapped Program Outcomes:a,b,c,e,k,l	

UNIT – 1 :

Introduction: Basic Concept, Types of Prestressing, Advantages and limitations of Prestressing, Pre-tensioning Systems and Devices. Post tensioning systems.

Prestressing Steel, Forms of Prestressing Steel, Types and properties of Prestressing Steel, Codal Provisions.

Losses in Prestress: Elastic Shortening, Friction, Anchorage Slip, Force Variation Diagram, Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Total Time-dependent Loss.

[06 Hrs.]

UNIT – 2 :

Analysis at Transfer, Service, Ultimate Strength, Cracking Moment, Kern Point, Pressure Line Analysis for Ultimate Strength Variation of Stress in Steel, Condition at Limit State, Analysis of a Rectangular Section,

Design of Members, Design of Sections for Axial Tension, Design for Type 1 and type 2 Members, Determination of Limiting Zone, Post-tensioning in Stages, Design of Sections for Flexure.

[07 Hrs.]

UNIT – 3 :

Analysis for Shear, Stress in an Uncracked Beam, Types of Cracks, Components of Shear Resistance, Modes of Failure, Effect of Prestressing Force, Limit State of Collapse for Shear, Design of Transverse Reinforcement, Modes of Failure, Effect of Prestressing Force, Design of Longitudinal Reinforcement, Design of Transverse Reinforcement.

[07 Hrs.]

UNIT – 4 :

Deflection due to Gravity Loads, Prestressing Force, Total Deflection, Limits of Deflection, Limits of Span-to-effective Depth Ratio, Calculation of Crack Width, Limits of Crack Width

Transmission of Prestress in Pre-tensioned and Post-tensioned Members.

[06 Hrs.]

UNIT – 5 :

Cantilever Beams, Analysis, Determination of Limiting Zone, Cable Profile.

[07 Hrs.]

UNIT – 6 :

Principle of Linear Transformation, Concordant Tendon Profile, Tendon Profiles, Partially Continuous Beams, Analysis for Ultimate Strength, Moment Redistribution.

[06 Hrs.]

Text Books:

1. N. Krishana Raju, Prestressed Concrete, Tata McGraw Hill Publishing Company Limited, New Delhi.5th edition, 2012
2. N. Rajagopalan, Prestressed Concrete, Alpha Science International, 2nd edition 2005
3. Dayaratnam P, Prestressed Concrete, Oxford & IBH, 5th edition 2014

Reference Books:

1. Lin T.Y., Design of Prestressed Concrete structures, John Wiley & Son's, 3rd edition,1904
2. Edward G. Nawy, Prestressed Concrete, Pearson Education Limited, 5th edition 2005.

VI SEMESTER

CV1317	PE I: Building Services			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand basic concepts of building services. 2. Understand various aspects of natural light and ventilation. 3. Understand various methods of acoustics and sound insulation. 4. Understand various equipments and installations used in building services	1. An ability to understand relivance of services related to lighting, ventilation & acoustics & understand the methodologies, materials & equipments in this regards. 2. An ability to understand special installations in buildings such as electrical, air conditioning, heating & mechanical ventilation & related practices. 3. An ability to understand specifications & usage of mechanical installations like lifts, security systems etc & special features required as per need. 4. An ability to understand facilities necessary for physically handicapped and aged people.
Mapped Program Outcomes: e, f, h, j	

UNIT – 1:
Lighting: Day lighting, Fenestration, Daylight Factor.
Advanced Daylight System: Sun tracking, day lighting system with Fresnell Collector.
Ventilation: Functions of ventilation, supply of fresh air, convective cooling, Stack effect, physiological cooling, provision for air movement; wind effect, Air flow through buildings, cross-ventilation, position and size of openings, air flow around buildings, humidity control.

[07 Hrs.]

UNIT – 2 :
Acoustics, Sound Insulation and Noise Control:
Basic terminology and definitions, Physics of sound. Behaviour of sound in an enclosed space. Requisites for acoustic environment,Acoustic design approaches for different building types with reference to applicable standards. Selection of acoustic materials, construction details and fixing. Noise and its control, control of structure borne sound and noise from different mechanical equipment.

[06 Hrs.]

UNIT – 3 :
Electrical and Allied Installations:
Different types of wiring, need of earthing, comparison between fuse and MCB, substation, types of lightening fixtures, sources for artificial illumination, power received and supplied in single storey buildings, electricity distribution in multistoried buildings. Building protection against lightening,
Calculation of luminaries required and their layout. Planning and layout of electrical installations within a building.

[07 Hrs.]

UNIT – 4 :
Air Conditioning, Heating and Mechanical Ventilation:
Requirement of air conditioning, air conditioning system, elements of air conditioning, load estimation, Working and Pressure-Enthalpy (heat) diagram of vapour compression cycle, refrigeration effect. Thermodynamics of human body, psychometric properties and process, Psychometric chart.

[06 Hrs.]

UNIT – 5 :
Mechanical Equipment & Installation: Installation of lifts and escalators, different types of Security and alarm systems, Fire detection and fire fighting systems.

[07 Hrs.]

UNIT – 6 :
Intelligent building, green building, smart concrete, smart materials. Facilities for aged and physically handicapped people.

[06 Hrs.]

VI SEMESTER

CV1317	PE I : Building Services			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. B.S. Patil, Building services, Orient Longman.
2. Fred Hall, Roger Greeno, Building Services Engineering, Butterworth-heinemann.
3. David V. Chadderton, Building Services Engineering, Taylor & Francis Group.

Reference Books:

1. E.R. Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G. Hopkinson and J.D.Kay, “The Lighting of buildings”, Faber and Faber, London, 1969.

VI SEMESTER

CV1323	PE I : Pavement Design			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
To understand 1. Different types of pavement design parameters for flexible and rigid pavements. 2. To establish pavement material characterization. 3. Analysis of flexible and rigid pavements. 4. Design of the flexible and rigid pavements by different methods for Highway and Airfields pavement. 5. Pavement testing and evaluation 6. Strengthening of the pavement, maintenance and rehabilitation	1. An ability to understand different design parameters for flexible and rigid pavements. 2. An ability to analysis flexible and rigid pavements. 3. An ability to design flexible and rigid pavements by different methods for Highways and Airfields 4. An ability to understand testing and evaluation of Pavement. 5. An ability to understand the techniques for strengthening of the pavement 6. An ability to understand cost evaluation and comparative study of pavements
Mapped Program Outcomes: a, b, c, f, j, k,	

UNIT – 1 :
Need and importance of pavement. Various types of pavement: Flexible, semi flexible and rigid pavements, composite pavement, Ultrathin thin white topping, Perpetual pavement. Characteristics of highway and airfield pavements.
Design Parameters: Standard Axle load, wheel assemblies for road vehicles, under carriage system for aircraft, Type and contact pressure, contact area imprints, Computations of ESWL for flexible and rigid pavements. Load repetitions and distribution of traffic for heavy and airfield pavement.

[06 Hrs.]

UNIT -2:
Materials Characteristics:
AASHO subgrade soil classification, CBR, North Dakota cone bearing value, plate load test for K, Marshal's method of Bituminous mix design, poison's ratio & coefficient of thermal expansion of concrete, layer equivalent concepts. Mechanistic Design Approach.
Analysis of Flexible and Rigid Pavements:
Stress, strain, deflection analysis for single, two, three and multi layered flexible pavement systems, stress and deflections for rigid pavements due to load and temperature, influence charts, ultimate load analysis, joints.

[07 Hrs.]

UNIT – 3 :
Specifications:
Review of IRC/MOST/ICAO/IAAI specification and standard for highway and airfield constructions. Analysis of Rigid Pavements, highway and airfield.

[06 Hrs.]

UNIT – 4 :
Highway Pavement Design:
Flexible: North Dakota cone, CBR, IRC-37, Brumister, TriaxialTest method, AASHO method of design.
Rigid : IRC 58, PCA, AASHO methods of design, Design of joints and reinforcement.
Cost Estimates: Cost evaluation and comparative study.

[07 Hrs.]

UNIT – 5 :
Airfield Pavement Design:
Flexible: US Corps of Engineering, CBR, FAA, Mcload
Rigid: PCA, FAA & LCN, ultimate load analysis, yield line pattern method.
Cost Estimates: Cost evaluation and comparative study.

[06 Hrs.]

UNIT – 6 :
Pavement Management System:
Systems management, case studies of highway and Airfield pavement projects.
Pavement testing and Evaluation: Field CBR test, plate load Test, Condition surveys and international roughness Index (IRI), rut depth, profilometers, Bump integrator, Benkalman Beam Deflection study.

VI SEMESTER

CV1323	PE I : Pavement Design			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Strengthening of Pavements:
Design of flexible, composite and rigid overlay design for flexible and rigid pavements, repairs, maintenance and rehabilitation of pavements. **[07 Hrs.]**

Text Books:
1. Pavement Design by R. Srinivasa Kumar
2. Principles And Practices Of Highway Engineering: (Including Expressways And Airport Engineering) by L. R. Kadiyali), N.B. Lal
3. N. J. Garber and L. A. Hoel, Traffic and Highway Engineering, Thomson Learning, Inc., 2002.
4. E. J. Yoder and M. W. Witczak, Principles of Pavement Design, John Willey, Inc., 1975.
5. F. L. Roberts, P. S. Kandhal, E. R. Brown, DY Lee, and T. W.Kennedy, Hot

References Books:
1. Association of State Highway and Transportation Officials (AASHTO) Specifications and Guides, 2002. Y. H. Huang, Pavement Analysis and Design, Prentice Hall, 1993.
2. Mix Asphalt Materials, Mixture Design and Construction, 2ndEdition, NAPA Research and Education Foundation, 1996.
3. R. Horonjeff and F. X. Mckelvey, Planning and Design of Airports, McGraw Hill, Inc., 4thEdition, 1994.
4. The Asphalt Institute (AI) Superpave Series No. 2 (SP 2), Superpave Mix Design, 1996.
5. The AI Manual Series No. 2 (MS 2), Mix Design Methods for Asphalt Concrete and Other Hot Mix Types, 1996.
6. The AI Manual Series No. 4 (MS 4), The Asphalt Handbook, 1989 Edition.

VI SEMESTER

CV1324	**PE I - Geotechnical Investigation & Ground Improvement Techniques**			**L= 3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	**15**	**10**	**60**	**100**		**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study important methods of soil exploration and interpretation of the results. 2. Understanding the methods of ground improvement. 3. Understand the use of geosynthetic materials.	udents will be able to understand 2. Various methods of soil exploration and interpretation of the results. 3. Various methods of ground improvement. 4. The use of geosynthetic materials in construction.
Mapped Program Outcomes: a, c, e, h, l,	

UNIT – 1 :

Importance and objectives of Geotechnical exploration: Planning of geotechnical exploration program: Methods of boring, location, number of boreholes, depth of boring. Sub-surface Investigation Report: Salient features and boring logs; Types of soil samplers& their suitability, precautions in sampling, preservation & shipment of samplers. Seismic refraction method, electrical resistivity method, qualitative and quantitative interpretation of test results.

[07 Hrs.]

UNIT – 2 :

Field investigations: Standard Penetration Test, static cone and dynamic cone penetration tests, interpretation of test results for obtaining design soil parameters for cohesive and cohesion less soils, Plate load test– purpose, procedure, interpretation for bearing capacity and settlement of foundation. Field vane shear test, design value of un-drained shear strength of clays, correction factor, pressure meter tests.

[06 Hrs.]

UNIT – 3 :

Introduction to ground improvement techniques - Need forground improvement, various ground improvement techniques, economic considerations and suitability. Grouting: Materials and methods of grouting, grout volume and grouting pressure, grout requirements and tests. Stone Column: Application, layout feature, procedures of installation, rammed & floated columns, quality control in construction, methods of improving the effectiveness of stone columns, skirted and cemented stone column techniques, geosynthetic encased stone columns.

[06 Hrs.]

UNIT – 4 :

Reinforced soil and Geo-synthetics: Basic theory of reinforced soil, concept of reinforced soil wall and reinforced slope, geo-synthetic types: applications in Civil Engineering, Applications of Geofoam & Geocell.

[07 Hrs.]

UNIT – 5 :

Ground Anchor and Soil Nailing: Concept, Design features, types, construction procedure, Functions, Applications, Advantages. Limitations of soil nailing system and ground anchors.

[07 Hrs.]

UNIT-6

Diaphragm wall: Construction sequence, cement slurry wall, Design features, Functions, applications, Case study on Diaphragm wall. Deep soil mixing.

[06 Hrs.]

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VI SEMESTER

CV1341	OE II: Elements of Earthquake Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study geology of earth and interior. 2. To study causes of earthquakes and its characteristics. 3. To study behavior of different types of structures under earthquake loading. 4. To study about disaster management, mitigation and different retrofitting techniques.	1. An ability to understand the the necessity and importance of earthquake engineering 2. An ability to understand the provision of IS code used for earthquake resistance design of structure 3. An ability to understand provision for earthquake resistance design of structures as per Indian standard 4. An ability to study of damages caused due to past earthquake in & outside India and remedial measures
Mapped Program Outcomes: a, c, e, l, m,	

UNIT – 1 :
Introduction to earthquakes:
Geology of earth, configuration of tectonic plates in a globe, behavior of plates, their motion and effects, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity, Seismic waves.
[07 Hrs.]

UNIT – 2 :
Analysis and interpretation of earthquake data, determination of magnitude, location of epicenter, focal depth.
[06 Hrs.]

UNIT – 3 :
Recording earthquakes, seismicity of the world, history of earthquakes in India and abroad, case studies of effects of earthquakes, causes and sources of earthquake damage.
[06 Hrs.]

UNIT – 4 :
Non-engineered earthquake resistant structures, load bearing structures, masonry structures, seismic zoning of India (IS 1893:2002 Part I), seismic coefficients for different zones, definitions, irregularities in buildings, consequences of irregularities.
[07 Hrs.]

UNIT – 5 :
Strengthening, rehabilitation and retrofitting of earthquake damaged structures.
[06 Hrs.]

UNIT – 6 :
Earthquake disaster management, mitigation and social aspects, lessons from past earthquake: - study of damages caused due to past earthquake in & outside India and remedial measures.
[07 Hrs.]

Text Books :
1. Agrawal & Shrikhande, Design of Earthquake Resistant Structures, 3rd 2006, Prentice – Hall of India Pvt. Ltd.
2. Roberto Villaverde, Fundamental Concepts of Earthquake Engineering, 2009, CRC Press
3. Asadour H. Hadjian, Basic Elements of Earthquake Engineering, 2015, Wiley

Reference Books:
1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org / iaee / E_FrontCover.pdf, NICEE Guidelines for Earthquake Resistant Non-Engineered Construction, 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition

VI SEMESTER

CV1342	OE II: Air Pollution and Solid Waste Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To provide general understanding of air pollution, air pollutants, their sources & their effects 2. To provide knowledge about meteorological parameters, air sampling & measurement of pollutants. 3. To provide knowledge of air pollution controlling technologies, air pollution due to automobiles & general Idea of noise pollution. 4. To study importance of solid waste management by processing, treatment, disposal & reuse of solid waste.	1. An ability to understand the type, sources & effect of air pollutants 2. An ability to understand the parameters affecting air pollution and various methods of measurement and estimation of pollutants 3. An ability to understand basics of noise pollution 4. An ability to understand various air pollution control equipments & pollution caused due to automobile exhaust 5. An ability to understand the concepts of solid waste management.
Mapped Program Outcomes: a, d, e, h, j,	

UNIT – 1 :
Introduction to air pollution: Air pollution episodes, Atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials

[06 Hrs.]

UNIT – 2 :
Meteorological Aspects: Atmospheric stability, plume behaviour**,** Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.

[07 Hrs.]

UNIT – 3 :
Air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.

[06 Hrs.]

UNIT – 4 :
Introduction to solid waste management, sources, quantification and characterisation, classification and components, sampling and analysis, Method of collection

[07 Hrs.]

UNIT – 5 :
Equipment used for collection and transportation, transfer stations, solid waste processing and management.

[06 Hrs.]

UNIT – 6 :
Treatment and disposal methods: composting, sanitary landfills, Incineration – concept, components and applications, leachate management.

[07 Hrs.]

Text Books:
1. M.N. Rao & H.V.N. Rao, 1988, Air Pollution, Tata McGraw Hill Publishing Co. Ltd.
2. C.S. RAO, 2007, Environmental Pollution Control Engineering, New Age International, Wiley Estern Ltd. New Delhi.
3. Stern A. C., 1973, Air pollution, Academic Press.
4. A.D. Bhide & Sunderesan B.B., 1983, Solid Waste Management in Developing countries, INSDOC, New Delhi.
5. Tohobanoglous, 1993, Intgrated Solid Waste Management Engineering Principle and Management Issues, McGraw-Hill publication Ltd.
6. K. V. S. G. Murlikrishna, 1995, Air Pollution, Kaushal& Company.

Reference books:
1. P. Aarne Vesilind, William Worrell & Debra Reinhart, 2002, Solid Waste Engineering, Cengage Learning India pvt. Ltd.
2. Dr. Y Anjaneyulu, 2002, Air Pollution and Control Technologies, Allied Publisher pvt. Ltd.
3. Waste Management: A Reference Handbook. Contributors: Jacqueline Vaughn - Author. Publisher: ABC-Clio

VI SEMESTER

CV1343	**OE II: Introduction to Finite Element Method**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the student with knowledge and analysis skills in applying basic laws and steps used in solving the problem by finite element method. 2. To provide the student the knowledge of various interpolation functions and elements to solve simple problems by finite element method. 3. To provide the student with some knowledge in is parametric formulation. 4. To provide students the knowledge of mathematical modeling techniques.	1. An ability to apply the steps required for FEM solution to variety of physical systems. 2. An ability to create models for simple structures. 3. An ability to extend the knowledge of the application of FE to solve engineering problems.
Mapped Program Outcomes: a, d, e, k,	

UNIT – I :
Introduction: Development, Historical background, Applications, Advantages and Disadvantages of FEM, General steps of FEM, direct equilibrium approach, Variational approach , weighted residual approach, local and global FEM, application to simple problems.

[07 Hrs.]

UNIT – II :
Shape functions: Introduction, requirement of Ideal displacement functions, Derivation of shape functions using Cartesian Coordinates, Lagrange and Serendipity elements.

[06 Hrs.]

UNIT – III :
Application of FEM to 1D problems: Derivation of element property matrix and influence vector, application, Application to bar, truss, steady state heat conduction, steady state flow through porous medium problems.

[06 Hrs.]

UNIT – IV :
Application of FEM to 2D problems: Equilibrium equations, Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis.

[07 Hrs.]

UNIT – V :
Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.

[07 Hrs.]

UNIT – VI :
Numerical integration, Modeling, storage and solution techniques.

[06 Hrs.]

Text Books :
1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P. N. , . Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y. M., Eldho T. I. and Shah A. H., Finite Element Method s and Application to Engineerimg, Pearson , 2011.

Reference Books :
1. Krishnamoorthy C S, “Finite Element Analysis – Theory and Programming”, Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Cook R D, Malkus D S, Plesha M E and Witt R J, “Concepts and Applications of Finite Element Analysis”, John Weily & sons inc, New York, Fourth Edition, 2003.
3. Rajasekaran S, “Finite Element Analysis in Engineering Design”. S Chand & Co., 2003.

VI SEMESTER

CV1344	OE II: Disaster Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
rious objectives of the course will be 1. To understand the nature & types of disaster, 2. To understand role of different government & private agencies in disaster management 3. To understand disaster management cycle.	At the end of syllabus, students shall be able to 1. Understand the nature & types of disaster, 2. Understand its preparedness, role of different government & private agencies, act & other statute 3. Understand provisions, management of disaster, post disaster condition & its management.
Mapped Program Outcomes: a, b, d, e, f, g, k, l,	

UNIT – 1 :
Unit 1: Understanding Natural Disasters
natural disasters, which have been categorised as hydrological, wind-related, geo-physical, and climatic. Under each category, an attempt is made to discuss the causes and impacts, along with past illustrations and geographical distribution.
Flood, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic Eruptions, Heat and Cold Waves, Climate Change: Global Warming, Sea Level Rise, Ozone Depletion

[07 Hrs.]

Unit 2: Man-Made Disasters
Nuclear Disasters, Chemical Disasters, Biological Disasters, Building Fire, Coal Fire, Forest Fire, Oil Fire, Air Pollution, Water Pollution, Deforestation, Industrial Pollution, Road Accidents, Rail Accidents, Air Accidents, Sea Accidents

[06 Hrs.]

UNIT – 3 :
Risk & Cost Assessment:
Geographical conditions, Population, Living habits, Threats, Extent of damages to the lives, agricultural area, industrial units, Awareness & Safety Program. Relief arrangement & essential components, Shelters, Rescue & search tools &equipments, transport facilities. Cost assessment of each unit and funding.

[06 Hrs.]

Unit 4: DISASTER PREPAREDNESS
Disaster Preparedness: Concept and Nature, Disaster Preparedness Plan, Disaster Preparedness for People with Special Needs/Vulnerable Groups, Disaster Preparedness with Relevance to Housing, Infrastructure and Livestock, Community Based Disaster Preparedness Plan, Role of Information, Education, Communication, and Training, Disaster Preparedness: Role and Responsibilities of Central, State, District, and Local Administration, Role and Responsibilities of Armed Forces, Police, Para-military Forces, National Service Scheme and Scouts, Role and Responsibilities of International Agencies, Non-governmental Organisations, Community Based Organisations, Community, and Media
Information Technology: Role in Disaster Preparedness with Special Reference to Geographical Information System, Use and Application of Emerging Technologies in Disaster Preparedness

[07 Hrs.]

Unit 5: DISASTER RESPONSE
Disaster Response Plan, Communication, Participation, and Activation of Emergency Preparedness Plan, Logistics Management, Needs and Damage Assessment, Disaster Response: Central, State, District, and Local Administration, Armed Forces in Disaster Response, Police and Other Forces. Role of Multiple Stockholders in Disaster Response, Psychological Response, Trauma and Stress Management. Rumour and Panic Management, Minimum Standards of Relief, Managing Relief, Funding Relief, Recovery

[06 Hrs.]

VI SEMESTER

CV1344	OE II: Disaster Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

Unit 6: Reconstruction and Rehabilitation

Damage Assessment, Role of Various Agencies in Disaster Management and Development Information Management Structure, Parameters of Vulnerability, Development of Physical and Economic Infrastructure, Creation of Long-term Job Opportunities and Livelihood Options, Funding Arrangements for Reconstruction, Nature of Damage to Houses and Infrastructure due to Disasters, Disaster Resistant House Construction, Role of Housing/Building Authorities, Education and Awareness Role of Information Dissemination, Participative Rehabilitation Process: Some Case Studies Long-term Recovery.

[07 Hrs.]

Text Books:

1. Satish Modh: Introduction to Disaster Management, Macmillan, 2009
2. Amit Awasthy: Disaster Management: Warning Response and Community Relocation, Global India Publications, 2009
3. Jyoti Purohit :Disaster Management in India: Structure and Challenges, 2013
4. Prakash Singh: Disaster Response in India, www.MilitaryBookshop.Companyuk, 2011

Reference Books:

1. D.B.N. Murthy: Disaster Management: Text and Case Studies, Deep and Deep Publications, 2007
2. National Policy on Disaster Management, NDMA, New Delhi, 2009.
3. A Global Report - Reducing Disaster Risk, A Challenge for Development; UNDP Publication, 2004.
4. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.

VI SEMESTER

CV1345	OE II: Environmental Impact Assessment			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To provide students with an overview of the principles and current practices of environmental impact assessment (EIA). 2. To learn and understand process, and necessary techniques for environmental impact assessment, mitigation and monitoring. 3. To introduce students to the legal, economic, administrative and technical process of preparing and/or evaluating environmental impact documents. 4. To relate the uses of scientific research to practical situations in project planning and decision making. 5. To provide experience and training in environmental planning and related professions	At the end of the course, students will be able to 1. Understand the EIA process, analyse major environmental issues for development projects. 2. Monitor and model tasks within an EIA cycle. 3. Prepare portions of environmental documents through administrative and legal requirements and standards of professional practice. .
Mapped Program Outcomes: b, d, e, f, h	

UNIT – I :
Evolution of EIA: Concepts, Nature & Type of impacts, Need of EIA, Participation in EIA, New concepts- Life cycle assessment.

[07 Hrs.]

UNIT – II :
Methods for impact assessment: Screening, Scoping, Base line studies, Check list, Mitigation, Matrices, Interaction of network methodologies, environmental setting various factors, environmental impact assessment methodology, documentation and selection process, environmental indices and indicators for describing affected environment.

[06 Hrs.]

UNIT – III :
Prediction and assessment of impact for air and noise environment: Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigations.

[07 Hrs.]

UNIT – IV :
Prediction and assessment of impact for water and soil environment: Basic information of water quality (Surface water and ground water), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and ground water standards, prediction and assessment of impact for ground water and soil, mitigations.

[06 Hrs.]

UNIT – V :
Prediction and assessment of impact on cultural and socioeconomic environment:
Basic information on cultural resources, rules and regulations for cultural resources, Basic information of socioeconomic environment, description of existing socioeconomic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.

[07 Hrs.]

UNIT – VI :
EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, general structure of EIA document, Environmental management plan, post environmental monitoring. Case studies in EIA.

[06 Hrs.]

VI SEMESTER

CV1345	OE II: Environmental Impact Assessment			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Book:

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.
2. Canter L.W. 1977. Environmental Impact Assessment. McGraw Hill, Inc. Printed in the United States of America.
3. Peter Watten (Eds.) - `Environmental Impact Assessment Theory and Practice', Unwin Hyman, London (1988).

Reference Books:

1. John G. Rau and David C Hooten (Ed)., “Environmental Impact Analysis Handbook”, McGraw-Hill Book Company, 1990.
2. “Environmental Assessment Source book”, Vol. I, II & III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, “Handbook of Environmental Impact Assessment Vol. I & II”, Blackwell Science, 1999.
4. Bass, Herson and K. Bogdon, 2001, The NEPA Book: A step-by-step guide on how to comply with the National Environmental Policy Act, Solano Press.
5. Shukla, S.K. and Srivastava, P.R., “Concepts in Environmental Impact Analysis”, Common Wealth Publishers, New Delhi, 1992.

VI SEMESTER

CV1314	**Seminar**			**L=0**	**T=0**	**P=2**	**CREDITS = 1**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	**--**	**40**	**60**		**100**	**--**

COURSE OBJECTIVES	**COURSE OUTCOMES**
1. To Recognize the principle of Information Literacy and its impact on research skills. 2. To aware students about importance of access to data, knowledge and results of scientific studies in Civil Engineering. 3. To promote and develop presentation skills and report Writing.	1. An ability to utilize technical resources. 2. An ability to understand information in detail for report writing. 3. An ability to write and present report of associated work effectively.
Mapped Program Outcomes: g, h, i, j	

The students are expected to deliver presentations related to the subjects of their choice. The topic of presentation will be related to Civil Engineering.

The evaluation will be based on the presentation skill and subject knowledge of the student.

VII SEMESTER

CV1401	Water Resources Engineering			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the importance, location, components and types of water resources structures. 2. To learn the procedure to design the water resources structures. 3. To get hand on experience in drawing of water resources structures.	1. An ability to understand water requirement for various crop pattern. 2. An ability to understand parameters and procedures adopted in reservoir planning 3. An ability to understand the design of water conveyance system like canal 4. An ability to understand the analysis and design of various water retaining structures like weirs and dams
Mapped Program Outcomes:a, c, e, f, g, h, i, k	

UNIT – 1 :
General: Irrigation, necessity, importance, benefits and ill effects of irrigation, types, methods of water distribution to the field.
Water requirement of crops : Crop seasons and major crops in India, crop rotation, suitability of soils for irrigation, standards of irrigation water, field capacity, wilting point, available moisture in soils for crops / plants, depth & frequency of irrigation, GCA, CCA, kor period, kor water depth, duty – delta relation, base period, outlet factor, PET-R method of crop water requirements.

[09 Hrs.]

UNIT – 2 :
Reservoir Planning: Selection of site for reservoirs, engineering surveys, geological and hydrological investigations, fixing of LWL, FTL/FRL, HFL, TBL, different storage zones in reservoirs, determination of storage capacity by mass curve method, reservoir sedimentation and its removal, life estimation of reservoir by Brunes method.

[08 Hrs.]

UNIT – 3 :
Canal Irrigation: types of irrigation canals, canal network, irrigation canals (cross section, longitudinal section and alignment), balancing depth, losses in canals
Canals In Alluvial Soils: Kennedy's silt theory – Design procedure, silt supporting capacity, drawbacks, Lacey's silt theory – definition of initial final and permanent regime channels, Lacey's Regime equations, channel design procedure, limitations
Lined Canals: design procedure, types of lining, relative merits and demerits of canal lining, economics of canal lining.

[09 Hrs.]

UNIT – 4 :
Diversion Head Works: Component parts of diversion headworks – fish ladder, divide wall, silt excluder and silt ejector, causes of failure of weirs on permeable foundation, Bligh's creep theory, Khosla's theory for design of weirs on permeable foundations

[08 Hrs.]

UNIT – 5 :
Introduction to Dams: Classification of dams, factors governing selection of type of dams
Gravity Dam: Definition; forces acting on gravity dam, stability requirements, theoretical & practical profile of gravity dam, low &high dam, galleries.

[09 Hrs.]

UNIT – 6 :
Earthen Dams: Types of earthen dams, failure of earthen dams, criteria for safety and design of earthen dam, seepage analysis, seepage control through embankment and foundation, stability analysis of slopes by swedish slips circle method, Spillways: Types of spillway only.

[09 Hrs.]

VII SEMESTER

CV1401	Water Resources Engineering			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	**15**	**10**	**60**	**100**		**3 Hours**

Text Books:

1. S.R. Sahastrabudhe, Irrigation Engineering and Hydraulic Structures, (1996), S.K. Kataria Publications New Delhi.
2. G.L. Asawa, Irrigation and Water Resources Engineering, 2005, New Age International Publishers, New Delhi.
3. Santosh Kumar Garg, Irrigation Engineering and Hydraulic Structures, 1998, Khanna Publisher New Delhi.
4. B.C. Punmia, Irrigation Engineering and Water power Engineering, 1993, Laxmi Publications, New Delhi.

Reference Books:

1. R.S. Varshney, S.C. Gupta, R.L. Gupta, Theory and Design of Irrigation Structures, Vol – II, 1979, Nem Chand & Bros. Publications Roorkee.
2. N.N. Basak, Irrigation Engineering, 1999, Tata McGraw-Hill Publications New Delhi.
3. S.K. Sharma, Principles and Practice of Irrigation Engineering, 1988, S. Chand Publications New Delhi.

VII SEMESTER

CV1402	Structural Analysis - II			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To develop an understanding, the basic principles of the matrix method of structural analysis	1 An ability to understand the matrix methods of structural analysis and its applications.
2. To analyze beam by flexibility method of structural analysis.	2 An ability to understand the flexibility matrix method and apply its application to beam structure.
3. To analyze structural elements (Beams, Frames, Trusses, etc.,) by stiffness method of structural analysis.	3 An ability to understand the stiffness matrix method and apply its application to pin jointed frame structure and beam structure.
4. To analyze non-prismatic structures (beams and frames) using column analogy method	4 An ability to understand the column analogy method and apply its application to beam and frame structure.
5. To analyze sway frames using moment distribution method.	5 An ability to understand the moment distribution method and apply its application to frames with sway.
6. To analyze multistoried frame structures using approximate methods	6 An ability to understand the approximate method of analysis and apply its application to multistoried frame structures
Mapped POs:- a, e, i, k, m	

UNIT – 1 :
Introduction to Flexibility Method, Analysis of Continuous Beam with and without Sinking of Supports with maximum **TWO** degree of Static Indeterminacy

[09 Hrs.]

UNIT – 2 :
Introduction to Stiffness Method, Development of Stiffness Matrix for Pin Jointed Structure, Analysis of Members for Temperature Loading, lack of fit and with Inclined Roller Support, Analysis of Pin Jointed Frame Structure with maximum **THREE** Degree of Kinematic Indeterminacy.

[09 Hrs.]

UNIT – 3 :
Development of Stiffness Matrix for a Beam Member without Axial Deformation, Analysis of Continuous Beam with and without Sinking of Support with maximum **THREE** Degree of Kinematic Indeterminacy.

[09 Hrs.]

UNIT – 4 :
Introduction to Column Analogy, Calculation of Stiffness Factors and Carryover Factor for Non-Prismatic Members, Analysis of Beams and Frame by Column Analogy Method

[09 Hrs.]

UNIT – 5 :
Moment Distribution Method Applied to Frames with Sway (upto Single Storey Two Bays)

[09 Hrs.]

UNIT – 6 :
Approximate Methods of Structural Analysis: Substitute Frame Method, Portal Frame Method, Cantilever Method, (maximum three bay three storey)

[08 Hrs.]

Text Books :
1. Pandit G.S and Gupta S.P, Structural Analysis (Matrix Approach), Tata McGraw-Hill Publishing company LTD, New Delhi. 27th Reprint 2006
2. C .S .Reddy, Basic structural Analysis, Tata McGraw Hill Publication, New Delhi .8th Edition
3. Timoshenko S.P. and D.H. Young; Theory of Structure, Tata Mc Graw Hill Publication, Delhi.2nd Edition
4. Gere and Weaver; Matrix Method of Structural Analysis, CBS Publication, 2004

Reference Books :
1. Bhavikatti S.S; Structural Analysis (volume II), Vikas publishing House LTD, Delhi, 2nd Edition (2011)
2. Meghre A.S. &Deshmukh S.K.; Matrix Method of Structural Analysis, Charotar publishing house, Anand, 1st Edition (2003).
3. P.N. Godbole, R.S. Sonparote, S.U. Dhote; Matrix Method of Structural Analysis, PHI Learning Pvt. Ltd, 2014 Edition.

VII SEMESTER

CV1403	Lab: Structural Analysis – II			L=0	T=0	P=2
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total
	--	--	40	60		100

COURSE OBJECTIVE	COURSE OUTCOME
1. To be able to analyze structural elements (Beams, Frames, Trusses, etc.,by matrix method of structural analysis. 2. To be able to analyse sway frames using moment distribution method. 3. To be able to analyse multistoried frame structures using approximate methods 4. To be able to develop models (Beam model, Plane truss model, Frame model) in the software package, apply the required properties, boundary conditions and forces in the developed models 5. To be able to execute the programme using standard software package without any error 6. To be able to understand the comparison of result between manual analysis and software analysis.	**1.**An ability to understand the effect of forces on structure. **2** An ability to develop and execute the Beam models in the software package without any error **3.** An ability to develop and execute the Plane truss models in the software package without any error **4.** An ability to develop and execute the Frame models in the software package without any error **5.** An ability to compare the result between hand calculation (manual analysis) and output result of the software. **6.** An ability to understand the application of software package and limitation of manual analysis
Mapped Program Outcomes: a, b, e, k, m:	

Any EIGHT, Analysis of Structures Using Standard Software Packages.

1. Analyze a **continuous beam** with maximum **two degree of static indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Flexibility Matrix Method.** Conclude it from both the result.

2. Analyze a **continuous beam with sinking of support** with maximum **two degree of static indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Flexibility Matrix Method.** Conclude it from both the result.

3. Analyze a **plane truss** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

4. Analyze a **plane truss subjected to inclined roller support** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

5. Analyze a **plane truss subjected to temperature effect and lack of fit** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

6. Analyze a **continuous beam** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

7. Analyze a **continuous beam with sinking of support** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

8. Analyze a **rigid sway frame one bay one story** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **moment distribution method.** Conclude it from both the result.

VII SEMESTER

CV1403	Lab: Structural Analysis – II			L=0	T=0	P=2
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total
	--	--	40	60		100

9. Analyze a **rigid sway frame one bay one story with ONE leg incline** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **moment distribution method.** Conclude it from both the result.

10. Analyze a **rigid sway frame one bay one story with TWO leg incline** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **moment distribution method.** Conclude it from both the result.

11. Analyze a **multi storied frame structure** subjected to **vertical forces** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **substitute frame method.** Conclude it from both the result.

12. Analyze a **multi storied frame structure** subjected to **horizontal forces** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **cantilever method and portal frame method.** Conclude it from the result.

13. Analyze a **multi storied frame structure** subjected to **vertical and horizontal forces** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **approximate method.** Conclude it from the result.

Text Books:

1. Pandit G.S and Gupta S.P, **"Structural Analysis (Matrix Approach)"**, Tata McGraw-Hill Publishing company LTD, New Delhi. 27th reprint 2006
2. Meghre A.S. & Deshmukh S.K.; **"Matrix Method of Structural Analysis"**, Charotar publishing house, 1st edition (2003).
3. Gere and Weaver; **"Matrix Method of Structural Analysis",** CBS publication, 2004

Reference Books :

1. Bhavikatti S.S, **"Structural Analysis (volume II)",** Vikas publishing House LTD, Delhi, 2nd edition (2011)
2. Dr. S.R. Karve & Dr. V.L. Shah, **"Illustrated Design of Reinforced Concrete Buildings (Design of G+3 Storeyed Buildings + Earthquake Analysis & Design)",** Standard Publisher Distributors, 7th edition, 2014

VII SEMESTER

CV1422	Transportation Engineering – II			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 HOURS

COURSE OBJECTIVES	COURSE OUTCOMES
1. To acquaint development of railway transportation in India. 2. To understand geometric design of railway tracks 3. To know zoning laws for development of air transportation in India 4. To study tunnel alignment and necessity of tunnels.	1. An ability to update and upgrade knowledge about transportation system in India 2. An ability to design railway tracks, crossings 3. An ability to avail information about development of air transportation in urban areas 4. An ability to understand the construction of tunnel and advances in tunneling
Mapped Program Outcomes: a, b, c, e, j, k, l,	

UNIT – 1 :
Railways: Transportation and its development, long term operative plans for Indian Railways, classification, lines and their track standards, Railway terminology, Administration & management, traction and tractive resistance, hauling capacity and tractive effort of locomotives, different types of tractions.

[08 Hrs.]

UNIT – 2 :
Permanent Way: Alignment surveys, requirement, gauges, track section, coning of wheels, stresses in railway track, high speed track, rail types and functions, selection for rails, test on rail wear & defects, corrugation and creep of rails, rail joints, short and long welded panels
Sleepers: Function, types, merits and demerits, sleeper density, ballast cushion, ballast section, rail fixtures and fasteners
Geometric design of railway track: Gauge, gradients, speed, super elevation, cant deficiency negative super elevation, curves, length of transition curves, grade compensation
Points and crossing: Left and right hand turnouts, turnouts & crossovers, railway track functions .

[09 Hrs.]

UNIT – 3 :
Station and Yards: Types, functions, facilities &equipments
Railway Signaling and interlocking: Objects and principles of signaling, classification and types of signals, control and movement of trains, track circulation, interlocking
railway track construction, inspection & modern techniques of maintenance, modern technology related to track & tractions, rolling stock, signaling & controlling

[09 Hrs.]

UNIT – 4 :
History of Air Transportation in India: Comparison with other transportation modes, aircraft components and characteristics, airport site selection, modern aircrafts
Airport obstructions: Zoning laws, imaginary surfaces, approach and turning zone, clear zone, vertical clearance for highway & railway
Runway And taxiway design: Windrose diagram, cross wind component, runway orientation and configuration, basic runway length and corrections, runway geometric design standards, taxiway layout and geometric design standards, exit taxiway.

[09 Hrs.]

UNIT-5:
Airport layout and classification: Terminal area, aircraft parking and parking systems, unit terminal concept, aprons, hangers, International airports layout, helipads and heliports
Visual Aids: Airport marking and lighting for runways, taxiways and other areas
Air traffic control: Need, networks, control aids, instrumented landing systems, advances in air traffic control

[08 Hrs.]

UNIT-6:
Tunnels: Alignment, surveys, cross section of highway & railway tunnels, tunneling methods in hard rock and soft grounds, tunnel lining, drainage, ventilation and lighting of tunnels, advances in tunneling techniques, tunnel boring machines, case studies.

[09 Hrs.]

VII SEMESTER

CV1422	Transportation Engineering – II			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

Text books:

1. A Text Book of Railway Engineering, S. C. Saxena and S. P. Arora, 2005, DhanpatRai Sons New Delhi.
2. Airport Planning and Design, S. K. Khanna, 1999,Nem Chand and Brothers, Roorkee.
3. Tunnel Engineering S.C. Saxena, 2012, DhanpatRai publication.

Reference books:

1. Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi
2. Planning and Design ofAirports, Robert Horonjeff, Francis Mckelvey, William Sproule, Seth Young, Fifth Edition 2010, McGraw Hill Professionals.

VII SEMESTER

CV1441	Environmental Engineering – II			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To study different methods of conveyance of sewage. 2. To study method of construction and maintenance of sewerage system. 3. To study treatment methods for sewage and industrial wastewater. 4. To study different causes of air pollution and methods to control it.	1. An ability to understand importance of effective collection and conveyance of sewage. 2. An ability to understand whole mechanism of construction and maintenance of sewerage system including house drainage system. 3. An ability to understand complete working of sewage treatment plant including difference with industrial wastewater treatment plant. 4. An ability to understand importance of air pollution control including methods to control it.
Mapped Program Outcomes: a, c, e, h, j,k	

UNIT – 1 :
Systems of sanitation: Conservancy and water carriage system. Patterns of sewage collection systems. Quantity of storm water and sanitary wastewater. Hydraulic Design of sewers - capacity, size, grade. Sewers – shapes and materials. Drains.

[08 Hrs.]

UNIT – 2 :
Sewer Appurtenances – manholes, street inlets, storm water overflows, inverted siphons, flushing and ventilation. Construction and Maintenance of sewers, equipment's for maintenance, safety equipment's. Sewage pumping.
House drainage systems, sanitary fitting and appliances, traps – function and types, anti-syphonage, inspection chambers. Storm water drainage.
Rain water harvesting for individual houses, Different Methods.

[09 Hrs.]

UNIT – 3 :
Characteristics of wastewater. Flow sheet of conventional sewage treatment plant.
Preliminary and primary treatment: Screens, Grit chambers, Primary settling tank. Design of bar screens, grit chambers and primary settling tanks**.**

[09 Hrs.]

UNIT – 4 :
Secondary Treatment: Principle of Biological Treatment. Activated sludge process, Trickling Filter – Concept, Functioning and Basic Load Calculations. Sludge digestion, Sludge drying beds.
Methods of disposal: Disposal on land and in water stream. Self-purification capacity of stream.

[08 Hrs.]

UNIT – 5 :
Rural sanitation: Pit Privy, Aqua Privy, Bio-gas Recovery, Eco-Sanitation. Septic tank including soak pit. Imhoff tanks.
Industrial Waste Water Treatment: Basic concepts of Industrial Waste Water Treatment, flow equalization, neutralization. Common treatment alternatives for industrial waste water.

[09 Hrs.]

UNIT – 6 :
Introduction to Air Pollution, Monitoring and Control. Meteorological Parameters. Monitoring methods. Techniques of air pollution control.

[09 Hrs.]

Text Books:
1. B.C. Punmia, Waste Water Engineering, Laxmi Publication
2. S.K. Garg, Environmental Engineering – Vol – II, Standard Publication
3. G.S. Birdie, Water Supply & Sanitary Engineering, Dhanpat Rai Pub Company
4. M.N. Rao & H.V.N. Rao, Air Pollution, McGraw Hill Publication.

Reference Books:
1. M.J. Machghee, Water Supply & Sewage, McGraw Hill Publication.

VII SEMESTER

CV1442	Lab: Computer Application in Civil Engineering			L=0	T=0	P= 2	CREDITS = 1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	--	40	60		100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To translate numerical methods into simple, reusable program modules 2. To choose appropriate numerical methods for solutions to specific mathematical problems 3. To analyze the applicability and accuracy of numerical solutions to specific mathematical problems 4. To synthesize multiple program modules into larger program packages 5. To distill numerical results into a readable format that answers specific civil engineering analysis and design questions	1. An ability to understand the basic concepts of C Programming language. 2. An ability to develop computer programs for the solution of Civil Engineering problems. 3. An ability to translate numerical meyhods into simple, reusable program modules. 4. An ability to develop good technical reporting and data presentation skills.
Mapped Program Outcomes:: a,f,g,i,k,l	

At least **TEN** assignments are to be submitted on following topics using '**C Programming Language'**.

1. Determination of Bending Moment. Deflections for different loading conditions for a Simply Supported Beam and Cantilever Beam. Determination of fixed end moments for different loading conditions of a fixed beam.
2. Determination of Water demand, empirical formulae, variation in demand, design of period and population forecasting methods.
3. Determination of coefficient of permeability, Degree of Consolidation and Shear Strength. Estimation of Settlement of foundations in Cohesive Soil, Stability Analysis of Slopes. Estimation of Earth Pressures in Cohesive and Cohesionless soils.
4. Computation of water surface profiles in open channel flows. Estimation of Friction factor for Laminar and Turbulent flows, Minor losses in pipe flow. Application of problems in Hydraulics such as Hardy cross method in the Analysis of pipe network,
5. Geometric design of roads, stopping and overtaking distances, design of super-elevation, design of summit and valley curves, Horizontal and vertical curves.
6. Design of Slabs using I.S. Code method. Analysis and Design of Beams using Limit state method. Design of columns subjected to axial load and Uni-axial Moment. Design of Isolated Footing. Design of rolled steel columns, built up columns, Beams and built up Beams.
7. Interpolation & extrapolation methods, Solution of non Linear Equations (Newton Raphson Schemes), Solution of Linear Algebric Equations, Gauss Elimination method.
8. Numerical Integration (Simpson's method, Trapezoidal method) , Initial & Two point boundary value problem , Euler's Runge-kutta,Milnes etc.

Text Books:

1. Yeshwant Kanetkar, LET US C, BPB Publications.
2. S.K. Parikh, Computer Applications in Civil Engineering, Tata McGraw Hill, New Delhi.
3. M. K. Jain, Numerical Methods, New Age International.

VII SEMESTER

CV1410	PE II: Traffic Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the calculations of spot speed, journey time & running time. 2. To understand the different statistical methods such as Binomial, Normal Poission, Chisquare to know the probabilities at various levels. 3. To study the analysis and designs of rotary intersections 4. To study different traffic signs, methods of design of traffic signal, Queingtheory. 5. To study causes and remedial measures of accidents, analysis of accident data. 6. To study the methods and design of parking.	1. An ability to understand different methods for measurement of spot speed, journey speed & running speed, 2. An ability to understand different statistical methods which can be used in various analyses of traffic studies. 3. An ability to understand design rotary intersection in field. 4. An ability to understand design of signals at various intersections considering practical problems. 5. An ability to understand Accident Reduction through analyses of accident data. 6. An ability to understand design the on and off street parking for different situations.
Mapped Program Outcomes: a, b, c, d, e, h, i, j	

UNIT – 1 :
General: Road, road user &road vehicle characteristics.
Traffic Surveys: speed, journey time and delay studies, methods of measurement of spot speed, measurements of running and journey speeds, highway capacity, level of service. **[07 Hrs.]**

UNIT – 2 :
Traffic Events: Statistical method for interpretation, regression, application of binomial normal and Poisson's distributions, test of significance–Chi-square &'T' test **[07 Hrs.]**

UNIT – 3 :
Road geometry: Hierarchy of urban roads and their standards, diverging, merging, crossing, weaving, maneuver's and conflict points, types of road junction, traffic rotary design, drive ways. **[06 Hrs.]**

UNIT – 4 :
Traffic controlling devices: Traffic signs, traffic signals, design of signalized intersections & signalling systems, Queingtheory. **[06 Hrs.]**

UNIT – 5 :
Traffic Safety: Driver's error, collection and interpretation of accident data and recording in standard Format, speed and weather effects on accidents, analysis of accidents, pedestrian, 3E's of traffic management **[07 Hrs.]**

UNIT – 6 :
Parking: Parking surveys, on and off-street parking & parking systems, parking demand, design of off-street parking lot, underground & multi-storeyed parking, **[06 Hrs.]**

Text books:

1. Highway Engineering, Khanna S.K. and Justo C.E.G., 1991, Nem Chand & Bros.
2. Traffic engineering and transportation planning, Kadiyali, Khanna Publications, 1987
3. Transportation Engineering: An Introduction, C. JotinKhisty , B. Kent Lall
4. Transportation Engineering and Planning ,C.S. Papacostas, P.D. Prevedouros

Reference books:

1. Highway Engineering, Rangawala B.S. Charotar Publishing House, 2011
2. IRC Handbook and MOST Specifications, Indian Road Congress, 2012

Reference books:

3. Highway Engineering, Rangawala B.S. Charotar Publishing House, 2011
4. IRC Handbook and MOST Specifications, Indian Road Congress, 2012

VII SEMESTER

CV1411	PE II : Advanced Hydraulics			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
The students will learn the:- 1. Concept of uniform flow and critical flow in open channels. 2. Concept of gradually varied flow profile in open channels. 3. Computation of length of gradually varied flow by various method 4. Concept of rigid water column theory and time of flow establishment. 5. Concept of elastic water column theory and water hammer in pipe. 6. Importance of surge tanks in pipe systems.	1. An ability to understand the concept of uniform flow and critical flow in open channels 2. An ability to understand the concept of gradually varied flow profile in open channels 3. An ability to understand the computation of length of gradually varied flow by various method 4. An ability to understand the concept of rigid water column theory and time of flow establishment 5. An ability to understand the concept of elastic water column theory and water hammer in pipe. 6. An ability to understand the importance of surge tanks in pipe systems.
Mapped Program Outcomes:a, c, e & k	

UNIT – 1 :
Uniform flow, Critical flow, wide rectangular channel, conveyance of channel, section factor, Hydraulic exponent M & N. [06 hrs.]

UNIT – 2 :
Basic equation of GVF, Dynamic equation of GVF in terms of normal depth & critical depth, conveyance K & section factor Z, hydraulic exponent M & N Channel transitions for subcritical and supercritical flow: hump in channel, reduction in channel width, chocking conditions in channel. [07 hrs.]

UNIT – 3 :
Gradually varied flow, channel slope, back water curve, dropdown curve. characteristic of GVF profiles, break in grade, composite GVF profiles, Various gradually varied flow profiles in channel. [06hrs.].

UNIT – 4 :
Computation of gradually varied flow length in channel, direct step method, Bresse's method, Chow's method.
[06 hrs.]

UNIT – 5 :
Unsteady flow in a pipe, Bernoulli's Equation of unsteady flow in a pipeline for incompressible fluid flow, Time flow establishment, rigid water column theory of water hammer , computation of water hammer pressures. [07 hrs.]

UNIT – 6 :
Elastic water column theory, Bernoulli's equation of motion when compressibility of fluid and elasticity of pipe is considered, continuity equation, Computation of water hammer pressure, Allievis theory for water hammer pressure, Surge tank.
[07 hrs.]

Text Books:
1. Ven Te Chow, Open channel hydraulics, International Student Edition, 1959, McGraw Hill Publications.
2. Narasimhan S., Engineering Fluid Mechanics, Vol. II, Edition 1981, Orient Longman Publication.

Reference Books:
1. RangaRaju K.G., Flow through open channels, 1998, Tata McGraw Hill Publications.
2. Subramanya K., Flow in open channels, 2009, Tata McGraw Hill Publications.
3. U.S. Department of the interior, Bureau of reclamation, U.S.B.R. Earthen Dams, 1998, United States Government Printing Office.

VII SEMESTER

CV1413	PE II: Natural Resources Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hours

COURSE OBJECTIVES	COURSE OUTCOME
1. To Study the state of natural resources , their challenges , opportunities and prospects for sustainable development 2. To study the various resources and related governance. 3. To study the methodologies and adaptation programmes for conservation of resources. 4. To develop the understanding about social aspect of civil engineering students.	1..An ability to solve important natural resource management problems. 2.An ability to describe planning and responsibilities taken by professional authorities. 3. An ability to understand laws, policies & practice implementation for private and public resource owners and users. 4 An ability to work on multiple environmental issues for a sustainability.
Mapped Program Outcomes:a, d, f, h, i, j	

UNIT – 1 :
Introduction to Natural Resource Bases:
Concept of resource, classification of natural resources, Factors influencing resource availability, distribution and uses. Forest resources, Land resources, Food resources, Mineral Resources Marine Resources.

[06 Hrs.]

UNIT – 2 :
Overview of policies & Governance of Natural Resources: National Environment Policy of 2004, National Conservation Policy, National Action Plan on Climate Change of 2008, Environmental Protection Act.

[07 Hrs.]

UNIT – 3 :
Renewable and Non Renewable Energy
Rural energy/Biomass to energy: Wood energy/ fuel wood use, Biochemical conversion, sources of energy generation, agro residues, anaerobic digestion and biogas production, thermo-chemical conversions, gasification and types of gasifiers, ethanol, Bio-diesel.

[06 Hrs.]

UNIT – 4 :
Programmes for NRM
Rural development programmes, Rural Livelihood Programmes, Welfare Programmes, Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Human Development Index (HDI), Environmental Clearance Programme, Environmental Management Plan.

[07 Hrs.]

UNIT – 5 :
Sustainable Natural Resources Management and Development:
Industrialization, Infrastructure development, globalization, urbanization and privatization, sustainability of modern developments Applications and case studies in NRM: Coastal zone management, disaster management.

[07 Hrs.]

UNIT – 6 :
Climate change and carbon trading, watershed management, wetland management, Urban Forestry, Biodiversity, migration & Rehabitations, Urban poverty and livelihood. Environmental problems in urbanizing world.

[06 Hrs.]

Text Books :
1. Tom Tietenberg and lynne lewis, 2013, Environmental and natural resource economics, Pearson education incorporation, publishing as Addison-wesley
2. Knight, Richard L., editor, et al. 1995. A New Century for Natural Resources Management. Island Press.

Reference Books :
1. Francois Ramade 1984. Ecology of Natural Resources. John Wiley & Sons Ltd.
2. Singh, Rajvir. 2000. Watershed Planning and Management
3. Harris, J.M. 2006. Environmental and Natural Resource Economics: A Contemporary Approach, 2ndedition. Houghton Mifflin

VII SEMESTER

CV1443	PE II: Optimization Techniques			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	**15**	**10**	**60**	**100**		**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the students the concepts of understand the need and origin of the optimization methods. 2. To provide the students the knowledge of various optimization methods and their applications in engineering. 3. To provide the students the knowledge of formulation of optimization problems.	1. An ability to understand the need of optimization techniques in engineering. 2. An ability to understand the various optimization techniques used in engineering design. 3. An ability to apply the optimization techniques and formulate the optimization problems in engineering.
Mapped Program Outcomes: a, c, e, k,	

UNIT – 1 :
Introduction, types of optimization problems, Statement of the problem, design vector, constraints, objective function. Classification of optimization problems.

[06 Hrs.]

UNIT – 2 :
Formulation of some structural problems as programming problems like Minimum weight and optimum cost considerations in Structural design, Minimum weight design of Trusses and Frames based on elastic and limit state criteria Optimum reinforcement design of reinforced and prestressed concrete beams and slabs.

[07 Hrs.]

UNIT – 3 :
Classical optimisation techniques: Single variable optimisation, multivariable optimisation, with no constraints. Multivariable optimisation with equality and the inequality constraints.

[06 Hrs.]

UNIT – 4 :
Linear Programming :
Introduction, Standard form of the problem, feasible, basic and optimal solution,Canonical form of system of equations.
Simplex method - Algorithm, two phases of the method, Identifying an optimal point, unbounded solution, degenerate solution.

[07 Hrs.]

UNIT – 5 :
Non - Linear Programming:
One dimensional minimization: Introduction, Unimodal function.
Elimination methods-Various search methods, Fibonacci and Golden section methods.

[06 Hrs.]

UNIT – 6 :
Non - Linear Programming:
Unconstrained Optimization Techniques: Introduction, Direct Search methods-Random search, Univariate method. Descent methods-Steepest descent method, Conjugate gradient method, Variable metric method.

[07 Hrs.]

Text Books :
1. Rao S.S, Engineering Optimization: Theory and Practice, New Age International (P) Ltd., New Delhi.
2. Arora J S., Introduction to Optimum Design, McGraw Hill.

Reference Books :
1. Fox R. L, Principles of Operation Research, Prentice Hall of India.
2. Wagner H.M., Principles of Operation Research, Prentice Hall of India
3. Stephen G. and Ariela Sofer Nash, Linear And Nonlinear Programming, McGraw Hill Book.Co.
4. Deb, K., Optimization for Engineering Design of Algorithms and Examples, Prentice-Hall of India Pvt. Ltd., New Delhi
5. Bhavikatti S.S., Structural optimization using sequential linear programming, Vikas publishing house, New Delhi

VII SEMESTER

CV1444	PE II Structural Dynamics			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students clear and thorough understanding of modeling of discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems. 2. To provide the students clear and thorough understanding of Calculation of the mode shapes and frequencies for the free response of continuous vibratory systems and use modal methods to calculate the forced response of these systems. 3. To provide the students understanding of modeling continuous vibratory systems – vibration of strings, axial and torsional vibration of bars and beams. 4. To provide the student with a basic understanding of IS codes related to earthquake loading.	1. An ability to apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response. 2. Ability to identify, formulate and solve engineering problems having motions varying with time. This will be accomplished by having students model, analyze and modify a vibratory structure, in order to achieve specified requirements. 3. Understanding professional and ethical responsibilities. This will be accomplished by emphasizing the importance of understanding how structural vibrations may affect safety and reliability of engineering systems. 4. An ability to Understand IS codes related to earthquake loading.
Mapped Program Outcomes: a, e, f	

UNIT – 1 :
Introduction to structural dynamics, types of prescribed loadings, formulation of equations of motion
Single-Degree-of-Freedom (SDOF) System: Application of Newton's law to lumped parameter model, d' Alembert's principle, torsional vibration, undamped systems, free vibrations, general solution, numerical examples
[06 Hrs.]

UNIT – 2 :
SDOF system: damped free vibrations, damping coefficient, experimental determination of fundamental frequency and damping coefficient, general solution, numerical examples.
[07 Hrs.]

UNIT – 3 :
SDOF system: forced vibrations, equation of motion, harmonic load, periodic load,
resonance, vibration isolation, force transmissibility and base motion, numerical examples.
[06 Hrs.]

UNIT – 4 :
SDOF system: General load, impulse load, Duhamel integration, Runge-Kutta method, central difference method, dynamic relaxation, numerical examples
[07 Hrs.]

UNIT – 5 :
Two and three DOF systems: equations of motion, natural frequencies, introduction to mode superposition, numerical examples.
[07 Hrs.]

UNIT – 6 :
Introduction to earthquake engineering, response spectra, response of SDOF systems to earthquake excitation, numerical examples
[06 Hrs.]

Text Books:
1. J. M. Biggs, Introduction to structural Dynamics, McGraw-Hill, NY, 1964.
2. M. Paz and W. Leigh, Structural Dynamics - Theory and Computations, 5th Edition,2004
3. R. W. Clough and J. Penzien, Dynamics of Structures, McGraw-Hill, Singapore, 2003.

Reference Books:
1. R. R. Craig, Structural Dynamics – An Introduction to Computer Methods, J. Wiley & Sons, 1981.
2. L. Meirovitch, Elements of Vibration Analysis, 2nd edition, McGraw-Hill, Singapore, 1986.
3. A. K. Chopra, Dynamics of Structures – Theory and Applications to Earthquake Engineering, Prentice Hall. 2009.
4. J.L. Humar, Dyamics of structures, McGraw Hill, 1993

VII SEMESTER

CV1445	PE II : Soil Dynamics			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study vibration fundamentals. 2. Understand Dynamics Soil Properties. 3. Analysis and design of Machine Foundations.	Students will be able to understand the 1. Vibration theory. 2. Dynamic soil properties. 3. Analysis and design of Machine Foundations.
Mapped Program Outcomes: a, c, e, h, l	

UNIT – 1 :
Introduction :- Nature and types of dynamic loading; Importance of soil dynamics, Elastic properties of soils, applicability of Hook's law to soils, elastic constants of soil and their determination, Coefficient of elastic uniform compression and shear, cyclic plate load test.

[06 Hrs.]

UNIT – 2 :
Vibration theory :- Vibration of elementary systems; Degrees of freedom; Equation of motion for SDOF system; Types of vibrations; theory of forced & free vibrations; natural frequency, resonance, effect of soil inertia on forced vertical vibration of foundation, undamped and damped free vibrations; Torsional vibrations; Critical damping; Decay of motion; undamped and damped forced vibrations; Constant force and rotating mass oscillators, impact and other types of forced vibrations, Vibration isolation; Vibration measuring instruments.

[07 Hrs.]

UNIT – 3 :
Dynamic Soil Properties Stresses in soil element; Determination of dynamic soil properties; Field tests; Laboratory tests; Stress-strain behaviour of cyclically loaded soils; Estimation of shear modulus; Damping ratio; Linear, equivalent-linear and non-linear models; Ranges and applications of dynamic soil tests; Liquefaction: Simplified procedure for liquefaction estimation, Factor of safety.

[06 Hrs.]

UNIT – 4 :
Wave Propagation in soils: Longitudinal and torsional waves in infinitely long rod; Solution for one-dimensional and three-dimensional equations of motion; Waves in semi-infinite body; Waves in layered medium; Earthquake waves – P-wave, S-wave, Rayleigh wave and Love wave; Locating earthquake's epicenter.

[06 Hrs.]

UNIT – 5 :
Machine Foundations: Types of machines; Basic design criteria; Methods of analysis; Mass-Spring-Dashpot model; Elastic-Half-Space theory; Tschebotarioff's reduced natural frequency method; Types of foundations; Modes of vibrations; Vertical, sliding, torsional (yawing) and rocking (and pitching) modes of oscillations; Design guidelines as per codes; Typical design problems.

[07 Hrs.]

UNIT – 6 :
Dynamic Soil-Structure Interaction: Dynamic earth pressures; Force and displacement based analysis; Pseudo-static and Pseudo-dynamic analysis; Guidelines of various design codes; Dynamic analyses of various geotechnical structures like retaining wall, soil slope, railway subgrade and ballast.

[06 Hrs.]

Text Books:
1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:
1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VII SEMESTER

CV1459	Computer Application in Civil Engineering	L=3	T=0	P=0	CREDITS = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1. To impart the knowledge of C programming language 2. To develop computer programs for the solution of Civil Engineering problems. 3. To provide the knowledge of various numerical with their applicability and accuracy to specific mathematical problems 4. To translate numerical methods into simple, reusable program modules.	1. An ability to understand the basic concepts of C Programming language 2. An ability to develop computer programs for the solution of Civil Engineering problems . 3. An ability to translate numerical methods into simple, reusable program modules 4. To develop good technical understanding & application.
Mapped Program Outcomes: a, f, g, i, k, l	

UNIT –I

Introduction : C-Fundamentals , character set data type constant and variables , Declaration of constants & variables , Expression, Statements , Symbolic constants.Operator and Expression , Arthmetic operator , Unary operator , Relation and Logical operator , Assignment operators,the conditional operator,Library functions.Data input & output.

[6Hrs]

UNIT -II

Control Statements :-Control statement , the WHILE statements , do-while , for nested loop , if –else , switch break, continue , goto statement .

[07 Hrs.]

UNIT –III

Advance Topics :-Functions , Storage class , Arrays , Pointers , structures and Unions, Data files, File Handling .

[06 Hrs.]

UNIT-IV

Fundamental of Numerical Methods, Interpolation & extrapolation. Numerical Integration (Simpsons method , Trapezoidal method , Newtons Gauss Quadrature method) , Interactive Computer Program Development.

[07 Hrs.]

UNIT-V:

Computer programme based on Transportation Engineering,Geotechnical Engineering, Hydraulic Engineering, Irrigation Engineering, Surveying, Estimating & costing.

[06 Hrs.]

UNIT-VI

Computer programme based on Structural analysis, Structural Design,Environmental Engineering, Matrix algebra , Solution techniques.

[07 Hrs.]

Text books:

SN	Title	Edition	Authors
1	LET US C, BPB Publications.	15th Edition 2016	Yeshwant Kanetkar,
2	Computer Applications in Civil Engineering,	1th Edition 2012	V.K.Singhal
3	Numerical Methods, New Age International.	2th Edition 1996	M. K. Jain

Reference books:-

SN	Title	Edition	Authors	Publications
1	C programming language	2th Edition 1996	Dennis Ritchie	Pearson
2	C: The Complete Reference	4th Edititon 2017	Herbert Schildt	Mc Graw Hill

VII SEMESTER

CV1406	Industrial Training / CRT	L=3	T=0	P=4	CREDITS = 3

Evaluation Scheme	MSE – I	MSE – II	TA	ESE	TOTAL	ESE Duration
	--	--	--	--	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1) To get information about latest methodologies and techniques used in the field of civil engineering. 2) To understand current practices adopted in construction management.	1) An ability to prepare detail notes and reports. 2) An ability to communicate effectively.
Mapped Program Outcomes: d,g,i,j,k	

Student would be required to undergo a practical training for two months during the summer vacation after 6th semester. They would submit a report about the same and also make the presentation for evaluation.

VII SEMESTER

CV1407	Project - Phase I			L= 0	T= 0	P= 4	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	----	40	60		100	---

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.	1. An ability to apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.
2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.	2. An ability to designed a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.
3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.	3. An ability to work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.
4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	4. An ability to apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.
5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	5. An ability to analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.
Mapped Program Outcomes: a,b,c,d, e,f, g,h, I,,j, k,l,m,n	

Project will be allotted to a group of students, (preferably not more than 06) as per their choice and previous scores. The project work will be carried out by the students as directed by their guides. Evaluation will be done by continuous assessment and will be based on involvement of the student in the work.

VIII SEMESTER

CV1421	Estimating and Costing			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the importance of subject and definition involved in the estimation of various structures. 2. To understand the estimates of buildings (Load bearing and framed structure) culverts, Hydraulic structures water supply and sanitary works etc. 3. Earthwork estimates in road, hill roads and canals. 4. Detail estimates of steel in RCC works with bar bending schedule. 5. To understand the procedure of submitting the tenders and types of contracts. 6. To understand the writing and developing detailed specification of items and finding out quantities of various materials in different items. 7. To understand the concept of valuation, methods of valuation and rent fixation. 8. To understand the methods of accounting	1. An ability to understand the definitions in estimates of structures. 2. An ability to develop the specifications and find out the quantities of materials in different items to prepare the estimate 3. An ability to workout the valuation and rent of civil engineering structures 4. An ability to do accounting 5. An ability to workout the estimate and costing of building, road, hydraulic structures etc. [Field problems] 6. An ability to fill the tenders and carry out the construction of civil engineering structures
Mapped Program Outcomes: a, b, c, d, e, f, j, l, n	

UNIT – 1 :

General: Importance of the subject, purpose of quantity estimates, mode and unit of measurement as per I.S.1200, methods and stages of estimates, items of a work and their description, approximate estimation of Civil engineering works.

Proposal and Development of Project: Project Management Consultant & their role, various important terminologies required like work charged establishment, muster roll, contingencies, percentage charges, measurement book, overheads etc**.**

[09 Hrs.]

UNIT – 2 :

Specifications: Purpose and principles of specifications, types of specifications, writing and developing detailed specifications of important items.

Cost Build up: Purpose and principles, importance of Schedule of rates (CSR) in cost estimates, factors affecting analysis of rates, information from National Building Organization, task work, factors affecting task work, market rates, escalation.

[08 Hrs.]

UNIT – 3 :

Valuation: Purpose of valuation, factors affecting value of property price and cost, market value, potential value, sentimental value, scrap value etc. real estate, guide edged securities, net and gross return, tenure of land, valuation of land, free hold and leasehold, sinking fund, depreciation, capitalized value, methods of valuation, differed annuity, time cost relationship, valuation table and rent fixation.

[09 Hrs.]

UNIT – 4 :

Cost Accounting: Various methods, classification of cost, direct and indirect charges, distribution of overheads, M.A.S. Account, issue rates and store account. Earthwork estimates in road, hill roads and canals. Mass excavation and mass haul curves

[08 Hrs.]

UNIT – 5 :

Quantity and cost estimates: Methods of detailed estimates, forms used for detailed estimates, working out the quantities of various materials required for construction of different Civil Engineering works like building, road works etc., detailed estimates of steel in RCC works, bar bending schedule.

[09 Hrs.]

VIII SEMESTER

CV1421	Estimating and Costing			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

UNIT – 6 :

Arranging Works : Construction agencies, method of carrying out works, arranging contract works, pretender and contract planning, tender notice, acceptance of tender, essentials of contract, types of contracts, conditions of contract, contract documents, various schedules in the tender document, measurement and payment to contractor, arbitration

[09 Hrs.]

Text books:

1. Estimating, Costing, Specification & valuation in Civil Engineering, Chakraborti M. UBS Publication, Calcutta, 2010

Reference books:

1. Estimating & Costing, Chandola S.P. &Vazirani V.N, Khanna Publishers 2-B, Nath market, Naisarak, Delhi, 2010
2. Estimating & Costing in civil Engineering, Dutta B.N, UBS Publishers distributors ltd., 5 Ansari road, New Delhi, February 1999
3. Estimating, Costing and valuation, Rangwala S.C, Charotar Publishing house, opposite Amul diary, court road, Anand, 2011

VIII SEMESTER

CV1446	PE III - New Engineering Materials			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand various civil engineering materials. 2. Understand various methods of testing of materials. 3. Understanding and use of various codes related to the civil engineering materials.	1. An ability to understand different high quality materials for Civil Engineering applications 2. An ability to use engineering materials for better and durable Civil Engineering Structures 3. An ability to utilize bionondegradbale materials for Civil Engineers 4. An ability to understand the use of Composite sections for effective utilization of materials
Mapped Program Outcomes: h, j, k	

UNIT – 1 :
Steel fiber reinforced concrete, Properties, Aspect ratio, strength and durability.
Fiber reinforced plastics, other types of fibers and their applications.

[07 Hrs.]

UNIT – 2 :
Light weight concrete, Ferro cement concrete, their types, foam concrete, workability, durability and composition, application.

[07 Hrs.]

UNIT – 3 :
Fly ash blended concrete, replacement procedures, effect of admixtures, adhesives, bond strength, durability, applications.

[06 Hrs.]

UNIT – 4 :
High-grade concrete, high strength performance concrete, tremieconcrete.

[06 Hrs.]

UNIT – 5 :
New engineering materials like light weight steel profile, aluminium profiles, pressed steel sections.

[06 Hrs.]

UNIT – 6 :
Introduction to steel concrete composite including infill, encased sections, properties of shear connectors, use of IS:11384, IRC 220.

[07 Hrs.]

Text Books:
1. Properties of Concrete, Neville A. M., Pearson Education Limited
2. Special Concretes, Rafatsiddhequi, Galgotia Publications
3. Concrete Technology, M Gambhir, Tata Mcgraw Hill Education Private Limited.

Reference Books:
1. Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
2. Shetty M. S, Concrete Technology, S. Chand Publisher.

VIII SEMESTER

CV1447	PE III: Advanced R.C.C.			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand different methods design of specialized RCC structures. 2. Understand different methods of bridge design. 3. Understand design methods of water tank, 4. Understand design methods of retaining walls. 5. Understand design methods of multistoried building	1. An ability to understand the importance of various structures like multistoried buildings, bridges, water tanks and retaining walls. 2. An ability to analyse the structures for various types of loading conditions as per Codal provisions 3. An ability to design various structures such as bridges, tanks, and retaining walls.
Mapped Program Outcomes: a, c, e, l,	

UNIT – 1 :
Design of circular and rectangular water tanks resting on ground.
Design of overhead service reservoirs. Analysis and design of staging by cantilever method including wind forces as per relevant IS codes. Design of foundation- Annular raft, Full raft.

[10 Hrs.]

UNIT – 2 :
Design of flat slab, Grid slab, design for cutouts in slab. Introduction to design of bridge deck slab for IRC loadings.

[09 Hrs.]

UNIT – 3 :
Design of building frames up to two bay/four story, including design of foundation. Using Limit state Method including effect of lateral loads. Introduction to ductile detailing & provisions of IS 13920.

[10 Hrs.]

UNIT – 4 :
Design of retaining walls–cantilever and counterfort. Introduction to reinforced earth retaining wall.

[10 Hrs.]

Text Books:
1. Dr. S.S. Bhavikatti, Advance R.C.C. Design Volume II, New Age international (p) limitedpublishers NEW DELHI. 1st Edition
2. N. Krishana Raju, Advanced concrete structures, CBS Publishers and Distributors NewDelhi.2nd Edition-
3. T.R. Jagadeesh, M.A. Jayaram, Design of bridge strucures, prentice Hall of India private limited , M-97 connaught circus New Delhi 1stEdition
4. George Verghese, Advanced RCC, Prentice-Hall of India Pvt. ltd New Delhi-2nd Edition

Reference Books:
1. Jain and Jaikrishana, Plain and Reinforced Concrete Structures Vol-II., Indian Standards Institution. New Delhi.- 2nd Edition
2. Johnson & Victor, Essentials of Bridge Engineering, IBH Publishing Co. Pvt. Ltd., New Delhi. Sixth edition
3. A K. Jain, -Reinforced Concrete Structures-published by Laxmi publication private limited, 22 Golden house, Daryaganj, New Delhi- 3rd Edition
4. Dr. V.L. Shah, Dr. S.R. Karve-structures publications Jal Tarang, 36 parvati pune411009, 5th Edition

VIII SEMESTER

CV1448	PE III: Remote Sensing & GIS			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understanding the Geoinformatics approach 2. Teach fundamental principles involved in RS and GIS 3. Understand the Fundamentals of Remote sensing Products 4. Know the Indian Remote Sensing Program 5. Role of Remote Sensing for various surveys and information extraction 6. Know about different software available in RS and GIS 7. Learn fundamental procedures in RS and GIS 8. Teach data integration and defining problems in digital format	The students should be able to 1. Identify, describe and explain the fundamental of principles of aerial photography and remote sensing. 2. Apply the basics of raster and vector data formats and able to interpret it. 3. Asses and compare spatial and non-spatial data, projection system, topology, geo referencing while using remote sensing data. 4. Collect logical information and apply digital image processing for supervised/un-supervised classification of given data
Mapped Program Outcomes: d, e, j,	

UNIT – I :
Definition and scope of remote sensing: electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and radar scanners, radiometers spectral response curve and spectral signatures

[06 Hrs.]

UNIT – II :
Elements of sensing system: Terrestrial, airborne and space borne platforms, Sun-synchronous and geostationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote-sensing data products and their types: analogues and digital data formats, Thermal and radar imageries.

[07 Hrs.]

UNIT – III :
Interpretation techniques: Elements of interpretation and methods, interpretation key, interpretation instruments. Relief displacement, image parallax and vertical exaggeration, Determination and calculation of elevation from RS data

[07 Hrs.]

UNIT – IV :
Digital image processing: image rectification and restoration, image enhancement-contrast manipulations, spatial feature manipulation, multi-image manipulation, image classification supervised and unsupervised classification, accuracy assessments and data merging.

[07 Hrs.]

UNIT – V :
Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

[06 Hrs.]

UNIT – VI :
Applications: Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects damns and bridges, site investigations, landslide studies.

[06 Hrs.]

Text Books:
1. Remote sensing Geology: Ravi P Gupta, Springer publication
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Remote Sensing: Sabins, Floyd F
4. Higher surveying volume III: Dr B C Punmia

Reference Books:-
1. Concepts and Techniques of GIS 2005 C.P. Lo Albert PHI Learning
2. Remote Sensing Of the Environment – An Earth Resource Perspective 2004 John R. Jensen Pearson Education.

VIII SEMESTER

CV1449	PE III-Earth & Earth Retaining Structures			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. Students are expected to analyze and design rigid, flexible earth retaining structures, 2. To learn sheet piles and bulk heads. 3. To get knowledge of embankments, cofferdams and braced cuts.	1. Students will be able to analyze and design rigid, flexible earth retaining structures. 2. Students will be able to carry out stress analysis of sheet piles and bulk heads. 3. Students will understand the basics of compacted embankments, cofferdams and braced cuts.
Mapped Program Outcomes: a, b, c, d	

UNIT – 1 :
Earth Pressure on retaining wall
Rankine's and Coulomb's theories of earth pressure Poncelet's and Culmann's graphical constructions for active and passive pressures, Effects of wall movement, wall friction, type of slip surface, wall back angle, backfill slope angle, surcharge and line loads on earth pressure, Direction and point of application of earth thrust.
[07 Hrs.]

UNIT – 2 :
Stability of Earth retaining structures
Types of walls: gravity, cantilever walls, walls with counterforts and relief shelves, their typical dimensional details. Stability requirement of overturning, sliding, bearing capacity failure: overall stability against shear failure in backfill & foundation soil; application of geo-synthetics in earth retaining structure.
[06 Hrs.]

UNIT – 3 :
Sheet pileretaining structures
Sheet pile wall and bulk heads. Types of sheet piles, constructional features of cantilever and anchored sheet pile walls, their suitability, Analysis for design of cantilever walls in cohesionless and cohesive soils, Analysis for anchored sheet pile walls with free & fixed end support conditions, Blum's criteria, Deadman and anchored, design principles.
[06 Hrs.]

UNIT – 4 :
Embankments
Control of field compaction, placement moisture content during field compaction, effect of compactive effort on compaction of clayey and sandy soils, effect of lifts in deep compaction, correction for excluded grain size in laboratory compaction. Theories of compaction: water film and lubrication concept, microstructure concept.
[07 Hrs.]

UNIT – 5 :
Stability of slopes :
Friction circle method, factor of safety, Taylor's stability numbers & stability charts, base failure, stability of earthen slopes for steady seepage and sudden drawdown, approximate analysis for plain slip surface, Bishop's method of slope stability.
[07 Hrs.]

UNIT – 6 :
Cofferdams and Caissons:
Types, stability analysis of cellular and Diapharm type cofferdams and caissons, TVA method of interlocked stresses.
Braced cuts:
Sheeting and bracing system in shallow and deep vertical cuts in different types of soils. Failure modes; lateral pressure distribution on sheeting, stability of bottom of excavation.
[06 Hrs.]

VIII SEMESTER

CV1449	PE III-Earth & Earth Retaining Structures			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.
4. Basic applied Mechanics, Gopal Ranjan, New Age International.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VIII SEMESTER

CV1450	PE III-Watershed Management			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
rious objectives of the course will be: 1. To understand the watershed and its characteristics. 2. To understand the importance of watershed management. 3. To plan and design of Watershed protection, conservation elements. 4. To envisage the management plan of Watershed.	The students will be able to: 1. Understand the Watershed and its characteristics. 2. Understand the importance of watershed in terms of drinking water, irrigation water, increases in ground water. 3. Plan and design of Watershed protection, conservation elements. 4. Envisage the management plan of Watershed.
Mapped Program Outcomes: a, e, h, k & l	

UNIT – 1 :
Soil and Water– Issues related to plant life like composition of soil, water requirement of crops, necessary conditions for plant growth etc. Soils, their origin and classification.Land classification for WM, Land capability rating, determination of land capability class, land capability and suitability surveys, (Desalination of water logging and its remedial measures).

[07 Hrs.]

UNIT – 2 :
Watershed Behavior– Physical elements of a watershed, effects of land use changes on hydrological cycle component Concept of vegetative management of water yield and quality. Watershed Experiments, extrapolation of results from representative and experimental basins, Regional studies. (Water auditing and Bench marking).Soil erosion – problem, types, conservation, and control measures in agricultural and non-agricultural land.

[06 Hrs.]

UNIT – 3 :
Water conservation and Harvesting– Agronomical measures in soil and water conservation. examples and critical reviews. Inventory techniques for precipitation runoff, soil, timber, range-land and wild life Water harvesting techniques – Elements, Development of modern harvesting Techniques Estimation of peak runoff rate Land capability classification.

[06 Hrs.]

UNIT – 4 :
Erosion process – Factors affecting erosion, Types of erosion, Assessment of erosion, Control measures for erosion Conservative practices-Objective and general practices, land and soil classification, identification of critical areas, (Catchment area treatment).

[07 Hrs.]

UNIT – 5 :
Watershed Management- Objectives of Planning, Watershed Projects, Guidelines for Project Preparation. Approach in Government programmes, people's participation, conservation farming, watershed-management planning and identification of problems, objectives and priorities, socioeconomic survey, use of tools like GIS.

[07 Hrs.]

UNIT – 6 :
Watershed Modelling: Runoff components –Simple parametric models – Curve Number Method, variable source area models; quasi- physically based models; a simple physically based model. Rainfall-Runoff modelling, USLE model for soil erosion.

[06 Hrs.]

Text Books:
1. J. V. S Murthy, Watershed Management, New Age International Publishers, 1998.
2. Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 2003.
3. V.V. N. Murthy, Land and Water Management, Kalyani Publishers, 1994.

Reference Books:
1. Ghanshyam Das, Hydrology &soil Conservation Engineering, PHI Publication.

VIII SEMESTER

CV1451	PE III: Urban Transportation Planning			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	**15**	**10**	**60**	**100**		**4 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
udents Understood about: 1. Importance of Planning, analysis and implementation. 2. Traffic forecasting and Environmental impacts. 3. O &D Studies based on trip distribution and generation. 4. Various Modes and Model split analysis 5. Traffic Regulation, ITS in urban traffic and illumination system.	1. Students understood about traffic forecasting and its effects on environment. 2. Students understood the necessity and importance of Traffic regulations. 3. Students understood the necessity and arrangement of street lighting. 4. Students understood about planning process and traffic problems.
Mapped Program Outcomes: a, b, c, e, h, i, k	

UNIT – 1 :
Importance of urban transport planning
Transport Planning Process: Scope, Independence of the land use and traffic, system approach to transport planning, stages, survey and analysis, forecast analysis and future condition of plan synthesis, evolution, programme adoption and implementation, continuing study, citizen participation, difficulties in transport planning process.
[07 Hrs.]

UNIT – 2 :
Traffic forecasting: Necessity, Limitations, Types of traffic, Methods of forecasting, Period of forecasting.
Traffic and environment: Introduction, Detrimental effects on environment, Noise, Air pollution, vibration, Visual intrusion and degrading aesthetics, Severance and land consumption, evaluation procedure, environmental areas, situation in India.
[06 Hrs.]

UNIT – 3 :
Trip Generation: introduc6tion and definition, trip purpose, factors governing trip generation and attraction rates.
Trip Distribution: Introduction, Methods: Uniform factor method, Average factor method. Farther method, Furness Method, Criticism of Growth factor method, Tranner's Model, Gravity Model, Opportunity Model. Delay studies.
[06 Hrs.]

UNIT – 4 :
Model Split: General consideration, factors affecting, Model split in transport planning process, recent development. Mode choice analysis. Introduction to Various modes of urban transportation: Local trains, Metro, Monorails, BRTS and MRTS.
[07 Hrs.]

UNIT – 5 :
Regulation of traffic: Basic principles of regulation, scope of traffic regulation, traffic laws, regulation of speed, vehicles, driver & traffic, parking & enforcement regulations, motor vehicle act.
[06 Hrs.]

UNIT – 6 :
Nature of traffic problems in cities: Growth of town & traffic, present difficulties in urban traffic condition, measures, Application of ITS in urban traffic management, VMS, Signal coordination, parking management.
Urban Street Light systems: Need, laws of illumination, decrement by artificial lightening, appearance of lighted pavement, types of surface, distribution of light, mounting height, spacing, lantern arrangement, types of lamps, quantity of illumination, lamp installation of T-junction and cross roads, illumination of traffic rotaries, lighting at bends, dual carriageway, roads, bridges, tunnels, maintenance of lightening installation.
[07 Hrs.]

Text books:
1. Traffic Engineering and Transport Planning, Kadiyali, L.R, Khanna Publishers
2. Principles & Practice of Highway Engineering, Chakroborty P Das, Khanna Publisher, 2000
3. Highway Engineering, Rangawala B.S, Charotar Publishing House, 2011
Reference books:
1. IRC Handbook and MOST Specifications, Indian Road Congress
2. Fundamentals of Transportation and traffic Operations. Pergamon, Elsevier science Inc
3. Institute of Transportation Engineers, 'Manual of Transportation Engineering Studies', Prentice Hall

VIII SEMESTER

CV1427	PE IV: Waste Water Treatment			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To study necessity and objectives of wastewater treatment and layout of a wastewater treatment plant. 2. To study disposal methods for wastewater. 3. To study principles of working and design of various waste water treatment units and processes. 4. To understand need & processes of Advanced wastewater treatment. 5. To study treatment of wastewater from various industries.	1. An ability to understand the necessity of water quality management 2. An ability to design various treatment units for waste water 3. An ability to understand advanced treatment processes for waste water 4. An ability to understand treatment of waste water from various industires.
Mapped Program Outcomes: a, c, e	

UNIT – 1 :
Holistic approach to Wastewater management, Effluent & Stream standards, wastewater characteristics and their significance, disposal methods for wastewater on land and in water and its impact, self-purification of streams

[06 Hrs.]

UNIT – 2 :
Preliminary and primary treatment processes and units: Screens, grit chamber and primary settling tank- Principles, types & designs.

[07 Hrs.]

UNIT – 3 :
Secondary treatment processes & units: Concepts in biological treatment, bacterial growth and biological oxidation, Activated sludge process, Trickling filter- Principles, types. Simple design problems.

[07 Hrs.]

UNIT – 4 :
Other biological treatment units: Aerated lagoons, Stabilization Ponds, Up flow Sludge Blanket Reactors, fixed film reactors, Sludge De watering methods, Sludge Digester.

[06 Hrs.]

UNIT – 5 :
Need of advanced treatment, removal of trace organics, micro screening and control of nutrients, nitrification and de-nitrification, removal of phosphorus.

[07 Hrs.]

UNIT – 6 :
Treatment alternatives for Industrial waste, volume reduction, strength reduction, equalization tank, neutralization tank, Specific industrial wastewater treatment for paper and pulp industry, sugar industry, distillery industry, dairy industry, textile industry.

[06 Hrs.]

Text Books:
1. B.C. Punmia, 2010, Wastewater engineering, Laxmi Publications (P) Ltd., New Delhi.
2. P. N. Modi, 2008, Sewage Treatment & Disposal and Waste Water Engineering, Standard Book House.
3. S. K. Garg, 2010, Environmental Engineering (Volume-2), Khanna Publication.
4. M. N. Rao, 2007, Waste water treatment, oxford and IBH publishing.
5. Patwardhan, 2008, Industrial wastewater Treatment, PHI learning Pvt. Ltd.
6. G.L. Karia and R. A. Christian, 2006, Wastewater Treatment, PHI learning Pvt. Ltd.

Reference Books:
1. Metcalf and Eddy, 2006, Wastewater Treatment Disposal and reuse, Tata McGraw Hill publishing company Ltd.

VIII SEMESTER

CV1428	PE IV : Earthquake Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study geology of earth and interior. 2. To expose student to understand the detailed study of earthquake. 3. To expose students to understand various provisions related to earthquake design. 4. To understand various aspects of tall structures. 5. To understand detailing of RCC members for ductile behavior as IS code provisions. 6. To understand various effects of earthquakes on structures	After completion of course the student will be able 1. An ability to understand the necessity and Importance of Earthquake Engineering 2. An ability to understand the provision of IS Code used for Earthquake Resistance Design of Structure 3. An ability to design the structure by considering various loads. 4. An ability to understand various special aspects in Multi-story buildings, ductile detailing and its design. 5. An ability to prepare mathematical model to design tall structures. 6. An ability to study of Damages caused due to past Earthquake in & outside India and remedial measures
Mapped Program Outcomes: a, c, e, l, m	

UNIT – 1 :
Origin of earthquakes, engineering geology, seismicity of the world, faults, earthquake waves, quantification of earthquake (magnitude, energy, intensity of earthquake), measurements of earthquake, analysis of earthquake records and its interpretation.

[07 Hrs.]

UNIT – 2 :
Determination of magnitude, epicenter, epicenter distances, focal depth, seismic zoning, ground motion and their characteristics, factors affecting ground motions, causes or sources of earthquake damages, evaluation of seismic hazards, concept of response spectra, generation of response spectrum from available earthquake.

[06 Hrs.]

UNIT – 3 :
Study of IS: 1893, IS: 13920 for analysis and ductile detailing of RCC structures and other related codes, concept of earthquake resistant design, design philosophy, virtues of earthquake resistant design.

[06 Hrs.]

UNIT – 4 :
Design and detailing of RCC members, beam, column, shear wall and beam-column joints for ductile behaviors, calculation of base shear distribution to various floors.

[07 Hrs.]

UNIT – 5 :
Special aspects in multi-storey buildings, effect of torsion, flexible first storey, P-delta effect, and soil-structure interaction on building response, drift limitation, soil liquefaction during earthquakes.

[07 Hrs.]

UNIT – 6 :
Load bearing structures, masonry structures, strengthening and rehabilitation of non-engineered building for earthquake, earthquake disaster management, mitigation and social aspects, lessons from past earthquakes.

[06 Hrs.]

Text Books :
1. Agrawal & Shrikhande, Design of Earthquake Resistant Structures, 3rd 2006, Prentice – Hall of India Pvt. Ltd.
2. Roberto Villaverde, Fundamental Concepts of Earthquake Engineering, 2009, CRC Press
3. Asadour H. Hadjian, Basic Elements of Earthquake Engineering, 2015, Wiley

VIII SEMESTER

CV1428	PE IV : Earthquake Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

References Books:

1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org / iaee / E_FrontCover.pdf, NICEE Guidelines for Earthquake Resistant Non-Engineered Construction, 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India.
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition
4. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, 2001, Kluwer Academic Publisher
5. Paulay, T. & Prestiley M.J.N., Seismic design of R C & Masonry Buildings, 2nd 1999, John Willey & Sons

VIII SEMESTER

CV1429	PE IV: Matrix Analysis of Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
At the end of the course the student will be able to understand 1. Basic concepts of direct stiffness method. 2. Analysis of various structural elements by stiffness method	1. An ability to understand the stiffness method for analyzing statically indeterminate structures. 2. An ability to model the behaviour of various structural elements and systems. 3. An ability to understand the effect of various loading and support conditions on structural elements and systems. 4. An ability to implement the computer program to analyse the structures.
Mapped Program Outcomes: a, e,g,h,j,k l, m	

UNIT – 1 :
Basic terminology, degree of freedom, basic concept of direct stiffness method, derivation of all stiffness coefficients, formulation of compatibility equations, rotation transformation matrix.

[06 Hrs.]

UNIT – 2 :
Analysis of Beam (without axial deformation): Formulation of elemental stiffness matrix for Beam, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, uniformly distributed load and moment, assembly of global load matrix, solution to problem without sinking of support with maximum three degree of freedom.

[07 Hrs.]

UNIT – 3 :
Analysis of Plane Truss: Formulation of elemental stiffness matrix and global stiffness matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, assembly of global load matrix, solution to problem of plane truss with maximum three degree of freedom.

[06 Hrs.]

UNIT – 4 :
Analysis of Plane Frame (Without axial deformation): Formulation of elemental stiffness matrix and, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[06 Hrs.]

UNIT – 5 :
Analysis of Plane frame (With axial deformation): Formulation of elemental stiffness matrix and transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[07 Hrs.]

UNIT – 6 :
Analysis of Beam with sinking of support, analysis of member for temperature loading, lack of fit in trusses with maximum three degree of freedom, storing of global stiffness matrix, full storage, banded storage and band minimization.

[07 Hrs.]

VIII SEMESTER

CV1429	PE IV: Matrix Analysis of Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Gere and Weaver, Matrix Method of Structural Analysis, McGraw Hill. 2004
2. Kanchi M.B., Matrix Method of structural Analysis, New age International,1993
3. Martin H.C. Introduction to Matrix Method of Structural Analysis, 1966
4. Pandit Gupta, Structural Analysis: A Matrix Approach,Tata McGraw-Hill, 2001

Reference Books:

1. Meghre A.S. &Deshmukh S.K., Matrix Method of Structural Analysis,Charotar Publishing House Pvt. Limited, 2003
2. Flemming Computer Analysis of Structures, McGraw-Hill Education , 1996
3. Wang C K,, Intermediate Structural Analysis, McGraw-Hill Education, 2010
4. S. Rajasekaran, G. Sankarasubramanian Computational Structural Mechanics, PHI Learning Private Limited, 2004

VIII SEMESTER

CV1452	PE IV: Advanced Surveying			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand the importance of Higher surveying in the field of civil engineering 2. To understand fundamental knowledge of working principles of Advanced Electronic Devices and Total Station. 3. To understand fundamental knowledge of principles of GPS, GIS and Remote Sensing.	1. The students will be able to understand the advantages of electronic surveying over conventional surveying methods. 2. The student will be able to handle and to understand the working principle of Advanced Electronic Devices and total Station. 3. The student will be able to understand and to apply knowledge of GPS, GIS and Remote Sensing technique /data for required purpose.
Mapped Program Outcomes: a, b, d, e, f, g, k, l,	

UNIT – 1 :
ELECTRONIC SURVEYING
Basic principles, classifications, applications, comparison with conventional surveying, electromagnetic wave theory - electromagnetic distance measuring system - principle of working and EDM instruments, application of Lasers in distance measurement.

[07 Hrs.]

UNIT – 2 :
TOTAL STATION SURVEYING
Basic Principle - Classifications -Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system.Care and maintenance of Total Station instruments. Modern positioning systems - Traversing and Trilateration.

[06 Hrs.]

UNIT – 3 :
GPS SURVEYING
Introduction: Introduction to GPS, History, Satellite Navigations constellations today – GPS system, GLONASS system, Galileo System, GPS Errors Future of GPS. Reference Systems and Coordinate systems: Geodetic coordinate systems, Datum transformations, Height systems, Time systems. Modernization plans of navigational satellites, Hardware and software improvements.

[07 Hrs.]

UNIT – 4 :
GIS SURVEYING
Map – mapping concepts, analysis with paper based maps, limitations, GIS- Definition, advantages of digital maps. Fundamentals of GIS – Information Systems, Modeling Real World Features Data , Data Formats – Spatial and Non-spatial, Components, Data Collection and Input, Hardware – Computing, printing and scanning systems; Introduction to Software – Standard Packages like Arcview, ArcGIS, Autocad Map, Map Info etc.

[06 Hrs.]

UNIT – 5 :
PHYSICS OF REMOTE SENSING
Physics of Remote Sensing: Sources of Energy, Active and Passive Radiation, Electromagnetic Radiation - Reflectance, Transmission, Absorption, Thermal Emissions, Interaction with Atmosphere, Atmospheric windows, Spectral reflectance of Earth's surface features, Multi concept of Remote Sensing.

[06 Hrs.]

UNIT – 6 :
MICROWAVE REMOTE SENSING
Microwave Remote Sensing: Active and Passive Systems, Advantages, Platforms and Sensors, Microwave Radiation and Simulation, Principles of Radar – Resolution, Range, Angular Measurements, Microwave Scattering, Imagery – characteristics and Interpretation.
Applications: Geosciences, Water Resources, Land use – Land cover, Transportation

[07 Hrs.]

VIII SEMESTER

CV1452	PE IV: Advanced Surveying			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 hours**

Text Books:

4. James B. Campbell & Randolph H. Wynne., Introduction to Remote Sensing, The Guilford Press, 2011.
5. Charles Elach & Jakob van Zyl., Introduction to the physics and techniques of Remote Sensing, John Wiley & Sons publications, 2006.
6. Thanappan Subash., Geographical Information System, Lambert Academic Publishing, 2011
7. Lillesand T.M and Kiefer R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, 2008.
8. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993

References Books:

1. Guocheng Xu, "GPS Theory, Algorithms and Applications", Springer - Berlin, 2003.
2. Satheesh Gopi, rasathishkumar, N. madhu, “Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2007

VIII SEMESTER

CV1453	PE IV-Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study basic features and theory of shallow foundations. 2. To familiarize the students with different types of shallow foundations. Analysis and geotechnical design of shallow foundations. 3. Student will develop ability to predict and estimate settlement of foundations. 4. To study basic features and theory of deep foundations. 5. To acquaint students with foundations provided in various soil conditions for offshore structures.	1. Students will be able to understand basic features and theory of shallow foundations. 2. Students will be able to estimate settlement of foundations. 3. Students will understand basic features and theory of deep foundations. 4. Students will understand basics of offshore foundations.
Mapped Program Outcomes: a, b, c, d	

UNIT – 1 :
Ultimate bearing capacity of shallow foundation:
Features & criteria for various types of shear failure in foundation soil, types of footings and rafts, location and depth of footings. Overview of theories of bearing capacity under centric vertical, inclined & vertical loads; Terzaghi's theory, theories of Meyerhof's, Balla, Vesic, Reddy-Srinivasan etc. Effect of interference of footings, Ultimate load computation for rectangular footing/raft; for limited depth of soil below the foundation. Theoretical approaches for footings on slope. Ultimate & allowable bearing capacity determination and settlement estimation from the data of penetration tests (SPT & SCPT), plate load test and pressure meter test.

[07 Hrs.]

UNIT – 2 :
Settlement analysis
Boussineq's theory, pressure distribution for strip load, square and circular areas, pressure bulbs, contact pressure distribution. Methods of computation f elastic settlement, Janbu's equation, use of strain influence factor, Schmentmann's approach, settlement from elasticity theory, computation of primary and secondary consolidation of foundation on Normally Consolidated Clay& Over Consolidated Clay; Differential settlement & its permissible values. Control of excessive settlement. Special considerations for rafts on sand and clay, concept and design principle of floating raft foundation, proportioning the footings of public building for equal settlement. Overview of shallow foundation on reinforced earth under centric vertical load**.**

[06 Hrs.]

UNIT – 3 :
Axially loaded Piles
Load transfer mechanism, piles in sand and clay, computation of end bearing and skin resistance; α, βand λ methods, drained and undrained capacity, effect of pile installation methods on load capacity and pile behaviors, critical length of piles in sands, dynamic formulae: limitations. Effects of pile driving on ground, & adjacent structures. Constructional features of bored piles in different soil conditions, large diameter bored piles and pier foundations, Load Capacity of single and multi-undereamed piles, various methods to determine base resistance of piles (Meyerhof, Vesic, Janbu, Coyle-Castello etc.).

[06 Hrs.]

UNIT – 4 :
Laterally loaded piles:
Applications, lateral resistance of single pile, long and short piles, failure mechanisms, Approaches of analysis with Winkler model for soil, Reese-Matlock's analysis, Equivalent cantilever approach, IS code provisions, p-y concept, construction of p-y curves for piles in soft clays and sands, effect of cyclic loading, salient features & design charts of Brom's analysis for different pile-soil systems.

[07 Hrs.]

UNIT – 5 :
Foundation for offshore structures:
Nature and magnitude of loads, features and construction methods of template type piled platforms, Gravity platforms and Tension leg platforms, Pile behaviours under environmental loading conditions.

[06 Hrs.]

VIII SEMESTER

CV1453	PE IV-Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

UNIT – 6 :
Anchor foundations:
Behaviour and failure mechanism of shallow anchors & deep anchors, Ultimate anchor capacity;
Well foundations:
Introduction to methods based on elastic theory and ultimate resistance, function and design of component parts of well foundations.

[07 Hrs.]

Assignment work shall comprise:
3 to 4 assignment based on the above syllabus.

Text Books:
1. Principles of Foundation Engineering, 1999, B.M. Das, PWS publishing co.
2. Advanced Foundation Engineering**,** 2007, Murthy V.N.S, CBS Publishing.
3. Foundation Engineering Handbook, 2004, H.Y. Fang.

Reference Books:
Theory & practice of foundation Design, 2002, Som N.N. & Das S.C., Sarita Prakashan, Meerut.

VIII SEMESTER

CV1454	PE IV: Water Power Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
rious objectives of the course will be: 1. To understand the significance of water power engineering 2. To correlate between hydrology and water power engineering 3. To understand the concepts of turbines and pumped storage tanks. 4. To design units of hydroelectric power station & its components.	1. An ability to understand Analysis and design of different components of hydro power plant 2. An ability to understand Analysis and design of surge tanks
d Program Outcomes: a, e, h, k & l	

UNIT – 1 :

Introduction: Sources of energy, types of power station, choice of type of generation, components of water power project, types and general layouts of various hydropower schemes, General arrangements of a power station, power house, sub-structure and super structure, underground power station–necessity, principal, types, development and economics.

[06 Hrs.]

UNIT – 2 :

Estimation of hydro power potential, basic water power equation, gross head, net head, nature of supply, storage and pondage, Method of computing hydrographs, mass curves, flow duration curves.

Nature of demand: Load curve, load duration curves, load factor, plant factor, plant use factor, firm power secondary power.

[07 Hrs.]

UNIT – 3 :

Intake structures: Types, level of intake, hydraulics of intake structures, trash rack, transition, intake gates. Conduits: Types, economic section, power canals, pen-stock types hydraulic design and economic diameter pipe supports, anchor blocks, tunnels – classification, location and hydraulic design, tunnel linings.

[06 Hrs.]

UNIT – 4 :

Surge Tank: Functions and behaviour of the surge tanks, location, types of surge tanks, basic design criteria of simple surge tank, fore-bay.

[07 Hrs.]

UNIT – 5 :

Turbines: Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitations Tail race: Functions, types, channel and tunnel draft tubes, function and principal types

[07 Hrs.]

UNIT-6:

Pumped storage plants, purpose and general layout of pumped storage schemes, main types, typical arrangements of the upper reservoirs, economics of pumped storage plants. Introduction to Tidal power stations.

[06 Hrs.]

Text Books:

1. Dandekar M. M. & Sharma K. N, Water Power Engineering, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Sharma R.K. & Sharma T.K., Water Power Engineering, S. Chand Publication.
3. Streeter V. L. & Wylie E. B, Hydraulic Transient, McGraw Hill Book Company, New York.

Reference Books:

1. Chaudhary Hanif, Applied Hydraulic Transients, Van Nostrand Rein Hold Company, New York. Varshney, Water power engineering, Nemchand Publication.

VIII SEMESTER

CV1432	PE V: Water Transmission & Distribution Systems			L= 3	T= 0	P= 0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
The students will learn the:- 1. Reservoir, pump, various valves in distribution system. 2. Analysis of flow in looped networks using various methods. 3. Analysis of flow in serial networks using node flow analysis. 4. Optimal and Economical diameter of pumping main 5. Design of water distribution networks 6. Optimization of water distribution network.	1. An ability to understand the Reservoir, pump, various valves in distribution system 2. An ability to understand Analysis of flow in looped networks using various methods 3. An ability to understand Analysis of flow in serial networks using node flow analysis 4. An ability to understand Optimal and Economical diameter of pumping main 5. An ability to understand Design of water distribution networks 6. An ability to understand Optimization of water distribution network
d Program Outcomes:a, c, e & k	

UNIT-1:
General Hydraulic Principles, Head loss formulae- Darcy-Weisbach formula, Hazen – Williams formula, Modified Hazen - Williams formula, minor losses, continuity equation,, Equivalent length of Pipes, Three Reservoirs, Pumps and Valves in Water distribution systems.

[06 Hrs.]

UNIT-2:
Types of network, Formulation of Equations for looped Water Distribution Networks, Analysis of flow in looped networks using Hardy-Cross method and Newton-Raphson method.

[07 Hrs.]

UNIT-3
Node flow analysis of water distribution networks (NFA): Necessity of node flow analysis, classification of node according to HGL, classification of node according to flow, compatibility, node head-discharge relationship, Application of NFA technique to serial networks.

[07Hrs.]

UNIT-4:
Optimal and Economical diameter of pumping main. Design of pumping main considering rising main diameter as continuous as well as discrete variable.

[06Hrs.]

UNIT-5:
Design of water distribution networks: Design of single source branching network using Critical path method, Determining number of branching configuration for a looped network by graph theory, Use of path concept and minimum spanning tree concept.

[07 Hrs.]

UNIT-6
Formulation of optimization model, Application of critical path method for design of looped networks. Application of Cost-head loss ratio method for optimal design of branched networks.

[06 Hrs.]

Text Books:
1. Bhave P.R., Optimal design of water distribution networks, 2003-12-04, Alpha science International Ltd
2. Bhave P.R., & Gupta R., Analysis of Water Distribution Networks, 2006-09-18, Alpha science International Ltd

Reference Books:
1. Jeppson, R.W., Analysis of flow in pipe networks, June 1976, Butterworth-Heinemann,
2. Walski, T. M., Analysis of water distribution systems, November 1992, Krieger Publishing Company CPHEEO, Ministry of Urban Development, New Delhi, 2005
3. Manual on Water Supply and Treatment, CPHEEO, GOI

VIII SEMESTER

CV1433	PE V: Advanced Steel Design			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the fundamental design philosophies of steel structures 2. To study the codal provision for design of steel structure 2. To study the relationship between structural analysis and design provisions.	1. An ability to understand different types of loading with respect to structural parameters. 2. An ability to identify the type of structure and its design methodology. 3. An ability to utilize the application of Indian Standard code for design purpose.
Mapped Program Outcomes: **a, c, e, i, k, l, m**	

UNIT – 1 :
Eccentric Connection: Bracket Connection, Seat Connection, Frame Connection, Moment Resistant Connection. Drawing in sketchbook about eccentric connections.

[10 Hrs.]

UNIT – 2 :
Plate Girder: Element of Plate Girder, Types of Section, Design Aspect, Stability of Webs, Design of Welded Plate Girder. Drawing in sketchbook about plate girder.

[10 Hrs.]

UNIT – 3 :
Gantry Girder: Loads Acting onGantry Girder, Fatigue Effect, Selection of Gantry Girder, Design of Gantry Girder. Drawing in sketchbook about Gantry girder

[09 Hrs.]

UNIT – 4 :
Bridges: Types of Bridges, Foot Bridge, Road Bridge, Railway Bridge, Rolled Beam Bridges, Plate Girder Bridges, Truss Bridge, Through And Deck Type Bridges, Weight of Bridge Truss By Empirical Formulae, Loading on Footways, IRC Loading, Loading on Railway Bridges, Design Of Footbridge.
Introduction to Bearings-Types of Bearings, Bearing Pads, Rocker, Roller and elastomeric Bearings.
Drawing in sketchbook about bearings and bridges.

[10 Hrs.]

Text Books:
1. Design of steel structures, By S. Arya and J. L. Ajmani, New Chand & Bros. Roorkee, 1992
2. Fundamentals of Structural Steel Design, By M. L. Gambhir, Mc Graw Hill Education, 2013
3. Design of Steel Structures, By N. Subramanian, OXFORD University Press, First Edition, 2008

Reference Books:
1. Limit State Design of Steel Structures, By S. K. Duggal, Mc Graw Hill Education Private Limited, 2011
2. Design of Steel Structures, By P. Dayaratnam, S. Chand Publication, 2008

VIII SEMESTER

CV1434	PE V: Maintenance & Rehabilitation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand various civil engineering materials. 2. Understand various methods of testing of materials. 3. Understanding and use of various codes related to the civil engineering materials.	1. Students will know about different high quality materials for civil engineering applications. 2. Ability to use materials for better and durable Civil Engineering Structures. 3. Student will know about various smart materials.
Mapped Program Outcomes: h, j, k	

UNIT – 1:

Introduction:

Deterioration of structures, definition of maintenance, need for maintenance of different civil engineering structures, maintenance characteristics, negligence and poor maintenance of structures, quantification of maintenance.

Classification of Maintenance Work:

Servicing, rectification, replacement, planned, unplanned, preventive, corrective, predictable and avoidable maintenance works, renovation and rehabilitation, routine maintenance of buildings, specifications for maintenance works.

Common Maintenance Problems:

Related to various civil engineering structures and systems, techniques of maintenance, areas prone to frequent maintenance, causes that aggravate maintenance work like high-rise buildings, special construction methods, new materials, accessibility, Environment etc., construction details for prevention.

[07 Hrs.]

UNIT – 2 :

Factors Affecting Frequency and Magnitude of Maintenance Work:

Over loading, movement of grounds, temperature variations, moisture, leakages and dampness, chemical actions and corrosion, growth of trees, earthquake, flood and fire, riots and vandalism, design defects, defects in construction and use of materials, choice of materials for durability and maintainability, design, exposure and other factors affecting durability, precautions to increase durability, effect of pollution on buildings.

Inspection, Identification and diagnosis of common defects and failures with possible causes in buildings, Roads, bridges, railway tracks, canals and C.D. Works, tunnels and special structures like service reservoirs, water supply, sewerage, storm water drains.

[06 Hrs.]

UNIT – 3 :

Preventive Maintenance: General, site selection, choice of structural systems and materials, specifications & detailing, special attention to foundations, walls, roofs, terraces, floors, doors, windows, plinth, compound walls, expansion joints and staircases to improve maintainability, water supply and sanitary works, termite control, external finishes.

Road stabilization techniques, compaction & drainage, shoulders, slope protection, joints in Cement Concrete Pavements, routine and service maintenance, recycling, bridges and Cross Drainage works repairs, strengthening and rehabilitation, reliability rating of existing structures and systems, service life & expected load carrying capacity, service & stability requirements, future service requirements, loads, fatigue and creep.

[07 Hrs.]

UNIT – 4 :

Materials and Techniques for Maintenance:

Materials for repairs like cement, cement grouts, epoxy grouts, mortars and coatings, polymer concrete composites, sealants, membrane overlays, fiber reinforced concrete, resin based compounds, emulsions, paints and geotextiles, techniques like stiffening, linings, guniting protection systems, prestressing, post-tensioning and base isolation technology, corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, stitching, repair and strengthening of concrete buildings, foundation repair and strengthening, underpinning, leakage of roofs and methods of repair.

Failure of Buildings:

Definition of building failure, functional, structural and aesthetical failures, case studies, methodology of failure investigation, diagnostic testing methods and equipments, effect of fire on buildings.

[06 Hrs.]

VIII SEMESTER

CV1434	PE V: Maintenance & Rehabilitation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

UNIT – 5 :

Maintenance Planning:

In-depth significance of maintenance as opposed to cosmetic treatments, broad action plan, planning, budgeting and controlling the cost of maintenance work, policy formulation, standards of maintenance & controlling cost, planned maintenance, inspection cycles and condition surveys, investigation for assessing condition of structures including non-destructive evolution techniques like proof load test, photogrammetric analysis, assets and optical electric motion analysis, Bovescopesfiber optic probes, chain-dragging, acoustic emission and ultrasonic techniques, infrared thermography, high-speed non-contact sensor, sonar and sound penetrating radar techniques, reliability rating, maintenance cost records, maintenance manuals, their functions, contents and types, difficulties in planned maintenance.

Conservation and Recycling –

Historical buildings, conservation movement (needs), documentation, materials and methods for conservation work, recycling of old building and its advantages, case study.

[07 Hrs.]

UNIT – 6 :

Maintenance Oriented Designs: Design and its relation to maintenance, relationship between initial maintenance and running costs, cost appraisal techniques, consideration of maintenance at design stage, design needs, importance of feedback and feedback systems, information gathering, design data communication, interaction between designers and contractors, maintainability, role of design professionals

Maintenance Management: Need for data, relationship of the data base system to management process, cost of data base and management, uses of data base, problems in data collection, setting criteria from data collected, operational assessment.

Research in Maintenance: Importance of research, areas of research including materials, techniques, field equipment and tools for investigation, repairs and monitoring non-destructive evaluation techniques.

[06 Hrs.]

Text Books:

1. Concrete Technology, 2009, Shetty M.S., S.ChandPublication,New Delhi.
2. Concrete for Construction - Facts and Practice, 1999, Raina V.K, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. SP: 25 -1984 - Hand Book on Causes and Prevention of Cracks in Buildings, 1999, Bureau of Indian Standards, New Delhi.

Reference Books:

1. Concrete - Building Pathology, 2003, Macdonald S., Blackwell Science Limited, Oxford.
2. The Maintenance and Adaptation of Buildings, 1981, Chudley, R., Longman Group Ltd, New York.
3. Corrosion Damaged Concrete - Assessment and Repair, 1987, Strecker, P.P, Butterworths, London.

VIII SEMESTER

CV1455	PE V: Finite Element Method			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the student with knowledge and analysis skills in applying basic laws and steps used in solving the problem by finite element method. 2. To provide the student the knowledge of various interpolation functions and elements to solve simple problems by finite element method. 3. To provide the student with some knowledge in is oparametric formulation. 4. To provide students the knowledge of mathematical modelling techniques.	1. Students will demonstrate an ability to apply the steps required for FEM solution to variety of physical systems. 2. Students will demonstrate an ability to create models for simple structures. 3. Students will be able to extend the knowledge of the application of FE to solve engineering problems.
Mapped Program Outcomes: a, d, e, k,	

UNIT – I :
Introduction: Development, Historical background, Applications, Advantages and Disadvantages of FEM, General steps of FEM, direct equilibrium approach, Variational approach , weighted residual approach, local and global FEM, application to simple problems.

[07 Hrs.]

UNIT – II :
Shape functions: Introduction, requirement of Ideal displacement functions, Derivation of shape functions using Cartesian Coordinates, Lagrange and Serendipity elements.

[06 Hrs.]

UNIT – III :
Application of FEM to 1D problems: Derivation of element property matrix and influence vector, application, Application to bar, truss, steady state heat conduction, steady state flow through porous medium problems.

[06 Hrs.]

UNIT – IV :
Application of FEM to 2D problems: Equilibrium equations, Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis.

[07 Hrs.]

UNIT – V :
Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.

[07 Hrs.]

UNIT – VI :
Numerical integration, Modeling, storage and solution techniques.

[06 Hrs.]

Text Books :
1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P. N. , . Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y. M., Eldho T. I. and Shah A. H., Finite Element Method s and Application to Engineerimg, Pearson , 2011.

Reference Books :
1. Krishnamoorthy C S, “Finite Element Analysis – Theory and Programming”, Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Cook R D, Malkus D S, Plesha M E and Witt R J, “Concepts and Applications of Finite Element Analysis”, John Weily & sons inc, New York, Fourth Edition, 2003.
3. Rajasekaran S, “Finite Element Analysis in Engineering Design”. S Chand & Co., 2003.

VIII SEMESTER

CV1456	PE V - Advanced Geotechnical Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the importance of engineering properties of soil in foundation design. 2. To create an ability to apply knowledge of geotechnical engineering.	1. Students will understand about clay mineralogy. 2. Students will understand the analysis and interpretation of data related to the field of Geotechnical engineering. 3. Students will understand about machine foundations and well foundations.
d Program Outcomes: a, b, e, h, l	

UNIT-1

Clay mineralogy:

Soil as three-phase system. Various soil weight & volume inter–relationship. Soil structure and clay mineralogy: atomic and molecular bonds, inter particle forces in a soil mass, clay minerals, mode of occurrence of water in soil, Effective, neutral and total stresses in soil mass.

[06 Hrs.]

UNIT-2

Shear strength parameters and their applications:

Shear strength parameters of cohesion less and saturated cohesive soils, Principle of effective stress, Stress- Strain relationship, Skempton's Pore pressure coefficients,

Bearing capacity of soils (IS: 6403), types of shear failure in foundation soil, Terzaghi's theory, its validity and limitations, bearing capacity factors, effect of water table on bearing capacity.

[07 Hrs.]

UNIT-3

Stability analysis of slope

Effective and total stress analyses, shape of slip surface, method of slices, graphic methods, location of critical slip circle, wedge analysis.

[07 Hrs.]

UNIT-4

Flow through soils:

Permeability, seepage, mathematical analysis, Finite difference formulae for steady state flow nets –computation of seepage, uplift pressure, and critical hydraulic gradient.

[06 Hrs.]

UNIT-5

Machine Foundation: Introduction, Types of machine foundation, Basic definitions, Degree of freedom of block foundation, General criteria for design of Machine foundation, free & forced vibrations, Vibration analysis of a machine foundation, Determination of natural frequency, foundations for impact loads and vibration isolation.

[07 Hrs.]

UNIT – 6 :

Well foundation : Different shapes of wells, forces acting on the well foundation, Analysis of well foundation, Individual components of well foundation, Uses, constructional features, sinking of wells, tilt and shift, their rectification, depth of well and grip length.

[06 Hrs.]

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VIII SEMESTER

CV1457	PE V: Design of Bridge Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand various types of bridges and loadings. 2. Understand seismic behavior of bridges. 3. Understand design philosophy for bridges.	1. Students will understand fundamentals of bridge design. 2. Students will understand analysis and design of various types of bridge decks. 3. Students will understand the Sub-Structure Design and design of various components.
Mapped Program Outcomes: a, b, c, e,h,l	

UNIT – 1 :
Introduction to IRC codes, Loads on bridges and load combinations.
Introduction to elevated rail transit system, grade separation structures, pedestrian crossing and sub- ways.
[06 Hrs.]

UNIT – 2 :
Design of Bridge Slabs: Longitudinally reinforced deck slabs, transversely reinforced bridge slabs.
[07 Hrs.]

UNIT – 3 :
Design of Reinforced Concrete Bridges: Design of T- beam, box girder bridges.
[06 Hrs.]

UNIT – 4 :
Design of Prestressed Concrete Bridges: Design considerations and design examples.
[07 Hrs.]

UNIT – 5 :
Design of bridge bearings, types of bridge bearings, design examples.
[05 Hrs.]

UNIT – 6 :
Sub-Structure Design: Foundation investigation, bridge pier design, abutment design, open foundation, pile foundation.
[08 Hrs.]

Text Books:
1. T.R. Jagadeesh, M.A. Jayaram, Design of Bridge Structure, PHI publication.
2. Krishnaraju „ Bridge Engineering, UPD Publishers, New Delhi,2000.
3. Baider Bakht and Leslie, G. Jaeger,‘ Bridge Analysis Simplied, Mcgraw Hill Book Co,1998.

Reference Books:
1. IRC 005, Standard Specifications and Code of Practice for Road Bridges, Section I (General Features of Design) (Seventh Revision), 1998.
2. IRC 006, Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses (Fourth Revision), 2014.
3. IRC 078, Standard Specifications and Code of Practice for Road Bridges, Section VII – Foundations and Substructure (Revised Revision), 2014.
4. IRC 083-1, Standard Specifications and Code of Practice for Road Bridges, Section IX (Bearings), Part I (Metallic Bearings) (First Revision), 1999.
5. IRC 112, Code of Practice for Concrete Road Bridges, 2011.
6. Johnson Victor, ‘Bridge Engineering’, Oxford IBH, New Delhi, 2000.
7. Raina, R.K, ‘Principles of Design of RCC Bridges, Tata McGraw Hill,1999.
8. Conrad P. Heins and Richard A. Lawrie, ‘Design of Modern Concrete Highway Bridges, John Wiley and Sons, 1999.

VIII SEMESTER

CV1458	PE V – Advanced Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various theories and design of regarding shallow foundations. 2. To familiarize students with geotechnical design of Deep foundations. 3. To acquaint students with criteria for design of Machine foundation.	1. An ability to understand various approaches of determining bearing capacity shallow foundation. 2. An ability to predict and calculate settlement of foundation. 3. An ability to design deep and machine foundations
Program Outcomes: a,c,e,f,g,h,i,j,k,l	

UNIT-1

Bearing Capacity of Foundations: Terzaghi's, Meyerhoff, Hansens bearing capacity theories, Bearing capacity based on SPT, SPT Correlations, Design N Values, Bearing Capacity of Foundations with Uplift or Tension Forces, layered soils, eccentric and inclined loads, Bearing capacity on slopes, Safety Factors in Foundation Design,

[07 Hrs.]

UNIT-2

Foundation Settlements:

The Settlement Problem, Stresses in Soil Mass Due to Footing Pressure, Immediate Settlement Computations, Alternative Methods of Computing Elastic Settlements, Stresses and Methods of Computing.

[06 Hrs.]

UNIT-3

Combined and Mat Footing:

Safe bearing pressures for mat foundations on Sand and clay, Eccentric Loading, The Coefficient of Subgrade, Proportioning of Cantilever Footing, Design of Combined Footings by Rigid Method (Conventional) Method, Design of Mat Foundation by Rigid Method, Design of Combined Footings by Elastic Line Method, Design of Mat Foundations by Elastic Plate Method, Floating Foundation.

[07 Hrs.]

UNIT-4

Vertically Loaded Pile: Design of pile foundation: Ultimate Bearing Capacity in Cohesionless Soils, Critical Depth, Static Bearing Capacity of Piles in Clay Soil, Bearing Capacity of Piles in Granular Soils Based on SPT Value, Bearing Capacity of Piles Based on Static Cone Penetration Test (CPT),

Pile group : Settlement of pile groups in sand, settlement of pile groups in cohesive soils, allowable loads on groups of piles, uplift capacity of a pile group, behavior of laterally loaded, Winkler's hypothesis, *p-y* curves for the solution of laterally loaded piles

[06 Hrs.]

UNIT-5

Machine Foundation: Introduction, Types of machine foundation, Basic definitions, Degree of freedom of block foundation, General criteria for design of Machine foundation, free & forced vibrations, Vibration analysis of a machine foundation, Determination of natural frequency, foundations for impact loads and vibration isolation.

[07 Hrs.]

UNIT – 6:

Well foundation: Different shapes of wells, forces acting on the well foundation, Analysis of well foundation, Individual components of well foundation, Uses, constructional features, sinking of wells, tilt and shift, their rectification, depth of well and grip length.

[06 Hrs.]

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.
2. Principles of Foundation Engineering: Das B.M., PWS publishing co., (1999)
3. Foundation Analysis & Design: Bowles J.E., McGraw Hill, (1996)
4. Shallow Foundation: Das B.M., CRC Press, (2009)

VIII SEMESTER

CV1424	Comprehensive Viva-Voce			L=0	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	----	----	100		100	---

COURSE OBJECTIVES	COURSE OUTCOME
1. To understand necessity to study a topic comprehensively. 2. To know various ways and means to collect data and technical information related to a topic. 3. To understand ways to present literature collected.	1. An ability to collect information regarding only topic related in civil engineering 2. An ability to present the information collected in the expected format 3. An ability to express and communicate about the information collected.
Mapped Program Outcomes: b, c, e, i	

Every student will be allotted a specific topic related to civil engineering with the consent of the student. The student will be expected to prepare a detailed note on the topic and submit it to the guide. Evaluation will be based on the extent of information provided by the student and viva voce conducted by a panel of experts constituted by the department.

Operative Procedure for Comprehensive Viva Voce.

1] At the beginning of VIII Semester every faculty member in the Department (Regular and MR) will contribute at least *FIVE* sub-topics falling within the purview of UG Syllabus for preparing presentation during Comprehensive Viva-Voce. It should be seen that not more than 5 minute presentation shall be required to deal with the sub-topic.

2] A committee consisting of HoD and Five Senior Faculty Members shall go through the compiled list of sub-topics and finalise the list for onward processing.

3] The topic shall be allotted to each student from within the finalized list randomly and shall asked to prepare a presentation of FIVE minutes (5- 10 slides) for comprehensive viva voce with the help of their project guide.

4] The evaluation of the comprehensive viva voce shall be carried out not on the basis of the presentation of the topic, but on the basis of how the student have answered the questions arising out of the presentation and it's relevance to the General Civil Engineering.

5] The evaluation of the comprehensive viva voce shall be done by a panel of experts and be more in the context of overall understanding of Civil Engineering Syllabus rather than the topic of the presentation.

VIII SEMESTER

CV1425	Project – Phase--II			L=0	T=0	P= 8	CREDITS = 8
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	----	40	60		100	---

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.	1. An ability to apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.
2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.	2. An ability to designed a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interprete the data.
3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.	3. An ability to work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.
4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	4. An ability to apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.
5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	5. An ability to analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.
Mapped Program Outcomes: a,b,c,d, e,f, g,h, I,,j, k,l,m,n	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII SEMESTER

CV1426	Extra / Co-Curricular / Competitive Examination			L=0	T=0	P=0	CREDITS = 2
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	----	100	----		100	---

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develope creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to develop team work, leadership qualities, competitive spirit. 2. An ability to develop thinking and analysis process for environmental, ethical society. 3. An ability to develop solution to engineering problems related with social, environmental and ethical issues. 4. An ability to develop and nurture soft and communications skills.
Mapped Program Outcomes:a, b, h, j, k	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING
AUTONOMOUS INSTITUTION
SEAL
NAGPUR

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NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur – 441 110

Bachelor of Engineering
SoE & Syllabus 2018
3rd & 4th Semester
Mechanical Engineering

Yeshwantrao Chavan College of Engineering

B.E. SCHEME OF EXAMINATION 2018

Mechanical Engineering

SN	Sem	Sub Code	Type	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Third Semester														
	3				T	3			3	3	3			3
	3				T	3			3	3	3			3
3	3			**Lab:-**	P									
	3	3			T	3			3	3	3			3
	3			**Lab:-**	P									
	3				T						3			3
	3			**Lab:-**	P									
	3				T	3			3	3	3			3
	3				T						3			3
	3			**Lab:-**	P									
				TOTAL THIRD SEM		**20**	**0**	**8**	**28**	**24**				
Fourth Semester														
					T	3			3	3	3			3
					T	3			3	3	3			3
3					T	3			3	3	3			3
				Lab:-	P									
					T	3			3	3	3			3
				Lab:-	P									
					T						3			3
				Lab:-	P									
				TOTAL FOURTH SEM		**16**	**0**	**6**	**22**	**19**				
List of Audit Courses														
					A	3			3					
					A									

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

		June 2018	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Fifth Semester

3rd SEMESTER

GE2201	Engineering Mathematics-III		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcomes
The aim of this paper is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	• Analyze and solve problems for basic DC circuit including series and parallel circuit. • Basic concept of AC fundamental, phasor diagram ,RLC series and parallel circuit. • Three phase balanced circuit and different types of measuring instruments. • Construction, principle, equivalent circuit and calculation ofefficiency and regulation for single phase transformer. • Constructional details, principle, characteristics, speedcontrol methods of DC machine • Construction, principle ,torque-slip characteristics andapplications of 3 phase and single phase induction motor.

UNIT-1: : Finite Differences(a,e) **[8 hrs]**

Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform (a,e) **[7 hrs]**

Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform (a,e) **[8 hrs]**

Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 : Matrices (a,e) **[9 hrs]**

Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigen vectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester"s theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation (a,e,h) **[8 hrs]**

Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.

Partial Differential Equations – PDE of first order first degree i.e. Lagrange"s form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

3rd SEMESTER

GE2201	Engineering Mathematics-III		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT-6 : Fourier Transform (a,h) **[6 hrs]**

Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval"s Identity, convolution Theorem.

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan

3rd SEMESTER

ME2201	Material Science and Metallurgy		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
1. To impart Knowledge for analysing different Microstructure and Crystalline nature of metals.	1. Student will be able to distinguish microstructure and analyse the effect of Crystalline nature of metals
2. To impart knowledge of Iron-Iron carbide equilibrium diagram and microstructure, general properties and heat treatment practices of commercial steels and Cast Iron.	2. Student will be able to construct Iron-Iron carbide equilibrium diagram and analyse microstructure, general properties and heat treatment practices of commercial steels and Cast Iron.
3. To impart knowledge of various heat treatment processes.	3. Student will be able to analyse and implement suitable heat treatment processes
4. To impart basic knowledge of powder Metallurgy for Powder metallurgical components	4. Student will be able to perceive the basics of powder Metallurgy for powder metallurgical components.

UNIT-1:[5 hrs]

Introduction to materials, classification of materials. Properties and applications of materials. Crystalline nature of metals, specially microscopic and macroscopic examinations of metals. Alloys and solid solutions, types and their formations, modified Gibbs's phase rule, Lever rule for phase mixtures and their application in system. **[CO1]**

UNIT-2:[8 hrs]

Study of equilibrium diagrams and invariant reactions. Iron-Iron carbide equilibrium diagram, critical temperatures. Microstructure of slowly cooled steels. Estimation of carbon from microstructures; structure property relationship. Classification and applications of steels. Effect of alloying elements. **[CO 1,2]**

UNIT-3:[8 hrs]

Classification and application of plain carbon steels. Examples of alloy steel such as Hadfield Manganese Steel, ball Bearing Steels, etc.Tool Steels – Classification, composition, application and commercial heat treatment practice for HSS, Secondary hardening. Stainless Steels - Classification, composition, application and general heat treatment practice for Stainless Steels. **[CO 1,2,3]**

UNIT-4:[8 hrs]

Heat treatment and its importance. Annealing, Normalizing, Hardening, Quench Cracks, Hardenability test.
TTT diagram and its construction and related Heat Treatment Processes such as Austempering, Martempering, Patenting etc.
Retention of Austenite, Effects and elimination of retained austenite, Tempering.Case / Surface hardening treatments such as Carburising, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening. **[CO 1,2,3]**

3rd SEMESTER

ME2201	Material Science and Metallurgy		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT-5:[8 hrs]

Cast Iron – Classification, White cast Iron, Gray Cast Iron, Nodular Cast Iron, Malleable Cast Iron, Chilled and alloy Cast Iron. (Production route, Composition, Microstructure and applications) Effects of various parameters on structure and properties of Cast Iron, Alloy cast Iron such as Ni-resist, Ni-hard.
Non-Ferrous Alloys – Study of non-ferrous alloys such as brasses (Cu-Zn diagram), Bronzes (Cu-Sn diagram), Aluminum Alloys (e.g. Al-Si & Al-Cu diagram), Bearing materials. **[CO 1,2,3]**

UNIT-6:[8 hrs]

Powder Metallurgy: Powder manufacture and Conditioning, Production of Sintered Structural Components, Self lubricating bearing, Cemented Carbides, Ceramics, Sintered Carbide cutting tools. **[CO 1,2]**

Reference books:

1	Introduction to Engineering Metallurgy	21st revised edition, 2007	Dr. B K Agrawal	Tata McgraHill
2	Introduction to Physical Metallurgy	29st revised edition, 2009	Sidney H.Avner	McGraw-Hill,1964
3	Engineering Physical Metallurgy and Heat Treatment	21st revised edition, 1988	Yu Lakhtin	Mir publishers, Moscow, Russia
4	Metallurgy for Engineers	4th Revised edition 1987	E C Rollason	E. Arnold,

3rd SEMESTER

ME2202	Lab :Material Science and Metallurgy		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
(1) To provide general information of material science and metallurgy to the engineering students. The student is required to understand important relationship between structure of metals and its properties.	(1)Students will be able to create specimen for metallographic examination . (2))Students will be able to analyze the microstructure and investigate various properties of ferrous and non-ferrous Materials (3) Students will be able to test different Engineering Materials

List of Practical

A set of 10 Experiments from following list to be performed.

A set of 10 Experiments from following list to be performed.

1) Study of Metallurgical Microscope. **[CO 1,2]**
2) Preparation of Specimen for metallographic examinations. **[CO 1,2]**
3) Study and drawing of microstructures of Steels. **[CO 1,2]**
4) Study and drawing of microstructures of Cast Iron.. **[CO 1,2]**
5) Study and drawing of microstructures of Non Ferrous Metals.. **[CO 1,2]**
6) Study of the effect of annealing and normalizing on properties of steels. **[CO 1,2,3]**
7) Determination of hardenability of steels by Jominy End Quench test.. **[CO 1,2,3]**
8) Tensile test on Mild Steel and Aluminum test specimen.. **[CO 1,2,3]**
9) Measurement of hardness of ferrous and non-ferrous materials with the help of Brinell hardness tester. **[CO 1,2,3]**
10) Measurement of hardness of ferrous and non-ferrous materials with the help of Vicker hardness tester. **[CO 1,2,3]**
11) Measurement of hardness of ferrous and non-ferrous materials with the help of Rockwell hardness tester. **[CO 1,2,3]**
12) Study the heat treatment of high speed steels. . **[CO 1,2,3]**
13) Study the heat treatment of stainless steel.. **[CO 1,2,3]**
14) Study of effect of alloying elements on properties of steels. **[CO 1,2,3]**
15) Study of macroscopic examinations. . **[CO 1,2,3]**
16) Study of mechanisms of quenching. . **[CO 1,2,3]**
17) Study of Pack carburizing of steel samples. . **[CO 1,2,3]**

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

3rd SEMESTER

ME2203	Machining Processes	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
1. To understand the basic tool geometry of cutting tool and basic machining parameters. 2. To analyse the various machining processes. 3. To identify and explain basic components and function of different machine tools. 4. To understand the application and limitations of various machining processes with regard to shape formation and surface quality.	After completion of this course, Students will be able to 1. Distinguish among various cutting tool materials and tool geometries. 2. Examine the different processes and machine tools for cylindrical surface machining. 3. Differentiate various machining processes and conditions for flat surface machining using SPCT. **4.** Justify machining processes for flat surfaces marching using MPCT.

Unit I

Mechanics of Machining And Machinability: Introduction to machining, geometry of SPCT. Mechanism of chip formation, Orthogonal and Oblique cutting, Use of chip breaker in machining, Merchant Circle (Analytical treatment expected), thermal aspects of machining, cutting temperature measurement during machining, Cutting Fluids, Machinability, Estimation of Tool life, Tool materials. [CO 1]

Unit II

Lathe: Kinematic systems and operations of lathes, attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, time estimation for turning operations such as facing, step turning, taper turning, threading, knurling. Capstan and Turret Lathe and special purpose Machines: Construction, Operation and selection of Machining Parameters, Machining Centers, Tool Heads and indexers. [CO 2]

Unit III

Shaper: Introduction, type, specification, description of machines, hydraulic drives in shapers, cutting parameters, attachments for shaper, work holding devices, shaper operations.

Planer: Introduction, specifications, description, type of planner, Mechanism for planner: Driving mechanism, feeding mechanism, planner cutting tools, cutting parameters

Slotter: Introduction, specifications, description, type of drives for slotter, types of slotting. [CO I,3]

Unit IV

Milling: Kinematic systems and operations of milling machines, attachments for Milling. Cutting parameters, Types of milling cutters, Tool geometry & their specifications. Indexing- simple, compound and differential. Screw threads and Gear Manufacturing Methods.. [CO 1,4]

Unit V

Grinding operations, grinding wheel, specifications & selection, cylindrical &centre less grinding operation, surface grinding, tool & cutter grinding, time estimation for grinding operations.

Super finishing process: Honing, Lapping, super finishing, polishing, buffing, metal spraying, galvanizing and electroplating. Process parameters and attainable grades of surface finish, surface roughness measurement. [CO 1,4]

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

3rd SEMESTER

ME2203	Machining Processes		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit VI

Drilling: Introduction, tools for drilling, classification of drills, twist drills, drill size and specifications, carbide tipped drills, type of drilling machines, Drilling machines operations, time estimation for drilling.
Reaming: Introduction, description of reamers, type of reaming operations.
Boring: Introduction, types of boring machine, horizontal boring machine, vertical boring machine, jig boring machine, micro boring, boring operations.
Broaching: Introduction, type of broaches, and nomenclature of broaches, type of broaching machines. [CO I1,4]

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Workshop Technology - Part I,	Chapman W.A.J	Fifth edition	CBS Publishers
2	Manufacturing Technology (Metal Cutting & Machine Tools)	P N Rao	2nd Edition (2009)	The McGraw-Hill Companies
3	Manufacturing Science	Ghosh & Malik	2nd Edition (2010)	East West
4	Workshop Technology (Volume-II)	Hajra Choudhary	2nd Edition (2012)	The McGraw-Hill Companies

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Manufacturing Engineering & Technology	S Kalpakjian & SR Schmid	1st Edition (2009)	Pearson Education Canada
2	Technology of machine Tools	Krar & Oswald	1st Edition (1984)	Gregg Division, McGraw-Hill
3	Manufacturing Processes	M Begman	1st Edition (1974)	Ballinger Pub. Co
4	Processes & Materials of Manufacture	R Lindberg	1st Edition (1990)	Allyn and Bacon Technology & Engineering
5	Production Technology	s. Karunakaran	1st Edition (2008)	HMT
6	Workshop Technology (Volume I & II)	Bawa	2nd Edition (2009)	The McGraw-Hill Companies

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3 SEMESTER

ME2204	Lab :Machining Processes		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
1. Understand the basic tool geometry of cutting tool and Identify basic components and function of different machine tools. 2. Understand the application and limitations of various machining processes with regard to shape formation and surface quality.	fter completion of this course, Students will be able to 1. Distinguish among various cutting tool materials and tool geometries. 2. Examine the different processes and machine tools for cylindrical surface machining. 3. Differentiate various machining processes and conditions for flat surface machining using SPCT. 4. Justify machining processes for flat surfaces marching using MPCT.

LIST OF PRACTICALS:

S No	Name of Experiment
1	Demonstration of single point cutting tools, their nomenclature, geometry materials and applications. CO 1
2	Demonstration of multi point cutting tools, their nomenclature, geometry materials and applications. CO 1
3	Demonstration of working of Lathe Machine and study of its mechanism. CO 2
4	Demonstration of working of Shaper Machine and study of its mechanism CO 3
5	Demonstration of working of Milling machine and study of its mechanism. CO 4
6	Demonstration of working of Drilling machine and study of its mechanism. CO 4
7	Practical on lathe for turning , facing , step turning , taper turning and threading. CO 2
8	Practical on Shaper with exposure to auto feed. CO 3
9	Practical on milling machine for slot cutting. CO 4
10	Practical on Drilling machine for drilling. CO 4
11	Demonstration of boring operations. CO 2
12	Study of Grinding machine and super finishing processes. CO 4
13	Introduction to NC and CNC machines. CO 4

			1.00	Applicable for AY2019-20 Onwards
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3 SEMESTER

ME2205	Mechanics of Material		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
1) The student should be able to acquire elementary knowledge of stress, strains and material properties. 2) To impart the knowledge on shear force and bending moment calculations for beams. 3) To impart the knowledge about bending and shear stress and its importance. 4) To impart basic knowledge on strain energy calculations due to various types of loads and to estimate the load carrying capacity of columns. 5) To impart basic knowledge to calculate deflection of beams. 6) To impart knowledge on the principal stresses and planes in three dimensional stress systems.	After completion of this course, Students will be able to 1) Describe the basic concepts of stress, strain and their variations under different types of loading 2) Apply the basic concepts involved in mechanics of materials, bending moment, shear force, stresses in beams to solve complex problems 3) Analyze strain, impact loading and crippling load 4) Evaluate the torsional shear stress in shaft and solve the problem on Slope and deflection in beams under different loading and support conditions.

Unit 1 **[8 hrs]**

Concept of simple stresses and strains: Introduction, Stress, strain, types of stresses, stress - strain diagram for brittle & ductile material, elastic limit, Hooks law, modulus of elasticity, modulus of rigidity, factor of safety, analysis of tapered rod, analysis of composite section, thermal stress and strain, thermal stresses with heat flow in cylinders and plates, Hertz's contact stresses. Longitudinal strain & stress, lateral stresses and strains, Poisson's ratio, volumetric stresses and strain with uni-axial, bi-axial & tri-axial loading, bulk modulus, relation between Young's modulus and modulus of rigidity, Poisson's ratio and bulk modulus. **[CO-1]**

Unit 2 **[8 hrs]**

Shear force and bending moments in Beam: Types of beam (cantilever beam, simply supported beam, overhung beam etc.), Types of loads (Concentrated and UDL), shear force and bending moment diagrams for different types of beams subjected to different types of loads, sign conventions for bending moment and shear force, shear force and bending moment diagrams for beams subjected to couple, Relation between load, shear force and bending moment. **[CO-2]**

Unit 3 **[6 hrs]**

Stresses in beams: Pure bending, theory of simple bending with assumptions & expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections.

Shear stresses in beams: - Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress. **[CO-2]**

Unit 4 **[7 hrs]**

Strain energy and impact: Concept of strain energy, derivation and use of expressions for deformation of axially loaded members under gradual sudden and impact loads. Strain energy stored in bending & torsion. Castingliano's theorem.

3 SEMESTER

ME2205	Mechanics of Material		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Column & Struts: Failure of long & short column, slenderness ratio, Euler's column theory, End conditions for column. Expression for crippling load for various end conditions of column. Effective length of column, limitations of Euler's formula, Rankine formula, Johnson's parabolic formula. **[CO-3]**

Unit 5 **[8 hrs]**

Torsion of circular shafts: Derivation of torsion equation. Torsional shear stress induced in the shaft, when it is subjected to torque. Torque transmitted by solid & hollow circular shaft. Derivation of maximum, minimum principal stresses and maximum shear stress induced in shaft when it is subjected to bending moment, torque & axial load.
Deflection of beams: Derivation of differential equation of elastic curve, Deflection & slope of cantilever, simply supported, overhung beams subjected to concentrated loads, UDL, Relation between slope, deflection & radius curvature McCauley's method, area moment method to determine deflection of beam.**[CO-4]**

Unit 6 **[8 hrs]**

Combined Stresses: Definition of principal planes & principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of stresses. Derivation of maximum and minimum principal stresses & maximum shear stresses when the member is subjected to different types of stresses simultaneously (i.e. combined stress) **[CO-1]**

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Strength of Materials	Ramamrutham S.	16th Edition (2010)	DhanpatRai Publishing
2	Strength of Materials	Beer and Johnston	4th Edition (2009)	McGraw-Hill
	Strength of Materials	P.Purushothama and V.Ramasamy	1st Edition 2012	Pearson

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Strength of Materials	Timoshenko and Young	Seventh Edition1984	CSB Publisher
2	Strength of Materials	Singer F. L	4th (February 1987)	Harper and Row Publications
3	Introductionto Mechanics of Materials	Popov E.P	2nd (June 1998)	Prentice Hall Publication

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3 SEMESTER

ME2206	Lab : Mechanics of Material		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
• The student should be able to acquire elementary knowledge ofstress,strainsandmaterialproperties. • To impart the knowledge on shear force and bending moment calculations for beams. • To impart the knowledge about bending and shear stress and its importance. • To impart basic knowledge on strain energy calculations due to various types of loads and to estimate the load carrying capacity of columns. • To impart basic knowledge to calculate deflection of beams. • To impart knowledge on the principal stresses and planes in three dimensional stress systems.	fter completion of this course, Students will be able to 1) Describe the basic concepts of stress, strain and their variations under different types of loading 2) Apply the basic concepts involved in mechanics of materials, bending moment, shear force, stresses in beams to solve complex problems 3) Analyze strain, impact loading and crippling load 4) Evaluate the torsional shear stress in shaft and solve the problem on Slope and deflection in beams under different loading and support conditions.

List of Practical

A set of 8 Experiments from following list to be performed.

1. Study and demonstration of Universal Testing Machine & its attachments. **[CO-1]**
2. Tension Test on mild steel on Universal Testing Machine. **[CO-1]**
3. Compression test on Aluminum on Universal Testing Machine.**[CO-1]**
4. To perform flexture test.**[CO-1,2]**
5. Izod&Charpy - Impact tests of a standard specimen. .**[CO-3]**
6. Torsion Test on Mild steel bar. **[CO-4]**
7. To study the spring testing machine and perform the compression test on open coil helical spring. **[CO-3]**
8. To study the Rockwell hardness testing machine & perform the hardness test.**[CO-1]**
9. Assignments: Drawing sheet on shear force & bending Moment diagrams for a given loading (At least four problems.) **[CO-2]**
10. Estimation of principal stresses and maximum shear strain for a given combined loading by analytical & Mohr's circle method. (At least two problems).**[CO-4]**
11. Experiment on fatigue analysis. **[CO-4]**

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3 SEMESTER

ME2207	Kinematics of Machinery		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
• To provide a study of understanding the concept of kinematics in Mechanisms and machines to students of mechanical engineering though the theoretical principles involved have immediate application to practical problems • To provides the foundation for the study of displacements, velocities, accelerations and static and dynamic forces. Required for the proper design of mechanical linkages, cams and geared systems.	1) Students should be able to understand the mechanical system, mechanism its components, relative between them. 2) Students should be able to determine the relative velocity & Acceleration of a kinematic link of a given mechanism and various forces coming on links in static condition. 3) Students should be able to identify the motion as per the application & draw the profile of a cam followers mechanism. 4) Students should be able to understand various types of Gears used in Machine terminologies and concepts of velocity ratios in gear trains.

Unit 1 **[8 hrs]**

Basic concept of mechanism, link, kinematics pairs, kinematics chain, mechanism, machine, simple & compound chain, Degree of freedom, estimation of degree of freedom of mechanism by Grubber's criterion and other methods. Harding's notations, classification of four bar chain [class-I & Class-II], inversion of four-bar-chain, Kutchbach theory of multiple drives, **[CO 1]**

Unit 2 **[7 hrs]**

Quantitative kinematics analysis of mechanism: - Displacement, Velocity and Acceleration analysis of planer mechanism by graphical method as well as analytical method [complex number method/matrix method], Instantaneous center method, Kennedy's theorem. **[CO 2]**

Unit 3 **[8 hrs]**

Concepts of cam mechanism, comparison of cam mechanism with linkages. Types of cams and followers and applications. Synthesis of cam for different types of follower motion like constant velocity, parabolic, SHM, cycloid etc.
Analysis of follower motion for cams with specified contours like eccentric cam, tangent cam and circular arc cam with concave and convex curvature. Pressure angle in cam, parameters affecting cam performance. **[CO 3]**

Unit 4 **[7 hrs]**

Concept of motion transmission by toothed wheels, comparison with cams and linkages, various tooth profiles, their advantages and limitations, gear tooth terminologies, concept of conjugate action, law of conjugate action, kinematics of in volute gear tooth pairs during the contact duration, highlighting locus of the point of contact, arc of contact, numbers of pairs of teeth in contact, path of approach and path of recess, interference, undercutting for in volute profile teeth. **[CO 4]**

Unit 5 **[8 hrs]**

Kinematics of helical, bevel, spiral, worm gears, rack and pinion gears, kinematics analysis, and torque analysis of simple epicyclical and double epicyclical gear trains. **[CO 4]**

Unit 6 **[7 hrs]**

Static force analysis: Free body diagram, condition of equilibrium. Analysis of all links of given linkage, cam, gear mechanism and their combinations without friction. **[CO 2]**

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3 SEMESTER

ME2207	Kinematics of Machinery		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Theory of mechanisms & machines	Shigley J. E	4TH Edition 2014	Tata McGraw-Hill
2	Theory of Mechanism and Machine	Khurmi & Gupta	Second Edition 2005	S. Chand
3	Mechanism and Machine Theory	Rao J.S & DukkiPati R.V.	4th Edition 2014	New Age International (P) Limited
4	Theory of Machine	Rattan S.S	4th Edition 2014	Tata McGraw-Hill
5	Theory of Machine	V. P. Singh	6th Edition 2014	Dhanpat Rai & Co.

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Theory of machines	Thomas Bevan	Third Edition	Pearson Education India
2	Theory of Machines	Sandor & Erdman	Fourth Edition	Tata McGraw-Hill

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3 SEMESTER

ME2208	Fluid Mechanics		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
Develop an understanding of fluid statics, kinematics and dynamics in Mechanical. Learn to apply Bernoulli's Equation and momentum equation to Fluid flow systems. Study various flow measuring devices. Understand the concept of viscosity as applied in real flows. Learn to use equations in combination with experimental data to determine losses in flow systems.	(1) The student will be able to EVALUATE various fluid properties and ANALYZE hydrostatic forces acting on submerged flat bodies **[PO: 1,3,5,12,13]** (2) The students will be able to CLASSIFY AND ANALYZE the various flow pattern, AND WILL BE ABLE TO EVALUATE velocity and acceleration using fluid kinematics. **[PO: 1,3,5,12,13]** (3)The students will be able to analyze and SOLVE ideal flow and real flow problems by applying Bernoulli's equations and momentum equations. The students will also be able to DESCRIBE AND ANALYZE the fluid flow over bodies . **[PO: 1,3,5,12,13]** (4) The students will be able to ALAYZE THE flow, through pipes. The students will be able to EVALUATE HEAD LOSSES, DISCHARGE, POWER LOST ETC FOR THE FLOW THROUGH PIPES WITH AND WITHOUT FITTINGS **[PO: 1,3,5,12,13]**

Unit1 **[8 hrs]**

Introduction to Fluid Mechanics: Definition of Fluid, Properties of fluids, Newton's law of viscosity, Pascal's law, Basic equation of fluid static, Pressure variations in compressible & incompressible fluids, Fluid pressure & its measurement (Manometers & Bourdon's pressure gauge), Hydrostatics: Forces on submerged plane surfaces **[CO:1]**

Unit2 **[7 hrs]**

Kinematics Of Fluid Flow: Types of flow, Stream line, Path line, Streak line, Stream tube, Continuity equation, One and Two dimensional flow, Velocity and Acceleration at a point, Circulation and Vorticity, Stream function and Velocity potential. **[CO:2]**

Unit3 **[8 hrs]**

Dynamics Of Fluid Flow: Integral Momentum Equation, One-dimensional method for flow analysis, Impact of jet on stationary and moving Flat and curved vanes, Theory of Rotodynamic machines. **[CO:3]**

Unit4 **[7 hrs]**

Derivation of Bernoulli's equation for incompressible flow & its applications for various ideal and practical systems, Venturimeter, Orifice Meter and Pitot tube **[CO:3]**

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3 SEMESTER

ME2208	Fluid Mechanics		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit5 **[8 hrs]**

Viscous Flow: Newton's law of viscosity and its applications, Introduction to laminar and turbulent flow through pipes, Reynolds number and its significance, Boundary layer concept, Wall shear and boundary layer thickness, Kinetic energy correction factor, Momentum energy correction factor, Drag and Lift on immersed bodies. . **[CO:3]**

Unit 6 **[7 hrs]**

Flow Through Pipes: Equations for pipe flow, Friction charts and their uses, Losses in pipes and fittings, Hydraulic gradient lines and total energy lines, Pipes in series and parallel. Siphon, Water hammer phenomenon, Economics of pipe systems. Power Transmission Through Pipeline: Condition for maximum power transmission through a given pipeline (single pipe), Relationship of nozzle diameter to pipe diameter for maximum power transmission. **[CO:4]**

Reference Books:

S. No.	Title	Authors	Publisher
1	Fluid Mechanics: Fundamentals and Applications	Yunus A. Cengel and John M. Cimbala	McGraw-Hill
2	Engineering Fluid Mechanics	K. L. Kumar	S. Chand & Company Ltd.
3	Basic Fluid Mechanics	C.P. Kothandaraman & R. Rudramoorthy	New Age Publication
4	Fluid Mechanics	J.F.Douglas, J.M.Gasiorek & J.A. Swaffield	ELBS Publication
5	Fluid Mechanics	A.K.Mohanty	Prentice Hall Publication
6	Fluid Mechanics & Fluid Power Engineering	D. S. Kumar	S. K. Kataria Publication
7	Fluid Mechanics	A.K.Jain	Khanna Publishers

3 SEMESTER

ME2209	Lab : Fluid Mechanics		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
Develop an understanding of fluid statics, kinematics and dynamics in Mechanical. Learn to apply Bernoulli's Equation and momentum equation to Fluid flow systems. Study various flow measuring devices. Understand the concept of viscosity as applied in real flows. Learn to use equations in combination with experimental data to determine losses in flow systems.	(1) The student will be able to EVALUATE various fluid properties and ANALYZE hydrostatic forces acting on submerged flat bodies [**PO: 1,3,5,12,13**] (2) The students will be able to CLASSIFY AND ANALYZE the various flow pattern, AND WILL BE ABLE TO EVALUATE velocity and acceleration using fluid kinematics.[**PO: 1,3,5,12,13**] (3)The students will be able to analyze and SOLVE ideal flow and real flow problems by applying Bernoulli's equations and momentum equations. The students will also be able to DESCRIBE AND ANALYZE the fluid flow over bodies . [**PO: 1,3,5,12,13**] (4) The students will be able to ALAYZE THE flow, through pipes. The students will be able to EVALUATE HEAD LOSSES, DISCHARGE, POWER LOST ETC FOR THE FLOW THROUGH PIPES WITH AND WITHOUT FITTINGS [**PO: 1,3,5,12,13**]

LIST OF PRACTICALS

1) Study of Pressure Measuring Devices **[CO:1]**
2) To determine hydrostatic Force on vertical Surface**[CO:1]**
3) To determine hydrostatic Force on horizontal Surface**[CO:1]**
4) Verification of Bernoulli's Equation**[CO:3]**
5) To Determine Coefficient of Discharge of Venturimeter**[CO:3]**
6) To Determine Coefficient of Discharge of Open Orifice **[CO:3]**
7) To Determine Coefficient of Discharge of Orifice for compressible fluids**[CO:3]**
8) To Determine Coefficient of Discharge of Triangular notch**[CO:3]**
9) To Determine Coefficient of Discharge of Rectangular Notch**[CO:3]**
10) To Determine friction factor of fluid flowing through pipe**[CO:4]**
11) Performance on pipes in series**[CO:4]**
12) Performance on pipes in parallel**[CO:4]**
13) To Determine Minor losses and Coefficients of Minor Losses**[CO:4]**
14) To Determine Force exerted by Jet**[CO:3]**
15) Study of fluid flow over immersed bodies **[CO:3]**
16) Any other practical based on Fluid Mechanics syllabus**[CO:1,3,4]**

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4th SEMESTER

GE2204	Advanced Mathematical Techniques		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcomes
The objective of this paper is to study numerical methods and their methods of solution and statistics and probability with simple applications and to introduced fuzzy sets and logics	1. Students are able to solve algebraic and transcendental equations and compute n variables in simultaneous equations. 2. This topic covers the alternative techniques to solve various types of differential equations. 3. Students are proficient to design linear programming problems; methods to get optimum solution of it related to multiple variables and simplify it using graphical solution. 4. The facts of probability are used to understand the most probable behavior of various systems. 5. The unit is used to determine mathematical expectation for the random variables define in real life problems and make available analytical techniques for getting standard deviation, dispersion etc. 6. This unit gives an overview of fuzzy set theory to deal and design problems related to fuzzy chips and fully automatic control system.

UNIT-1: (a,e) **[9 hrs]**

NUMERICAL METHODS FOR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Errors in numerical calculation, Errors in series approximation. Rounding of error solutions of algebraic and transcendental equations. Iteration method, Bisection method, False position method, Newton Rapphson method and their convergence

NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss -Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2:(a,e) **[8 hrs]**

NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor"s series method, Picard's method, Runge"s second and third order method, Runge-Kutta 4th order method, Euler"s method, Euler"s modified method, Milne"s Predictor and Corrector method. Numerical methods of solving 1st order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques (a,h) **[6 hrs]**

Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 (a,h,k) **[7 hrs]**

Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

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4th SEMESTER

GE2204	Advanced Mathematical Techniques		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT-5:(a,h,k) **[8 hrs]**
Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 (a,h,k) **[6 hrs]**
FUZZY SETS AND FUZZY LOGIC ; Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition (2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers

4th SEMESTER

ME2251	Design of Machine Elements		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
This subject occupies a predominant position in the curriculum of Mechanical Engineering. It consists of application of scientific principles, technical information & creative thinking for the development of a new or improved machine or mechanical system, to perform desired function with maximum efficiency.	Student will be able to 1) Apply the knowledge of design principal in machine components. 2) Design and analyze various joints i.e., Welded joints, Bolted joints and Riveted joints. 3) Learn the design principals of power screw, springs, clutches and brakes. 4) Apply principal of design of pressure vessel and power transmission shafts.

Unit1 **[8 hrs]**

Definition of design, types of design, design process, need, defining the problem, feasibility, design alternatives, final design selection, preliminary and final plant drawings.
Theories of failure, Design for Fatigue & manufacturing considerations in design, basis of good design, failure of machine parts, Mechanical properties, Design considerations and selection of materials. **[CO – 1]**

Unit2 **[7 hrs]**

Design of Joints:
Welded joint: design of single transverse, double transverse, parallel fillet, combination fillet butt joint, Eccentrically loaded welded joints.
Bolted joint: Design of bolted fasteners, bolt of uniform strength, bolted joints under eccentric loading.
Design of riveted joints. **[CO – 2]**

Unit3 **[7 hrs]**

Power screw and Leaf spring: Design of power screw
Design of Helical and Leaf Springs. **[CO – 3]**

Unit4 **[7 hrs]**

Brakes and clutches: Kinematics of Friction Drives such as Brakes, Clutches Design of Friction Clutch, Single Plate, Multiple Plate, Cone, Centrifugal Clutch, Design of Brake, Shoe Brake, Band Brake,, Internal Expanding brake. **[CO – 3]**

Unit5 **[7 hrs]**

Pressure Vessel: Classification of Thick and Thin Cylindrical Pressure Vessel, Stresses in Thin and Thick Cylindrical Pressure Vessels when it is subjected to internal pressure, Expression for Circumferential and Longitudinal stresses, Design of pressure vessel, Heads and Cover Plate. **[CO – 4]**

Unit 6 **[8 hrs]**

Design of Shafts: Design of transmission Shafts on the Basis of Strength and rigidity, ASME Code for shaft Design, Design of Stepped shaft Axle splined Shaft, Keys. **[CO – 4]**

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4th SEMESTER

ME2251	Design of Machine Elements		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Mechanical Engg. Design	Shigley J. E	7 th Edition. 2000	McGraw-Hill,
2	Design of Machine Element	Shiwalkar B. D	3rd Edition 2008	Denett & Co.
3	Design of machine elements	Bhandari V.B.	5th Edition	Design of machine elements
4	Machine Design	U. C. Jindal	2010	Dovling Kinderslay

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Mechanical Design of Machine	Maleev hartman	5th Edition.	Cbs Publishers & Distributors
2	Design Data Book	Shiwalkar B. D	7th Edition	PSG Tech, Coimbatore, India

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

4th SEMESTER

ME2252	Engineering Thermodynamics		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
To develop the understanding of thermodynamic principles/laws for ideal gas/pure substance and to use it for evaluation of the energy interaction with the thermodynamic systems undergoing process.	***On completion of this course, the student will be able to:*** 1) **Apply**the First and zeroth law of thermodynamics for the **analysis** of thermodynamic systems to **evaluate** energy interactionin various processes. a. (Analyzing, Applying, Evaluate) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13) 2) **Evaluate** the performance of cyclic devices, change in the entropy and availability in various processes **applying** the laws of thermodynamics. a. (Evaluating, Applying) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13) 3) **Evaluate** various thermodynamic parameters in various *processes with phase change***using** phase change diagrams, relations and steam tables/ charts**applying** Law of thermodynamics. a. (Evaluating, Analyzing, Applying) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13) 4) **Analyze** the performance of various Thermodynamic cycles **applying** Law of thermodynamics for **evaluation** of energy interaction. a. (Evaluating, Analyzing, Applying) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13)

UNIT I:
Introduction To Thermodynamics:
Basic concepts of Thermodynamics, Continuum and macroscopic approach; thermodynamic system, Concept of energy and various forms of energy; internal energy, enthalpy; specific heats;, thermodynamic properties and equilibrium; state of a system, state postulate, state diagrams, paths / processes and cycles on state diagrams . The Ideal Gas equation of state.
The concepts of heat and work interactions. Evaluation of different modes of work.
Zeroth Law of Thermodynamics, concept of temperature [CO 1]
UNIT II
First Law of Thermodynamicsapplied to the various processes in Closed Systems, Various Steady flow systems, Steady-Flow Engineering Devices and Unsteady Flow process such as: charging and discharging of gas cylinder. [CO 1]

4th SEMESTER

ME2252	Engineering Thermodynamics		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT III
Second Law of Thermodynamics :
Limitations of the Zeroth and First law of thermodynamics,
concepts of Thermal energy reservoirs, heat engines and heat pumps/refrigerators,
Kelvin-Planck and Clausius statements and their equivalence; reversible and irreversible processes;
Carnot cycle and Carnot principles/theorems; thermodynamic temperature scale; [CO 2]

UNIT IV
Entropy:
Clausius inequality and concept of entropy; microscopic interpretation of entropy, the principle of increase of entropy, T-s diagrams, Change in entropy for processes in Closed and Steady flow systems.
Introduction to concept of Availability. [CO 2]

UNIT V
Properties of Pure Substances (Steam) :
Thermodynamic properties of pure substances in solid, liquid and vapor phases; P-v-T behavior of simple compressible substances, phase rule, thermodynamic property tables (Steam Tables) and charts.
Calculations of work and heat interactions in non- flow and steady flow processes.
Determination of dryness fraction using various calorimeters. [CO 3]

UNIT VI:
Thermodynamic Cycles
Vapor Power Cycles: Carnot vapor cycle, Rankine cycle: ideal and the reheat, the analysis of vapor power cycle.
Air-standard cycles:air standard assumptions,basic considerations and the analysis of power cycles: Otto cycle, Diesel engine cycle, and Brayton cycle.
Refrigeration Cycle: Introduction to Vapor-compression Refrigeration Cycle [CO 4]

Text books:				
1	Engineering Thermodynamics	6th edition 2017	P. K. NAG	Tata McGraw-Hill
2	Thermodynamics- An Engineering approach	7TH Edition (2017)	Yunus A. Cengel, Michael A. Boles	McGraw-Hill
3	Thermodynamics & Heat Engines vol-I & II	8TH Edition (2017)	R.YADAV	Central Publishing House,.
Reference books				
1	Fundamentals of Classical Thermodynamics	1st edition 2007	GordenJ.VanWylen Richard E.Sonntag	John Wiley
2	Basic Engineering Thermodynamics	3rd edition 2009	5 Reiner Joel	Longman

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

4th SEMESTER

ME2253	Lab : Machine Drawing		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
To familiarize the students with- 1) To gain knowledge of different types of line and its application, conventional representation of various machining and mechanical details as per IS 2) To visualize an object and convert it into a drawing. 3) To become conversant with 2D and 3D.	The student will able to 1) Apply standards practices and conventions in machine drawing. 2) Draw a Orthographic and Isometric drawing 3) Preparing and visualizing detailed drawing of various machine components. 4) Create a 2D and 3D using CAD software with due manufacturing consideration.

Unit1 **[8 hrs]**

Drawing Standards for following- Drawing Sheets, Name Blocks, Lines, Dimensioning of Tolerances, Standard features, Machining Symbols, Welding Symbols, Heat Treatment, manufacturing Instructions, Allowances, and Materials. [CO 1]

Unit2 **[6 hrs]**

Orthographic Projection of Elements, section, dimensioning, Dimensioning of tolerances, Orthographic Projections, Sectional Views, Missing Views, conventional representation of machine elements. [CO 2]

Unit3 **[6 hrs]**

Preparation of drawing of machine Elements such as - threads, Bolts, Nuts, Washers, Rivets, Welds, Keys and Keyways, splines, Couplings, shaft. [CO 1,2]

Unit4 **[8 hrs]**

Assembly and Dismantling Principles : Fits and Tolerances (Standards, Types Application and Selection) , Tolerance Charting, Surfaces Finishing Requirement for Assembly, Geometry suitable for Assembly, Assembly / Dismantling Tools, Bearing Assemblies, Assemblies by Fastening. [CO 3]

Unit5 **[9 hrs]**

Study of some Standard Assemblies.
Assembly Drawings: Principles, Techniques and standards for Preparing Component Drawings, Subassembly Drawing, Full Assembly Drawing, Exploded Views.
Assembly drawings of :- Lathe machine tail stock and tool post , radial engine sub assembly, plummer block, steam stop valve or safety valve, etc. [CO 3,4]

Unit 6 **[8 hrs]**

Production Drawing : Name Plates, Part List, Revisions Etc., Essential Parts/ Formats Required for Production Drawings, Process Sheet, blue print reading. [CO 4]

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4th SEMESTER

ME2253	Lab : Machine Drawing		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

LIST OF PRACTICALS

1. Drawing of some Standard Components. (Two Sheets). [CO 1]
2. Drawings of two Standard Assemblies with Components. (Two Sheets). [CO 2]
3. Computer printout of a small Assembly with Components. [CO 4]
4. Pencil Drawing / Computer printout of a Large Assembly with components Drawings, subassembly drawings and assembly drawings using all standard formats. [CO 4]
5. Computer Printout of Production Drawing and process Sheets for One Component having maximum five Operations. Pencil Drawing should be in full imperial sheet folded to quarter Imperial size, Computer printouts should be on a plotter in A3 size. All drawings should be submitted in one folder. [CO 4]
6. To parts and assembly drawing using suitable CAD software. [CO 3,4]

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Machine Drawing	Bhatt N.D	38th Edition 2010	CharotarPulishe
2	Machine Drawing	SiddheshwarShastri	6th Edition 2009	Kanhaiah. Tata Mcgraw Hill
3	Machine Drawing	Parkinson	4th Edition 2011	Sir Isaac Pitman & Sons Limited
4	Machine Drawing	Venkat Reddy, Narayan and Kanhaiya	2nd Edition	B.S. publication
5	Fundamentals of Engineering Drawing	Warren J. Luzadder	11th Edition 2017	Parson
6	Machine Drawing	K. L. Narayana & Kannaiah	3rd Edition 2012	New Age Publications
7	Machine Drawing	P. S. Gill	BD Katariya & sons	

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Relevant IS Codes		Edition	TATA McGraw hill

			1.00	Applicable for AY2019-20 Onwards
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4th SEMESTER

ME2254	Manufacturing Processes		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
Subject is the essential framework of manufacturing processes and is composed of the scientific and practical inter relationship among the processing, structure, properties and performance of all conventional methods of manufacturing techniques	After completion of this course, 1) The student will be able to illustrate the basics of moulding process and compare various casting processes 2) The student will be able to analyze various Forming and sheet metal working processes. 3) The student will be able to Elaborate and classify different welding processes. 4) The student will be able to discuss and analyze unconventional machining processes.

Unit 1 **[8 hrs]**

Casting Process: Introduction, Pattern making: Types, materials used, Pattern making allowances, color codes. Core making: - Types, core material & its properties. Molding: Types of sand moulds, molding sand composition, molding sand properties, molding machines. Gating design – Elements of gating systems, pouring time, riser design Choke area (Analytical treatment). **[CO-1]**

Unit 2 **[5 hrs]**

Foundry mechanism: Special casting processes such as investment Casting, Centrifugal Casting, Shell Molding, CO Molding, Slush Casting, Die Casting, Cleaning, inspection & casting defects. **[CO-1]**

Unit 3 **[5 hrs]**

Mechanics of forming processes (including analytical treatment). Rolling (Determination of variables in Rolling), Forging (Hammer/Press), Extrusion & Wire Drawing. Melting furnaces – Types, Electric furnace, Induction furnace,Cupola-construction & operation. **[CO-2]**

Unit 4 **[7 hrs]**

Sheet metal working:- Introduction, Terminology, Types of Presses and operations, Classification of dies, Introduction to design parameters, Analytical treatment—Blanking dies (calculation of cutting force), Bending dies (calculation of blank length, bending force) , Drawing dies (design of blank size, calculation of drawing force, blank holder force) **[CO-2]**

Unit 5 **[9 hrs]**

Joining processes: Introduction to Welding, Soldering, Brazing Processes. Types of Welding, Arc Welding & Gas Welding Processes, Defects & Inspection of Welding Joints, Electrodes, Weldability of Metals, Welding equipments of Fixtures. Advance Welding Methods: Introduction to TIG, MIG, spot welding, Plasma Arc welding, Electron Beam, and Electron Laser Beam welding. **[CO-3]**

			1.00	Applicable for AY2019-20 Onwards
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4th SEMESTER

ME2254	Manufacturing Processes		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit 6 **[7 hrs]**

Nonconventional Machining Processes: Characteristics, Operation, applications, Limitation and selection of process parameters of the following processes, Abrasive Jet Machining, Ultrasonic Machining, Water Jet Machining, EDM, and ECM. **[CO-4]**

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Manufacturing Technology (Foundry Forming & Welding)	P N Rao	4 th Edition (2013)	The McGraw-Hill Companies
2	Manufacturing Science	Ghosh & Malik	2nd Edition (2010)	
3	Workshop Technology (Volume-I)	HajraChoudhary	2nd Edition (2009)	The McGraw-Hill Companies
4	Manufacturing Engineering & Technology	S Kalpakjian& SR Schmid	1st Edition (2018)	Pearson Education Canada
5	Manufacturing Technology	Adithan, Gupta	5 TH Edition (2012)	
6	Modern Machining Processes	Pandey, Shah	1st Edition (2008)	The McGraw-Hill Companies

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Workshop Technology: Vol. I - III	WAJ Chapman	2ndEdition	St. Martin's Press
2	Manufacturing Processes	M Begman	1st Edition	Ballinger Pub. Co
3	Processes & Materials of Manufacture	R Lindberg	1st Edition	Allyn and BaconTechnology & Engineering
4	Workshop Technology (Volume I & II)	Bawa	2nd Edition	The McGraw-Hill Companies
5	Workshop Technology Vol. I & II	B.S. Raghuvanshi	1st Edition	Dhanpat Rai & Sons

4th SEMESTER

ME2255	Lab: Manufacturing Processes		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
Practical is the essential framework of manufacturing processes and is composed of the scientific and practical inter relationship among the processing, structure, properties and performance of all conventional methods of manufacturing techniques.	**(1)** The student will be able to illustrate the basics of moulding practices and various casting process . **(2)** The student will be able to illustrate CUPOLA and other furnaces. **(3)** The student will be able to Elaborate and classify different welding processes. **(4)** The student will be able to discuss various SMW processes

List of Practical:-

A set of 10 Experiments from following list to be performed.

- Preamble about Foundry practices used in industries.[CO 1]
- Preparation of mould sand. [CO 1]

- Study of Various moulding processes. [CO 1]
- Study of various types of melting furnaces and cupola in detail. [CO 2]
- Study of different types of wooden pattern[CO 1]
- Grain fineness test of moulding sand. [CO 1]
- Demonstration of mould making along with Study of foundry tools. [CO 1]
- Preparation of mould making. [CO 1]

- Preparation of casting job along with Study of casting processes. [CO 1]
- Preparation of wooden pattern in pattern making shop. [CO 1]
- Job making involving various operations such as MIG ,TIG welding processes etc. [CO 3]
- Preparation of job on punching press. [CO 4]
- Report of foundry visit [CO 1]

A Visit: A visit to a foundry shop for more understanding of the casting practices**.** [CO 4]

4th SEMESTER

ME2256	Mechanical Measurement and Metrology	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
To make the student aware of various Fundamental principles applicable to instruments used for measuring various mechanical parameters. To expose the students about limits, fits, tolerances & implement them to achieve the goal of interchangeable manufacturing. To impart the fundament quality control concepts & their implementation in manufacturing industry.	The Students will be able to – (1) Demonstrate the basic knowledge of measuring instruments and evaluate various characteristics(Static & Dynamic) (2) Select proper measuring instrument & use it for measuring various mechanical paramenters. (3) Demonstrate the basic knowledge of limits, fits, tolerance & design of limit gauges, tolerance charts. (4) Various quality control concepts & implement them to control quality of manufacturing processes.

UNIT 1

Purpose, Structure, and elements of a general measurement system. Static characteristics of measurement system, measurement error, Type of inputs, methods of corrections. Dynamic characteristics of measurements system, Mathematical modeling, transfer function, order of system, Standard input signals. Response of Zero, First and second order instruments.(no analytical treatment) [CO 1]

UNIT 2

Standards of measurements, interchangeability, simple gauging instruments for linear and angular measurements, form measurement, surface finish measurement, comparators, measurement of straightness and flatness, measurement thread , interferometers, calibration of equipment, CMM. [CO 2]

UNIT 3

Tolerance analysis of limit and fits, Design of limit gauges(analytical treatment), types of fits, shaft basis system ,hole basis system, selective assembly ,allowances, process planning sheet, preparation of tolerance chart (analytical treatment). [CO 3]

UNIT 4

Study of instruments for measurements of linear & angular displacement, speed, acceleration, force, torque, power and Strain.. [CO 2]

UNIT 5

Study of instruments for measurement of temperature, level, pressure and flow. [CO 2]

UNIT 6

Acceptance sampling techniques, O.C. Curve, sampling plans, (analytical treatment), inspection types and objective. Quality control and control charts. [CO 4]

			1.00	Applicable for AY2019-20 Onwards
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4th SEMESTER

ME2256	Mechanical Measurement and Metrology		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Measurement Systems	Beckwith and Buck	6th edition 2014	Pearson Education India,
2	Mechanical Measurements Applications and Design	Doebelin	6 Edition 2014	McGraw-Hill.
3	Text book of Engineering Metrology	R. K. jain	20th Edition 2014	Khanna Publicatiion Delhi
4	Production Engineering	P. C. Sharma	2009	S. Chand Co.
5	Mechanical measurement & Instrumentation	Er. R. K. Rajput	2nd Edition 2017	SK Katariya & sons
6	Mechanical measurement & Instrumentation	A. K. Sawhney	12th Edition 2010	Dhanpatrai & Co

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Engineering Metrology `	I.C. Gupta	15th Edition 2003	Dhanpatrai & Co
2	SQC	E L. Grant	3rd Edition 19988	McGraw-Hill.
3	SQC	Mahajan	2015	Dhanpatrai & Co

4th SEMESTER

ME2256	Lab: Mechanical Measurement and Metrology	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	---

Objective	Course Outcome
To make the student aware of various Fundamental principles applicable to instruments used for measuring various mechanical parameters. To expose the students about limits, fits, tolerances & implement them to achieve the goal of interchangeable manufacturing. To impart the fundament quality control concepts & their implementation in manufacturing industry.	The Students will be able to – (1) Demonstrate the basic knowledge of measuring instruments and evaluate various characteristics(Static & Dynamic) (2) Select proper measuring instrument & use it for measuring various mechanical paramenters. (3) Demonstrate the basic knowledge of limits, fits, tolerance & design of limit gauges, tolerance charts. (4) Various quality control concepts & implement them to control quality of manufacturing processes.

List of Practical:-

A set of 10 Experiments from following list to be performed.

1. Measurement of strain by using a basic strain gauge and hence verify the stress induced.[CO 1,2]
2. Speed Measurement by using Stroboscope. [CO 1,2]
3. Speed Measurement by using Magnetic Pick Up [CO 1,2]
4. Speed Measurement by using Photo-electric Pick Up [CO 1,2]
5. Measurement of flow by using Rota meter. [CO 1,2]
6. Displacement measurement by inductive transducer. [CO 1,2]
7. Calibration of Thermocouple. [CO 1,2]
8. Calibration of RTD. [CO 1,2]
9. Calibration of LVDT [CO 1,2]
10. Determination of negative temperature coefficient and calibration of a thermistor. [CO 1,2]
11. Measurement of force & weight by using a load cell. [CO 1,2]
12. Liquid Level Measurement by using Capacitive Transducer system. [CO 1,2]
13. Measurement of Air velocity using Hot wire anemometer. [CO 1,2]
14. Measurement of Air velocity using turbine type anemometer[CO 1]
15. Scope of metrology lab and study of all metrological instruments. [CO 1]
16. Study of slip gauges and its uses. [CO 1,2]
17. To find half taper angle of a w/p using sine bar[CO 1,2]
18. To find various parameters of screw thread using TMM. [CO 1,2]

			1.00	Applicable for AY2019-20 Onwards
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4th SEMESTER

ME2256	Lab: Mechanical Measurement and Metrology	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	---

19. To find effective diameter of a threaded plug by two wire method using floating carriage machine. [CO 1,2]
20. Study of flatness of surface using monochromatic light with the help of fringe pattern. [CO 1,2]
21. To measure the surface roughness of a given w/p using Stylus probe. [CO 1,2]
22. To study the profile of given w/p using optical profile projector. [CO 1,2]
23. Design of limit gauge. [CO 3]
24. Preparation of process planning sheet and tolerance chart. [CO 3]
25. Problems on acceptance sampling. [CO 4]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2014

5 to 8 Semester

Mechanical Engineering

Update on June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Mechanical Engineering

Sl.No.	Sub Code	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE- I	MSE- II	TA	ESE	
		FIFTH SEMESTER										
1	GE1311	Fundamental of Management	3	0	0	3	3	15	15	10	60	3 Hours
2	ME1301	Metrology & Quality Control	3	0	0	3	3	15	15	10	60	3 Hours
3	ME1302	**Lab.:** Metrology & Quality Control	0	0	2	2	1			40	60	
4	ME1303	Heat Transfer	4	0	0	4	4	15	15	10	60	3 Hours
5	ME1304	**Lab. :** Heat Transfer	0	0	2	2	1			40	60	
6	ME1307	Applied Thermodynamics	4	0	0	4	4	15	15	10	60	3 Hours
7	ME1323	Dynamics Of Machinery	3	0	0	3	3	15	15	10	60	3 Hours
8	ME1324	**Lab. :** Dynamics Of Machinery	0	0	2	2	1			40	60	
9	**Open Elective-I**		3	0	0	3	3	15	15	10	60	3 Hours
	ME1315	OE-I:Operations Research Techniques										
	ME1317	OE-I:Automobile Engineering										
	ME1321	OE-I:Plastic Engineering										
10	**ME1334**	Industrial Visit	0	0	1	1	1			100		
		Total	**20**	**0**	**7**	**27**	**24**					

		SIXTH SEMESTER										
1	GE1312	Fundamental of Economics	3	0	0	3	3	15	15	10	60	3 Hours
2	ME1308	**Lab. :** Machine Drawing	0	0	4	4	2			40	60	
3	ME1310	Energy Conversion	4	0	0	4	4	15	15	10	60	3 Hours
4	ME1311	**Lab.:** Energy Conversion	0	0	2	2	1			40	60	
5	ME1312	Computer Aided Design	3	1	0	4	4	15	15	10	60	3 Hours
6	ME1313	**Lab.:** Computer Aided Design	0	0	2	2	1			40	60	
7	ME1320	Control System Engineering	3	1	0	4	4	15	15	10	60	3 Hours
8	**Open Elective-II**		3	0	0	3	3	15	15	10	60	3 Hours
	ME1331	OE-II:Total Quality Management										
	ME1332	OE-II:Reliability Engineering										
	ME1333	OE-II:Power Generation Engineering										
9	ME1325	Seminar Based On Mini Project	0	0	2	2	1			100		
		Total	**16**	**2**	**10**	**28**	**23**					

Chairperson	**Version**	**1.00**	**Applicable for AY 2016-17 Onwards**
Dean (Acad. Matters)	**Date of Release**	**May 2016**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Mechanical Engineering

Sl.No.	Sub Code	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE- I	MSE- II	TA	ESE	
SEVENTH SEMESTER												
1	ME1447	Production Management	3	0	0	3	3	15	15	10	60	3 Hours
2	ME1448	Design Of Mechanical Drives	3	0	0	3	3	15	15	10	60	3 Hours
3	**Professional Elective - I**		4	0	0	4	4	15	15	10	60	3 Hours
	ME1401	PE-I: Tool Design										
	ME1402	PE-I: Material Handling Systems										
	ME1404	PE-I: Engineering Of Plastics										
	ME1405	PE-I: Project Evaluation & Management										
	ME1449	PE-I: Computational Fluid Dynamics										
	ME1456	PE-I: Advanced Manufacturing Techniques										
	ME1461	PE-I: Rapid Prototyping										
	ME1462	PE-I: Fuel Cells Technology										
	ME1463	PE-I: Data Structure and Algorithm										
4	**Professional Elective - II**		4	0	0	4	4	15	15	10	60	3 Hours
	ME1408	PE-II: Synthesis Of Mechanism										
	ME1409	PE-II: Finance & Cost Management										
	ME1410	PE-II: Renewable Energy System										
	ME1411	PE-II: Artificial Intelligence										
	ME1412	PE-II: Maintainance Management										
	ME1465	PE-II: Energy Management										
	ME1466	PE-II: Design For Manufacturing & Assembly										
	ME1467	PE-II: Quantitative Techniques										
	ME1468	PE-II: Database Management System										
5	**Professional Elective - III**		4	0	0	4	4	15	15	10	60	3 Hours
	ME1406	PE-III: Finite Element Methods										
	ME1417	PE-III: CIM										
	ME1419	PE-III: I.C. Engines										
	ME1421	PE-III: Refrigeration & Air Conditioning										
	ME1445	PE-III: Mechatronics										
	ME1469	PE-III: Refrigeration & Cryogenics										
	ME1476	PE-III: Machine Tool Design										
6	**Lab.:Professional Elective - III**		0	0	2	2	1			40	60	
	ME1407	**Lab. :** PE-III: Finite Element Methods										
	ME1418	**Lab. :** PE-III: CIM										
	ME1420	**Lab. :** PE-III: I.C. Engines										
	ME1422	**Lab. :** PE-III: Refrigeration & Air Conditioning										
	ME1446	**Lab. :** PE-III: Mechatronics										
	ME1470	**Lab. :** PE-III: Refrigeration & Cryogenics										
	ME1477	**Lab. :** PE-III: Machine Tool Design										
7	ME1433	Project Phase-I	0	0	4	4	4			40	60	
8	ME1434	Industrial Training / CRT	0	0	0	0	2			100		
Total			**18**	**0**	**6**	**24**	**25**					

Chairperson		**Version**	**1.01**	**Applicable for AY 2017-18 Onwards**
Dean (Acad. Matters)		**Date of Release**	**May 2017**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Mechanical Engineering

Sl.No.	Sub Code	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE- I	MSE- II	TA	ESE	
EIGHTH SEMESTER												
1	ME1435	Automation In Production	3	0	0	3	3	15	15	10	60	3 Hours
2	ME1436	**Lab. :**Automation In Production	0	0	2	2	1			40	60	
3	ME1475	Optimisation Techniques	3	1	0	4	4	15	15	10	60	3 Hours
4	**Professional Elective - IV**		4	0	0	4	4	15	15	10	60	3 Hours
	ME1415	PE-IV: Vibration										
	ME1437	PE-IV: Industrial Fluid Power										
	ME1439	PE-IV: Cnc & Robotics										
	ME1441	PE-IV: Vehicle Engineering										
	ME1443	PE-IV: MIS										
	ME1478	PE-IV: Solar Energy and Utilization										
	ME1480	PE-IV: Design For Fatigue and Fracture										
5	**Lab.: Professional Elective - IV**		0	0	2	2	1			40	60	
	ME1416	**Lab. :** PE-IV: Vibration										
	ME1438	**Lab. :** PE-IV: Industrial Fluid Power										
	ME1440	**Lab. :** PE-IV: Cnc & Robotics										
	ME1442	**Lab. :** PE-IV: Vehicle Engineering										
	ME1444	**Lab. :** PE-IV: MIS										
	ME1479	**Lab. :** PE-IV: Solar Energy And Utilization										
	ME1481	**Lab. :** PE-IV: Design For Fatigue And Fracture										
6	**Professional Elective - V**		4	0	0	4	4	15	15	10	60	3 Hours
	ME1451	PE-V: Stress Analysis										
	ME1452	PE-V: Design Of Experiments And Taguchi Methods										
	ME1453	PE-V: Value Engg.										
	ME1454	PE-V: Lean Sigma										
	ME1455	PE-V: Product Design And Development										
	ME1457	PE-V: Power Plant Engineering										
	ME1458	PE-V: Machine Tool Design										
	ME1459	PE-V: Industrial Safety										
	ME1460	PE-V: Advance Welding Techniques										
	ME1482	PE-V: Air Conditioning										
	ME1483	PE-V: Cryogenic Systems										
	ME1484	PE-V: Tribology										
7	ME1472	Comprehensive Viva Voce	0	0	0	0	3				100	
8	ME1473	Project Phase-II	0	0	8	8	8			40	60	
9	ME1474	Extra Curricular Activities	0	0	0	0	2			100		
Total			**14**	**1**	**12**	**27**	**30**					

Chairperson		**Version**	**1.02**
Dean (Acad. Matters)		**Date of Release**	**Dec. 2017**

Applicable for AY 2017-18 Onwards

5th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
Principle of Management	To familiarize the students with the basic concepts and principles of management. The students should clearly understand the definitions of different areas of management. This course will facilitate students to understand and describe specific theories related to perception, motivation, leadership. This will help the students to demonstrate effective management skill by knowing the various functions of management like planning, organising, directing, coordinating and controlling.
Legal Aspects of Management	The present course aims at familiarizing the students with various legal aspects of business, contract, partnership and companies. It aims at providing a rich fund of contemporary knowledge, time tested principles, basic concepts, emerging ideas and practices in the field of law in a comprehensive way.
Human Resource Management	The objective of this course is to endow the student with a broad perspective on themes and issues of Human Resource Management, Human Resource Development, Training and Development activities, Job Analysis, Performance Appraisal, disciplinary and grievance procedure. It will help the students to build up and refine decision making skills so that they can help organizations effectively manage employee relations.
Project Management	The course is intended to develop the knowledge of the students in the management of projects, special emphasis will be provided on project formulation as also on various tools and techniques for project appraisal and control so that they are able to draft the project proposal in any area of management and evaluate the projects.
Marketing Management	This course intends to provide an experienced-based approach to marketing concept and its practical application. The course is designed to enable the students to learn the basic of marketing, customer behaviour, marketing research & sales promotion. Topics of the syllabus shall be addressed and discussed from an application oriented perspective
Financial Management	The present course aims at familiarizing the participants with the skills related to basic principles, tools and techniques of financial management. This will help the students to demonstrate their skill in understanding the budgets and budgetary control, balance sheet, and profit and loss statement.

Mapped Program Outcomes:

5th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1: Principles of Management
Evolution of Management Thought : Scientific, Classical, Neo Classical and Modern Theory of Management, Defintion Meaning and Concept of Management, Functions of Managment : Planning, Organizing, Directing Coordinating and Controlling. Motivation Theory, Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, Types of Partners, Right and Duties of Partners, Registration and Dissolution of firm, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Directors : Powers and duties, Winding up of the Company

UNIT-3: Human Resource Management
Human Resource Management-Meaning, Nature and Scope, Principles of HRD, Human Resource Planning, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Discipline and Grievance Procedure.

UNIT-4 Project management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Project Management, Tools and Techniques of Project Management, SWOT Analysis, Project Risk Analysis, Project cost, Project Planning, Project Control, Network techniques - Introduction and Use of CPM &PERT for planning.

UNIT-5 Marketing Management:-
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Rural Marketing, Marketing Environment, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

UNIT-6 Financial Management:-
Definition & Functions of Finance department, Sources of finance , Financing organizations, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

TEXT BOOKS:

1. S.C.Saxena, Business Management and Administration, Sahitya Bhawan Publication
2. P. Subba Rao, Management -- Theory and Practice (Text and Cases) (Himalaya Publication)
3. Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
4. P.S Rao , Essentials of Human Resource Managemen & IR, Himalaya , Mumbai
5. Avraham Shtub and Jonathan F. Bard, Project Management: Processes, Methodologies, and Economics (2nd Edition)
6. Kotler, Keller, Koshy & Jha, Marketing Management, Pearson, New Delhi
7. R.K. Sharma, Shashi K Gupta, Management Accounting,. Kalyani Publishers.

5th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

TEXT BOOKS FOR REFERENCE:

1) Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2) Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3) Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4) C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,

5) Lock, Gower - Project Management Handbook
6) Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7) Rajan Saxena: Marketing Management, Tata McGraw Hill.
8) Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9) Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10) Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11) Khan M Y - Financial Services (Tata Mc Graw Hill, 1998)

5th Semester

ME1301	**Metrology and Quality Control**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	

Course Objectives	**Course Outcome**
• To emphasis the need of metrology and its role in quality control. • To enable the students to take up metrology work in Industries using latest metrological equipments. • An introduction to limit,fit &tolerances. • To impart knowledge of Acceptance sampling techniques. • To understand Emerging concepts of Quality management.	• **I**Introduction to standards based on production drawing, Interpretation of production drawing , preface to Classification of operations. **[a,e]** • **II** Aware of Tolerance analysis of limit &fits, Design of limit gauges. Preparation of tolerance chart. **(a,b,e)** • **III**Introduction to Metrology. Identify Standard of measurements &measuring instruments. Illustrate CMM. **(a,b,e,k)** • **IV**Understand the Quality Control concept and process control charts. . **(a,b,e)** • **V**Understand the introductory concepts of Acceptance sampling techniques ,ISO, TQM &TPM . **[a,b,e,k]**
Program Outcomes: **(a, b, e, k)**	

Unit 1 **[7 hrs]**
Introduction to standards based on production drawing: - Interpretation of production drawing Classification of operations –basic, qualifying process, critical product, critical secondary, auxiliary, supporting operations, Product design function, Process design function, break even analysis**. (a, e)**

Unit 2 **[8 hrs]**
Limits , Fits and Tolerances:-Tolerance analysis of limit &fits,Interchangeability, Design of limit gauges, types of fits, shaft basis system, hole basis system selective assembly, allowances, IS specification process planning sheet preparation of tolerance chart (problems on tolerance chart are expected in theory examination). **(a,b,e)**

Unit 3 **[8 hrs]**
Introduction to Metrology: - Standard of measurements simple gauging instruments for linear and angular measurements, form measurement, Surface finish measurement, Comparators, measurement of straightness and flatness. Measurements of thread, measurements of gear tooth, interferometery, Laser Meteorology, Coordinate measuring machine (CMM**). (a,b,e,k)**

Unit 4 **[8 hrs]**
Quality Control: - Definition, function, objective, Quality characteristics., Quality of design, conformance &performance, Control charts and process capability. Statistical quality control**. Quality audit, Quality circle(a,b,e)**

Unit 5 **[7 hrs]**
Acceptance sampling techniques, objectives, O.C. curves, sampling plans, types of inspection, Sampling methods. **(a,b,e)**

Unit 6 **[6 hrs]**
ISO, TQM Principles, **Introduction to Taguchi technique , 5S, Kaizen, Poka yoke, Kanban, JIT,**. Total productive maintenance.**(a, k)**

Text Books :			
1	Text book of Engineering Metrology	17th Edition (2009)	R. K. Jain
2	Totall Quality management	2rd Edition (2009)	N. Shrinivasan,Gupta, valaramthi
3	Production Engineering	Edition (2007)	P.C. "Sharma
4	Total quality control	3rd Edition	A.V.Feigenbaum

5th Semester

ME1301	**Metrology and Quality Control**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	

Reference books:			
1	Engineering Metrology	15th Edition (2003)	I.C. Gupta
2	Statistical Quality control	3rd Edition (1988)	E.L.Grant
3	Quality control and applications	1993	Bertrand L. Hassan,Ghare
4	Statistical quality control	Edition (2010)	Mahajan M
5	Metrology for Engineers	Edition (1990)	John Frederick Wise Galyer, Charles Reginald Shotbolt

5th Semester

ME1302	Lab. Metrology and Quality Control	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	

Objective	Course Outcome
To emphasis the need of metrological instrument and its role in quality control. To enable the students to take up metrology work in Industries using latest metrological equipments .To impart knowledge of tolerance chart & quality control techniques.**[a,b,e]**	The students will be able to - (I) Ability to select & use metrological instruments.[a,b,e]
	(II) Ability to apply acceptance-sampling techniques & prepare tolerance chart.[a,b,e]

List of Practical

A set of 10 Experiments from following list to be performed.

1. Scope of metrology laboratory and introduction of all metrological hand instruments and precision measuring instruments.**[a]**
2. Study of slip gauges and its use. Description of slip gauges. **[a.e]**
3. To find the half taper angle of a work piece using sine bar. **[a,b,e]**
4. To find the various parameter of screw threads using toolmakers microscope. **[a,b,e]**
5. To find the effective diameter of a threaded plug by two wire method with the help of floating carriage diameter measuring machine. **[a,b,e]**
6. Design of limit gauges. **[a,e]**
7. Study of flatness of surface using monochromatic light with the help of fringe pattern. **[a]**
8. To measure the surface roughness of a given work piece. **[a]**
9. To study the profile of a given work piece using an optical profile projector. **[a]**
10. To measure the diameter of a circular bar and mark the center on the faces of the bar. **[a]**
11. Measurement of angles with clinometers. **[a]**
12. Measurement of internal and external tapers. **[a]**
13. Marking and measuring exercise with all measuring devices. **[a]**

Quality control

1. Case studies on process control
2. Design of sampling plans
3. Study of ISO 9000/BIS14000 series
4. Study of TQM

Process planning & Tolerance chart

1. Preparation of process planning sheet and Tolerance chart (Two case studies on two different jobs) **[a]**
2. Design of limit gauges. **[a]**
3. Problems on tolerance Analysis (limit & Fits) **[a]**

5th Semester

ME1303	Heat Transfer	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
a)The contents of syllabus intend to understand basic principles and physical phenomenon of Thermal Energy transfer and to understand heat transfer applications and formulate the problem. b) To apply experimental tools for analysis of heat transfer applications in engineering. c) To receive results from experimental and the mathematical tools and interpret the results to provide solutions for improvement. d)In all to generate interest in learning to develop intuitive understanding in Heat Transfer.**[a,e,k,l,m]**	(I)Student will be able to understand the basic concepts of law & governing equation for heat transfer through all modes.[a,e,k,l,m] (II)Student will be ability to analyze and solve the heat transfer problems (involve in all mode) analytical and graphical techniques. **[a, e, k, l, m]** (III) Student will be ability to understand basic methodology in analysis and design of heat exchangers. **[a, e, k, l, m]**

Unit 1 **[8 hrs]**

Introduction: Basic modes of Heat Transfer, Basic Laws of Heat Transfer and Conservation of Energy requirement, **Derivation of general Heat conduction equation** in Cartesian, Cylindrical and Spherical Co-ordinates, Thermal conductivity and Thermal diffusivity,

One dimensional steady state conduction equation for the plane wall, Cylinder and Sphere, Thermal resistance of composite structures, Contact resistance, overall heat transfer coefficient.

Critical thickness of insulation. **[a,e,k,l,m]**

Unit 2 **[8 hrs]**

Conduction with uniform internal heat generation : within plane wall, Cylinder and sphere,

Extended Surfaces with uniform cross section area, temperature distribution and their heat transfer rate, Fin efficiency and effectiveness, Error in temperature measurement,

Lumped Heat Capacitance analysis, Biot number, Fourier number and their significance.

[a,e,k,l,m]

Unit 3 **[8 hrs]**

FORCED CONVECTION:

Physical signification of related non-dimensional parameters, Newton's law of cooling,

Concept of velocity and thermal boundary layer, Local and average heat transfer coefficient, Stanton Number, Fluid friction and heat transfer

Empirical co-relation for heat transfer during external and internal flow in laminar and turbulent regime for UHF and UWT condition. **[a,e,k,l,m]**

Unit 4 **[8hrs]**

Natural Convection:

Grashof number, Rayleigh number, Hydrodynamic and Thermal Boundary Layer.

Empirical co-relation for heat transfer during external flow in laminar and turbulent regime for UHF and UWT condition (over plates & cylinders in Horizonal and vertical position, and over sphere).

Heat transfer with phase change:

Pool boiling phenomenon , curve and regimes of pool boiling,

Film and drop wise condensation, Filmwise condensation on vertical surface (plate & cylinder), horizontal tube & bank of tubes, effect of superheated and non-condensable gasses on condensation heat transfer.

[a,e,k,l,m]

5th Semester

ME1303	Heat Transfer	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit 5 **[8 hrs]**

Heat Exchanger:

Classification of heat exchangers, overall heat transfer coefficient, fouling factor,temperature distribution
Heat Exchanger Analysis for parallel & Counter flow heat exchangers using LMTD Approach and Effectiveness -NTU approach
LMTD correction factors. **[a,e,k,l,m]**

Unit6 **[7hrs]**

RADIATION

Basic Radiation Concepts:
Fundamentals, Basic ideas, spectrum, basic definitions, radiative properties of opaque surfaces, Spectral and directional variations, emissive power, radiosity, intensity of radiation and solid angle,Band Emission.

Black Body Radiation Laws:
Planck's law, Stefan Boltzman law, Wien's Displacement law, Kirchhoff's law, Lambert cosine law,

Radiation Energy Exchange:
Concept of black and gray bodies
Radiation exchange between black surfaces,
Radiation exchange between gray surfaces

Shape Factor Concepts–
Definition, relations and its properties.
Radiation network for radiative exchange

Radiation Shields.
radiation between parallel plates, Cylinder and sphere, enclosures. **[a,e,k,l,m]**

Reference books:				
1	Introduction to heat transfer	5th Edition(2006)	Incropera & Dewitt J. Wiley	John Wiley & Sons
2	Elements of heat transfer	Edition (2007)	M.N.Ozisik	McGraw-Hill
3	Heat transfer	4th Edition(2005)	S.P.Sukhatme	Universities press (India)
4	Heat Transfer	Edition (1998)	Yunus A Cengel	McGraw-Hill,
5	Fundamentals of Heat & Mass transfer	1st Edition (2006)	M. Thirumaleshwar	Pearson

5th Semester

ME1304	Lab. : Heat Transfer	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	

Objective	Course Outcome
• To demonstrate and perform basic principles finding thermal conductivity of various materials like asbestos, brass, etc. • To demonstrate basic method for determination of overall heat transfer coefficient (and conductance) of composite slabs. • To perform experimentation for determination of heat transfer coefficients in free and forced convection. • To demonstrate basic method for determination of emissivity of grey body and Stefan Boltzmann's constant. • To perform experimentation for determination of heat transfer coefficients, effectiveness and heat transfer rates Heat Exchangers.**(a, k, m)**	(I) The students will be able to determine the heat transfer rates through various cross-sections and mediums in different modes [a,m] (II) Student will be ability to analyze variation of term in the body. [a,m] (III) Student will be ability to acquire tabulate, analyze experimental data, and draw interpretation and conclusions. [a,m]

List of Practical

A set of 8 Experiments from following list to be performed.

1) Study of different methods of temperature measurements with special emphasis on thermocouples. **[a,m]**
2) Study of different thermal properties of matter with special emphasis on thermal conductivity of various materials. **[a,m]**
3) Determination of thermal conductivity of metal bar. **[a,m]**
4) Determination of thermal conductivity of insulating material in the powder form. **[a,m]**
5) Determination of thermal conductivity of liquids. **[a,m]**
6) Determination of thermal conductivity by guarded plate heater methods. **[a,m]**
7) Determination of temperature distribution and heat transfer plate from a fin under. **[a,m]**
   A) Free convection & B) Forced convection condition. **[a,m]**
8) Determination of forced convection heat transfer coefficient for fluid flow through a closed conduit. **[a,m]**
9) Determination of forced convection heat transfer coefficient for flow over a vertical surface. **[a,m]**
10) Determination of critical heat flux in saturated pool boiling. **[a,k,m]**
11) Determination of condensation heat transfer in film wise & drop wise modes. **[a,k,m]**
12) Study of various types of heat exchangers. **[a,k,m]**
13) Determination of emmissivity of non black surfaces. **[a,m]**
14) Determination of Stefen-Boltzmann constant. **[a,m]**
15) Study of heat pipes **[a,m]**

5th Semester

ME1307	Applied Thermodynamics - I	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
Application of fundamentals of engineering thermodynamics to steam nozzle, steam turbine, condensers, gas turbine. To understand the methods of power generation by steam and gas. To study the basis of Jet propulsion.**[a,e]**	(I)The student will be able to understand the basic behavior of compressible fluid..[a,e]
	(II) The student will be able to understand steam power generation and its system.**[a,e]**
	(III) The student will be able to understand Gas turbine and its analysis.**[a,e]**

Unit 1 **[7 hrs]**
Compressible Flow: Stagnation properties, speed of sound wave, Mach number, one dimensional isentropic flow, Stagnation properties, Normal shock. **[a,e]**

Unit 2 **[8 hrs]**
Steam Nozzles: Isentropic flow through convergent-divergent nozzles, Adiabatic Expansion in Nozzles, Maximum Discharge Critical Pressure Ratio and effects of Friction, Calculation of Throat and Exit Areas, Supersaturated Flow, Wilson Line. **[a,e]**

Unit 3 **[8 hrs]**
Steam Turbine: Principle and Working of Steam Turbines, Classification of Steam Turbines, Difference between Impulse Turbine & Reaction turbine.
Impulse turbines: Compounding of Steam Turbines, Velocity Diagrams, Graphical and Analytical Methods (single stage, two stages), Work, Done, Thrust and Power, Steam Turbine Efficiencies, Governing of steam Turbines, Energy Losses in steam turbines.
[a,e]

Unit 4 **[7 hrs]**
Reaction Turbines: Velocity diagram for reaction turbine blade, degree of reaction, condition for maximum efficiency, Reheat and Regenerative Cycles of steam turbine, co-generations & combined power cycles.
Steam Condensers: Types of Condensers, Condensers Quality of cooling water required, Daltons Law of Pressures, Cooling Towers: Types of Cooling Towers. **[a,e]**

Unit 5 **[8 hrs]**
Gas Turbines:-General aspects, application of gas turbine, Classification of gas turbines, Constant pressure combustion gas turbine, open cycle gas turbines, methods for improvement of thermal efficiency of open cycle gas turbine plant (intercooling, reheat & regeneration), Effect of operating variables on thermal efficiency, fuel-air ratio, thermal efficiency, work ratio calculation, **[a,e]**

Unit 6 **[7 hrs]**
Closed cycle gas turbine –Merits & demerits of closed cycle gas turbine over open cycle, Gas turbine fuels,.
Jet Propulsion:-principles &working of simple turbojet, Thrust power, propulsive power. Thermal efficiency, propulsive efficiency. Overall efficiency, other propulsion systems (Turbofan, Turboprop, and Ramjet). **[a,e]**

5th Semester

ME1307	Applied Thermodynamics - I	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	Thermal Engineering	6th (2005)	**R.K.Rajput**	Laxmi publisher
2	Thermal Engineering	8th (2005)	Mathur & Mehtra	Jain Brothers
3	Thermal Engineering	3rd (2005)	Vasandani & Kumar	Metropolitian
4	Power Plant Engineering	3rd (2005)	V.M. Domkundwar	Dhanpatrai P
5	Gas turbine & Jet Propulsion	3rd (2003)	Khajuria & Dubey	Dhanpatrai P
6	Gas Turbine Theory	4th (1996)	Cohen & Rogers	Heritage Publishers

5th Semester

ME1323	Dynamics of Machinery	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:	Course outcomes:
To develop the concept of rigid body motion and impart knowledge of rigid body dynamics. To enables the students to analyze dynamic forces in mechanism. To introduce the concept of unbalanced forces need for balancing of various machines and the different ways to achieve balancing. To impart elementary knowledge of vibrations, its effect on machines .To prepares students for calculations of important parameters and vibration isolation.**[b,e]**	(i)The students will have ability to understand the dynamics of machine and machine elements. **[b,e]**
	(ii)To ability of understand thee effects of unbalance in machine and methods to reduce/elements these effect. **[b,e]**
	(i) To ability to analyze the vibration. **[b,e]**

Unit1 **[b,e]**

[8 hrs]

Introduction: D'Alembert principle, Dynamic force analysis of simple mechanism

Gyroscope: simple precession and gyroscopic couple, gyroscopic effect on airplane, ship, vehicles and grinding mills.

Unit2 **[b,e]**

[7 hrs]

Governors **– Classification, Watt, Portal, Proell, Hartnell governors etc,**

Fly wheel: Turning moment Vs crank angle diagram for single- cylinder and multiple-cylinder engines, punching machines etc. Flywheel selection.

Unit3[b,e]

[7 hrs]

Balancing in rotating mechanism: Static & Dynamic balancing in rotating masses, balancing of multiple masses rotating in same plane, Balancing of several masses rotating in different planes, Dynamic balancing machine.

Unit4 **[b,e]**

[8 hrs]

Balancing of reciprocating masses**: Primary and secondary unbalanced forces of reciprocating masses. Partial balancing of unbalanced primary forces in a reciprocating engine.**
Balancing of primary and secondary force and couples in multiple inline engine, Balancing of radial engines (Direct and reverse crank method)

Unit5[b,e]

[8 hrs]

Vibration: Derivation of equation of motion for vibratory system. Free vibration of single-degree-of-freedom system with and without damping. Logarithmic decrement and damping estimation. Forced vibration of single-degree-of-freedom and vibration isolation, whirling of shaft and critical speed of rotors.

Unit 6 **[b,e]**

[7 hrs]

Torsional vibration: Lagranges equations and introduction to multi degree freedom systems. Equation of motion for two-degree-of-freedom system. Natural frequencies and mode shapes vibration absorber. Torsional oscillation of two-disc and three disc rotors

5th Semester

ME1323	Dynamics of Machinery	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Theory of Machines and Mechanism	4 Edition (2009)	Shigley	Oxford University
2	Theory of Machines and Mechanism	2 Edition (1999	Ghosh & Mallik	Affiliated East-West
3	Theory of Mechanism	2 Edition (2005)	Rattan S. S	Tata McGraw-Hill
4	Mechanism and Machine Theory	3rd edition **2004**	Rao &Dukipatti	Wiley & Sons
5	Theory of Vibrations	2nd edition 1995	Thomson W T	Prentice Hall of India

Reference books:				
1	Theory of Machine	3rd Edition (2009)	Thomas Bevan	Pearson Education
2	Theory of Machines	4th Edition (2006)	Sandor & Erdman	Prentice Hall
3	Mechanical vibrations	3rd Edition (2009)	Grover M.P	prentice hall of india

5th Semester

ME1324	Lab. : Dynamics of Machinery	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	

Objectives:	Course outcomes:
To study the dynamics of machine and machine elements and their characteristiics.To study the cause and problems of unbalancing of machine and methods to reduce/ eliminate these problems to do the practical's on types of vibration and its analysis. **[b,e]**	(i)The students will have ability to understand the dynamics of machine and machine elements. **[b,e]**
	(ii)To ability of understand thee effects of unbalance in machine and methods to reduce/elements these effect. **[b,e]**
	(iii)To ability to analyze the vibration and apply vibrations isolation technique. **[b,e]**

List of Practical

A set of 8 Experiments from following list to be performed.

1. Study of static and dynamic force analysis **[b,e]**
2. Determination of Gyroscopic couple through motorized Gyroscope**[b,e]**
3. Experiments on Governors - Pronell Governor, Hartnell Governor **[b,e]**
4. Determination of Balancing of rotating mass, statically and dynamically. **[b,e]**
5. Determination of natural frequency of longitudinal vibration**[b,e]**
6. Determination of natural frequency of transverse vibration of beam. **[b,e]**
7. Determination of natural frequency of simply supported beam using dunkerlays method. **[b,e]**
8. Determination of natural frequency of torsional vibration of single rotor. **[b,e]**
9. Determination of natural frequency of torsional vibration of double rotor.**[b,e]**
10. Determination of whirling speed of shaft.**[b,e]**

5th Semester

ME1315	OE I : Operations Research Techniques	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.**[a,k,m]**	The student will be able to 1.(I) Use basic operations research techniques for solving linear programming problems. Learn to formulate and solve real-world problems as linear programs, CPM, PERT for better decision –making. [a,k,m] (II) Solve transportation Models and Assignment Models [a,k,m] (III) Understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type. [a,k,m]

Unit 1 **[7 hrs]**
Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR linear programming solutions of LPP by graphical methods and simplex method. Sensitivity analysis & formulation of Dual of LPP. **[a,k,m]**

Unit 2 **[8 hrs]**
Assignment Model, Travelling Salesman Problem by branch and bound method transshipment model, Transportation Model. **[a,k,m]**

Unit 3 **[7 hrs]**
Dynamic programming structure and characteristics of Dynamic programming application of Dynamic programming to resource allocation, Inventory control & linear programming. **[a,k]**

Unit 4 **[8 hrs]**
Project Management : Drawing of Network, CPM & PERT, probability of completion of project, cost analysis, Allocation and updating of Networks. **[a,k]**

Unit 5 **[7 hrs]**
Replacement Models : Concept of equivalence , Interest Rate, Present worth ,economic Evolutions of Alternatives, Group replacement models. Inventory control models, Analysis of single product deterministic models. **[a,k]**

Unit 6 **[8 hrs]**
Waiting line situations, Queuing Theory and models (No derivations expected simulations, concept and its applications in waiting line situations, inventory and networks. **[a,k]**

Reference books:

1	Operation Research		Heera & Gupta	
2	Operation Research		JK Sharma	
3	Operation Research		Askhedkar & Kulkarni	
4	Operation Research		Vohra ND	
5	Operation Research		Liberman	

5th Semester

ME1317	OE I : AUTOMOBILE ENGINEERING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about Automobile systems which are used in the regular vehicle. The modernization in automobile is also included to understand recent trend in the field.**[d,i,k]**	(I) Student should understand basic operations of Automobile engine and power transmission systems.**[d,i,k]** (II) Student should understand basic operations various control system in automobile.**[d,i,k]** (III) Student should understand electrical system and various safety equipments automobile.**[d,i,k]**

UNIT-1: **[8 hrs]**
- Introduction, Automobile history and development and classification. Vehicles layout.
- Engine construction and working of 2 stroke and 4-stroke cycle.
- Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic)
- Engine cooling and lubrication systems., **.[d,i,k]**

UNIT-2: **[8 hrs]**
- Resistance to vehicle motion: Air, Road and gradient resistance and power calculation.

Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch.
Gear box: Necessity of gear box , working principle, Classification :Sliding mesh, constant mesh, synchromesh, synchromesh and Transfer case gear box, Gear Selector mechanism, lubrication and control. Introduction to Automatic Transmission. **.[d,i,k]**

UNIT-3: **[8 hrs]**
- Transmission system: Propeller shaft, Universal joint, constant velocity joint, Hotchkiss drive, torque tube drive.
- Differential - Need and working. Differential lock.
- Rear Axles and Front Axles
- Wheel and Tyres: tyres specification, factors affecting tyre performance. **.[d,i,k]**

UNIT-4: **[8 hrs]**
- Steering systems, principle of steering, Steering linkages, steering geometry and wheel alignment, steering gear box and its types,
- Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber. **[d,i,k]**

UNIT-5: **[8 hrs]**
- Drum and Disc brakes, Comparison.
- Brakes - Need, types : Mechanical, hydraulic (Master and wheel cylinder), Air brakes.
- Electrical systems: Battery construction. Specification. Operation of Batteries. Charging of battery, Alternator.
- Starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator , wiper.**[d,i,k]**

UNIT-6: **[8 hrs]**
- Automobile air-conditioning, Panel board instruments. Overhauling, Engine tune up
- Recent Advances in automobiles such as ABS, Power Steering, Collision avoidance, Navigational aids and Intelligent vehicle highway system. **.[d,i,k]**

5th Semester

ME1317	OE I : AUTOMOBILE ENGINEERING	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1	Automotive Technology		H.m.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automotive Machanics		Joseph Heitner	
4	Motor Vehicle Technology		J.A. Dolan	
5	Automotive Engines		W.H. Crouse	

5th Semester

ME1321	OE I : Plastic Engineering	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcome
To familiarize students with : 1. Various Plastic materials, Their properties and applications 2. Different plastic processing techniques	Students will be able to : 1. Select the suitable plastic material for given application 2. Select suitable plastic processing technique

Unit 1 **[7 Hrs]**
Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages.**[c]**

Unit 2 **[8 Hrs]**
Extrusion - Blow Molding – Thermo Forming – Rotomolding **[c]**

Unit 3 **[7 Hrs]**
Compression and Transfer Molding - study of compression molds **[c]**

Unit 4 **[7 Hrs]**
Injection Molding- study of injection molding machines and molds. **[c]**

Unit 5 **[8 Hrs]**
General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics -Mechanical Fasteners - Thermal bonding - Press Fitting. Testing of plastic **[c]**

Unit 6 **[8 Hrs]**
Fibers - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics. Open Mould Processes, Bag Molding, Compression Molding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Molding - Application of PMC's. **[c]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Plastic Engineering		Patten	
2	Plastic Processing		R. J. Crawfortd	
3	Plastics Extrusion technology	1988	F.Hensen,	
4	Injection Moulding Machines	1983	F.ohannaber	Hanser Publishers,
5	Polymer extrusion	1990	C.Rauwendaal,	Hanser Publishers,
6	Blow Moulding Handbook	1989	D.V.Rosatao,	Hanser Publishers,
7	Modern Plastics Moulding		E.B Seamour,	John Wiley.
8	Manufacturing Engineering & Technology	6st Edition (2013)	S Kalpakjian & SR Schmid	Pearson Education Canada
9	Machining of Plastics	1981	Akira Kobyashi,	Mc-Graw Hill.

5th Semester

ME1334	**Industrial Visit**	**L=0**	**T=0**	**P=1**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	-	**-**	**100**	**-**	**100**	**-**

6th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Sr. No.	Course Objectives	Course outcomes	Mapped Program Outcomes
1	It introduced the concept of economics and provides knowledge about consumer's rational behaviour.	It will helps for rational selection of goods and services.	12
2	This introduced various factors of production and its role in production process, gives idea about short run and long run production constraint, types of cost and depreciation.	It helps to prepare students being a businessman how to deal with various production constrain.	12
3	It provide knowledge to the students about various market structure, demand and revenue curves in it, How price and output determine in various forms of market and how price discriminate for consumer to consumer.	To make use of these concepts while performing the entrepreneurial operations.	12
4	It gives knowledge about various national products, its counting with respect to various factors and factors causes to economic growth and development.	Provide idea about national income accounting.	12,7
5	Provide knowledge of functioning of money, financial institution and various sources of public finance/revenue and its types.	Helps to create awareness about functioning of financial institutions and taxation system.	12,7
6	To provide knowledge about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institution.	It provides knowledge about international economics.	12

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

6th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

6th Semester

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

Text Books:
1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:
1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

6TH Semester

ME1308	Lab. : Machine Drawing	L=0	T=0	P=4	Credits=2

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

Objectives:	Course outcomes:
To familiarize the students with- 1) To gain knowledge of different types of line and its application, conventional representation of various machining and mechanical details as per IS 2) To visualize an object and convert it into a drawing. 3) To become conversant with 2D and 3D.	(i) The student will able to apply standards practices and conventions in machine drawing. (ii) The will be capable of visualizing and preparing detailed drawing of given objects. (iii) The student will able to create to 2D and 3D using any standard CAD software with due manufacturing consideration.**[d,k]**

Unit1

[8 hrs]

Drawing Standards for following- Drawing Sheets, Name Blocks, Lines, Dimensioning of Tolerances, Standard features, Machining Symbols, Welding Symbols, Heat Treatment, manufacturing Instructions, Allowances, and Materials. .**[d,k]**

Unit2

[6 hrs]

Orthographic Projection of Elements, section, dimensioning, Dimensioning of tolerances, Orthographic Projections, Sectional Views, Missing Views, conventional representation of machine elements. .**[d,k]**

Unit3

[6 hrs]

Preparation of drawing of machine Elements such as - threads, Bolts, Nuts, Washers, Rivets, Welds, Keys and Keyways, splines, Couplings, shaft..**[d,k]**

Unit4

[8 hrs]

Assembly and Dismantling Principles : Fits and Tolerances (Standards, Types Application and Selection) , Tolerance Charting, Surfaces Finishing Requirement for Assembly, Geometry suitable for Assembly, Assembly / Dismantling Tools, Bearing Assemblies, Assemblies by Fastening. .**[d,k]**

Unit5

[9 hrs]

Study of some Standard Assemblies.
Assembly Drawings: Principles, Techniques and standards for Preparing Component Drawings, Subassembly Drawing, Full Assembly Drawing, Exploded Views.
Assembly drawings of :- Lathe machine tail stock and tool post , radial engine sub assembly, plummer block, steam stop valve or safety valve, etc. .**[d,k]**

Unit 6

[8 hrs]

Production Drawing : Name Plates, Part List, Revisions Etc., Essential Parts/ Formats Required for Production Drawings, Process Sheet, blue print reading. .**[d,k]**

Practical:

1. Drawing of some Standard Components. (Two Sheets).
2. Drawings of two Standard Assemblies with Components. (Two Sheets).
3. Computer printout of a small Assembly with Components.
4. Pencil Drawing / Computer printout of a Large Assembly with components Drawings, subassembly drawings and assembly drawings using all standard formats.
5. Computer Printout of Production Drawing and process Sheets for One Component having maximum five Operations. Pencil Drawing should be in full imperial sheet folded to quarter Imperial size, Computer printouts should be on a plotter in A3 size. All drawings should be submitted in one folder.
6. To parts and assembly drawing using suitable CAD software.

6TH Semester

ME1308	Lab. : Machine Drawing	L=0	T=0	P=4	Credits=2

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	--

Text books:				
1	Machine Drawing	38th Edition (2003)	Bhatt N.D	CharotarPulishe
2	Machine Drawing	6th Edition (2005)	SiddheshwarShastri	Kanhaiah. Tata Mcgraw Hill
3	Machine Drawing	4th Edition (2003)	Parkinson	Sir Isaac Pitman & Sons Limited
4	Machine Drawing	2nd (2008)	Venkat Reddy, Narayan and Kanhaiya	B.S. publication
Reference books				
1	PSG data book	4th Edition (2007)		Tata McGraw-Hill Education
2	CMTI Data Book	3rd Edition (2007)		New age international
3	Relevant IS Codes	Edition (2007)		TATA McGraw hill

6TH Semester

ME1310	Energy Conversion	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
Students should apply the fundamentals of fluid dynamics and thermodynamics to compressors. To understand basic cycles, types and components of I.C. Engines. To understand the basics of refrigeration, air conditioning.**[a,e,k]**	**(1)** The student will be able to understand the working & analysis of compressors.[a,e,k]
	(2) The student will be able to understand the working & analysis of I.C.Engines.[a,e,k]
	(3) The student will be able to understand the working & analysis of Refrigeration & Air conditioning unit.[a,e,k]

Unit 1 **[8 hrs]**
Reciprocating compressors: - Parts, Operations, Work done during isothermal, polytropic &adiabatic compression process, P-V diagram, isothermal efficiency, Effect of clearance, volumetric efficiency, Mechanical efficiency. [a,e,k]

Unit 2 **[7 hrs]**
Multistaging in reciprocating compressor, condition for minimum work input, capacity control, Actual indicator diagram Centrifugal compressor:-Principle, operation, parts, velocity diagram, static& total head quantities, work done by impeller, isentropic efficiency of compressor. Slip factor, pressure coefficient and power input factor.
[a,e,k]

Unit 3 **[8 hrs]**
Axial flow compressor:-Principle, operation, parts. Velocity diagram, work done, degree of reaction stage efficiency compressor characteristics, surging & chocking.
Positive displacement Rotary compressor: Vanes, Roots and screw compressor
Principle, operation, parts, indicator diagram, work done, Roots efficiency, vanes efficiency. [a,e,k]

Unit 4 **[7 hrs]**
I.C.Engines: Air standard cycles, parts of I.C.Engines, working of I.C. Engines, Classification of IC Engines, I.C.Engines Testing:-Measurement of power: indicated, friction &brake power, measurement of speed, fuel & air consumption, calculation of indicated &brake thermal efficiency, volumetric efficiency, mechanical efficiency, Heat balance sheet. [a,e,k]

Unit 5 **[7 hrs]**
Refrigeration: Introduction, unit of refrigeration, Vapour compression refrigeration system
Introduction to cryogenics and application of cryogenics, Linde hampson system (Basic). [a,e,k]

Unit 6 **[8 hrs]**
Air conditioning: Introduction, psychrometric properties and processes, Bypass factor, human comfort and factors affecting comfort, application of Psychrometrics to simple air conditioning systems, Typical summer and winter air conditioning system(concept only) Evaporative cooling. [a,e,k]

Reference books:

1	Thermal Engineering	20 Edition (1994)	P.L.Ballaney	Khanna Publication
2	Thermal Engineering and heat engines	(1994)	R.Yadav	Central Publishing house
3	Heat power engg	3rd Edition (Yr of publication)	Kumar & Vasandani	Metro Politon Publisher
4	IC Engine	3rd Edition (2008)	V. Ganeshan	Tata McGraw Hill
5	Refrigeration & Air Conditioning	2nd Edition (2000)	C.P. Arora	Tata McGraw Hill
6	Internal Combustion Engines	3rd Edition (1968)	E.F. Obert	International Textbook Co.
7	Gas Turbine	5th Edition (1992)	Dubey & Khajuria	Dhanpat Rai Publications
8	Thermal Engineering	8th Edition (2010)	R.K.Rajput	Laxmi Publication

6TH Semester

ME1311	Lab. : Energy Conversion	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	

Objective	Course Outcome
Students should able to carry out performance analysis of Compressors , I.C.Engines and RAC systems.**[a,b,k,m]**	(I) The student will be able to carry out the performance analysis of compressors, I.C. Engines & RAC unit and evaluate their performance..[a,b,k,m]

List of Practical

A set of 8 Experiments from following list to be performed.

1) Trial on reciprocating compressor **[a,b,k,m]**
2) Trial on rotary compressor. **[a,b,k,m]**
3) Demostration of 2 stroke and 4 stroke engine **[a,b,k,m]**
4) Performance testing of a single cylinder I.C. Engine. **[a,b,k,m]**
5) Trial on Multicylinder Petrol Engine with energy balance sheet**. [a,b,k,m]**
6) Heat balance on Multicylinder Diesel Engine. **[a,b,k,m]**
7) Morse test on Multicylinder I.C. engine. [a,**b,k,m]**
8) Performance on Vapor Compression Refrigeration System (VCRS). **[a,b,k,m]**
9) Experiment on desert cooler. **[a,b,k,m]**
10) Demonstration & Study on household Refrigerator. **[a,b,k,m]**
11) Performance on air-conditioning system. **[a,b,k,m]**

6TH Semester

ME1312	Computer Aided Design	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:	Course outcomes:
To educate students on -Main concepts of computer aided design -Graphics representation of curves. -Surface and solids. **[a,e, k]**	After completion of the course students would be able to, concept valise &model any machine component**[a,e,k]**

Unit 1 CAD TOOLS **[a,e,k]**

[6 hrs]

Definition of CAD Tools, Types of system CAD/CAM system evaluation Criteria, functional areas of CAD, Modeling and viewing, efficient use of CAD software.

Unit2 Two / Three Dimensional Transformations **[a,e,k]**

[8 hrs]

Two& Three dimensional geometric and co-ordinate transformations likes calling , translation, rotation, reflection, shear. Concept of homogeneous representation and concatenated transformations. Inverse transformations.(Enumeration of entity on graph paper).

Unit 3 Wire Frame Modeling **[a,e,k]**

[7 Hrs]

Types of mathematical representation of curves, wire frame models, wire frame entities,
parametric representation of analytical and synthetic curves- Hermit cubic splines, Bezier curves, BS plines

Unit4 Surface Modeling **[a,e,k]**

[8 hrs]

Mathematical representation of surfaces, Surface model, Surface entities, surface representation, parametric representation of surfaces, plane surface, ruled surface, surface frevolution, Tabulated surface.

Unit 5 Solid Modeling [a,e,k]

[8 hrs]

Solid Representation - Boundary Representation (B-rep), Constructive Solid Geometry (CSG) and other methods, Design Applications: Introduction of eature based and Assembly modeling.

Unit 6 CAD CAM Data Exchange **[a,e,k]**

[8 hrs]

Evaluation of data-exchange formats, IGES data representations and structure, STEP Architecture, implementation, ACIS&DXF.

6TH Semester

ME1312	Computer Aided Design	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	CAD/CAM, Theory & Practice	1st Edition (1991)	Ibrahim Zeid	McGraw-Hill
2	Procedural elements for computer Graphics	1st Edition (1998)	D Rogers	WCB/McGraw-Hill
3	CAD CAM Principles and Applications	3rd Edition	P N Rao	McGraw-Hill
4	Computer-Aided Design and Manufacturing	1st Edition	M. Groover& E. Zimmer	Prentice Hall

Reference books:				
1	Computer Graphics	McGraw-Hill	Hearn D. & Baker M.P	Prentice Hall
2	Computer Graphics	2nd Edition (1987)	S. Harrington	Mcgraw-hill Professional
3	Mathematical Elements for Computer Graphics	1st Edition (1990)	RoggersDravid F., Adams J. Alan	McGraw-Hill
4	CAD CAM Principles and Applications	3rd Edition	P N Rao	McGraw-Hill
5	CAD/CAM, Theory & Practice	1st Edition (1991)	Ibrahim Zeid	McGraw-Hill

6TH Semester

ME1313	Lab.: Computer Aided Design	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	--	--	40	60	100	

Objectives:	Course outcomes:
Toeducate studentson -Mainconceptsof computeraideddesign -Graphics representationof curves. -Surfaceandsolids. **[a,e, k]**	Aftercompletionof thecoursestudentswouldbeableto,conceptualize&model anymachinecomponent**[a,e,k]**

List of Practical

A set of 10 Experiments from following list to be performed.

1. Introduction to CAD software.**[e,k]**
2. Simple examples of two dimensional transformations**[a,e,k]**
3. Simple examples on three dimensional transformations.**[a,e,k]**
4. Programs on 2-D transformations- scaling, rotation, reflection and translation.**[a,e,k]**
5. 3-D Wireframe object modeling using any CAD software.**[a,e,k]**
6. Generation of analytical curves using any CAD software.**[a,e,k]**
7. Generation of synthetic curves using any CAD software.**[a,e,k]**
8. Basics of surface modeling using Extrude, Revolve, fill, sweep, variable section sweep commands using any CAD software.**[a,e,k]**
9. Creating fill surfaces, lofted multi-section surfaces, blended surfaces using any CAD software. **[a,e,k]**
10. Analyzing the curve and surface quality using any CAD software.**[a,e,k]**
11. Generation of at least two simple solid models showing geometric properties using any CAD software.**[a,e,k]**
12. To generate at least two simple assembly model using any CAD software.**[a,e,k]**
13. Solid model generation using feature based modeling using any CAD software.**[a,e,k]**
14. Drafting of the solid models previously developed in any CAD software.**[a,e,k]**
15. Programs on windowing and clipping.**[a,e,k]**

6TH Semester

ME1320	Control Systems Engineering	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
•To impart knowledge of modeling and stability analysis of linear time-invariant system. • To understand the stability, time domain specifications and tools •To study frequency domain analysis of linear system. An introduction to state space approach. **[a,c,e,m]**	I) Students will be able to Model the linear systems and study the control system components, specifications through classical and state variable approach.. **[a,e,m]**
	II) Students will be able to understand the time response and time response specifications and determine time response.. **[a,e,m]**
	(III) Students will be able to analyze the absolute and relative stability and will be able to determine Frequency response using tools like Bode plot and Nyquist plot. **[a,e,m]**

Unit 1 **[7hrs]**
Introduction, System concept Open and Closed loop control systems. Transfer function, Mathematical Modeling of Physical System and system representation through Block Diagram. Transfer function through Block Diagram Simplification. Signal Flow Graph, Masons Gain Formula Block diagrams of various control systems. **[a,e,m]**

Unit 2 **[7 hrs]**
Representation of Control components: Mechanical and Electrical components; Analogous systems; Thermal and Fluid systems. **[a,e,m]**

Unit 3 **[8 hrs]**
Electrical systems: - ac/dc servomotors; field controlled and armature controlled servomotors; positional servomechanisms; stepper motors.
Hydraulic systems: - Hydraulic pumps (gear; vane; and reciprocating piston) Cylinders, Direction control valves (2, 3, 4 way) Flow control valve; Relief valve Hydraulic servomotor. **[a,e,m]**

Unit 4 **[8 hrs]**
Transient and steady state response of first and second order systems Concept of stability; relative stability; Routh stability criteria. **[a,e,m]**

Unit 5 **[8 hrs]**
Frequency response and its characteristics; Bode plots; Nyquist plots. Gain margin and phase margin. Identification of system transfer function. **[a,e,m]**

Unit 6 **[7 hrs]**
Basic control actions; Proportional Integral and Derivative control actions and their effect on system performance. Root locus technique. Introduction to control system design log load compensation Feed Back Compensation and Pole - Zero placements. **[a,c,m]**

Text books:				
1	Modern Control Engineering	3rd Edition (2009	Ogata	Prentice Hall
2	Control system Engineering	4th Edition (2007)	Nise	John Wiley & Sons
3	Control system	4th Edition (2009)	Nagrath & Gopal	New Age International
4	Modern Control System	12th Edition (2009)	Dorf	pearson

6TH Semester

ME1331	OE I : Total Quality Management	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To familiarize the student with :- 1. Understand the philosophy and core values of Total Quality Management (TQM) **[d,k]** **2.** Various Techniques for Quality Improvement. **[d,k]**	**(I)Students will be able to Select and apply appropriate techniques in identifying customer needs, as well as the quality impact in TQM methodologies. [d,k]**
	(II)The students will be able to Select and Implement Proper Quality Improvement Techniques. [d,k]

Unit 1 **[7 hrs]**
Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering **[d, k]**

Unit 2 **[7 hrs]**
Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards. **[d, k]**

Unit 3 **[8 hrs]**
Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA -YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design **[d, k]**

Unit 4 **[8 hrs]**
Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes **[d, k]**

Unit 5 **[8 hrs]**
Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling, **[d, k]**

Unit 6 **[7 hrs]**
Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing **[d, k]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Total Quality Management for Engineers	1991	Mohamed Zairi	Woodhead Publishing Limited 1991
2	Production and Operations mangament - Total Quality and Responsiveness	1995	Harvid Noori and Russel	McGraw-Hill Inc, 1995
3	Managing for Total Quality	1998	N.Logothetis	Prentice Hall of India Pvt .Ltd,1998
4	The Essence of Total Quality Management	1995	John Bank	Prentice Hall of India Pvt.Ltd., 1995.
5	Introduction to Statistical Quality Control	1991	Douglus C. Montgomery	2nd Edition, John Wiley and Sons, 1991.
6	Statistical Quality Control	1984	Grant E.L and Leavensworth	McGraw-Hill, 1984.

6TH Semester

ME1332	OE II: Reliability Engineering	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
1.To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution. **2.**Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.[**a, c, d, e, f, g, h, i ,j ,l]**	(I) Student will be able to use reliability modeling as a tool for evaluating system performance..**[a,c,d,f,g,h,i,j,l]**
	(II) Student will be able to analyze the failure of a machine, determine the failure rate of systems or components.. **[a,c,d,f,g,h,i,j,l]**
	(III) Student will able to understand importance of the maintenance of engineering systems and factors affecting maintainability. **[a,c,d,f,g,h,i,j,l]**
	(IV) Student will be able to prepare the production & maintenance schedule of particular engineering system. **[a,c,d,f,g,h,i,j,l]**

Unit 1 **[7hrs]**

Fundamental concepts:-

Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability, **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 2 **[8hrs]**

Probability theory:-

Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 3 **[7hrs]**

System reliability and modeling:

Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 4 **[8hrs]**

Maintainability and Availability:

Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 5 **[7hrs]**

System reliability Analysis:

Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing. **[a, c, d, e, f, g, h, i ,j ,l,]**

Unit 6 **[8hrs]**

Strength based reliability:

Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads. **[a, c, d, e, f, g, h, i ,j ,l,]**

6TH Semester

ME1332	OE II: Reliability Engineering	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

. .**Reference books:**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Concepts of Reliability Engg	1985	L.S. Srinath	Affiliated East-Wast Press (P) Ltd
2	Reliability Engineering	1983	A.K. Govil	Tata McGraw-Hill Publishing Co. Ltd
3	Reliability Engineering	1984	E. Balagurusmy	Tata McGraw-Hill Publishing Co. Ltd
4	Engineering Reliability	1980	B.S. Dhillion, C. Singh	John Wiley & Sons
5	Probabilistic, Reliability	1968	M.L. Shooman	McGraw-Hill Book Co.,
6	Practical Reliability Engg	1985	Patric D.T.O'connor	Heyden and sons ltd.
7	Reliability in Engineering Design	1977	K.C. Kapur, L.R. Lamberson	John-Wiley and sons.
8	Reliability Engineering, Theory and Practice	Third Edition, 1999	A.Birolini	Springer,

6TH Semester

ME1333	OE II: Power Generation Engineering	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
1.To study the basics of power generations systems.	(I)
2.To study conventional & non-conventional power plants.	(II)
3.To study the combined operations of different power plants.	(III)
	(IV)
4.To study Power load analysis & Economic analysis of power generations systems. **[a,c,d,e,h,j,k,l]**	(V)

Unit 1
THERMAL POWER PLANT- I
Introduction to thermal power plants and power plant layouts. Site selection.
Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling.
Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers. **[a, d, h, j, l]**

[7 Hrs]

Unit 2
THERMAL POWER PLANT- II
Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations
Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout. Comparison with other power plant. (visit to nearby power plant shall be arrange for the students) **.[a,d, l,]**

[8 Hrs]

Unit 3
HYDROELECTRIC POWER PLANT.
Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve.
Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection.Governing.Comparison with other power plant. **.[a, c, e, l]**

[7 Hrs]

Unit 4
POWER PLANT ECONOMICS
Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load. Economic Analysis: - Cost of electric energy [**a, c, e, l]**

[8 Hrs]

Unit 5
NUCLEAR POWER PLANT
Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India.
Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor. Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal. Comparison with other power plant. **.[a, h,]**

[8 Hrs]

Unit 6
COMBINED OPERATION OF DIFFERENT POWER PLANTS
Combined operation: - Need division, combination of different plant & their coordination, advantages.
NON CONVENTIONAL POWER GENERATION SYSTEMS
Introduction to Non Conventional power Generation Systems
Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant. **[a, d, h, j, l]**

[7 Hrs]

6TH Semester

ME1333	OE II: Power Generation Engineering	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Power Plant Engineering	2002	Domkundwar.	Dhanpat Rai & Co.

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Power Plant Engineering	2007	Vopal & Slortzki	

6TH Semester

ME1325	Seminar Based on Mini Project	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	-	-	100	-	100	-

7th Semester

Me1447	Production Management	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
The course aims to develop an insight into working of production systems, their evaluation analysis and control. The overall objective is to learn to plan, design, execute or operate, control and measure the efficiency/ effectiveness of production systems.**[a,c,e,k]**	Students will develop (I)Ability to manage production system with cost and resource constraints..**[a,e,k]**
	(II)Ability to manage production systems to produce right quality goods and services as per the standards and specifications to meet delivery schedule with minimum resources and at the optimum level.. **[a,e,k]**
	(III) Ability to optimize the production system.. **[a,c,e,]**

Unit1 **[7 hrs]**
Work Study: Productivity, factors affecting productivity. Measurement of productivity. Work study and methods study: Definitions, objectives, steps in method study, Process charts, string diagram, motion study, micro motion study, SIMO Chart . **[a,e,k]**

Unit2 **[8 hrs]**
Work measurement: Objectives, definition, stop watch study, work sampling, PMTs, MTM & Work factor method
Value analysis and value Engineering:, Introduction, steps involved in value analysis. Applications in Manufacturing. **[a,e,k]**

Unit3 **[8 hrs]**
Plant Layout: Types of Plant Layout, Layout Functions and problems, Organization, Automated material handling, Concepts of AGVs, AS/RS and other automated devices. Design of integrated plant layout for product handling system. **[a,c,e]**

Unit4 **[7 hrs]**
Forecasting: Need for forecasting, classification of forecasting methods, like judgmental technique, time series analysis, least square method, moving average method, exponential smoothing method. **[a,e]**

Unit5 **[7 hrs]**
Production planning and control: Definition, objectives of PPC, functions of PPC, types of production, Inventory control, EOQ, Techniques in inventory control and associated problems. **[a,e,k]**

Unit 6 **[8 hrs]**
Process analysis and Cost Estimation:
Steps involved in manual production planning, Selection of process, analysis. Aims of Cost Estimation, Difference between cost and Estimation, Elements of cost: material, Product cost, Analysis of overhead expenses, Product cost estimation. **[a,e]**

Text books:				
1	Introduction to Work study	4th Edition (1992)	George Kanawaty	ILO
2	Motion and Time study	1st Edition (1980)	Barnes	Wiley
3	Ergonomics	1st Edition (1985)	Murell	Chapman & Hall
4	Production Planning and Control	2nd Edition (2006)	Jain & Agrawal	McGraw-Hill
5	Industrial Engg. And Project management	2nd Edition (2006)	Mart and Telsang	s. Chand
6	Plant layout and Material Handling	1st Edition (1977)	James Apple	Wiley, Technology & Engineering

7th Semester

ME1448	Design of Mechanical Drives	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:	**Course Outcome:**
To develop the concept of drive system and impart knowledge of various components of industrial drives. To enable the students in selecting proper drive system. To make the students capable of selecting proper gear drive and design the components of geared system. To emphasize the need of reducing cyclic fluctuations in speed by providing appropriate flywheel.To enable to take up small projects in design of haulage system.	(ii) The student will be able to apply the fundamentals of stress analysis and material science to design the mechanical drive.**[a,e]** (iii) Student will be able to design the components of system for mechanical drives.**[a,e]**

Unit1

[8 hrs]

Flat belt drive: Types of belts & belt material, analysis of belt tension, condition for transmitting maximum power, design of flat belt, flat belt pulley.
V belt drive: Types of V-belt, analysis of V-belt tension, design of V belt pulley.**[a,e]**

Unit2

[7 hrs]

Chain Drive: Design of roller chain drive, types of chain, concept of chordal action, lubrication ,types of sprocket,
Rope drive: Introduction to haulage system, construction of rope, design of wire rope, sheave and drums Electric motor rating, their Characteristics, controls, selection motors. .**[a,e]**

Unit3

[8 hrs]

Gear drive: Review of Kinematics of gears & terminology, interference, tooth profiles, formative number of teeth etc. Bukingham equation, design of spur gear drive, helical gear drive.**[a,e]**

Unit4

[8 hrs]

Worm gear drive: Types and proportion of worm and worm gear, force analysis, beam strength of worm gear teeth, dynamic tooth load, wear load, thermal rating of worm gear, design of worm and worm gear.
Bevel gear drive: Types of bevel gear, proportions of bevel gear, force analysis of bevel gear drive design of bevel gear drive. .**[a,e]**

Unit5

[7 hrs]

Coupling: Types of shaft coupling, design of flange coupling, flexible bush coupling.
Flywheel: Coefficient of fluctuation of energy and Coefficient of fluctuation of speed, energy store in flywheel, stresses in flywheel, design of flywheel. .**[a,e]**

Unit 6

[7 hrs]

Bearing: Surface finish, friction wears, lubrication, oil seals, design of journal bearings for radial and thrust loads, selection of ball and roller bearing for radial and thrust loads. Failures of antifriction bearing, design of hydrostatic pocket type thrust bearing such as circular step thrust bearing, bearing housing. .**[a,e]**

7th Semester

ME1448	Design of Mechanical Drives	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Mechanical Design of Machine	4th Edition (1965)	Maleev, Hartman	International Textbook Co.
2	Machine Design	3rd Edition (1968)	Black P.H	Tata McGraw Hill
3	Mechanical Engg. Design	8th Edition (2008)	Shigley	Tata McGraw Hill
4	Design Data book	1st Edition (2005)	Shiwalkar B.D	Central Techno Publication
5	Design of Machine Elements	Edition (Yr of publication)	Bhandari V. B	Publisher
6	Machine Design	2nd edition	Norton	McGraw publication

Reference books:				
1	Hand book of Machine Design	3rd Edition (2004)	Shiglay&Mischke	Tata McGraw Hill
2	Mechanical Engineering Hand book (Vol 1 & 2)	Vol 1: 12 Edition (1950) Vol 2: 11Edition	Kent	J.Wiley& Sons inc
3	PSG. Tech. Machine Tool Design Data Book	(1966)	CMTI	PSG College of Technology

7th Semester

ME1401	PE I : Tool Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To learn the mechanism of metal cutting and the design of metal cutting tools. Also to understand various press working operations along with tools to dies design.**[c,l]**	(I)Student will able to design of various tools needed for machining operations..[c,l]
	(II)Student can apply the concept of tool design, jigs and fixtures design & press work in machine operations..[c,l]

Unit1

[8 Hrs]

Design of single Point Cutting Tool ,Theory of metal Cutting Introduction, Mechanics of chip formation, Cutting tool materials, Single point cutting tool, Designation of cutting tools, ASA system, Importance of Tool angles, Orthogonal rake system, Classification of cutting tools, Types of chips, determination of shear angle, velocity relationship, force relations, Merchant's Theory, Cutting power, Energy consideration in metal cutting, Tool wear, Tool life, Tool life criteria, variable affecting tool life, Machine ability **[c,l]**

Unit2

[8hrs]

Form tools- Introduction, Types, design of form tools. Drills- Introduction, Types, Geometry, Design of drill. Milling cutters - Introduction, Types, Geometry, and Design of milling cutters**. [c,l]**

Unit3

[10hrs]

Press tool Design

Introduction, Press operations - Blanking, piercing, Notching, Perforating, Trimming, Shaving, Slitting, Lancing, Nibbling, Bending, Drawing, Squeezing. Press working equipment - Classification, Rating of a press, Press tool Equipment, arrangement of guide posts. Press selection, press working

Terminology, Working of a cutting die, Types of dies - Simple dies, inverted die, Compound dies, combination dies, progressive dies, Transfer dies, multiple dies Principle of metal cutting, strip layout, clearance, angular clearance, clearance after considering elastic recovery, cutting forces, method of reducing cutting forces, Die block, Die block thickness, Die opening, Fastening of die block, back up plate, Punch, Methods of holding punches, Strippers. Stoppers, Stock stop, Stock guide, Knockouts, Pilots. Blanking & Piercing die design - Single & progressive dies. **[c,l]**

Unit4

[10hrs]

Bending Forming & Drawing dies Bending methods - Bending Terminology, V- Bending, Air bending, bottoming dies, spring back & its prevention. Design Principles - Bend radius, Bend allowance, Spanking, width of die opening, Bending pressure. Metal flow during drawing, Design, Design consideration - Radius of draw die, Punch radius, Draw clearance, Drawing speed, Calculating blank size, Number of draws, Drawing pressure, Blank holding pressure. **[c,l]**

Unit5

[7 Hrs]

Forging Die Design: Introduction, Classification of forging dies, Single impression dies, Multiple Impression dies. Forging design factors - Draft, fillet & corner radius, parting line, shrinkage & die wear, mismatch, finish allowances, webs & ribs Preliminary forging operation - fullering, edging, bending, drawing, flattering, blacking finishing, cutoff. Die design for machine forging - determination of stock size in closed & open die forging. Tools for flash trimming & hole piercing, materials & manufacture of forging dies. **[c,l]**

Unit6

[10 Hrs]

Design of jigs & fixture: - Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures. Drilling Jigs: - Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures, Automatic clamping Devices. **[c,l]**

7th Semester

ME1401	PE I : Tool Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	"Tool design"	2001	Donaldson	TATA Mc-Graw Hill.
2	"Fundamentals of Tool design	1988	ASTME,	TATA Mc-Graw Hill.
3	"Fundamentals of Tool design"	1962	Pollock,	Reston Publishing Company
4	, "Fundamentals of Tool design"	1971	Kempster	Hall of India Pvt. Ltd
5	Computer aided fixture design	--	Rong , Yeming	Marcel Dekker

7th Semester

ME1402	PE I : Material Handling System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop the awareness about principles and practices of material handling equipments. Study the different components design and applications of material handling devices.[c,e]	(I)The student will able to identify the need for material handling system. They will be able to select and design the system.[c,e]

Unit1 **[8 Hrs]**
Types of intraplant transporting facility, principles of material handling and classification of material handling equipments, selection of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments. **[c, e]**

Unit 2 **[10 Hrs]**
Component selection and design Flexible hoisting appliances like ropes and chains, welded load chains, roller chains, selection of chains, hemp rope and steel wire rope, selection of ropes, rope reeving arrangement and pulley blocks fastening of chains and ropes, different types of load suspension appliances, fixed and movable pulleys, different types of pulley systems, multiple pulley systems. Chain and ropes heaves and sprockets.**[c, e]**

Unit 3 **[7 Hrs]**
Load handling attachments, standard forged hook, hook weights, hook bearings, cross piece and casing of hook, crane grab for unit and piece loads, carrier beams and clamps, load platforms and side dump buckets, Electromagnetic lifting system, grabbing attachments for loose materials, crane attachments for handling liquid materials. **[c, e]**

Unit 4 **[10 Hrs]**
Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thrusters operated, controlled brakes, shoe brakes, Electro-Hydraulic thrusters safety handles, load operated constant force and variable force brakes, Rope drum design and assembly, design of guides and column, **[c, e]**

Unit 5 **[8 Hrs]**
Different drives of hoisting gears like individual and common motor drive for several mechanisms, travelling gear, travelling mechanisms for moving trolleys and cranes on runway rails, mechanisms for trackless, rubber-tyre and crawler cranes, motor propelled trolley hoists and trolleys, rails and travelling wheels, slewing, jib and lifting gears. Operation of hoisting gear during transient motion, selecting the motor rating and determining braking torque for hoisting mechanisms, selecting the motor rating and determining braking torque for travelling mechanisms, slewing mechanisms, jib and lifting mechanisms. (Elementary treatment is expected)
[c, e]

Unit 6 **[7 Hrs]**
Cranes with rotary pillar, cranes with a fixed post, jib cranes with trolley, portal cranes with luffmg boom, cantilever cranes, cage elevators, safety devices of elevators, belt and chain conveyors and their power calculations, vibrating and oscillating conveyors, pneumatic and hydraulic conveyors, screw conveyors, hoppers, gates and feeders. Introduction to AGV's as new material handling device, use of robot for material handling. **[c, e]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Materials Handling Equipment-	1964	N. Rudenko ,	Envee Publishers, New Dehli
2	Materials Handling Equipment-	1968	M.P. Alexandrov.	Mir publications

7th Semester

ME1404	PE I : Engineering of Plastics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To familiarize students with : 1. Various Plastic materials, Their properties and applications 2. Different plastic processing techniques.**[c]**	(I)Students will be able to select the suitable plastic material for given application.**[c]**
	(II)Students will be able to select suitable plastic processing technique..**[c]**

Unit 1 **[7 Hrs]**
Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages.**[c]**

Unit 2 **[7 Hrs]**
Extrusion - Blow Molding – Casting – Thermo Forming – Rotomolding Study of molds **[c]**

Unit 3 **[8 Hrs]**
Compression and Transfer Molding - Injection Molding- study of compression and injection molding moulds **[c]**

Unit 4 **[8 Hrs]**
General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics -Mechanical Fasteners - Thermal bonding - Press Fitting. Testing of plastic **[c]**

Unit 5 **[8 Hrs]**
Fibers - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics. Open Mould Processes, Bag Molding, Compression Molding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Molding - Application of PMC's. **[c]**

Unit 6 **[7 Hrs]**
Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques - Plasma Spray,Chemical and Physical Vapor Deposition of Matrix on Fibers - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting - Compocasting - Application of MMCS. **[c]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Product Design and Process Engineering	1995.	Harold Belofsky,	Hanser Publishers,
2	High Performance Polymers	**1991**	Bera, E and Moet	Hanser Publishers,
3	Plastics Extrusion technology	**1988**	F.Hensen,	
4	Injection Moulding Machines	**1983**	F.ohannaber	Hanser Publishers,
5	Polymer extrusion	**1990**	C.Rauwendaal,	Hanser Publishers,
6	Blow Moulding Handbook	**1989**	D.V.Rosatao,	Hanser Publishers,
7	Modern Plastics Moulding		E.B Seamour,	John Wiley.
8	Plastics Moulding	**1952**	John Dalmonte,	John Wiley.
9	Machining of Plastics	**1981**	Akira Kobyashi,	Mc-Graw Hill.
10	Composite Materials science and Engineering	**1998**	Krishan K.Chawla	Springer-Verlag, 1987.

7th Semester

ME1405	PE I : Project Evaluation & Management	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economical feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.[**a,d,e,h,k]**	(I)The students will be able to use the concepts of monitoring and evaluation, appraise and determine best monitoring methods, appreciate evaluation in the context of developmental project work..[a,d,e,h,k]
	(II)The students will be able to carry out problem analysis, determine relevant indicators and data necessary for evaluation, prepare for and implement a monitoring and evaluation process, establish baselines and targets.. [a,d,e,h,k]

Unit1

[7 hrs]

Project Identification considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty.[**a,d,e,h,k]**

Unit 2

[7 hrs]

Technical feasibility : Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation: .[**a,d,e,h,k]**

Unit 3

[9 hrs]

Economic feasibility: Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Break even point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes. .[**a,d,e,h,k]**

Unit 4

[7 hrs]

Project Planning and Control: Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating .[**a,d,e,h,k]**

Unit 5

[7 hrs]

Project report: Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital .[**a,d,e,h,k]**

Unit 6

[8 hrs]

Initial review, performance analysis , ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects**.** .[**a,d,e,h,k]**

7th Semester

ME1405	PE I : Project Evaluation & Management	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Projects	Seventh edition 2007	Prasanna chandra	Tata mc graw Hill publishing company Ltd.
2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	Fifth edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	Sixth edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	Fourth edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	Eighth edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

7th Semester

ME 1449	PE I : Computational Fluid Dynamics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
• To understand the applications of fundamental and advanced principles of fluid mechanics. • To be familiar with mathematical models for various CFD applications such as Navier-Stokes equations • To be familiar with the common numerical methods and understand how to estimate the numerical errors (verification), modeling errors (validation), and uncertainties for CFD.	(I) Student will be able to understand the various mathematical approaches and various CFD equations for various applications in Fluid dynamics and Heat transfer. (a,e,k,m)
	(II) Student will be able to understand the various CFD equations and basics of discretisation for various applications in Fluid dynamics and Heat transfer. (a,e,k,m)
	(III) Student will be able to be familiar with the common numerical methods and understand how to estimate the accuracy and errors in solving different problems in CFD. (a,e,k,m)

Unit1 **[7 hrs]**
Mathematical Preliminaries:
Numerical integration, Review of linear algebra, solution of simultaneous linear algebraic equations – matrix inversion, solvers – direct methods, elimination methods, ill conditioned systems, Gauss- Seidel method, successive over relaxation method. (a,e,m)(I,II).

Unit2 **[8 hrs]**
Equations of fluid dynamics:
Basic concepts Eulerarian and Lagrangian methods of describing fluid flow motion, acceleration and deformation of fluid particle, vorticity, Laws governing fluid motion, continuity, Navier – stokes & energy equations. Boundary layer equation, Euler equations, potential flow equations, Bernoulli's equation and vorticity transport equation. Initial and boundary conditions. Classification of equation of motions – hyperbolic, parabolic, elliptic. (a,e)(I)

Unit3 **[8 hrs]**
Grid Generation:
General principles of grid generation – structured grid's in two and three dimensions, differential equations based grid generation; Elliptic grid generation, algorithm, Grid refinement, Adaptive grids, Moving grids. Algorithms, CAD interfaces to grid generation. (a,e,k)(I,II)

Unit4 **[8 hrs]**
Finite Difference Discretisation:
Elementary finite difference coefficients, basic aspects of finite difference equations, steady and unsteady state heat conduction with FDM approach, consistency, explicit and implicit methods, errors and stability analysis. Stability of elliptic and hyperbolic equations. Finite difference applications in heat transfer – conduction, convection. (a,e,k,m)(I,III)

Unit5 **[8 Hrs]**
Finite Volume Method:
Introduction, Application of FVM in diffusion and convection problems, steady and unsteady state heat conduction with FDM approach, NS equations – staggered grid. (a,e,k,m)(I,III)

Unit6 **[6 Hrs]**
SIMPLE algorithm. Solution of discretised equations using TDMA. Finite volume methods for unsteady problems – explicit schemes, implicit schemes. (a,e,k,m)(I,III)

7th Semester

ME1449	PE I : Computational Fluid Dynamics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1.	Computational Fluid Dynamics	1995	Anderson John D.	Mc-Graw Hill Corp.
2.	Introduction to Computational Fluid Dynamics : The Finite Volume Method	2nd Edition	Versteeg, H. K. and Malalasekara, W.	(Indian Reprint) Pearson Education.
3.	Numerical Heat Transfer and Fluid Flow	1962	S. V. Patankar,	McGraw-Hill
4.	Computational Methods for Fluid Dynamics		Ferziger J. H., Springer P. M.	Verlag Berling
5.	Computational Fluid Flow and Heat Transfer	2nd Edition	Sunderarajan M. K.	Narosa Publishing

7th Semester

ME1456	PE I : Advanced Manufacturing Techniques	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop the ability to understand & analyze different advanced manufacturing processes and different advanced manufacturing machines. **(a,c,k)**	(I)The Students will be able to understand and operate advanced production machines.. (a,c,k)
	(II)The Students will be able to understand advanced machining processes with applications. (a,c,k)

Unit 1 **[7 hrs]**
Non-traditional machines process: Need, classification & historical development. Abrasive machine and finishing operations, high speed grinding, creep feed grinding, belt grinding, hot and cold machining. **[a, c, k]**

Unit 2 **[8 hrs]**
Abrasive Jet Machine: Mechanics of AJM. Process parameter and characteristics ultrasonic machining mechanics, process parameter & control, effect of USM on materials, water jet machining. **[a, c, k]**

Unit 3 **[9 hrs]**
Electro – chemical machining: Electrochemistry of ECM, tool design, effect of variable on performance chemical milling, Chemical Engraving, Photo chemical machining, EC grinding, Electric discharge machining, machine surface finish & machining accuracy, electron beam. Laser beam and plasma arc machining **[a, c, k]**

Unit 4 **[6hrs]**
High energy rate forming process. Burnishing, dallising and other miscellaneous forming and finishing processes, electroforming. Thermoform High velocity forming, Vacuum forming, **[a, c, k]**

Unit 5 **[8 hrs]**
Unconventional welding techniques, laser, electron beam, plasma arc, atomic hydrogen, submerged arc, explosive welding techniques, electro slag welding and casting. **[a, c, k]**

Unit 6 **[7 hrs]**
Adhesive bonding, solid phase welding, technique such as ultrasonic welding, friction welding, recent development in welding, comparative analysis, economics and applications of nontraditional processes for machining, welding and forming.**[a, c, k]**

Reference Books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Manufacturing Science	2007	A. Ghosh & A. Mallik.	Ellis Horwood, 1986
2	Non Traditional Machining	2005	P.C. Paonoey & H. S. Shan.	Tata McGraw-Hill Education, 1980
3	New Technology		A Bhattacharya	
4	Advance machining process		V.K.Jain	Allied publisher

7th Semester

ME1461	PE-I : Rapid Prototyping	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To learn the Product Life Cycle. Study the process of Rapid prototyping and different Rapid Prototyping methods .[d,l]	(I) Student will learn basics of Rapid Prototyping.[d,l] (II)Student will learn the process of RP.[l] (III)Student will learn model slicing for RP [l] (IV)Student will learn Liquid and solid based RP systems [l] (V) Student will learn powder based RP system [l] (V) Student will learn RP tooling and manufacturing [d,l]

Unit 1 Introduction **[7 hrs]**
CAD-CAM and its integration, Development of CAD CAM., The importance of being Rapid, The nature of RP/T,The state of RP/T industry. Rapid Prototyping Defined. Time compression Technologies, Product development and its relationship with rapid prototyping. **[d,l]**

Unit 2 Process Chain for RP **[7 hrs]**
Data Preparation (Pre-processing), Part Building, Post Processing. CAD Model Preparation, Reverse Engineering and CAD model, Digitizing Techniques: Mechanical Contact Digitizing, Optical Non-contact Measurement, CT Scanning Method, Data Processing for Surface Reconstruction.
Data interface for Rapid Prototyping: STL interface Specification, STL data generation, STL data Manipulation, Advantages and limitations of STL file format. Open files. Repair of STL files. Alternative RP interfaces.
Part orientation and support generation: Factors affecting part orientation, various models for part orientation determination, the function of part supports, support structure design, Automatic support structure generation. **[d,l]**

Unit 3 Model Slicing and Contour Data Organization **[8 hrs]**
Model slicing and skin contour determination, Identification of external and internal contours, Contour data organization, Direct and adaptive slicing: Identification of peak features, Adaptive layer thickness determination, Skin contour computation. Tool path generation.
Part Building: Recoating, parameters affecting part building time, part quality.
Post Processing: Part removal, finishing, curing.
Other issues: Shrinkage, Swelling, Curl and distortion, Surface Deviation and accuracy, Build Style Decisions, **[d,l]**

Unit 4 LIQUID BASED AND SOLID BASED RP SYSTEMS **[8 hrs]**
Stereolithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies. **[d,l]**

Unit 5 POWDER BASED RP SYSTEMS **[8 hrs]**
Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations – Case Studies.. **[d,l]**

7th Semester

ME1461	PE-I : Rapid Prototyping	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit 6 RAPID TOOLING AND MANUFACTURING [7 hrs]

Classification of RT Routes, RP of Patterns, Indirect RT: Indirect method for Soft and Bridge Tooling, Indirectmethod for Production Tooling, Direct RT: Direct RT method for Soft and Bridge Tooling, Direct method forProduction Tooling, Other RT Approaches. Rapid Manufacturing: Methods, limitations. **[d,l]**

BOOKS RECOMMENDED

1 Bjorke, Layer Manufacturing, Tapir Publisher. 1992.
2 Jacobs, PF (Ed), Rapid Prototyping and Manufacturing, Society of Manuf. Engrs, 1992.
3 Burns, M., Automated Fabrication: Improving Productivity in Manufacturing, 1993.
4
Jacobs, P.F. (Ed.), Stereo lithography and Other RP&M Technologies: From Rapid Prototyping to Rapid Tooling, Society of Manuf. Engrs. NY, 1996.
5 Chua C. k. and L. K. Fai, Rapid Prototyping: Principles and Applications in Manufacturing.
6
Gibson, I. (Ed.), Software Solutions for Rapid Prototyping, Professional Engineering Publications, London., 2002.

7th Semester

ME1462	PE-I: Fuel Cell Technology	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome

Unit I: Introduction to Fuel Cells
Brief history of fuel cells, Operating principles, Types of fuel cells- Solid Oxide Fuel Cell (SOFC), Alkaline Fuel Cell (AFC), Molten Carbonate Fuel Cell (MCFC), Phosphoric Acid Fuel Cell (PAFC), Fuel Cell Stack, Advantages, Limitations and Applications of Fuel Cell, Polarization curve for performance characterization of fuel cells, Representing various losses (Activation, Ohmic, concentration loss), Hydrogen Production, Storage and Transportation.

Unit II: Fuel Cell Thermodynamics
Heat Potential (Enthalpy of Reaction), Work Potential (Gibbs free energy), Reversible fuel cell voltage (Nernst equation), Fuel Cell Efficiency.

Unit III: Fuel Cell Electrochemistry
Electrochemical Reaction Basics, Faraday's law, Tafel equation, Butler – Volmer equation, Exchange Current.

Unit IV: Fuel Cell Charge Transport and Mass Transport
Ion Transport (Electrolyte), Electron Transport, Gas phase (single phase) mass transport in different fuel cell components (Diffusion layer, flow channels), Multiphase Mass Transport in fuel cell components , Fuel Crossover and Internal Currents, Heat generation and transport in fuel cell.

Unit V: Fuel Cell Characterization
In Situ Versus Ex Situ Characterization, Polarization Test, Electrochemical Impedance Spectroscopy, Linear Sweep Voltammetry, Cyclic Voltammetry, Current Interrupt, High frequency resistance.

Unit VI: Polymer Electrolyte Membrane Fuel Cell (PEMFC)
Components and Materials: Membrane, Catalyst Layer, Bipolar Plate, Current Collector, Water Management, Thermal Management, Direct Liquid Fuel Cell (DLFC), Advantage of Liquid Fuel over Gaseous Fuel, Different types of DLFC, Direct Methanol Fuel Cell (DMFC).

Textbooks/Reference Books
1. O'Hayre, R.P.,S. Cha, W. Colella, F.B.Prinz, Fuel Cell Fundamentals, Wiley, NY (2006).
2. J. Larminie and A. Dicks, Fuel Cell Systems Explained, 2nd Edition, Wiley (2003).
3. Matthew M. Mench, Fuel Cell Engines, Wiley (2008).
4. S. Srinivasan, Fuel Cells: From Fundamentals to Applications, Springer (2006)
5. X. Li, Principles of fuel cells, Taylor & Francis (2005).

7th Semester

ME1463	PE-I : Data Structure and Algorithm	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
This Engineering course focuses on detail study of various data structures, the concept of Algorithm and programming for data structures used in computer environment. Also provides the learning of sorting and searching processes, non linear data structure	

.

Unit 1	Introduction to computer, Evolution of Computers, Classification of Computers, Applications of Computers, Advantages and Disadvantages of Computers, Components of a Computer System	**[7hrs]**
Unit 2	Introduction to data structures, abstract data types, array as an ADT, using one-dimensional arrays, arrays as parameters, character string operations, multi-dimensional arrays, structures and classes.	**[8 hrs]**
Unit 3	Stack and its Application, Definition and Examples, Primitive Operations, Recursion, Fibonacci sequence, Binary Search, Recursive Chains, Recursive Definition of Algebraic Expressions	**[8 hrs]**
Unit 4	Queues and Lists, the queues representation insert operation, priority queue, array implementation of a priority queue, linked lists, inserting and removing nodes from a list, linked implementation of stacks, linked implementation of queues, linked list as a data structure, non integer and non homogeneous lists, dynamic and array implementation of lists, simulation using linked lists simulation process, data structures, other list structures, circular lists, doubly linked lists , multiple linked lists	**[7 hrs]**
Unit 5	Trees, Binary Trees Operations, Applications Representations of Binary Tree. Internal and External Nodes, Implicit Array Representation of Binary Trees, Choosing a Binary Tree Representation, Binary Tree Traversals, Heterogeneous Binary Trees	**[7 hrs]**
Unit 6	Sorting:- Bubble sort, Quick sort, Selection and Tree Sorting, Straight Selection Sort, Binary Tree sorts, Heap sort, Insertion Sorts, Simple Insertion, Shell Sort Searching:- linear search, binary search, interpolation search, tree searching, inserting and deleting in a binary search tree	**[7 hrs]**

Books for Reference:

1. Langsam Y., Augenstein M. J. And Tenenbaum A. M., —Data Structures Using C and C++, Prentice Hall of India Pvt. Ltd.
2. Trembly J. P. And Sorenson P. G., —An Introduction to Data Structures with Applications, Tata McGraw Hill Pub. Co. Ltd.
3. Horowitz E. And Sahani S., —Fundamentals of Computer Algorithms, Galgotia Publications Ltd.

7th Semester

ME1408	PE II : Synthesis Of Mechanism	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To make the students understand various types of mechanisms and criterion used in their selection. To give detailed knowledge of type, number and dimensional synthesis of mechanisms. To introduce various graphical and analytical methods so as to enable students to design the mechanisms to meet kinematic needs. Introducing various optimization techniques for synthesis. **[a,e,k,l,m]**	(I)Students will be able to understand the fundamentals of mechanisms and machines.. **[a,e,k,l,m]**
	(II)Students will be able to formulate mathematical model for given mechanism. **[a,e,k,l,m]**
	(III)Students will be able to apply various graphical and analytical methods to design the mechanisms to meet kinematic needs.. **[a,e,k,l,m]**
	(IV)Students will be able to apply various optimisation techniques for synthesis. **[a,e,k,l,m]**

Unit 1

[7 hrs]

Introduction to kinematics, types of mechanism, kinematics synthesis, science of relative motion, tasks of kinematic synthesis with practical applications, Degree of freedom, class-I, class-II chain, Harding's notation, Grashof criterion, Grubler's criterion. **[a,e,k,l,m]**

Unit 2

[8 hrs]

Introduction to position generation problem, concept of pole, two &three position generation synthesis, pole triangle, Relationship between moving & fixed pivots, Four position generation, opposite pole quadrilateral, center point &circle point curve, Burmester's point. Matrix method for position generation problem, rotation matrix, displacement matrix. **[a,e,k,l,m]**

Unit 3

[7 hrs]

Introduction to function generation problem, co-ordination of input-output link motion, relative pole technique, inversion technique, overlay technique, graphical synthesis of quick return mechanisms for optimum transmission angle. Types of errors, accuracy points, cheby sher's spacing, frudenstein's equation with problems**.[[a,e,k,l,m]**

Unit 4

[8 hrs]

Introduction to path generation problem, synthesis for path generation with and without prescribed timing using graphical method. Coupler curves, cognate linkages, Robert's law of cognate linkages.
Complex number method for path generation problem 3 precision points. **[a,e,k,l,m]**

Unit 5

[7 hrs]

Synthesis for infinitesimally separated position, concept of polode and centrod, Euler's savery equation, inflection circle, Bobbilier and Hartman's construction**. [a,e,k,l,m]**

Unit 6

[8 hrs]

Optimal synthesis of planer mechanisms, powell's search method, least square method, penalty function. Introduction to spatial mechanisms, D-H notations, introduction to kinematic analysis of robot arm. **[a,e,k,l,m]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Applied linkage synthesis	Fifth edition	Tao D.C.	New York, NY,
2	Advanced mechanism design	1984	Erdman A.G.; Sandor G.N	Prentice-Hall, 1984
3	Kinematics and mechanism design	Third edition 2010	Sue C.H; Radchiffe C.W	

7th Semester

ME1409	PE II : Financial & Cost Management	L=5	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
•To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles of Management to find its solution. •To be able to take a proper decision at proper time which will be beneficial in future. **[c,d,e,f,i,l**	1.(I)The student will have ability to decide the cost of the product **[c,d,e,f,i,l]**
	(II) The student will have the ability to Analyze the financial requirement. **[c,d,e,f,i,l]**
	(III) The student will have improved Decision making ability. **[c,d,e,f,i,l]**
	(IV) The student will have ability to take a proper decision on waste or scrap material. **[c,d,e,f,i,l]**

Unit 1 **[7 Hrs]**
Business Finance:
Need for finance, sources of finance (fixed and working capital), equity and preference shares, deposits from public, debentures, bonds, term loans, financial institutions in India, Financial statements and their analysis.
[c,d,e,f,i,l]

Unit 2 **[7 Hrs]**
Concept of Cost:
Concept of cost, classification of cost, direct and indirect , fixed and variable , semi variable, product and period, controllable and uncontrollable costs, opportunity costs , sunk cost, joint cost, prime cost, factory cost, cost of production, selling and distribution cost, administrative cost, cost of sales. **[c,d,e,f,i,l]**

Unit 3 **[7 Hrs]**
Cost ascertainment and cost reduction:
Concept of overhead, collection of overheads, allocation and appointment, absorption of overheads, absorption rates, under – over absorption , cost centers, cost units, cost statement sheet.
Areas of cost reduction, techniques, productivity. **[c,d,e,f,i,l]**

Unit 4 **[8 Hrs]**
Costing System:
Job costing, contract costing, cost plus contracts, batch costing, process costing, simple process costing, normal abnormal losses and gains, waste, scrap & spoilage, joint & byproducts, operating costing. **[c,d,e,f,i,l]**

Unit 5 **[8 Hrs]**
Cost Planning and Control:
Concept of budgeting, advantages and limitations, budgetary control, key factors, fixed and flexible budget.
Standard costing, selling of standards, variance analysis. **[c,d,e,f,i,l]**

Unit 6 **[8 Hrs]**
Decision Making:
Marginal costing, break even analysis, cost volume, profit analysis, application of costing to various decisions like make or buy, add or drop products, cost or process further, operate or shut down, replace or retain. **[c,d,e,f,i,l]**

7th Semester

ME1409	PE II : Financial & Cost Management	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Principles and Practice of Cost Accounting	Fifth edition	N.K.Prasad	Pearson Education
2	Cost Accounting		Jawahar Lal	
3	Management Accountancy	Third edition2010	J. Batty	Tata Mc Graw Hill
4	Financial Management		Khan and Jain	
5	Financial Management	2007	Prasanna Chandra	Tata Mc Graw Hill
6	Engineering Economy	1973	Paul Degarmo	Macmillan, 1973
7	Cost Accounting	2008	B.K.Bhar	Academic publishers
8	Costing and finance managment	2012	Mrunalini Naik	Thakur publications

7th Semester

ME1410	PE II : Renewable Energy System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To realize understand the importance of various renewable energy sources in this era of energy crisis. To study the theory of conversation of various renewable energy such thermal, electrical, etc. Apply thermodynamics cycles to above systems. To study Magneto Hydrodynamic systems. [a, c, e, m]	(I)Student will understand the renewable energy technologies, and there primary applications. [a, c, e, m]
	(II)Student will able to describe the challenges and problems associated with the use of various energy sources.. [a, c, e, m]
	(III)Student will be able to apply and use solar energy for specific applications.
	(IV) Better awareness of potential of wind energy, Biogas and micro hydroelectric systems. [a, c, e, m]

Unit 1 **[8 hrs]**
Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & diffuse radiation, measurement of solar radiation and measuring instruments. Solar radiation geometry, solar angles, estimation of average solar radiation, radiation as tilted surface, tilt factors. **[a, c, e, m]**

Unit 2 **[7 hrs]**
Solar flat plate collectors: Types of collectors, liquid flat plate collectors, solar air heaters, transmissivity of glass cove(system, collector efficiency, analysis of flat plate collector, fin efficiency, collector efficiency factor and heat removal factor, selective surfaces, evacuated collectors, novel designs of collector. **[a, c, e, m]**

Unit 3 **[8 hrs]**
Concentrating collectors: line focusing, point focusing and non focusing type, central receiver concept of power generations compound parabolic collector, comparison of flat & concentrating collectors. Applications of solar energy to water heating, space heating, space cooling, drying refrigeration, distillation, pumping. Solar furnaces, solar cookers, solar thermal electric conversion, solar photo- voltaics Solar energy storage, sensible, latent and thermochemical storage, solar pond **[a, c, e, m]**

Unit 4 **[7 hrs]**
Biogas: - Introduction, bio gas generation, fixed dome & floating drum biogas plants their constructional details, raw material for biogas production, factors affecting generation of biogas and methods of maintaining biogas, production, digester design considerations, fuel properties of biogas and utilisation of biogas Bio Mass :- Introduction, methods of obtaining energy from biomass, Incineration, thermal gasification, classification of gasifiers & constructional details chemistry of gasification fuel properties, applications of gasifiers. **[a, c, e, m]**

Unit 5 **[8 hrs]**
Wind and Ocean energy: -Power in wind, forces on blades, wind energy: Basic principle of wind energy conversion site selection consideration wind data and energy estimation, basic components of WECS Classification of WEC systems, savonius and darrieus rotars applications of wind energy.
Ocean energy: Introduction: - ocean thermal electric conversion open and closed cycle of OTEC, hybrid cycle, energy from tides basic principles of tidal power & components of tidal power plants, single & double basin arrangement estimation of tidal power and energy. Energy from ocean waves -energy availability, wave energy conversion devices. **[a, c, e, m]**

UNIT 6 **[7 hrs]**
Geothermal and MHD power generation :
Geothermal energy: Introduction, classification of geothermal systems vapour dominated, liquid dominated system, total flow concept, petrothermal systems, magma resources, applications of geothermal operational & environmental problems. Magneto Hydro Dynamic power generation: Introduction principles of MHD power generation, MHD open and closed systems, power output from MHD generators, design problems of MHD generation, gas conductivity, seeding **[a, c, e, m]**

7th Semester

ME1410	PE II : Renewable Energy System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Energy Technology	3rd edition	Parulekar & Rao	Khanna Publishers
2	Non Conventional Energy Sources		G D Rai	Standard Publishers Distributors
Reference book				
1	Solar Energy	3rd edition	S.P. Sukhatme	Tata McGraw-Hill Education,
2	Solar Energy	3rd edition, 2006	John A. Duffie, William A. Beckman	Wiley
3	Solar energy engineering	2007	Jui Sheng Hsieh	Prentice-Hall,

7th Semester

ME1411	PE II : Artificial Intelligence	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
•To learn about the automation of machines tools making the system intelligent. •Understanding the different techniques used for implementation of artificial intelligence.[a,b,j]	(I) The student will have ability to analyze the concept of NLP,Expert System and role of Knowledge base in Artificial Intelligence.**a,b,j]**
	(II) The student will have ability to understand the rule based System and rules for conflict resolution. **[a,b,j]**
	(III) The student will have ability to analyze the role of Knowledge Engineer and Domain Expert with the help of routine example.. **[a,b,j]**
	(IV) The student will have ability to analyze the NN/ANN applications in Mechanical Engineering. **[a,b,j]**
	(V) The student will have ability to apply the fundamentals of OOP in Artificial Intelligence. **[a,b,j]**
	(VI) The student will have ability to apply the concepts Semantic nets and Automated Learning.. **[a,b,j]**

Unit 1 **[7 hrs]**
Human and machine intelligence, Artificial Intelligence (AI), Programming in AI environment,. Natural Language processing (NLP) Architecture of an Expert system, Knowledge base, inference engine forward and backward chaining, Selection of inference mechanism. **[a, b, j]**

Unit 2 **[7 hrs]**
Introduction, to Rule Based System, Conflict Resolution, Advantages and Drawbacks of Rule Based Systems Clausal Form Logic; Rule Base Verification, Refinement and Validation **[a, b, c, d, j]**

Unit 3 **[9 hrs]**
Creating Knowledge Base, Knowledge Engineer and Domain Expert, Phases of Knowledge Engineering, Tools for Knowledge Engineering **[a, b, j]**

Unit 4 **[7 hrs]**
Neural network applications, artificial neural network models, NN applications in Cellular manufacturing and other areas of mechanical Engg. **[a, b, j]**

Unit 5 **[7 hrs]**
Fundamentals of OOP (Object oriented programming), creating structures and objects, object operations, invoking procedures, programming applications, Object oriented expert systems. **[a, b, j]**

Unit 6 **[8 hrs]**
Semantic nets, ruled systems for semantic nets, certainty factors, automated learning; **[a, b, j]**

7th Semester

ME1411	PE II : Artificial Intelligence	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Designing Knowledge Based System	1985	Addis, T.R	Prentice Hall
2	Principles of Artificial Intelligence and Expert Systems Development	1988.	Rolston, D.W	McGraw Hill
3	Handbook of Expert Systems in Manufacturing	1991	Maus, R. and Keyes	McGraw Hill
4	A comprehensive guide to artificial intelligence and expert systems	1990	Robert Levine	McGraw-Hill, 1990
5	Artificial Intelligence	1991	Elain Rich	McGraw-Hill, 1991
6	Rule based expert systems	1990	Sasikumar, Ramani	
7	Design for Knowledge Based Systems	1978	Graham Winstanley	Galgotia Publications
8	Artificial Neural Networks	1992	Zurada	West, 1992
9	Neural Networks and Fuzzy Logic		V.B. Rao and H.V. Rao, "C^{++} :	BPB Publications

7th Semester

ME1412	PE II : Maintenance Management	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To Study (1)Functions of maintenance dept. (2)Types of maintenance policies (3)Various failures modes and their diagnosis (4)Various conditioned monitoring technique (5)Various types of maintenance costs & their estimation (6)Various techniques for measurement of maintenance work **(7)**Plan for maintenance of machines **[b,d]**	The student will be able to, (I)understand the maintenance function, its importance, types and organize the maintenance department..[d]
	(II)analyze the failure of a machine and plan the condition monitoring program for a machine ..[d]
	(III)Estimate repair and maintenance cost and evaluate maintenance performance..[b]
	(IV) Understand the maintenance needs of basic electrical and mechanical devices.,[d]

Unit I

[8 Hrs]

Objectives, scope, structure of maintenance organization and operating policies to guide management, policies with respect to work allocation, work force, intra and inter plant relation, material, finance and control.
Concept of life cycle maintenance ,optimization of total maintenance, analysis of productivity ,Reliability ,Maintainability, and Availability, **[d,]**

Unit II

[7 Hrs]

Maintenance policies, Preventive maintenance program, corrective maintenance guidelines, replacement policies-cyclic replacement, group replacement, standbys, economics of machine replacement, TPM,RCM and CMMS. **[d]**

Unit III

[7 Hrs]

Failure analysis:
General practice, failure classification , data collection, failure pattern recognition ,determination of replacement period, time between preventive maintenance checks. Use of various modern techniques to monitor the condition of machine to facilitate maintenance **[b, d]**

Unit IV

[8 Hrs]

Work measurement for maintenance:
Need for Work measurement ,various techniques for work measurement of direct and indirect labour. Work force requirement, location and size. **[d]**

Unit V

[8 Hrs]

Control and estimation of maintenance cost:
Job classification, various estimating techniques and its use.
Maintenance manual, plant performance improvement, Maintenance training program, Maintenance control indices and factor affecting them .Lubrication system-need ,design and implementation. **[a, d, m]**

Unit VI

[7 Hrs]

Maintenance of various mechanical and electrical equipments. **[d]**

7th Semester

ME1412	PE II : Maintenance Management	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Maintenance engineering handbooks	2008	Mobley and Higgins	Mc-graw Hill
2	Guide to Complete Maintenance	1988.	Rolston, D.W	Heintzelment
3	Maintainability and maintenance management	1991	J. Patton	Maus, R. and Keyes
4	Operation research in Maintenance	--	Jarding	--
5	Introduction to reliability and maintainability Engineering.	--	Thomos Ebelling	Mc-graw Hill
6	Advanced operations management		R.P.Mohanty and S.G.Deshmukh	Pearson Education
7	Maintenance engineering and management		R.C.Mishra and K.Pathak	PHI Publications
8	Industrial Maintenance management		S.K.Shrivastava	S.Chand

7th Semester

ME1466	PE-II : Design for Manufacturing and Assembly	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To learn the Product Life Cycle. Study different design techniques, process selection, material selection.Study different design mechanizms like DFM, DFA,DFX. Study Rapid Prototyping.[d,l]	(I) Student will be able to design a new product.[d,l] (II)Student will be able to select proper materia and Processes.[l] (III)Student will learn criterias for DFM [l] (IV)Student will learn criterias for DFA [l] (V) Student will learn criterias for DFX [l] (V) Student will learn RP [d,l]

Unit 1 **[7 hrs]**
Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods. **[d,l]**

Unit 2 **[7 hrs]**
Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart, other constrain effect. Process selection – Impotence types of manufacturing processes and their classification, sources of information, selection criteria, **[d,l]**

Unit 3 **[8 hrs]**
DFM – Concepts, Design for Casting ,Design for Bulk deformation, Design for Sheet metal forming, Design for Machining, Design for Powder metallurgy, Design for Polymer processing **[d,l]**

Unit 4 **[8 hrs]**
DFA – Concepts, Assembly process- Top down and Bottom up, Mating criterias, Design for Welding ,Design for Brazing and Soldering, Design for Adhesive Bonding, Design for Polymer joining, Design for Heat Treatment . **[d,l]**

Unit 5 **[8 hrs]**
DFX - Design for Quality Benchmarking, Robust design, QFD and concurrent engineering. Introduction to green design. **[d,l]**

Unit 6 **[7 hrs]**
Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereolithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations **[d,l]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Fourth Eye (Excellence through Creativity	1992.	KHANDWALLA P.N.;	Wheeler Publishing, Allahabad,
2	Product Design and Manufacturing	4th edition, 2007	A. K. Chitale and R. C. Gupta	PHI Pvt. Ltd., 2002 ,
3	Engineering Design	4th edition 2008	Dieter George E	McGraw Hill Pub. Company

7th Semester

ME1466	PE-II : Design for Manufacturing and Assembly	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference Books:				
1	Product Design and Development	2003	Ulirich Karl T. and Eppinger Steven D	McGraw Hill Pub. Company
2	Handbook of Product Design for Manufacturing	1986	Bralla, James G.	McGraw Hill Pub. Company
3	I.P.R. Bulletins			TIFAC, New Delhi,
4	Creativity and innovation	2008	Harry Nystrom	John Wiley & Sons, 1979.
5	Managing technological innovation	4th edition	Brain Twiss	Pitman Publishing Ltd
6	New Product Planning		Harry B.Watton	Prentice Hall Inc.
7	Techniques in Reverse engineering and new product development.		Kevin Otto and Kristin wood.	Pearson Education

7th Semester

ME1467	**PE-II : QUANTITATIVE TECHNIQUES**	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	TOTAL	ESE Duration
	15	15	10	60	100	3HRS

COURSE OBJECTIVES:-	COURSE OUTCOME:- Students will be able to apply
• To understand concept of different quantitative techniques that include linear programming, non linear programming ,dynamic programming and the students should be able to use different decision making theories.	• **CO-I:-** Use basic operation research techniques to formulate given situation as linear programming problem and solve by revised and two phase simplex method. **[a,k,m]** • **CO-II:- I**nteger programming problems and solve them with cutting plane methods, or branch and bound method. **[a,k,m]** • **CO-III:-** Dynamic programming by Bellman's principle of optimality for problem solving. **[a,k,m]** • **CO-IV:-** Quadratic programming for K.T. condition and Wolfe's modified simplex method. **[a,k,m]** • **CO-V:-** Game theory to analyze real world systems. . **[a,k,m]** • **CO-VI:-** Non-linear programming for different optimization techniques that are appropriate for solving realistic engineering problems.. **[a,k,m]**

Unit 1: Linear Programming [7 Hrs]
- Liner programming: formulation of problems, solution of LPP by revised simplex methods. Two phase simplex method, sensitivity analysis. **[a,k,m] (CO-I)**

Unit 2: Advanced Linear Programming [7 Hrs]
- Pure & mixed integer programming, Zero-one and Goal programming and its application. **[a,k,m] (CO-II)**

Unit 3: Dynamic Programming [7 Hrs]
- Dynamic programming: Decision tree. Bellman"s principle of optimality. Application in industry. **[a,k,m] (CO-III)**

Unit 4: Quadratic Programming [7 Hrs]
- Kuhn-tucker conditions, Wolfe's modified simplex method, Beale's method. **[a,k,m] (CO-IV)**

Unit 5: Game Theory [7 Hrs]
- Decision making, decision theory, game theory. **[a,k,m] (CO-V)**

Unit 6: Non Linear Programming [7 Hrs]
- Non-liner programming: Fibonacci and golden section search: Powells pattern search algorithm, complimentary Pivot algorithm, optimizations by geometric programming. **[a,k,m] (CO-VI)**

Text Books :-
1. Gupta ,Swaroop," Operation Research"
2. Hira , Gupta," Operation Research Techniques"

Reference Books:
1. Ravindran, Phillips Solberg , "OR Principles & Practice "
2. Hiller Libermen, "OR (Operation Research)"
3. Taha ,"OR (Operation Research) "
4. S.S. Rao , " Optimization Techniques".
5.Linear and non linear optimization, Griva, Nash, Sofer.

7th Semester

ME1468	PE-II : Database Management System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
This Engineering course focuses on detail study of various data structures, the concept of Algorithm and programming for data structures used in computer environment. Also provides the learning of sorting and searching processes, non linear data structure.	

Unit 1	Introduction to Databases and Transactions: database management system, purpose of database system, view of data, relational databases, database architecture, transaction management,	**[7hrs]**
UNIT 2	Data Models: The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction.	**[8 hrs]**
UNIT 3	Database Design ,ER Diagram and Unified Modeling Language:- Database design and ER Model: overview, ER -Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML Relational database model: Logical view of data, keys, integrity rules. Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCN, DKNF)	**[8 hrs]**
UNIT 4	Relational Algebra and Calculus: Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, Relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities.	**[7 hrs]**
UNIT 5	Constraints, Views and SQL:- What is constraints, types of constrains, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Trigger	**[7 hrs]**
UNIT 6	Transaction management and Concurrency control, Lock based concurrency control (2PL, Deadlocks),Time stamping methods, optimistic methods, database recovery management.	**[7 hrs]**

Books for Reference:

1. Silberschatz and Galvin., —Database System Concepts
2. Henry F. Korth and Abraham Silberschatz, — Database System Concepts, McGraw-Hill International Editions Series
3. Ivan Bayross, SQL, PL/SQL the Programming Language of Oracle, Paperback – 1 Dec 2010
4. P.S. Deshpande, SQL & PL / SQL for Oracle

7th Semester

ME1406	PE III : FINITE ELEMENT METHOD	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop ability to analyze simple mechanical engineering problems. To understand and apply basic governing principals in logical manner to find solutions. [e]	(I)The students will be able to understand fundamentals of finite element method.[e]
	(II)The students will be able to analyse the Mechanical engineering problems[e]
	(III)The students will be able to find solutions for simple mechanical Engineering problems.. [e]

Unit 1 **[7 hrs]**
Fundamentals of stress & strain, stress & strain components, stress strain relationship, Elastic constants, plane stress, plane strain., differential equation of equilibrium, compatibility equations, boundary conditions, Saint Venant's principle. **[e]**

Unit 2 **[7 hrs]**
Fundamental concepts of FEM -' Historical background, Scope of FEM in Engg. Applications, Principle of minimum potential energy. Concept of Virtual work. Raleigh-Ritz method. FEM analysis procedure. Mathematical understanding required for FEM, Matrix algebra & operations, Eigen values & Eigen vectors. Methods for solution of simultaneous equations. like Gauss elimination. Matrix decomposition method.
Concept of discritization of body into elements. degrees of freedom, bandwidth, Basic types of 2-D & 3-D elements, displacement models, convergence requirements, shape function. Programming for above matrices.**[e]**

Unit 3 **[8 hrs]**
Finite element modeling and analysis of one dimensional problems:
Finite element modeling & analysis using Bar & Beam element -stiffness matrix, assembly, boundary conditions, load vector, temperature effects.
Two dimensional plane trusses-Local & Global coordinate system, element stiffness matrix, assembly, boundary conditions, load vector, force & stress calculations. Programming for simple bar and beam elements.**[e]**

Unit 4 **[8 hrs]**
Two dimensional problems using CST & LST -formulation of CST & LST elements, elemental stiffness matrix, assembly, boundary conditions, load vector. stress calculation. Temperature effect .
Axi-symmetric solids subjected to axi-symmetric loading -axi-symmetric formulation using CST ring, element, stiffness matrix, boundary conditions, load vector, calculation of stresses. Programming for simple 2-D problems using CST and LST elements. **[e]**

Unit 5 **[7 hrs]**
Introduction to Isoperimetric & Higher order elements. Introduction to Numerical Integration.
Introduction to dynamic analysis, formulation of mass matrix for one-dimensional bar element, free vibration analysis using one-dimensional bar element.
Torsion of prismatic bars using triangular elements. Programming for these elements. **[e]**

Unit 6 **[8 hrs]**
Application of commercial software for simple machine elements and interpretation of results. **[e]**

7th Semester

ME1406	PE III : FINITE ELEMENT METHOD	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Introduction to Finite Elements in Engineering	4th edition 2011	Chandrupatla T.R; Belegundu AD	Pearson Education
2	Theory of Elasticity	2nd edition 1951	Timoshenko S.P	Tata McGraw-Hill Education
3	Concept and applications of Finite element Analysis	2nd edition revised, 2010	Cook RD	I. K. International Pvt Ltd
4	The Finite Element Method -A basic introduction for engineers	2nd edition	Griffiths D. W; Nethercot D.A	BSP Professional, 1983
5	Finite element methods	6th edition, 2005	O. C. Zienkiewicz, Richard Lawrence Taylor, Perumal Nithiarasu, J. Z. Zhu	Butterworth-Heinemann
6	Applied elasicity	--	Chi The Wang	Amazon
7	Finite to Infinite	--	--	Infinite seris

7th Semester

ME1407	**PE III : Lab. : FINITE ELEMENT METHOD**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	-	**-**	**40**	**60**	**100**	**-**

7th Semester

ME1417	PE III : Computer Integrated Manufacturing	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.**[a,b,d,h,k,lm]**	(I) The student will have ability to understand integration of business function with manufacturing planning and control..[a,b,d]
	(II) The student will have ability to apply fundamentals of robotics for industrial applications..[d,h,l]
	(III) The student will have ability to develop CNC programs for manufacturing applications.[a,b,k]
	(IV) The student will have ability to understand the process of Group technology for Flexible manufacturing system..[a,b,d,k,l]

Unit 1 **[7 hrs]**
Concept and scope of CIM, components of CIM, benefits, limitations.Basics of computer graphics NC basics, NC words, Manual part programming (NC part programming) Punch Tape, Tape Format CNC , DNC, APT programming Adaptive control, application. Tooling for CNC machine. **[a, b, d, h, k ,l]**

Unit 2 **[7 hrs]**
Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT. Part families , classification and coding , Production flow analysis , Machine cell design , Benefits **[a, b, d, h, k]**

Unit 3 **[8 hrs]**
Introduction & Components of FMS , Application work stations , Computer control and functions , Planning, scheduling and control of FMS , Scheduling , Knowledge based scheduling , Hierarchy of computer control , Supervisory computer Manufacturing data systems , data flow , CAD/CAM considerations , Planning FMS database **[a, b, d, h, k ,l]**

Unit 4 **[8 hrs]**
Industrial robotics Robot anatomy, Robot control, accuracy, repeatability, End Effectors Sensor, Introduction to robot programming, Robot application (Material handling processing assembly and inspection) introduction to robot Kinematics. **[a, b, d, h, k]**

Unit 5 **[10 hrs]**
Process Planning in the Manufacturing cycle , Process Planning and Production Planning Process Planning and Concurrent Engineering, CAPP, Variant process planning , Generative approach , Forward and Backward planning, Input format, Logical Design of a Process Planning , Implementation considerations ,manufacturing system components, Automated material handling systems, AS/RS, general considerations , selection, evaluation and control . Inspection and Quality control, CAQC, CMM types, working, applications Expert process planning **[a, b, d, h, k ,l]**

Unit 6 **[5 hrs]**
Totally integrated process planning systems, Integration of CNC robotics for CIM, Agile manufacturing, Nano Manufacturing. Simulation **[a, d, h, k ,l]**

7th Semester

ME1417	PE III : Computer Integrated Manufacturing	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Systems Approach to Computer Integrated Design and Manufacturing	1996	Nanua Singh	John Wiley & Sons, 1996.
2	Automation, Production Systems and Computer Integrated Manufacturing	2002	Groover M.P	Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
3	Handbook of Flexible Manufacturing Systems	1991	Jha, N.K	Academic Press Inc., 1991
4	Group Technology in Engineering Industry	1979	Burbidge, J.L	Mechanical Engineering pub. London, 1979.
5	G.T Planning and Operation, in The automated factory-HandBook: Technology and Management	1991	Askin, R.G. and Vakharia, A.J	Cleland, D.I. and Bidananda, B (Eds), TAB Books, NY, 1991.
6	Cellular Manufacturing Systems		Irani, S.A	Hand Book
7	Planning, design and analysis of cellular manufacturing systems	1995	Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds)	Elsevier

7th Semester

ME1418	PE III : Lab. : Computer Integrated Manufacturing	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.**[a,b,c,d,e,h,k,m]**	(I) The student will be able to develop CNC program ad carry out execution..[a,b,d,k,m]
	(II) The student will be able to apply fundamentals of Robotics for industrial applications..[a,b,k]
	(III)The Students will be able to use Group technology and various components of automated system to form flexible manufacturing system..[a,b,c,d,e,h,k,m]

List of Practical

1. Study of CIM. **[a, c, e, k]**
2. Study of CAD systems **[a, b, k ,m]**
3. Numerical control – Fundamental & Application **[a, b, e, k]**
4. CNC- Lathe – Features, Specification, & Part Program. **[a, b, ,m]**
5. CNC- Milling – Features, Specification, & Part Program. **[a, b, ,m]**
6. Group Technology. **[a, b, e ,m]**
7. FMS & CIM. **[a, b, e ,m]**
8. Computer Aided Process Planning. **[a, b, d, e ,m]**
9. Manual Part Programming. **[a, b, ,m]**
10. APT Part Programming. **[a, b, e ,m]**
11. Robots Fundamental and Applications **[a, b, ,m]**
12. AGVS- Fundamental and applications **[a, b, e ,m]**
13. CNC Lathe – Programming, Simulation & Actual Machining of Part.(Thread Cutting , Facing , Turning , Grooving etc.) **[a, b, ,m]**
14. CNC Milling – Programming , Simulation & Actual Machining of Part. (Profile Cutting , Various Interpolation , Pocketing , Mirroring etc.) **[a, b, e ,m]**
15. Programming , Simulation of Robot. **[a, b, e ,m]**

7th Semester

ME1419	PE III : I.C.Engines	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
•To understand basic working cycles, construction and development of I.C. Engines. •To study the various systems related to I.C. Engines. •To study fuels, combustion process, pollution and its control of engines. •To carry out analysis of engine performance through mathematical approch **[a, b, h, m]**	(I) Students will be able to understand basics of I.C. Engines & its systems..**[b,h,m]** (II)Students will be able to understand combustion in I.C. Engines & its evaluation to improve the performance and reduce the pollution...**[b,h,m]** (III)Students will be able to formulate heat balance, power calculation and analyse performance characteristics of I.C. Engines..**[a,b,h,m]**

UNIT 1

[7 HRS]

Historical Perspective, Engines classification, Working cycles and operation, P-V, Valve Timing diagrams,
Engine components and their material .Engine cycle Energy Balance, various losses in the engine like Frictional losses, blow by losses, pumping loss etc. Engine system: Air supply, Fuel supply, lubrication systems, cooling systems and their importance. **[a,b,h,m]**

UNIT 2

[8 HRS]

I.C.Engines fuel and its desirable properties. Requirements of S.I and C.I. Engine fuel
Rating of I.C. engine fuels, Other fuel like CNG, LPG, Alcohols,
Air pollution from I.C.Engines and their control using EGR, Catalytic converters, particulate traps. **[a,b,h,m]**

Unit 3

[8 HRS]

Fuel supply systems for S. I. Engine: A-F mixture requirements, Basic principle, Simple Carburetor and systems like main metering, choke, idle, acceleration pump. Operating difficulties for carburetors. Petrol Injection SPFI., MPFI, Direct Gasoline Injection, Ignition system & components for S.I.Engine - Battery, Magneto & Electronic. **[a,b,h,m]**

Unit 4

[7 hrs]

Combustion in S. I. Engine: Stages of combustion with p-θ diagram. Factors affecting various stages of combustion. Abnormal combustion Pre ignition, Detonation and Knocking. HUCR, S.I.Engine combustion chamber. **[a,b,h,m]**

Unit 5

[7 HRS]

Fuel supply systems for C.I.Engine: Requirements of an ideal FI system, Types of Injection, Fuel injection pumps, fuel injectors and nozzles.
Combustion in C. I. Engines. Stages of combustion with p-θ diagram, Factors affecting various stages of combustion. Abnormal combustion Diesel Knock,
Supercharging and turbo charging in engine. **[a,b,h,m]**

Unit 6

[8hrs]

Engine performance Parameters. MEP, Torque ,speed, power, Specific fuel consumption and various efficiencies., Air measurement, Excess air and Volumetric efficiency, Measurement and Testing of friction power ,indicated power, Brake power, Fuel consumption, Air consumption, etc. Heat balance sheet calculation**[a,b,h,m]**

7th Semester

ME1419	PE III : I.C.Engines	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Internal Combustion Engine Fundamentals	1988	John B. Heywood	McGraw-Hill
2	Internal Combustion Engines and Air pollution	1973	Edward F. Obert	
3	Internal Combustion Engines	2007	M. C. Mathur, R.D. Sharma.	McGraw-Hill
4	Internal Combustion Engines	2007	V. Ganesan	McGraw-Hill
5	Internal Combustion Engines	2010	V. M. Domkundwar	Dhanpat Rai & Co
6	Internal Combustion Engines	2012	R.K.Rajput	Laxmi publications (P) Ltd.

7th Semester

ME1420	PE III : Lab. : I.C. Engines	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
•To study the basic cycles & various systems related to I.C. Engines through models,charts & animations. •To conduct an Engine trial for Engine performance evaluation. **[a, b, h, m]**	**(1)**(I)Students will be able to understand basic of I.C. Engines & its systems.**[d,i,m]** (II)Students will be able to formulate heat balance, power calculation and analyse performance characteristics of I.C. Engines..**[a,b,h,m]**

List of Practical

1. Demonstration to understand working of 2-S & 4-S Engines with its components. **[d,i,m]**
2. Demonstration the working of Lubrication & Cooling systems. **[d,i,m]**
3. Demonstration of fuel systems for S.I. engines (Carburattor/MPFI) **[d,i,m]**
4. Demonstration of fuel systems for C.I. engines. **[d,i,m]**
5. Determination of Air: Fuel ratio for Petrol Engine. **[a, b, h, m]**
6. Determination of Air: Fuel ratio for Diesel Engine**[a, b, h,m]**
7. Determination of BP/FP/IP of Engine. **[a, b, m]**
8. Heat balance sheet calculation. **[a, b, h, m]**
9. Visit to Automobile Industry/ workshop. **[a, b, h, m]**

7th Semester

ME1421	PE III : Refrigeration and Air Conditioning	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To familiarize with terminologies associated with refrigeration and Air conditioning. To understand principle of Refrigeration and Air conditioning systems.. TO understand basic and applied psychrometry. To understand air conditioning load calculations and duct design. To understand energy conservations and management [a,e,k,m]	(I)The students will be able to apply psychometric processes to live problems. [a,e,k,m]
	(II)The student will be able to analyze various types of refrigeration systems and apply as per requirement. [a,e,k,m]
	(III)The students will have fundamental knowledge of cryogenic systems suitable for advanced studies.. [a,e,k,m]

UNIT-I: PSYCHROMETRY [7 Hrs.]
Introduction, psychometric properties of air, psychometric chart, psychometric processes, bypass factor, apparatus dew point temperature. [a,e,k,m]

UNIT-II: ADVANCED PSYCHROMETRY: [8 Hrs.]
HUMAN COMFORT
Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.
HEAT LOAD CALCULATIONS:
Data collection for load calculation, various components of heat load estimate, method of cooling load calculation. Application of psychrometry to various air-conditioning systems. RSHF, GSHF, ESHF, air washers, air coolers. [a,e,k,m]

UNIT-III [7 Hrs.]
AIR TRANSMISSION & DISTRIBUTION:
Principle of air distribution, types of grills & diffusers & their selection criteria, air alteration, types of air filters, distribution of air through ducts, pressure losses in ducts, methods of duct design, duct friction chart, air conditioning controls.
REFRIGERATION SYSTEMS:
Air cycle refrigeration, Applications in air refrigeration systems, Vortex tube, and thermoelectric refrigeration. [a,e,k,m]

UNIT-IV [8 Hrs]
REFRIGERATION:
Introduction, Definition, Applications.
STUDY OF SIMPLE VAPOUR COMPRESSION REFERIGERATION SYSTEM:
Analysis of simple vapour compression refrigeration system, effect of subcooling, superheating, polytropic compression & pressure drops on the performance of the system.
Refrigerants**:**
Nomenclature of refrigerants, refrigerant properties, mixture refrigerants, global warming potential & Ozone depletion potential, Montreal & Kyoto protocol, alternate refrigerants. [a,e,k,m]

UNIT-V [8 Hrs]
MULTISTAGE VAPOUR COMPRESSION REFRIGERATION SYSTEMS:
Multiple compressor & multiple evaporator systems, cascade refrigeration systems.
Study of equipments such as compressors, evaporators, expansion devices & controls defrosting methods (types & principle only). Testing & charging of refrigeration systems. [a,e,k,m]

UNIT-VI [7 Hrs]
STUDY OF VAPOUR ABSORPTION REFRIGERATION SYSTEM:
Introduction Ammonla-Water, Lithium bromide-water systems, three fluid refrigerators.
CRYOGENICS:
Introduction, Application of cryogenics, Joule- Thomson coefficient, inversion curve, methods of liquefaction of air. [a,e,k,m]

7th Semester

ME1421	PE III : Refrigeration and Air Conditioning	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Refrigeration & Air-conditioning	2000	Dr.C.P. Arora	Tata McGraw-Hill Education
2	Refrigeration & Air-conditioning	2005	Dr. P.L. Ballany	Khanna Publications
3	Refrigeration & Air-conditioning	2007	Dr. Manohar	New Age International
4	Refrigeration & Air-conditioning	2007	S.V. Domkundwar	Dhanpat Rai Company (P) Ltd
REFERENCE BOOKS:				
1	Refrigeration & Air-conditioning	1986	Stocker & Jones	McGraw-Hill
2	Principle of Refrigeration & Air-conditioning	1997	Roy J.Dossat	Prentice Hall
3	ASHRAE hand books	2003		ASHRAE
4	Air conditioning Principles & System. Energy approach	1989	E.G. Pita	Wiley
6	Basic Refrigeration& Air-conditioning	2005	P.N. Ananthnarayanan	Tata McGraw-Hill Education

7th Semester

ME1422	**PE III :** Lab. : Refrigeration & Air conditioning	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	0	**0**	**40**	**60**	**100**	

Objective	**Outcome**
Students should able to carry out performance analysis of vapour compression refrigeration systems, air conditioning systems and cryogenics systems. **[a,b,k,m]**	**(1)** The student will be able to carry out performance analysis of vapour compression refrigeration systems.[a,b,k,m]
	(**2)** The student will be able to study various components of vapour compression refrigeration systems.[[a,b,k,m]
	(**2)** The student will be able to study miscellaneous refrigeration devices of vapour compression refrigeration systems.[[a,b,k,m]
	The student will be able to carry out performance analysis of air conditioning systems. [a,b,k,m]
	(**2)** The student will be able to study cryogenics systems.[[a,b,k,m]

PRACTICALS:
[Minimum seven experiments to be performed / demonstrated / studied]

1) Demonstration of use of various tools and equipments used by a refrigeration mechanic. [a,b,k,m]
2) Demonstration and study of various types of compressors. [a,b,k,m]
3) Demonstration and study of various condensers, evaporators, expansion devices used in refrigeration systems. [a,b,k,m]
4) Demonstration and study of various controls used in refrigeration and air-conditioning. [a,b,k,m]
5) Study of demonstration of miscellaneous refrigeration devices such as vortex tube. Thermoelectric Cooler, Cascade Refrigeration Unit etc. [a,b,k,m]
6) Study & demonstration of window air conditioner / packaged A/c / automotive/ A/c system. [a,b,k,m]
7) To perform experiments on vapour compression test rig to determine COP of the system. [a,b,k,m]
8) To perform experiments on Air-conditioning test rig. [a,b,k,m]
9) To perform experiments on air washer to evaluate its performance. [a,b,k,m]
10) Demonstration of charging a vapour compression refrigeration system. [a,b,k,m]
11) Report on visit to air-conditioning or cold storage plant or ice liquefaction plant. [a,b,k,m]
12) Visit to central A/c plant [a,b,k,m]
13) Exercises on computer assisted cooling load calculation. [a,b,k,m]
14) Exercises on computer assisted duct design. [a,b,k,m]
15) Study of Cryogenics System [a,b,k,m]

7th Semester

ME1445	PE III : Mechatronics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
(1)Understand the concept of Mechatronics (2)Develop the ability to understand the working of various electronically and computer control devices. (3)Concept development to bridge the existing gap between machines, Automation and Computer control system.**[a,b,c,i,j]**	(I) Students will be able to model various mechatronic systems..[a,b,c]
	(II) Students will be able to understand the working of various motors used in mechatronic systems..[a,b]
	Analyze the characteristics and use of various IC's.[a.b,i]
	(III) Student will be able to analyze the characteristics and use various IC's.a,b,j]
	(IV) Students will be able to analyze the internal hardware structure in Mechatronics Systems.[a,b,c,j]
	(V) Students will be able to understand the working of various integrated Systems..[a,b,i,j]
	(VI) Students will be able to apply concepts of Fuzzy Logic Control. .[a,b,i,j]

Unit 1 **[7 hrs]**
Introduction, sensors, actuators, modeling of systems. Recent trend of designing machine units along with electronic circuits for operation and supervision of mechanisms. Techniques of interfacing mechanical devices with computer hardware. **[a, b, i]**

Unit 2 **[8 hrs]**
Basic principles ,working and specific applications of armature and field controlled D.C. Motors, Variable voltage and variable frequency control of 3 phase and single phase Induction motors, speed control of synchronous motors, Different types of stepper motors-Constriction ,working and application. Position control of stepper motors.
[a, b, i]

Unit 3 **[8 hrs]**
Common and commercial I.Cs used for amplification, timing and digital indication.
Different types of actuators, working of synchro-transmitter and receiver set, Pressure to current (P/I) and I/P conversion. Electrical and hydraulic servomotors.
Design of solenoid plungers and pressure and force amplification devices. **[a, b, i, j]**

Unit 4 **[7 hrs]**
Add-on cards for sampling and actuation, 4-20 mA ports, AD-DA conversion, Peripheral interface organization, general layout of data bus and data transfer through serial and parallel modes of communication, schemes of computer networking and hierarchy in supervisory control. **[a, b, i, j]**

Unit 5 **[8 hrs]**
Study of various integrated systems by using block diagrams. Study of systems used in Ink Jet Printers, Photo copying, Washing Machines, IC Engine fuel injection system etc **[a, b, c, i]**

Unit 6 **[7 hrs]**
General philosophy of Artificial Neural Network simulations, Fuzzy logic for operation and control of mechatronic systems. **[a, b, d, e, i]**

7th Semester

ME1445	PE III : Mechatronics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Introduction to Mechatronics and Measurement Systems	2007	Michael B.Histand and David G. Alciatore	Tata McGraw-Hill Education
2	Mechatronics	2007	Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ.,	Chapman and Hall, 1991
3	Microprocessor Architecture, Programming and Applications	2002	Ramesh.S, Gaonkar	Prentice Hall
4	Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics	1996	Lawrence J.Kamm	John Wiley and Sons
5	Introduction to Microprocessors for Engineers and Scientists	2004,	Ghosh, P.K. and Sridhar	PHI Learning Pvt. Ltd.

7th Semester

ME1446	PE III : Lab. : Mechatronics	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
(1)Understand the concept of Mechatronics (2)Develop the ability to understand the working of various electronically and computer control devices. (3)Concept development to bridge the existing gap between machines, Automation and Computer control system.[a,b,c,i,j]	(I)The student will be able to use various motors, Switches, Timers & Flip-flops and various IC's..[a,b,i] (II)The student will be able to carry out interfacing of various mechanical and electronic equipments..[a,b,c,j]

List of Practical (Minimum 10 Experiments)

1. Verification of P, P+I, P+D, P+I+D control actions.[a,b,c,I,j]
2. Demonstration on XY position control systems. .[a,b,c,I,j]
3. Demonstration on linear conveyor control system. .[a,b,c,I,j]
4. Demonstration on rotary table positioning systems. .[a,b,c,I,j]
5. Demonstration on different switches and relays. .[a,b,c,I,j]
6. Analysis of control system using software like MATLAB/SIMULINK or equivalent. .[a,b,c,I,j]
7. Development of ladder diagram/programming PLC for level control, position control or any other mechanical engineering application. .[a,b,c,I,j]
8. Demonstration on A/D and D/A converters. .[a,b,c,I,j]
9. Demonstration on Flip Flops and Timers. .[a,b,c,I,j]
10. Demonstration on Application of Op – Amp circuits. .[a,b,c,I,j]
11. Demonstration on Data acquisition system. .[a,b,c,I,j]
12. Demonstration on Microcontrollers. .[a,b,c,I,j]

7th Semester

ME1469	PE-III : Refrigeration & Cryogenic	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcome
I)To explain and analyse VCRS system II) To study about vapour absorption and other refrigeration system III) To explain about cryogenic technology	COI- student will be able to understand and analyse vapour compression refrigeration system [a,e,k]
	COII- student will be able to explain construction ,working of different components and use of different refrigerant in VCRS [a,c,h]
	COIII- student will be able to explain different vapour absorption and other refrigeration system [a,h]
	COIV- student will be able to analyse multistage VCRS system [a,e,k]
	COV- student will be able to explain and analyse air refrigeration system.[a,e,k]
	COVI- student will be able to explain and analyse different methods of production of ultra low temperature. [a,d.k]

UNIT I Vapor Compression Refrigeration system
Introduction to refrigeration, applications of refrigeration, development of simple saturated Vapour compression refrigeration cycle, effect of change in evaporator and condenser pressure, effect of pressure drops, polytropic compression, sub cooling, superheating. **[a,e,k]**

UNIT II Components of Vapor compression system
Various components used in refrigeration system like compressors, condensers, evaporators, expansion devices, cooling towers, control use in refrigeration system
Refrigerants
Types and classification, properties and nomenclature, environment friendly refrigerants. **[a,c,h]**

UNIT III Other refrigeration systems
Vapor absorption systems (NH3- H20, LiBr- H2O) , Electrolux refrigeration system, steam jet refrigeration systems, thermoelectric refrigeration, vortex tube refrigeration. **[a,h]**

UNIT IV Multistage Refrigeration systems
Working and analysis of multistage systems multiple evaporator and multiple compressor systems. **[a,e,k]**

UNIT V Air refrigeration systems
Gas cycle refrigeration, reversed Brayton /Joules/Bell Coleman cycle, aircraft refrigeration, simple cycle, boot strap cycle, reduced ambient air cycle, regenerative cycle. **[a,e,k]**

UNIT VII Cryogenics
Introduction and applications of cryogenics, cascade refrigeration, Joules Thomson effect, methods of air liquification, Linde's and Claude's cycle . cryogenic insulation. **[a,d,k]**

Recommended Books:
1. Dossat Roy J.; Principles of Refrigeration, 4th Ed.; Pearson Education Asia Publication
2. Arora C.P.; Refrigeration and Air conditioning, 2nd Ed.; Tata Mc Graw Hill Publication
3. Ballaney P.L.; Refrigeration and Air conditioning; Khanna publishers
4. Prasad Manohar; Refrigeration and Air conditioning, 2nd Ed.; New edge Publication
5. Arora, Domkundwar; A course in Ref. &Air Conditioning, 7th Ed.; Dhanpat Rai Publications.
6. Pita Edward G.; Air conditioning principles and systems, 4th Ed.; Prentice Hall
7. ASHRAE handbook and CARRIER hand book.

7th Semester

ME1470	Lab: PE-III : Refrigeration & Cryogenic	L=0	T=0	P=2	Credit=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE duration
	---	---	40	60	100	--

Objectives	Course Outcome
I) To carry out performance analysis and study of components, used in VCRS II) To explain about vapour absorption refrigeration system III) To visit different refrigeration plant.	CO I- The student will be able to carry out the trial on Refrigeration trainer and evaluate their performance.[a,b,k,m]
	CO II- The student will be able to study of expansion devices used in VCRS [a,c,k]
	CO III- The student will be able to study of condenser ,evaporators and cooling tower used in VCRS [a,c,k]
	CO IV- The student will be able to study of vapour absorption refrigeration system [a,c,k]
	CO V - The student will be able to study of controls used in VCRS system [a,c,k]
	CO VI- student should visit and understand the refrigeration system used for cold storage, ice plant and production of ultra low temperature.

List of experiment

1. Experiment on Determination of COP of Refrigeration trainer [a,b,k,m]
2. Trial on ice-plant test rig [a,b,k,m]
3. Study of expansion devices used in vapour compression refrigeration system [a,c,k]
4. Study of condensers and cooling towers used in vapour compression refrigeration system [a,c,k]
5. Study of evaporators used in vapour compression refrigeration system [a.c.k]
6. Study of vapour absorption refrigeration system [a,c,k]
7. Study of electrolux refrigeration system [a,c,k]
8. Study of controls used in refrigeration system [a,c,k]
9. Visit to air liquefaction plant [a,d,k]
10. Visit to cold storage [a,c,k]
11. Visit to Industrial cooling tower [a,c,k]
12. Visit to ice plant [a,c,k]

7th Semester

ME1476	PE-III : Machine Tool Design	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles. This subject consists of application of scientific principles, technical information & creative thinking for the development of a new or improved machine tools, to perform desired machining operation with maximum efficiency. **[a,e,k,l]**	(I)The student will be able to design Gear boxes (II)The student will be able to design machine tool structure (III) The student will be able to design guide ways and power screws (IV) The student will be able to design spindles (V) The student will be able to test machine tools (VI) The student will be able to understand control system of machine tools

UNIT 1 **[7Hrs]**

Introduction to Machine tool drives & Mechanisms, Working & auxiliary motions in machine tools, Parameters defining the working motions of a machine tool; Machine tool drives, Hydraulic Transmission & its elements, Mecll.'U1ical Transmission & its elements, General requirements of machine tool design, layout of machine tool.**[a, e,k,l]**

UNIT 2 **[8 Hrs]**

Regulation of speed & feed rates - Aim of speed & feed regulation, Stepped regulation of speed -Various laws of stepped regulation, Selection of range ratio, Standard values of Geometric progression Ratio & guidelines for selecting proper value, break up of speed steps; Structure diagrams & their analysis, Speed classification. Design of feed box, machine tool drives using multiple speed motors, Special cases of gear box design -speed box with overlapping speed steps, speed box with a combined structure, speed box Wit11 broken geometric progression, General recommendation for developing the Gearing diagram, determining the Number of teethes of gears, Classification of speed & feed boxes. Electromechanical system of Regulation, Friction, Pressure and Ball Variation, Epicyclic Drive . **[a, e,k,l]**

UNIT 3 [7Hrs]

Machine Tool Structure - Functions of machine tool structures & their requirements, Design criteria for machine tool structU1.es, Materials of machine tool structures, Static &Dynamic stiffness, Profiles of machine tool structures, Factors affecting stiffness of machine tool structures & methods of improving it; Basic design procedure of machine tool structures -design for strength, design for stiffness. Design of Beds, Column, housings, Bases & Tables, Cross Rails, Arms, Saddles, Carriages, Rams. **[a, e,k,l]**

UNIT 4 [8Hrs]

Design of Guide ways & Power Screws - Functions & types of guide ways, Design of Sideways - Shapes, materials, methods of adjusting clearances. Design Criteria & Calculations for sideways, Design for wear resistance, Design for stiffness. Guide ways operating under liquid friction conditions -Hydrodynamic & Hydrostatic sideways, Design of Aerostatic sideways, Design of Antifriction Guide ways, Combination guide ways, protecting devices for sideways.

Design of Power Screws -Sliding friction power screws, Rolling friction Power Screws. **[a, e,k,l]**

UNIT 5 ***[7Hrs]***

Design of Spindles & Spindle Supports Functions of spindle unit & requirements, Materials of spindles, design calculations of spindles – Deflection of spindle axis due to bending, deflection of spindle axis due to compliance of spindle supports, optimum spacing between spindle supports deflection due to compliance of the Tapered Joint permissible deflection & design for stiffness. Antifriction bearings -Preloading of antifriction bearing. Sliding bearings - Sleeve bearings, hydrodynamic journal bearing, and air -lubricated bearings**.** [a, e,k,l]

7th Semester

ME1476	PE-III : Machine Tool Design	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT 6 **[8Hrs]**

Testing & Control of Machine Tools

a) Testing: Objects and procedure for Acceptance Test, Instrumentation for acceptance, Accuracy of machine tools, and accuracy of work pieces.

b) Control systems: Electrical control, push button control, directional control relays, electrical brakes, automation in feed mechanism

c) Hydraulic control: positional control, power pack for lubrication system in hydraulic drive.

d) Control system for gear sliding and feed mechanism (open loop or close loop) for NC/CNC machine using stepper motor or DC motor. **[a, e,k,l]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Machine Tool Design	2007	N. K. Mehata	Tata McGraw-Hill, 1984
2	Principles of Machine Tools	2011	Gopal Chandra Sen, Amitabha Bhattacharyya	New central book agency
3	Design Of Machine Tools	5th edition 2008	Basu, Pal	Oxford and IBH Publishing, 2008
4	Principles of Machine tools		Sen and Bhattacharya	New central book agency

7th Semester

ME1477	Lab.: PE-III : Machine Tool Design	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles. This subject consists of application of scientific principles, technical information & creative thinking for the development of a new or improved machine tools, to perform desired machining operation with maximum efficiency. **[a,e,k,l]**	(I)The student will be able to design Gear boxes (II)The student will be able to design machine tool structure (III) The student will be able to design guide ways and power screws (IV) The student will be able to design spindles (V) The student will be able to test machine tools (VI) The student will be able to understand control system of machine tools

List of Practical (Minimum 10 Experiments)

13. Introduction to Machine Tool Design
14. Gear box design
15. Design of Beds, Column, housings, Bases & Tables
16. Design of, Cross Rails, Arms, Saddles, Carriages, Rams
17. Design of Guide ways
18. Design of Power Screws.
19. Design of Spindles
20. Design of Spindle Supports.
21. Testing of Machine Tools.
22. Study of Machine Tool controls.

7th Semester

ME1433	Project Phase-I	L=0	T=0	P=4	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	
	0	0	40	60	100	Internal Evaluation

Objective	Course Outcome
The objective is to prepare the student to examine any design or process or phenomenon fron all angles.This will encourage and develop the process of independent thinking and team working in them and expose them to the needs of industry and society The group of students (not more than 4) will work under the guidance of the faculty member on the project work .It is expected to carry out literature survey for their project work and finalized the methodology and schedule of project. Each student from the project batch shall present [(1st Preliminary and 2nd Progress) using audio visuals, aids] the seminar of about 10 to 15 minute duration on their project methodology. Seminar delivery will be followed by question – answer session. The batch of the students shall also require to submit a progress report of minimum 3 pages before 2nd seminar .The seminar committee (minimum 3 members) shall be constituted for the purpose of evaluating seminar. [d,e,g,j,k,l]	1.(I)The student will able to understand various facets of engineering problems.**d]**
	(II)The student will able to communicate his ideas with others. **[g]**
	(III)The student will able to identify various solutions to engineering problems.. **[e]**
	(IV)The student will able to understand the need to update knowledge.. **[j]**
	(V)The student will able to use latest techniques to find solutions.. **[k,l]**

S.No	Rubrix
I	Objective and literature survey
II	Innovativeness,Presentation and reasoning skill
III	Working & fabrication,experinentation
IV	Presentation of result and discussion

7th Semester

ME1434	Industrial Training / CRT	L=0	T=0	P=0	Credits=2

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	
	0	0	100	0	100	Internal evaluation

Objective	Course Outcome
To work in an industry for understanding- 1.Nature of work 2.Different machines used 3.Different technologies used 4.Work culture **5.** Various problems exist in Industry. **[e,h,m]**	1.(I)The student will able to understand nature of work environment in industry..[h] (II)The student will able to understand working of different machines and processes..[m] (III)The student will able to understand various problems associated with industry..[e]

S.No	Rubrix
I	Know edge and details of Industry
II	Technical Content in report
III	Technical report presentation
IV	Innovation in content
V	Evaluation on the basis of question answer

TRAINING: The student shall undergo training in an industry for minimum period of one month duration during summer vacation after completion of 6th Semester. They will be required to prepare and submit a comprehensive report on the training undergone by them. They will have to submit a certification of completion of training from the industry at the time of joining 7th Semester. They will have to face or undergo a viva-voce by a committee of teachers during 7th semester.

8th Semester

ME1435	Automation In Production systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.[a,b,c,d,h,k,l]	(I)The Students will be able to interpret advanced automated systems.[a,b,h,k]
	(II)The Students will be able to develop and understand CNC machine programming and its execution.[a,b,k]
	(III)The Students will be able to understand System integration of automated system such as flexible manufacturing system..[a,b,c,d,h,k,l]

Unit 1 **[7 hrs]**

Automation- Definition, types, reasons for automating, arguments for and against automation. Types of production, functions in manufacturing, Organization and information processing in manufacturing.

Automated Flow 'Lines- Methods of workpart transport, Transfer mechanisms, Buffer storage. Analysis of flow lines- General terminology and analysis, analysis of transfer lines without storage, partial automation, automated flow lines with storage buffers, manual assembly lines. Line Balancing Problem, Methods of line balancing. Automated Assembly Systems- Types, parts delivery system**[a, b, d, h, l]**

Unit 2 **[8 hrs]**

Numerical Control Production Systems- Basic concepts, coordinate system and machine motion- Types of NC systems- Point to point, straight cut and continuous path. Machine control unit and other components, Tape and tape readers.

NC part programming- Punched tape and tape formats, NC words, methods of part programming, manual part programming: APT programming, Direct numerical control. Computer numerical control. Adaptive control. Applications and economics of NC. **[a, b, c, k ,l]**

Unit 3 **[8 hrs]**

Industrial Robotics- Introduction, robot anatomy, robot control systems, accuracy and repeatability and other specifications, end effectors, sensors, introduction to robot programming, safety monitoring.

Robot applications- Characteristics of robot applications, work cell layout, robot applications in material handling, processing, assembly and inspection. **[a, c, d, h, l]**

Unit 4 **[7 hrs]**

Automated material handling & storage-Conveyor systems : Roller conveyer , Skate wheel conveyer, Belt conveyers, Chain conveyers, Slat conveyers , Overhead trolley conveyers , Infloor towline conveyers, Cart on track conveyers .

Automated Guided Vehicle Systems -

Types: - Driverless trains, AGVS pallet trucks, AGVS unit-load carriers. Vehicle guidance & Routing, Traffic control & safety, System management, Analysis of AGVS systems, AGVS applications.

Automated Storage & Retrieval System -

Types :- Unit load AS/RS , mini load AS/I{S , man on board AS/RS , automated item retrieval system, deep lane AS/RS -Basic components & special features of AS/RS , Carousel storage systems , Work in process storage, quantitative analysis. **[a, b, c, d , l]**

Unit 5 **[7 hrs]**

Automated inspection & Group technology:- Automated inspection principles & methods -100% automated inspection, off -line & on -line inspection, distributed inspection & final inspection; Sensor technologies for automated inspection , coordinate measuring machines -con~tructiol1 , operation & benefits; Machine vision -image aquisition & digitigation, image processing & analysis, interpretation,

machine vision applications; Other optical inspection methods -Scanning laser systems , linear allay devices, optical tringulation techniques. Introduction to Group Technology. **[a, b, d, k ,l]**

Unit 6 **[7 hrs]**

Computer aided manufacturing -Manufacturing planning, manufacturing control ; Computer integrated manufacturing ; Flexible manufacturing systems -Components, Types of systems, FMS layout configuration computer functions, data files, system reports, FMS benefits.

Computer aided process planning: Retrieval CAPP systems, generative CAPP systems, benefits of CAPP . Shop floor control. Computer Process Control. **[a, c, d ,l]**

8th Semester

ME1435	Automation In Production systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Automation, production System & CIMS	Third edition (2007)	M P, Groover PHI	Prentice Hall
2	CAD/CAM	Fifth edition (2008)	Zimmers & Groover PIII	Pearson Education India
Reference Books:				
1	Numerical Control And Computer Aided Manufacturing	13th edition (2007)	Rao, N K Tiwari, T K Kundra	Tata McGraw-Hill Education
2	Computer Control of Manufacturing Systems	2005	Koren	Mcgraw Hill

8th Semester

ME1436	Lab. : Automation In Production	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.[a,b,c,d,e,h,k,m]	(I)The Students will be able to develop the CNC programs and execute..**[a,b,d,k,m]**
	(II)The Students will be able to understand fundamentals of robotics engineering and its industrial application..**[a,b,k,]**
	(III)The Students will be able to use Group technology and various components of automated systems to form flexible manufacturing system.. **[a,b,c,d,e,h,k,m]**

Practicals:

1) Performance, Simulation on lathe (atleast two Complex Geometric) **[a, b, e, k ,m]**
2) Performance, Simulation on CNC milling (atleast two Complex Geometries) **[a, d, h, m]**
3) Practice Programming on Manual Part Program **[a, b, c, m]**
4) Practice Programming on APT **[a, b, e, k ,m]**
5) Case Study on Automated System of any Industry. **[a, b, k ,l]**
6) Performance/ Practical on Robot. **[a, b, k ,l]**
7) Part Coding and Group Technology **[a, d, h ,l]**
8) Study of FMS**[a, b, c, k ,l]**
9) Study of Automated material handling **[a, b, e ,l]**
10) Study of Automated inspection **[a, d, h ,l]**

8th Semester

ME1475	Optimisation Techniques	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

The course aims to develop the engineering - analysis capability for engineering-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.

COURSE OUTCOME:-	
(I)	Use basic operations research techniques for solving linear programming problems. Learn to formulate and solve real-world problems as linear programs, CPM, PERT for better decision –making.
(II)	Solve transportation Models and Assignment Models.
(III)	Understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.

Unit 1 **[7 hrs]**

Introduction of operation research. LP Formulations, Graphical method for solving LP's with 2 variables, Simplex method, Duality theory in linear programming and applications, Integer linear programming, dual simplex method.**[a,k, m]**

Unit 2 **[7 hrs]**

Transportation model,Assignment model (Maximization and minimization problem), Travelling Salesman Problem by branch and bound method**[a, k, m]**

Unit 3 **[8 hrs]**

Dynamic Programming: Basic Concepts, Bellman's optimality principles, Dynamics programming approach in decision making problems, optimal subdivision problem.

Sequencing Models: Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines.**[a, k, m]**

Unit 4 **[8 hrs]**

Project Management: PERT and CPM : Project management origin and use of PERT, origin and use of CPM, Applications of PERT and CPM, Project Network, Diagram representation, Critical path calculation by network analysis and critical path method (CPM), Determination of floats, Construction of time chart and resource labeling, Project cost curve and crashing in project management, Project Evaluation and review Technique **[a, k]**

Unit 5 **[7 hrs]**

Replacement Models and Economic Equivalence: Concept of equivalence interest rate, present worth, economic evaluation of alternatives, group replacement models. **[a, k]**

Unit 6 **[8 hrs]**

Waiting line situations, Queuing Theory M/M/1models (No derivations expected),Monte- Carlo simulations, Inventory Models:Probabilistic and Deterministicmodel, EOQ.**[a, k]**

8th Semester

Me1475	Optimisation Techniques	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

S. N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Introduction to Operation Research, Computer Oriented Algorithmic approach	2007	Gillet B.E	Tata McGraw Hill Publising Co. Ltd. New Delhi.
2	Operations Research	Third edition 2008	P.K. Gupta & D.S. Hira	S.Chand& Co.
3	Operations Research: Theory and Applications	Second edition 2002	J.K. Sharma	Mac Millan
4	Operations Research	2006	S.C. Sharma	Discovery Publishing House
5	Optimization Theory and Application	Second edition 2010	S.S. Rao	Halsted Press
6	Operations Research - An Introduction	Ninth Edition 2010	Tata Hamdy	Prentice Hall of India Pvt. Ltd., New Delhi.

8th Semester

ME1415	PE IV : Vibrations	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop in students fundamentals knowledge of vibrations. To familiarize with energy methods for multi degree freedom systems. To impart, knowledge of vibration of continuous systems and applications of factor in vibration analysis. TO impart knowledge of use of FFT in vibration analysis for condition monitoring purpose [b,e]	(I) The student will have ability to analyze various types of Vibrations..[b,e] (II) The student will have ability to measure Vibrations and carryout its analysis..[b,e]

Unit 1 **[7 hrs]**
Free body diagram, free & forced vibration, un damped and damped single degree of freedom systems subjected to harmonic and other periodic excitations. Impulse response, convolution integral and response to arbitrary excitation. Vibration isolation and transmissibility. Solution using laplace transform, Runga kutta method, structural damping.**[b,e]**

Unit 2 **[7 hrs]**
Energy method applied to multi degree freedom system. Lagranges equation. Generalized mass formulation of mass , damping and stiffness matrix and its numerical solutions . Vibration absorber, conservative and non conservative systems. Geared rotor system, Influence Coefficients and flexibility matrix of bending vibration of beam and multi-disc rotor. Mode shapes and orthogonality principle. **[b,e]**

Unit 3 **[8 hrs]**
Numerical techniques for M.d.o.f. systems. Matrix iteration method. Holzer's method for torsional vibration. Dunkeleys method for critical speed determination of multi disc rotor. Rayleigh quotient sweeping matrix method for determination of all the natural frequencies and mode shapes. Rayleigh Rit method. Modal matrix and expansion theorem. Free and forced response by modal analysis. **[b,e]**

Unit 4 **[8 hrs]**
Vibration of continuous system. Axial vibration of rod, bending vibration of beam and torsional vibration of shaft. Hamiltons principle and derivation of equation of motion, Rayleigh quotient. Modal co-ordinates and modal forces. Free and forced response through modal analysis. **[b,e]**

Unit 5 **[8 hrs]**
Vibration pickup, seismometers, accelerometer, proximity probe spectrum analyzer, FET & DFT (DiscreteFT), torsional, Vibration measurement, Digital vibration measurement, philosophy of vibration. condition monitoring. **[b,e]**

Unit 6 **[7 hrs]**
Introduction to Finite element method in vibration of continuous system. Natural frequencies and mode shape computation for simple rod and beam problem.**[b,e]**

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Theory of vibration	2001	Thomson W.T	Prentice hall
2	Elements of vibration analysis	1986	Meirovitch L	McGraw-Hill Science/Engineering/Math; 2 Sub edition (January 1, 1986)
3	Mechanical vibration	1984	Rao J.S.;Gupta K	Wiley Eastern, c1984
4	Theory of vibrations	1983	Morse TSE; Hinkle	New Delhi: CBS Publishers, 1983.
5	Advanced theory of vibration	1992	Rao J.S	Wiley, 1992
6	Vibration condition Monitoring of Machines	2000	Rao J.S	Alpha Science International Limited, 2000
7	Random vibration		Gandall & Mark	

8th Semester

ME1416	PE IV : Lab. : Vibration	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
To do Experimentation on Types of Vibrations. To do analysis of Vibration of different systems and machines using different methods And through Instrument. [b,e]	(I) The student will have ability to do analyze different types of Vibrations..[b,e] (II) The student will have ability to measure Vibrations and carry out its analysis..[b,e]

List of Practical

1. To determine transmissibility of single degree freedom system using load cells and exciter.**[b,e]**
2. To Study the Transverse Vibrations of Cantilever Beam and to determine the frequency or period of Vibration (oscillation) theoretically and actually by experiment.**[b,e]**
3. To determine natural frequency of Torsional vibration of geared system.**[b,e]**
4. To Study the forced vibration of equivalent spring mass System.**[b,e]**
5. Study and determination of modes shapes for two degree and three degree freedom systems. .**[b,e]**
6. To Study the Free Vibration of two rotor and three rotor System and to determine the natural frequency of vibration theoretically & experimentally. .**[b,e]]**
7. To verify the Dunkerley's Rule. .**[b,e]**
8. Determination of Whirling of shaft. .**[b,e]**
9. To study the effect of damping on natural frequency and plot frequency response curves at various damping coefficient. **[b,e]**
10. To determine vibration parameters (Amplitude Velocity acceleration for machines using FFT.**[b,e]**
11. To diagnose faults in simple machines like pumps motor gearbox using FFT. .**[b,e]**
12. To remove dynamic unbalance using FFT. .**[b,e]]**

8th Semester

ME1437	PE IV : INDUSTRIAL FLUID POWER	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
1. .To introduce and understand the simple fluid power systems and to realize its importance in the world of automation and power transmission. 2. To study various fluids, filters and seals for hydraulic systems 3. To study various components of fluid power systems. 4. To understand the language and symbols associated with fluid power components & systems. 5. To design and analyze fluid power systems. **6.** To identifying fluid power maintenance, troubleshooting and safety practices. **[a,b,c,e,g,k,l]**	Students will be able to: (I)To understand and apply fluid power laws and principles [a,e,g,l] (II)Students will be able to understand the basic fluid power hardware system components.. [a,b,c,e,l,m] (III)Students will be able to interpret and draw hydraulics and pneumatics system drawings..[a,g,k,l] (IV)Students will be able to design, analyze, use, maintain, carryout troubleshooting, and establish safety procedures of Fluid Power systems..[a,b,c,k,l]

Unit 1

[8 hrs]

Fluid power systems: Components, advantages, applications in the field of M/c tools, material handling, hydraulic presses, mobile & stationary machines, clamping & indexing devices etc. **Transmission of power at static & dynamic states**. Pascal's Law, continuity equations,
Types of Hydraulic fluid petroleum based, synthetic & water based. Properties of fluids. Selection of fluids, additives, effect of temperature & pressure on hydraulic fluids.
Seals, sealing materials, selection of seals.
Filters, strainers, sources of contamination of fluid & its control.
JIC symbols/ISO Symbols for hydraulic & pneumatic circuits. **[a, e, g,k,l]**

Unit 2

[7 hrs]

Pumps: Types, classification, principle of working & constructional details of vane pump, gear pumps, radial & axial plunger pumps, power and efficiency calculations, characteristic Curves, selection of pumps for hydraulic power transmission.
Accumulators & Intensifiers: Types & functions of accumulators & intensifiers, applications, selection & design procedure. **[a,c,k,e,l]**

Unit 3

[8 hrs]

Control Of Fluid Power: Necessity of pressure control directional control, flow control valves,
Pressure Control Valves: Principle of pressure control valves, direct operated, pilot operated, relief valves, pressure reducing valve, sequence valve & methods of actuation of valves.
Flow Control Valves: Principle of operation, pressure compensated, temperature Compensated flow control valves, meter in & meter out flow control circuits, bleed off circuits.
Direction Control Valves: Check valves, types of D.C. valves:- Two way two position, four way three position, four way two position valves, open center, close center, tandem center valves, method of actuation of valves, manually operated, solenoid operated, pilot operated etc **[a,c,e,k,l]**

Unit 4

[7 hrs]

Actuators: Linear & Rotary actuators.
Hydraulic motors: Types, vane, gear piston, radial piston.
Theoretical torque, power & flow rate hydraulic motor performance.
Hydraulic Cylinders: Types of cylinder & mountings, calculations of piston velocity, thrust under static & dynamic applications. Design consideration for cylinders. **[a, c,e, k, l]**

8th Semester

ME1437	PE IV : INDUSTRIAL FLUID POWER	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit 5

[7 hrs]

Design Of Hydraulic Circuits:
Meter in meter out circuits. Pressure control for cylinders, Flow divider circuits, etc. Circuit illustrating use of pressure reducing valves, sequencing valve, counter balance valves, unloading valves with the use of electrical controls, accumulators etc. Hydraulic circuit analysis.
Maintenance, trouble shooting & safety precautions of Hydraulic Circuits.
Hoses & Pipes: Types, materials, pressure drop in hoses/pipes, valves and fittings.
Hydraulic piping connections. **[a, b, c, e,g,k, l]**

Unit 6

[8 hrs]

Pneumatics: **Introduction** to pneumatic power sources, e.g. reciprocating & rotary compressors, roots-blower etc. **Comparison** of pneumatics with Hydraulic power transmission. **Air preparation units**, filters, regulators & lubricators. **Actuators**, linear, single & double acting, rotary actuators, air motors, **Pressure Regulating Valves**, **Directional Control Valves** two way, three way & four way valves, solenoid operated, push button; & lever control valves. **Flow Control Valves**. Check valves methods of actuation, mechanical, pneumatic & electrical etc.
Pneumatic circuits for industrial applications & automation. **[a, b, c, e, g,k, l]**

Text books:			
Title of the book	**Edition (Year of publication)**	**Author(s)**	**Publisher**
Introduction to Fluid Power	2002	James L Johnson	**Delmar Thomson Learning**
Fluid Power With Applications	6th	Anthony Esposito	PEARSON Prentice Hall
Industrial Hydraulics	3rd or above	J.J. Pipenger & T. G. Hicks	McGraw Hill Co.
Pneumatic Systems: Principles and Maintenance	16th (2006)	S. R. Majumdar	Tata McGraw-Hill Education
Reference Books:			
Power pneumatics	(2007)	Michael J. Pinches	Prentice Hall
Vickers manuals on Industrial Hydraulics	3rd edition or above	Vickers	Vickers, 1996
Hydraulics & Pneumatics	4th edition	Harry L. Stewart	Industrial Press
Fluid Power Design Handbook	3rd edition	Franklin D. Yeaple	Marcel Dekker, 1996

8th Semester

ME1438	PE IV : Lab. : INDUSTRIAL FLUID POWER	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
• Develop an understanding of basic principles of simple fluid power & systems. • Study & Select the proper hydraulic /pneumatic component for an application. • Read & understand the language and symbols associated with fluid power components & systems. • Design, assemble and analyze basic fluid power circuits. • Troubleshoot and maintain the hydraulic /pneumatic components and systems. • Understand & follow the safety and precaution norms in fluid power lab. **[a,b,c,e,g,k,l]**	(I) Student will be able to use the appropriate safety precautions. [a,b,c,e,g,k,l] (II) Student will be able to differentiate, install, and maintain the different types of hydraulic and pneumatic pumps, valves, motors and actuators. [a,b,c,e,g,k,l] (III) Student will be able to understand, install and maintain Hydraulic/Pneumatic circuit. [a,b,c,e,g,k,l]

Practical: - Minimum eight practical to be conducted /studied

Note: Demonstrations shall be carried out on Hydraulic and Pneumatic Kit

1) Study of JIC/ISO symbols for Hydraulics and Pneumatics .{a,b,c,e,g,k,l]
2) Demonstration of hydraulic pumps used in hydraulic systems.{a,b,c,e,g,k,l]
3) Demonstration of Actuators used in Fluid Power systems.{a,b,c,e,g,k,l]
4) Demonstration of various valves used in Fluid Power systems.{a,b,c,e,g,k,l]
5) Demonstration of accumulators and Intensifiers used in Fluid Power systems.{a,b,c,e,g,k,l]
6) Demonstration of different flow control methods used in Fluid Power systems.{a,b,c,e,g,k,l]
7) Demonstration of various hydraulic circuits (three to four applications) .{a,b,c,e,g,k,l]
8) Demonstration of various industrial hydraulic circuits (another three to four applications) .{a,b,c,e,g,k,l]
9) Demonstration of FRL unit used in pneumatic systems. .{a,b,c,e,g,k,l]
10) Demonstration of valves used in pneumatic systems. .{a,b,c,e,g,k,l]
11) Demonstration of industrial pneumatic circuits (three to four app.) .{a,b,c,e,g,k,l]
12) Study of hydraulic fluids used in hydraulic systems.{a,b,c,e,g,k,l]
13) Study of hydraulic seals used in Fluid Power systems.{a,b,c,e,g,k,l]
14) Study of Contamination Control of Hydraulic Fluids. .{a,b,c,e,g,k,l]
15) Design report of a hydraulic or pneumatic system using manufacturer's catalogue.{a,b,c,e,g,k,l]

8th Semester

ME1439	PE IV : CNC and Robotics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines and Robots, their components, functions, functions, programming and applications.[k,m]	(I)Student will be able to understand construction of CNC machines & Robots..[k,m]
	(II)Student will be able to prepare a program for making components using CNC machines..[k,m]
	(III)Student will be able to operate CNC machines & Robots..[k,m]

Unit 1 **[7 hrs]**
Concepts of NC, CNC, DNC. Classification of CNC machines, MCU architecture and functionality, Machine configurations, Types of control, CNC controller's characteristics, Interpolators**. [k,m]**

Unit 2 **[8 hrs]**
Qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, of CNC Machines.
Programming CNC machines, Part print analysis and Process planning, Advanced Programming features , Canned cycles. APT part programming CAD/CAM, Parametric Programming.**[k,m]**

Unit 3 **[8 hrs]**
Manual part programming for CNC turning, milling and machining center. Wire EDM machines. Computer assisted part programming techniques, Conversational and Graphics based software, Solid based part programming. Freeform surface machining. Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM. **[k,m]**

Unit 4 **[7 hrs]**
Robotics, Basic concepts , Robot configurations , Basic robot motions , Types of drives , Applications
Transformations and kinematics, Vector operations, Translational transformations and Rotational transformations , Properties of transformation matrices,
Homogeneous transformations and Manipulator, Forward solution, Inverse solution, Introduction to robot dynamics.
Controls, Control system concepts, Analysis, control of joints, Adaptive and optimal control. **[k,m]**

Unit 5 **[8 hrs]**
End effectors, Classification, Mechanical, Magnetic, Vacuum, and Adhesive, Drive systems, Force analysis and Gripper design**.**
Robot programming, Methods, Languages ,Computer control and Robot Software – Programming Languages, Robot application (Assembly, inspection, material handling, processing) **[k,m]**

Unit 6 **[7 hrs]**
Sensory devices, Non optical and optical position sensors, Velocity and Acceleration, Range, Proximity, touch, Slip, Force, Torque. Machine vision, Image components , Representation , Hardware , Picture coding , Object recognition and categorisation Integration of Robots with CNC machines for CIM. **[k,m]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Robot Engineering An Intergrated approach	2004	Klafter R.D., Chmielewski T.A. and Negin M	Springer

8th Semester

ME1439	PE IV : CNC and Robotics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference :				
1	CNC Technology and Programming	2003	Krar, S., and Gill	Industrial Press Inc
2	An Introduction to CNC Machining	1991	Gibbs, D.	Industrial Press
3	Computer Numerical Control Concepts and Programming	1991	Seames, W.S.	Thomson Learning EMEA, Limited
4	Computer Numerical Control for Machining	1993	Lynch, M	McGraw-Hill
5	Computer Control of Manufacturing Systems	2005	Koren Y	Tata McGraw-Hill Education
6	Robotics control, sensing, vision, and intelligence	2004	Fu K.S., Gonzalez R.C., and Lee C.S.G.	Tata McGraw-Hill Education
7	Robotics Technology and Flexible Automation	2001	Deb S.R	Tata McGraw-Hill Education
8	Introduction to Robotics Mechanics and Control	2008	Craig J.J	Pearson Education India

8th Semester

ME1440	PE IV : Lab. : CNC and Robotics	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines and Robots, their components, functions, functions, programming and applications.[k,m]	(I)Student will be able to understand construction of CNC machines & Robots. [k,m]
	(II)Student will be able to prepare a program for making components using CNC machines.. [k,m]
	(III)Student will be able to operate CNC machines & Robots. [k,m]

List of Practical

1) Demonstration on Automation through development in NC machines. **[K,m]**
2) Numerical control – Fundamental & Application. **[K,m]**
3) Manual Part Programming. **[K,m]**
4) APT Part Programming. **[K,m]**
5) CNC- Lathe – Features, Specification, & Part Program. **[K,m]**
6) CNC Lathe – Programming, Simulation & Actual Machining of Part. **[K,m]**
7) **[a, b ,e ,i, j, k, l, m]** (Thread Cutting, Facing, Turning, Grooving etc.) **[[K,m]**
8) CNC- Milling – Features, Specification, & Part Program. **[a, b ,e ,i, j, k, l, m]**
9) CNC Milling – Programming, Simulation & Actual Machining of Part. **[K,m]**
   (Profile Cutting, Various Interpolation, Pocketing, Mirroring etc.)
10) Robots Fundamental and configurations. **[K,m]**
11) Robots Applications **[K,m]**
12) Programming, Simulation of Robot. **[K,m]**
13) Problems on Robot kinematics. **[K,m]**

8th Semester

ME1441	PE IV: Vehicle Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about Automobile systems which are used in the regular vehicle. The modernization in automobile is also included to understand recent trend in the field.**[d,i,k]**	(I) Student should understand basic operations of Automobile engine and power transmission systems.**[d,i,m]**
	(II) Student should understand basic operations various control system in automobile.**[d,i,m]**
	(III) Student should understand electrical system and various safety equipments automobile.**[d,i,m]**

UNIT-1: **[8 hrs]**
- Introduction, Automobile history and development and classification. Vehicles layout.
- Various engine system and components
- Introduction to Fuel supply system: for Petrol and Diesel Engine.
- Engine cooling and lubrication systems., **[d,i,m]**

UNIT-2: **[8 hrs]**
- Resistance to vehicle motion: Air, Road and gradient resistance and power calculation.
- Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch.
- Gear box: Necessity of gear box, working principle, Classification: Sliding mesh, constant mesh, synchromesh, synchromesh and Transfer case gear box, Gear Selector mechanism, lubrication and control. Introduction to Automatic Transmission **[d,i,m]**

UNIT-3: **[8 hrs]**
- Transmission system: Propeller shaft, Universal joint, constant velocity joint, Hotchkiss drive, torque tube drive.
- Differential - Need and working. Differential lock.
- Rear Axles and Front Axles.
- Wheel and Tyres: tyres specification, factors affecting tyre performance. **[d,i,m]**

UNIT-4: **[8 hrs]**
- Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types.
- Suspension systems – Function, conventional and Independent suspension System, shock absorber
- Brakes - Drum and Disc brakes, Comparison, Mechanical, hydraulic (Master and wheel cylinder), Air brakes.**[d,i,m]**

UNIT-5: **[8 hrs]**
- Electrical systems: Battery construction. Specification. Operation of Batteries. Charging of battery, Alternator.
- Starting system, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator, wiper. and other electrical systems.**[d,i,m].**

UNIT-6: **[8 hrs]**
- Automobile air-conditioning,
- Panel board instruments .
- Overhauling, Engine tune up.
- Recent Advances in automobiles such as ABS, Power Steering, Collision avoidance, Navigational aids etc. **[d,i,m]**

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1	Automotive Technology		H.M.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automobile Engineering	First Edition - 2015	Dr.D.S.kumar	S.K.Kataria & sons
4	Automotive Mechanics		Joseph Heitner	
5	Automotive Engines		W.H. Crouse	

8th Semester

ME1442	PE IV : Lab. : Vehicle Engineering	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
The main objective of the syllabus to understand working of Automobile systems like power development, transmission & controls etc which are used in the regular vehicle..**[d,i,k]**	(I)Student will be able to understand and identify various components and its assembly and de-assembly in vehicle .**[d,i,m]**
	(II)Student will be able to understand and identify various operating system in automobiles. .**[d,i,m]**

List of Practical: Minimum eight practical to be conducted

1. Demonstration to understand vehicle layout and important constituents of four wheel ,two-wheel & four-wheel drive vehicle. **[d,i,m]**
2. Demonstration to understand various components and working of 2S & 4S Engine. **[d,i,m]**
3. Demonstration to understand working of single plate/Multiplayer/Diaphragm automobile clutch. **[d,i,m]**
4. Demonstration of synchromesh gearbox with gear shifting mechanism. **[d,i,m]**
5. Demonstration of final drive and differential. **[d,i,m]**
6. Demonstration of working Hydraulic braking system and comparison with other braking system. **[d,i,m]**
7. Demonstration to undersatnd front wheel steering geometry and steering mechanism. **[d,i,m]**
8. Demonstration to understand suspension system and working of shock absorber. **[d,i,m]**
9. Demonstration of various components of battery and working of its charging system. **[d,i,m]**
10. Demonstration of vehicle starting system(Kick start and Self start). **[d,i,m]**
11. Demonstration to understand working principle of Electric horn, Brake light and side indicator. **[d,i,m]**
12. Visit to workshop to understand wheel balancing. **[d,i,m]**
13. Visit to servicing station for vehicle maintenance, repairs and report. **[d,i,m]**

8th Semester

ME1443	PE IV : Management Information Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
•To focus on the integration of computer systems with the overall goals set by an organization. • To learn the development and management of information technology tools for assisting executives and the general workforce in performing any tasks related to the processing of information MIS and business systems are especially useful in the collation of business data and the production of reports to be used as tools for decision making.[**a ,b, c, e, h, i, j, k]**	(I) Student will be able to analyze the system..[**a ,b, c, e, h, i, j, k]** (II) Student will be able to improve the decision making. . [**a ,b, c, e, h, i, j, k]** (III) Student will be able to use various MIS tools.. [**a ,b, c, e, h, i, j, k]**

Unit 1 **[7 hrs]**
Introduction to MIS;
System & Its components, System Concepts, system control, Types of systems, Date & Information, Nature and scope, Character Function & Applications, system life cycle design. **[a, b, c, e]**

UNIT 2 **[7 hrs]**
System Analysis: System planning, Information Gathering, Structure Analysis tools, Feasibility Study, cost/benefit analysis. **[a ,b, c, e, h, i, j, k]**

UNIT 3 **[7 hrs]**
System Design: Stages of system Design, Input/output & form design, Database Design, Design Documentation.
[a, b, h, i, j, k]

UNIT 4 **[7 hrs]**
SYSTEM IMPLEMENTATION & EVALUATION :
System testing, Implementation Detailed evaluation, System maintenance. **[a, b, i, j, k]**

UNIT 5 **[7 hrs]**
DECISION SUPPORT SYSTEM :
Concepts & Philosophy of DSS, Deterministic System, Artificial Intelligence(AI), knowledge Based Expert system(KBES). **[a, b, i, j, k]**

UNIT 6 **[7 hrs]**
MIS TOOLS & PACKAGES/AREAS OF MIS
ERP(Enterprise Resource Planning)
SCM(Supply Chain arrangement)
CRM(Customer Relation argt.)
Concept of data ware housing and data mining. **[a, e, f, g, h]**

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	MIS	2002	WS Jawadekar	Tata McGraw-Hill
2	MIS	2006	D. P. Goyal	Macmillan
3	System Analysis and Design	1985	Elias M. Awad	R.D. Irwin
4	System Analysis and Design	2004	Donald Yeales.	Financial Times Prentice Hall

8th Semester

ME1444	PE IV : Lab. : Management Information Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Objective	Course Outcome
•To focus on the integration of computer systems with the overall goals set by an organization. • To learn the development and management of information technology tools for assisting executives and the general workforce in performing any tasks related to the processing of information MIS and business systems are especially useful in the collation of business data and the production of reports to be used as tools for decision making. **[a ,b, c, e, h, i, j, k]**	(I) Student will be able to analyze the system..**[a ,b, c, e, h, i, j, k]** (II) Student will be able to improve the decision-making **[a ,b, c, e, h, i, j, k]** (III) Student will be able to use various MIS tools.. **[a ,b, c, e, h, i, j, k]**

PRACTICALS :

1. Inventory control, [a ,b, c, e, h, i, j, k]
2. MRP, [a ,b, c, e, h, i, j, k]
3. Office Automation by using: MS-Access [a ,b, c, e, h, i, j, k]
4. Visual Basic, [a ,b, c, e, h, i, j, k]
5. Oracle or any other database Languages. [a ,b, c, e, h, i, j, k]

8th Semester

ME1478	PE-IV : Solar Energy & Utilization	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit1 Basics of solar energy **[7hrs]**
Brief History of solar energy &utilization, Various approaches of utilizing solar energy, Blackbody radiation, Relation between radiation field energy density and radiation spectrum, Planck's formula in energy unit, Maximum spectral density, Planck's formula in wavelength unit, Wien displacement law, Stefan - Boltzmann law, Photoelectric effect, Einstein's theory of photons, Einstein's derivation of the black-body formula.

Unit2 Solar radiation, measurement and estimation **[8hrs]**
History of solar energy utilization, basic definitions, Solar radiation and modeling, Empirical equations for predicting the availability of solar radiation, Measurement of global, direct and diffuse radiation, Radiation computations on inclined surfaces, Angstrom's turbidity, Solar chart, Standard radiation scale, Measurement of solar radiation, Solar energy measuring instruments, Pyranometer, Pyrheliometer, Sunshine recorder, Estimation of average solar radiation, Ratio of beam and total radiation on tilted surface of that on horizontal surface.

Unit3 Concentration of solar energy **[7hrs]**
Three types of imaging optics: trough or linear collectors, central receiver with heliostats, and parabolic dish concentrator with on -axis tracking, Solar thermal electricity is using Stirling engine or Ranking engine, Solar photovoltaic with concentration.

Unit4 Solar Thermal systems: **[7hrs]**
Liquid Flat, Plate collector, air heater and concentrating collector, Solar pond, Solar distillation, Solar drying. Thermal storage. Solar Passive Architecture Passive heating and cooling of Buildings. Solar Cooking, Distillation, Desalination, Solar Drying, Solar Chimney.

Unit5 Solar cells: **[8Hrs]**
Formation of a PN–junction, Space charge and internal field, Quasi - Fermi levels, The Shockley diode equation, Structure of a solar cell, The solar cell equation, Fill factor and maximum power, Various electron, hole-pair recombination mechanisms, Crystalline silicon solar cells, Thin film solar cells: CIGS, Cite and silicon - Tandem solar cells, Dye - sensitized solar cells, Organic solar cells. Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping etc., solar PV power plant, Net metering concept.

Unit6 Storage of solar energy: **[8Hrs]**
Types of Energy Storage, Thermal Storage, Simple water and rock bed storage, pressurized water storage system, Electrical Storage, Fundamental concept of batteries, measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries, Chemical Storage, Fuel Cell, History of Fuel cell, Principles of Electrochemical storage, Types, Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis, advantage and drawback of each type, hydro-storage.

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1.	Solar Energy Utilization	2010	Rai, G.D.	Khanna Publishers, N. Delhi
2.	Solar Energy	3rd Edition, 2008	Sukhatme S.P.,	Tata McGraw Hills P Co.
3.	Solar Energy Thermal Process	2007	Duffie, J.A., and Beckman	John Wiley and Sons, NewYork,
4.	The Physics of Solar Cells	2003	Nelson	Imperial College Press
5.	Solar Energy: Principles of Thermal Collection and Storage	3rd Edition, 2008	S Sukhatme and J Nayak	Tata McGraw Hill,

8th Semester

ME1479	Lab. : PE-IV : Solar Energy & Utilization	L=3	T=0	P=0	Credits= 1

Evaluation Scheme	MSPA	ESE	Total	ESE Duration
	40	60	100	2Hrs

List of Experiments

1. Solar Radiation Measurements
2. **Flat Plate Solar Water Heater**
3. **Flat Plate Solar Air Heater**
4. **Flat Plate Collector with Reflector**
5. Parabolic Tube Collector
6. Evacuated Tube Collector
7. **Solar Cookers**
8. Thermal Storage System
9. **Study on Solar Cell Characteristics**
10. **Testing of SPV Standalone Systems**
11. **Testing of SPV system with tracking unit**
12. **Performance Evaluation of SPV**

8th Semester

ME1451	PE V : STRESS ANALYSIS	L=3	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles of stress analysis.[c,e]	(I)The students will able to prepare mathematical model of general stress analysis problem. [c,e] (II)Students will be able to obtain stress distribution using analytical as well as experimental methods. [c,e] (III) Student will be able to design and carry out improvement in exiting design. [c,e]

Unit 1 **[7 hrs]**
Two Dimensional Problems in. Cartesian Coordinate system -Fundamentals of stress & strain, stress-strain relationship, Elastic constant, plane stress, plane strain., differential equation of equilibrium Boundary conditions, Saint Venant's principle, compatibility equation. **[c,e]**

Unit 2 **[7 hrs]**
Airys stress function. Stress analysis of cantilever subjected to concentrated load at its end and simply supported beam subjected to uniformly distributed load.
Two dimensional problems in polar coordinate systems -General equations of equilibrium in polar coordinate compatibility equation. **[c,e]**

Unit 3 **[7 hrs]**
Stress distribution about symmetric. axis, stress analysis of cylinder subjected to ~ internal & external pressure, Pure bending of curved beams, effect of hole on the stress distribution in plates, Stress analysis of rotating circular disk. **[c,e]**

Unit 4 **[8 hrs]**
Introduction to various methods of stress analysis like grid techniques, brittle coating method, Moire fringe method etc.
Two Dimensional Photo elasticity - Introduction to basic optics related to photo elasticity, stress optic law, plane & circular polariscope arrangements, diffusion and lens type polariscope .Effect of stressed model in plane & circular polariscope, Isoclinic & Isochromatics, stress trajectories, calibration of photo elastic material (determination of fringe constant). Various photoelastic materials and their properties, Casting of photo elastic models, Tardy's and other compensation technique. Separation techniques like, shear difference, oblique incidence & electrical analogy. **[c,e]**

Unit 5 **[8 hrs]**
Strain gage technique for stress & strain analysis -Introduction to electrical resistance strain gages, gage . factor, bridge circuit, bridge balance, output voltage of Wheatstone bridge, balancing of bridge, temperature compensation, various bridge configurations, bonding of strain gages to the specimen, determination of principle strains & stresses using strain rosettes. Environmental effects on performance of strain gages, Strain gages response to dynamic strains, Effect of lead wires. Introduction to Strain measurement on rotating components, Static & Dynamic Strain Measurement introduction to semiconductor gages, high temperature strain gages & self-temperature compensated gages. Introduction to Commercial strain indicators. **[c,e]**

Unit 6 **[7 hrs]**
Introduction to fatigue and fracture mechanics. **[c,e]**

8th Semester

ME1451	PE V : STRESS ANALYSIS	L=3	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Theory of Elasticity	2nd edition	Timoshenko S.P;	Tata McGraw-Hill Education, 1951
2	Experimental Stress Analysis	3rd edition	Dally ;Riley	McGraw-Hill, 1991
3	Experimental Stress Analysis	1982	Ray T.K.	S. Chand,
4	Experimental Stress Analysis	1984	Srinath L.S	Tata McGraw-Hill Publishing Company Limited, 1984
5	Vol - I and Vol – II."Theory of photoelasticity	2009	Max Mark Frocht	Pergamon Press, 1969
6	Applied elasicity	--	Chi The Wang	Amazon

8th Semester

ME1452	PE V : Design of Experiments and Taguchi methods	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course. (a,e,l)	(I)Students will be able to develop engineering analysis capability with basic statistical tools and techniques.. [a,e,l] (II) Students will be able to implement different optimization techniques. [a,e,l]

Unit 1 **[7 Hrs]**
Frequency Distribution & Histograms, Probability & its Distribution, Measures of Central Tendency & Distribution, Presentation of Statistical Data. Importance and significance of statistics in an engineering industry.
[**a,e,l]**

Unit 2 **[8 Hrs]**
Confidence intervals, Hypothesis Testing, Correlation, Liner & Multiple Repression Analysis, Signification Testing, Introduction to minitav[**a,e,l]**

Unit 3 **[7 Hrs]**
Full & fractional factorial experiments, analysis of variance, Latin squares, response surface methology, [**a,e,l]**

Unit 4 **[7 Hrs]**
Group Method of Data Handling, shainin variable search technique, Regression equation in matrix form. [**a,e,l]]**

Unit 5 **[8 Hrs]**
Taguchi techniques, concept of six sigma, DoE and six sigma, Six sigma implementation. [**a,e,l]**

Unit 6 **[8 Hrs]**
Industrial application of Taguchi technique, orthogonal arrays, OA selection, DoE with Taguchi and comparison with conventional DoE. [**a,e,l]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Experimental Design	1950	Cochran & Cox	Wiley,
2	Taguchi Techniques in Quality Engineering	2nd edition	Phillip J. Ross	McGraw-Hill, 1996
3	Statistical Analysis for Engineers and Scientist	2010	Barnes	McGraw-Hill, 1994
4	Introduction to Probability and Statistics	4th edition 2003	Milton	McGraw-Hill,
5	Engineering Statistics	2nd edition	Bowker & Liberman	Prentice-Hall, 1972

8th Semester

ME1453	PE V : Value Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To familiarize students with : 1. Philosophy of Value Analysis / Value Engineering , its importance and application 2. The various steps involved in systematic implementation of Value Analysis / Value Engineering **[d,l]**	(I)Students will be able to improve the value of given product/system using Value Analysis / Value Engineering techniques. **[d.l]**

Unit 1 **[7 hrs]**
Introduction to Value Engineering (V.E.) and Value Analysis, Quantitative definition of Value, Use Value and Prestige Value, Estimation of product quality/performance, Types of Functions. **[e, g, l]**

Unit 2 **[7 hrs]**
Life Cycle of a Product, Product life cycle Management, Methodology of V.E., **[f, h, m]**

Unit 3 **[8 hrs]**
Relationship between Use Functions and Esteem Functions in product design, Functional Cost and Functional Worth, Effect of value improvement on profitability, Aims of VE systematic Approach [**c, i, l]**

Unit 4 **[8 hrs]**
Introduction to V.E. Job plan / Functional Approach to Value Improvement, Various phases and techniques of the job plan **[a, j, m]**

Unit 5 **[8 hrs]**
Factors governing project selection, Life Cycle Costing for managing the Total Value, Concepts in LCC, Present Value concept, Annuity concept, Net Present Value, Pay Back period, Internal rate of return on investment (IRR), Examples and illustrations. **[b, k, l]**

Unit 6 **[7 hrs]**
Creative thinking and creative judgment, False material, labor and overhead saving, System Reliability, Reliability elements in series and parallel, Decision matrix, Estimation of weights and efficiencies, Sensitivity analysis, Utility functions, Fast diagramming, Critical path of functions, DARSIRI method of value analysis, Purchase price analysis. **[a, c, d, m]**

Reference Books

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Value Engineering	1962	L.D.Miles	Materials Management International,
2	Getting more at less cost	1995	Jagannathan	Tata McGraw-Hill Publishing Company Limited,
3	Value Engineering		Tufly	
4	Value Engineering	3rd edition	Donald Parker	
5	Value Engineering	4th edition 1984	Zimmerman	City of Tulsa, 1984

8th Semester

ME1454	PE V : Lean Sigma	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES	Course Outcome
• The course aims to develop a broad understanding of Lean/Six Sigma principles. • It focuses on build capability to implement Lean/Six Sigma initiatives in manufacturing as well as service operations will also help the capability to operate with awareness of Lean/Six Sigma at the enterprise level.[a,b,c,d,e,f,h,k,l,m)	(I)The students will able to manage the industrial resources more efficiently.. [a,b,c,d,e,f,h,k,l,m) (II)The students will be able to reduce wastage, cost and at the same time improve efficiency through use of various lean techniques. [a,b,c,d,e,f,h,k,l,m) (III)The students will be able to design, optimise and innovate six sigma.. [a,b,c,d,e,f,h,k,l,m)

UNIT 1 **[8 hrs]**
Business process, Quality management, Need and significance of LS, COQ, COPQ, LS implementation, LS culture, Team roles and function, benefits. **[c, d, f, l]**

UNIT 2 **[8 hrs]**
Six sigma essentials, SS tools, DMAIC methodology, case studies and applications.**[a, b, e, m]**

UNIT 3 **[8 hrs]**
Statistical applications and methods using Minitab Software, cases and problems.**[a, b, k, l]**

UNIT 4 **[7 hrs]**
Process capability, Gage R & R,MSA, ANOVA,HYPOTHESIS testing, DOE, process characterization. **[b, k, l]**

UNIT 5 **[7 hrs]**
Lean manufacturing concepts, Lean means speed, efficiency, waste time and cost reduction.
Lean Tools and Techniques-VSM,7 waste,5S,Kanban,Poka-yoke,Kaizen,TPM,SMED,Pull vs Push, JIT, single piece flow. **[a, c, h]**

UNIT 6
Design for Six Sigma, (DFSS)- need and significance, DMADV methodology, DFSS tools, Product and process optimization, innovations, TRIZ, case studies and applications.**[a, b, k, m]**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
Test Books :				
1	Getting started in Six-sigma		Michel C Thomset	John Wiley and Sons
2	Six Sigma for every one		George Eclees	John Wiley and Sons
3	Transactinal Six sigma nad Lean servicing		Betsi Harris Ehrlich	St.Lucie Press
4	Six sigma for small business		Greg Brue	Ep- Entrepreneur press
5	Six sigma for Quality and productivity promotion	2003	Sung H.	Park Asian Productivity organization

8th Semester

ME1454	PE V : Lean Sigma	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference Books				
1	Six sigma and Beyond- Vol I to VII		D. S Stamalatis	St. lucie Press
2	Demystifying Six Sigma	2003	Alan Lasson	AMCON(American management Association)
3	The Six sigma Way	2003	P.Pande R Nenman & R.Cavanagh	Mc GraHill
4	Lean Production Simplified: A plain- Language Guide to the World's Most powerful Production System	2002	Dennis, Pascal	New York: Productivity Press, ISBN: 1563272628
5	Lean Six sima		Michel L George	Mc GraHill
6	Design for Six Sigma		Kai Yang,Basen El-Haik	Mc GraHill
7	Design for Lean Six sigma			

8th Semester

ME1455	PE V : PRODUCT DESIGN AND DEVELOPMENT	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To understand the Product Life Cycle. Study different design techniques, product development phases, process selection, material selection and costs associated with PDD.[d,l]	**(I) Student will be able to design a new product.[d,l]**
	(II)Student will be able to select proper material..[l]
	(III)Student will be able to select proper manufacturing process [l]
	(IV)Student will be able to Estimate and Decide Cost.[d,l]
	(V) Student will be able to Implement product Development.[d,l]

Unit 1 **[7 hrs]**
Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods. **[d,l]**

Unit 2 **[7 hrs]**
Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart, other constrain effect. **[d,l]**

Unit 3 **[8 hrs]**
Process selection – Impotence types of manufacturing processes and their classification, sources of information, selection criteria, Material and Process selection Methods- Expert systems, Computer Database Approach, Performance indices, decision matrix, AHP and fuzzy approach, introduction to material and process selection software **[d,l]**

Unit 4 **[8 hrs]**
Benchmarking, integrated product design and development, DFM, DFA, DFX, Early supplier involvement, robust design, QFD and concurrent engineering. Introduction to green design. **[d,l]**

Unit 5 **[8 hrs]**
Mathematics of Time Value of Money, Cost Comparison, Depreciation, Taxes, Inflation, Profitability of Investment and Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates. Industrial Engineering Approach, Parametric Approach, Introduction to Assembly Modelling, Top-Down and Bottom-Up Approaches of AM, Mating Conditions, Representation Schemes, Generations of Assembly Sequences **[d,l]**

Unit 6 **[7 hrs]**
Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereolithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations **[d,l]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Fourth Eye (Excellence through Creativity	1992.	KHANDWALLA P.N.;	Wheeler Publishing, Allahabad,
2	Product Design and Manufacturing	4th edition, 2007	A. K. Chitale and R. C. Gupta	PHI Pvt. Ltd., 2002 ,
3	Engineering Design	4th edition 2008	Dieter George E	McGraw Hill Pub. Company

8th Semester

ME1455	PE V : PRODUCT DESIGN AND DEVELOPMENT	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference Books:				
1	Product Design and Development	2003	Ulirich Karl T. and Eppinger Steven D	McGraw Hill Pub. Company
2	Handbook of Product Design for Manufacturing	1986	Bralla, James G.	McGraw Hill Pub. Company
3	I.P.R. Bulletins			TIFAC, New Delhi,
4	Creativity and innovation	2008	Harry Nystrom	John Wiley & Sons, 1979.
5	Managing technological innovation	4th edition	Brain Twiss	Pitman Publishing Ltd
6	New Product Planning		Harry B.Watton	Prentice Hall Inc.
7	Techniques in Reverse engineering and new product development.		Kevin Otto and Kristin wood.	Pearson Education

8th Semester

ME1457	PE V : Power Plant Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
1.To study the basics of power generations systems. 2.To study conventional & non-conventional power plants. 3.To study the combined operations of different power plants. 4.To study Power load analysis & Economic analysis of power generations systems. **[a,c,d,e,h,j,k,l]**	(I) Student will be able to understand the various systems of thermal power plant (Steam and Gas) [a,d,h,j,l]
	(II) Student will be able to understand hydraulic power plants. [a,d.l]
	(III) Student will be able to undertake power load analysis & Economic analysis of power generations systems.[a,c,e,l]
	(IV) Student will be able to understand nuclear power plat and safety aspect.[a,h]
	(V) Student will be able to understand basics of combine cycle and Non conventional power generations systems.[a,d,h,j,l]

Unit 1 **[7 Hrs]**

THERMAL POWER PLANT- I

Introduction to thermal power plants and power plant layouts.
Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling.
Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers, water treatment, Waste Disposal-Present practices, environmental hazards and other social aspects**.** [a,d,h,j,l]

Unit 2 **[8 Hrs]**

THERMAL POWER PLANT- II

Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations
Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout. Comparison with other power plant. Introduction to captive power plant.(To study the practical aspect ot power plant,the visit to nearby power plant shall be arrange for the students) **.** [a,d,h,j,l]

Unit 3 **[7 Hrs]**

HYDROELECTRIC POWER PLANT.

Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve.
Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection, models & model testing, governing.
Comparison with other power plant. **.[** a,d,l]

Unit 4 **[8 Hrs]**

POWER PLANT ECONOMICS

Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load.
Economic Analysis: - Cost of electric energy, load division, and. Tariff methods for Electrical Energy. **[a, c, e, l]**

Unit 5 [8 Hrs]

NUCLEAR POWER PLANT

Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India.
Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor. Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal-Present practices, environmental hazards and other social aspects.
Comparison with other power plant. **.[a, h]**

8th Semester

ME1457	PE V : Power Plant Engineering	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit 6 **[7 Hrs]**

COMBINED OPERATION OF DIFFERENT POWER PLANTS

Combined operation: - Need division, combination of different plant & their coordination, advantages.

NON CONVENTIONAL POWER GENERATION SYSTEMS

Introduction to Non Conventional power Generation Systems

Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant

Global scenario, prominent installations worldwide present & proposed plant locations. **.[a, d, h, j, l]**

.Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Power Plant Engineering	2002	Domkundwar.	Dhanpat Rai & Co.

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Power Plant Engineering	2007	Vopal & Slortzki	
2	Power Plant Engineering	1984	M.M. Wakil	TATA Mc-Graw Hill.
3	Power Plant Engineering	2008	P. K. Nag	TATA Mc-Graw Hill.
4	Power Plant Engineering	2005	R. K. Rajput	TATA Mc-Graw Hill.

8th Semester

ME1458	PE V : Machine Tool Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles. This subject consists of application of scientific principles, technical information & creative thinking for the development of a new or improved machine tools, to perform desired machining operation with maximum efficiency. **[a,e,k,l]**	((I)Students will be able to analyze components of machine tools.. **[a,e,k,l]** (II)Students will be able to design various components of machine tool like machine bed, machine drive and structure etc.. **[a,e,k,l]**

UNIT 1 **[7Hrs]**

Introduction to Machine tool drives & Mechanisms, Working & auxiliary motions in machine tools, Parameters defining the working motions of a machine tool; Machine tool drives, Hydraulic Transmission & its elements, Mecll.'U1ical Transmission & its elements, General requirements of machine tool design, layout of machine tool.**[a, e,k,l]**

UNIT 2 **[8 Hrs]**

Regulation of speed & feed rates - Aim of speed & feed regulation, Stepped regulation of speed -Various laws of stepped regulation, Selection of range ratio, Standard values of Geometric progression Ratio & guidelines for selecting proper value, break up of speed steps; Structure diagrams & their analysis, Speed classification. Design of feed box, machine tool drives using multiple speed motors, Special cases of gear box design -speed box with overlapping speed steps, speed box with a combined structure, speed box Wit11 broken geometric progression, General recommendation for developing the Gearing diagram, determining the Number of teethes of gears, Classification of speed & feed boxes. Electromechanical system of Regulation, Friction, Pressure and Ball Variation, Epicyclic Drive . **[a, e,k,l]**

UNIT 3 [7Hrs]

Machine Tool Structure - Functions of machine tool structures & their requirements, Design criteria for machine tool structU1.es, Materials of machine tool structures, Static &Dynamic stiffness, Profiles of machine tool structures, Factors affecting stiffness of machine tool structures & methods of improving it; Basic design procedure of machine tool structures -design for strength, design for stiffness. Design of Beds, Column, housings, Bases & Tables, Cross Rails, Arms, Saddles, Carriages, Rams. **[a, e,k,l]**

UNIT 4 [8Hrs]

Design of Guide ways & Power Screws - Functions & types of guide ways, Design of Sideways - Shapes, materials, methods of adjusting clearances. Design Criteria & Calculations for sideways, Design for wear resistance, Design for stiffness. Guide ways operating under liquid friction conditions -Hydrodynamic & Hydrostatic sideways, Design of Aerostatic sideways, Design of Antifriction Guide ways, Combination guide ways, protecting devices for sideways.
Design of Power Screws -Sliding friction power screws, Rolling friction Power Screws. **[a, e,k,l]**

UNIT 5 **[7Hrs]**

Design of Spindles & Spindle Supports Functions of spindle unit & requirements, Materials of spindles, design calculations of spindles – Deflection of spindle axis due to bending, deflection of spindle axis due to compliance of spindle supports, optimum spacing between spindle supports deflection due to compliance of the Tapered Joint permissible deflection & design for stiffness. Antifriction bearings -Preloading of antifriction bearing. Sliding bearings - Sleeve bearings, hydrodynamic journal bearing, and air -lubricated bearings**.** [a, e,k,l]

8th Semester

ME1458	PE V : Machine Tool Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT 6 **[8Hrs]**

Testing & Control of Machine Tools

a) Testing: Objects and procedure for Acceptance Test, Instrumentation for acceptance, Accuracy of machine tools, and accuracy of work pieces.

b) Control systems: Electrical control, push button control, directional control relays, electrical brakes, automation in feed mechanism

c) Hydraulic control: positional control, power pack for lubrication system in hydraulic drive.

d) Control system for gear sliding and feed mechanism (open loop or close loop) for NC/CNC machine using stepper motor or DC motor. **[a, e,k,l]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Machine Tool Design	2007	N. K. Mehata	Tata McGraw-Hill, 1984
2	Principles of Machine Tools	2011	Gopal Chandra Sen, Amitabha Bhattacharyya	New central book agency
3	Design Of Machine Tools	5th edition 2008	Basu, Pal	Oxford and IBH Publishing, 2008
4	Principles of Machine tools		Sen and Bhattacharya	New central book agency

8th Semester

ME1459	PE V : INDUSTRIAL SAFETY	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcome
•To understand the need and importance of safety. Study different types of accidents and its preventions. Also study the various safety equipments and their applications.	(I) Student will be able to understand the risk management [**a, c, d, e, f, g, h, i ,j ,k**]
	(II) Student will be able to handle the accidental situation in plant. [**a, c, d, e, f, g, h, i ,j ,k**]
•Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject. [**a, c, d, e, f, g, h, i ,j ,k**]	(III) Student will be able to understand the operations of different type of safety instruments. [**a, c, d, e, f, g, h, i ,j ,k**]
	(IV) Student will be able to arrange the training for employees on Safety. [**a, c, d, e, f, g, h, i ,j ,k**]

Unit 1 **[7Hrs]**

Introduction

Introduction to occupational safety & health, need for occupational safety, Safety Organization, Safety Policy, Safety Committee, Safety Officer, Medical Officer, Labour welfare Officer, Safety manual, Disaster management plan, Government & other autonomous occupational safety & health organizations. Introduction to OHSAS 18000.**[a, c, d, e, f, h]**

Unit 2 **[8Hrs]**

Occupational Accidents

Accident, causes of accident, cost of accident, unsafe conditions, unsafe actions, unsafe personal factors, Accident causations models, accident reporting, accident investigation & analysis, Application of remedial measures, result monitoring, Personal Protective Equipments(ppe), Types of ppe, legal provisions of accident reporting, safety performance measurement, Frequency Rate, Severity Rate, Incidence Rate, Introduction to IS:3786.[**a ,c ,d, f ,g]**

Unit 3 **[7Hrs]**

Risk Identification & Risk management

Plant safety inspection, Job safety analysis, Hazards identification & Risk analysis **(HIRA)**, Fault tree analysis **(FTA)**, Hazards & operability Study **(HAZOP)**, Failure mode & Effect analysis**(FMEA)**, Failure mode, criticality & effect analysis **(FMCEA)**, Safety audits, Safety Integrity Level **(SIL)**, Level of Protection Analysis **(LOPA)**.**[a, d, g,h ,I ,k]**

Unit 4 **[7Hrs]**

Safety & The Law

Introduction to various Laws & Rules pertaining to Safety, Health & Welfare of Indian work-force. Provisions of Factories Acts' 1948 pertaining to Safety only, **[b, c, d, e, g, h]**

Unit 5 **[8Hrs]**

Safety with Machines

Safety in design, Plant layout & housekeeping, Machine maintenance, Machine guarding, types of machine guards, special tools for enhancing safety, safety in use of compressed gas cylinder, safety around grinding wheel, safety in drill machines, safety in use of hand tools, safety in press machines, handling and disposal of hazardous chemicals, electrical safety, fire safety.**[a, c, d, i, j, k,]**

Unit 6 **[7Hrs]**

Safety Training & Awareness

Safety training and safety education, safety awareness methods viz safety competitions, safety posters and hording, safety magazine, safety pamphlets, safety campaign, Tool-Box talk, Employees participation in promoting safety.**[a, c, d, i, j, k]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Industrial Safety	3rd editiion	Roland Patton Blake	Prentice-Hall, 1963
2	Industrial Safety	1977	Jack W. Boley	Gulf Publishing Company, Book Division,

8th Semester

ME1460	**PE V : Advance Welding Techniques**	**L=4**	**T=0**	**P=0**	**Credits=4**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

Objective	**Course Outcome**
To study and analyze various welding methods with advanced techniques to pin engineering materials [c,m]	**1.Student will understand the concept of advance welding processes applicable to industry.[c,m]**
	2.Student can understand the parameters needed for welding to increase the durability of product.[c,m]

Unit 1 **[8 hrs]**
High energy Density Welding processes, Mode of metal transfer in welding, Electron Beam Welding, Principle Bead geometry, Mediums of beam, Vacuum range, Laser Beam welding, Principle, Keyhole technique, applications, Laser materials, Gaseous Lasers..**[c,m]**

Unit 2 **[7 hrs]**
Resistance Welding Methods, Variations in the process, Effect of current, Pressure and resistance on nugget quality, Expulsion of metal, Mushrooming of electrodes, Materials, Direct spot welding, two sides spot welding, multiple spot welding, Shunt current, Electrode material, Seam welding, Projection welding, Butt welding, Flash butt welding, applications. **[c,m]**

Unit 3 **[8 hrs]**
Solid state welding Processes, Friction, Welding, Principle, Variables affecting weld quality, Heat generated, Machines used, Ultrasonic welding, Principle, Comparison with Resistance Spot Welding,Diffusion Bonding., Explosive Welding. **[c,m]**

Unit 4 [7 hrs]
Brazing, Soldering, ,Capillary action, wetting action, joint designs for sheet metal brazements, brazing filler wire, Butt Joint design for sheet metal brazements, brazing methods, filler materials in brazing, Soldering, materials solder combinations, soldering fluxes,
Oxy-fuel welding with chemical reaction . Welding problems and remedies for ferrous and non-ferrous metals. [c,m]

Unit 5 **[8 hrs]**
Cutting:- Arc cutting, Flame cutting, Plasma cutting, Gouging, Plasma cutting with different gases, Comparision with Oxyacetylene cutting, Oxyacetylene cutting, colour codes for cylinder.
Arc welding processes with consumable and non-consumable electrodes**,** Use of Inert Gas, Submerg arc welding. **[c,m]**

Unit 6 **[7 hrs]**
Welding defects, Weldment testing, Destructive and non destructive testing, Coupon, Determination of yield strengths, ultimate strength, visual Inspection, Dye Penetrant test, penetrants and developers, Eddy current testing, Ultrasonic testing, Magnetic particle Inspection , advantages and application of each method.Welding Procedure specifications, Weldor qualification. **[c,m]**

8th Semester

ME1460	PE V : Advance Welding Techniques	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Welding and Welding Technology	2008	Richard Little	McGraw-Hill, 1973
2	Welding	10th edition	A. C. Davies, Davies	Cambridge University Press, 2002
3	Laser Machining and Welding	2007	Rykalin, Uglov, kokora	Pergamon Press, 1978
4	Welding Engineering and Technology	1997	R. S. Parmar	Khanna, 1997
5	Welding Metallurgy	2nd edition 2003	Sindo Kau	John Wiley & Sons, 2003
6	Manufacturing Science		Ghosh and Mallik	Ellis Horwood
7	Manufacturing Technology Vol-I 3E	3rd edition 2009	P.N.Rao	Tata McGraw-Hill Education,

8th Semester

ME1482	PE-V : Air Conditioning	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcome
II)To study about psychrometric properties and change in properties in different psychrometric process. III) To explain about design of year round air conditioning system and duct design IV) To explain the method of cooling load calculation for human comfort .	COI- student will be able to understand various psychrometric properties COII- student will be able to understand and change in psychometric properties in the process.[a,e,k] COIII- student will be able to student will be able to design year round air conditioning system.[a,e,k] COIV- student will be able to find out cooling load calculation and understand different parameters for human comfort..[a,e,k] COV- student will be able to understand industrial practices in air conditioning.[a,e,k] COVI- student will be able to understand air distribution and duct design system..[a,e,k]

UNIT I Fundamentals of Air conditioning
Introduction to air conditioning, psychometrics, important terms and definitions, enthalpy of air, adiabatic saturation ,temperature, psychrometric properties, psychometric chart, its construction and use. [a,e,k]

UNIT II Psychometric processes
Sensible heating and cooling, humidification and dehumidification, adiabatic mixing, bypass factor, evaporative cooling, drying process, air-washer.[a,e,k]

UNIT III Air-conditioning systems
Sensible heat factor, design of summer air conditioning system, calculation of dehumidified air quantity and apparatus dew point, ERSHF method, air-conditioning systems for monsoon and winter, air conditioning systems using all fresh air. **[a,e,k]**

UNIT IV Comfort and Cooling load Estimation
Comfort and its requirements, mechanism of body heat loss, effect of heat on body and body defence mechanism, effective temperature, comfort chart and its use, factors affecting human comfort, Cooling load estimation, components of cooling load, sensible and latent loads, ASHRAE methods of load estimation. Cold storage heat load calculation **[a,e,k]**

UNIT V Industrial practices in Air conditioning
General layout of central air conditioning Plant, , selection of pump.
Fans, types and characteristics, filters types and selection, defrosting methods Systems .Applications of air conditioning, working of room air-conditioning and split air-conditioning and package air conditioning. **[a,e,k]**

UNIT VI Air Distribution and duct design
Components of air handling systems, principles of air distribution, types of supply and return air openings and related definitions, consideration s for selection and location of supply and return air openings. Duct design: General duct design rules, equivalent diameter of ducts ducting materials, friction chart and its use, methods of duct design. Visit to central air conditioning unit, frozen food processing unit. **[a,e,k]**

8th Semester

ME1482	PE-V : Air Conditioning	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Recommended Books:

1. Dossat Roy J.; Principles of Refrigeration, 4th Ed.; Pearson Education Asia Publication
2. Arora C.P.; Refrigeration and Air conditioning, 2nd Ed.; Tata Mc Graw Hill Publication
3. Ballaney P.L.; Refrigeration and Air conditioning; Khanna publishers
4. Prasad Manohar; Refrigeration and Air conditioning, 2nd Ed.; New edge Publication
5. Arora, Domkundwar; A course in Ref. &Air Conditioning, 7th Ed.; Dhanpat Rai Publications.
7. Pita Edward G.; Air conditioning principles and systems, 4th Ed.; Prentice Hall
8. ASHRAE handbook and CARRIER hand book.

8th Semester

ME1483	PE V: Cryogenic Systems	L=4	T=0	P=0	Credit=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcome
	After learning the course the students should be able to: Properties of material at low temperature. Pressure, temperature, flow, fluid quality and liquid level measurement at low temperature. Different types of cryogenic insulations. Different cryogenic applications. Low temperature hazards. After learning the course the students should be able to know about different methods of producing cryogenic temperature, types of cryocoolers, Liquefaction of gases.

Unit I: - Introduction to Cryogenics System
Introduction, application areas of cryogenic engineering, Low temperature properties of engineering materials, Properties of cryogenic fluid.

Unit II: - Gas liquefaction System
Open and closed cycles, liquefaction system such as Linde Hampson, Claude cycle for liquefaction, liquefaction system for hydrogen and helium and other gases, Simulation of performance of different liquefaction cycles.

Unit III: - Gas Cycle Cryogenic Refrigeration System
Cryogenic Refrigerators – Recuperative and Regenerative cycles, Microminiature and miniature cryocoolers for space and defence applications.

Unit IV: - Gas Separation and Gas Purification Systems
Design criteria for equipment associated with low temperature systems – heat exchangers, compressors, expanders, Separation and purification systems, and commercial air separation cycles.

Unit V: - Cryogenic Fluid Storage and Transfer Systems
Cryogenic fluid storage vessels, Inner vessel, Outer Insulation, Suspension system, Cryogenic fluid transfer, External pressurization, Self pressurization, Transfer pump. Industrial Safety and handling of cryogens.

Unit VI: - Application of Cryogenic Systems
Cryogenic application for food preservation – Instant Quick Freezing techniques, Super conductive devices, Cryogenic applications for space technology.

References:-

1. Randall F. Barron, "Cryogenics Systems", Second Edition Oxford University Press New York, Clarendon Press, Oxford, 1985.
2. Timmerhaus, Flynn, "Cryogenics Process Engineering", Plenum Press, New York.
3. Cryogenics fundamentals, HaseldonG, Academic press.1971
4. Advance cryogenic –bailey, plenum press

8th Semester

ME1484	**Tribology**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives
Tribology deals with design of fluid containment systems like seals and gasket, Lubrication of surfaces in relative motion to achieve reduced friction and wear. The structure of the bearing and the nature of fluid flow determine the loads that can be supported. Modeling systems as hydrostatic squeeze film and Elasto-hydrodynamic lubrication will be studied as infinite and later finite structures. Gas (air) lubricated and rolling contact type motions with deformation at contact will be studied as special systems.

UNIT-1: Introduction
Introduction to tribology, History of tribology, Interdisciplinary Approach, Economic Benefits.

UNIT-2: Friction
Causes of Friction, Adhesion Theory, Abrasive Theory, Junction Growth Theory, Laws of Rolling Friction, Friction Instability.

UNIT-3: Wear
Wear Mechanisms, Adhesive Wear, Abrasive Wear, Corrosive Wear, Fretting Wear, Wear Analysis

UNIT-4: Lubrication and Lubricants
Importance of Lubrication, Boundary Lubrication , Mixed Lubrication , Full Fluid Film Lubrication ; Hydrodynamic, Elastohydrodynamic lubrication , Types & Properties of Lubricants, Lubricants Additives.

UNIT-5: Fluid film lubrication
Fluid mechanics concepts, Equation of Continuity & Motion, Generalised Reynolds Equation with Compressible & Incompressible Lubricants.

UNIT-6: Application Tribology
Introduction, Rolling Contact Bearings, Gears, Journal Bearings - Finite Bearings.

Reference Books:

1. Dowson D, History of Tribology, Longman London, 1979.
2. Stachowiak G N, Batchelor A W and Stachowick G B "Experimental methods in Tribology", Tribology Series 44, Editor D Dowson, 2004.
3. Michael M Khonsari, Applied Tribology (Bearing Design and Lubrication),John Wiley & Sons, 2001.
4. Jost H P, Lubrication (Tribology) : A Report on the present position and industry`s needs, Her Majesty`s Stationary Office, London, 1966.
5. J Halling, Principles of Tribology, The Macmillan Press Ltd, London, 1975.
6. Archard J F and Hirst W, The Wear of Metals under Unlubricated Conditions, Proc. R. Soc., London, A 236, 397-410, 1956.
7. Ludema K C, Friction, Wear, Lubrication: A textbook in Tribology, CRC Press, 2010.

8th Semester

ME1472	Comprehension Viva Voce	L=0	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	External Evaluation

Objective	Course Outcome
To equip the students with the thorough knowledge of the Mechanical Engineering branch. Through knowledge of each and every subject learnt till date. This will be helpful for preparations of competitive examinations and campus interviews.[i]	(I)The student will able to give good performance in competitive examinations. [i]
	(II) The student will able to give good performance in campus recruitments. [i]

COMP. VIVA VOCE

The viva voce will be on complete syllabus learnt during the period of 4 years for completion of studies to obtain the degree of Mechanical Engineering.

8th Semester

ME1473	PROJECT – Phase-II	L=0	T=0	P=8	Credits=8

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	External Evaluation

Objective	Course Outcome
The project topic for the batch is decided in the 1st semester of final year, the student shall carry out the project work further 2nd semester of final year. [d,e,g,j,k,l]	(I)The student will able to understand various facets of engineering problems..**[d]**
	(II)The student will able to communicate his ideas with others **[g]**
	(III)The student will able to identify various solutions of engineering problems. **[e]**
	(IV)The student will able to understand the need to update knowledge. **[j]**
	(V)The student will able to use latest techniques to find solutions. **[k,l]**

S.No	Rubrix
I	Objective and literature survey
II	Innovativeness,Presentation and reasoning skill
III	Working & fabrication,experinentation
IV	Presentation of result and discussion
V	Paper presentation

Evaluation : The term work will be assessed by the project guide. The students will be examined by the external examiner and the project guide. Marks will be allotted on the basis of work done and performance in the examination.

8th Semester

ME1474	EXTRA CURRICULUR ACTIVITIES	L=0	T=0	P=0	Credits=2

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	100	0	100	Internal Evaluation

Objective	Course Outcome
To develop the personality of student, nurture his talent and help him to achieve the goals. **To inculcates the some responsibility towards society in general.** **To communicate and develop the team work ability.[f,g,i]**	(I)The student will be able to develop his hobbies and interests..[i] (II)The student will be able to communicate and work in team..[g] (III)The student will be able to develop the sense of responsibility..[f]

EXTRA CURRICULUR ACTIVITIES

Every student has to participate in at least two extra-curricular activities from Second year. The certificate of these activities to be submitted to the related Coordinator/head of the department.
The credit for these activities shall be given in 8th semester.

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2014

3 to 8 Semester

Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

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B.E. SCHEME OF EXAMINATION 2014

Electrical Engineering

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE-I	MSE-II	TA	ESE	
Third Semester												
1	GE1201	Engineering Mathematics - III	3	1	0	4	4	15	15	10	60	3
2	EE1215	Analog Electronics	3	0	0	3	3	15	15	10	60	3
3	EE1216	**Lab:** Analog Electronics	0	0	2	2	1			40	60	
4	EL1201	Network Analysis	3	1	0	4	4	15	15	10	60	3
5	EL1202	**Lab:** Network Analysis	0	0	2	2	1			40	60	
6	EL1203	Electrical Machines-I	3	1	0	4	4	15	15	10	60	3
7	EL1204	**Lab:** Electrical Machines-I	0	0	2	2	1			40	60	
8	EL1205	Electrical Measurement & Instrumentation	3	0	0	3	3	15	15	10	60	3
9	EL1206	**Lab:** Electrical Measurement & Instrumentation	0	0	2	2	1			40	60	
		TOTAL	**15**	**3**	**8**	**26**	**22**					
FourthSemester												
1	GE1204	Advance Mathematical Techniques	3	1	0	4	4	15	15	10	60	3
2	EL1207	Electrical Machines-II	3	1	0	4	4	15	15	10	60	3
3	EL1208	**Lab:** Electrical Machines-II	0	0	2	2	1			40	60	
4	EL1209	Signals & Systems	3	0	0	3	3	15	15	10	60	3
5	EL1211	Electrical Machine Design	3	1	0	4	4	15	15	10	60	3
6	EL1213	Electric and Magnetic Fields	3	1	0	4	4	15	15	10	60	3
7	EL1210	**Lab:** MATLAB Programming	0	0	2	2	1			40	60	
8	EL1212	**Lab:** Electrical Engg. Workshop	0	0	2	2	1			40	60	
		TOTAL	**15**	**4**	**6**	**25**	**22**					

Chairperson	**Dean (Acad. Matters)**	**1.00**	**May 2015**	**Applicable for AY 2015-16 Onwards**
		Version	**Date of Release**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Electrical Engineering

Sl.No.	Sub Code	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE- I	MSE- II	TA	ESE	
FIFTH SEMESTER												
1	GE1312	Fundamental of Economics	3	0	0	3	3	15	15	10	60	3 Hrs
2	EL1301	Electrical Power System - I	3	1	0	4	4	15	15	10	60	3 Hrs
3	EL1302	Power Electronics	3	1	0	4	4	15	15	10	60	3 Hrs
4	EL1303	**Lab. :** Power Electronics	0	0	2	2	1			40	60	
5	EL1304	Power Station Practice	3	0	0	3	3	15	15	10	60	3 Hrs
6	**Open Elective I**		3	0	0	3	3	15	15	10	60	3 Hrs
	EL1316	OE I : Renewable Energy Generation Systems										
	EL1320	OE I :Electrical Machines and their applications										
	EL1321	OE I : Testing and Maintenance of Electrical Equipments										
7	ET1329	Microprocessors	4	0	0	4	4	15	15	10	60	3 Hrs
8	ET1330	**Lab. :** Microprocessors	0	0	2	2	1			40	60	
9	EL1318	**Lab. :** Electronics Engineering Workshop	0	0	2	2	1					
TOTAL			**19**	**2**	**6**	**27**	**24**					

SIXTH SEMESTER

1	GE1311	Fundamental of Management	3	0	0	3	3	15	15	10	60	3 Hrs
2	EL1306	Control System	3	1	0	4	4					
3	EL1307	**Lab.:** Control System	0	0	2	2	1					
4	EL1308	Electrical Power System-II	3	1	0	4	4	15	15	10	60	3 Hrs
5	EL1309	Electrical Drives	4	0	0	4	4	15	15	10	60	3 Hrs
6	EL1310	**Lab.:** Electrical Drives	0	0	2	2	1			40	60	
7	**Prof. Elective I**		3	0	0	3	3	15	15	10	60	3 Hrs
	EL1311	PE-I: Advanced Power Electronics										
	EL1322	PE-I: Optimization Techniques										
	EL1323	PE-I: Electrical Installation										
8	**Open Elective II**		3	0	0	3	3	15	15	10	60	3 Hrs
	EL1324	OE II:Electrical Energy Audit and Safety										
	EL1325	OE II:Utilisation of Electrical Energy										
	EL1326	OE II Power System Engineering.										
9	EL1312	Lab. : Simulation in Power Electronics & Drives	0	0	2	2	1			40	60	
10	EL1319	Seminar	0	0	2	2	1			100		
TOTAL			**19**	**2**	**8**	**29**	**25**					

Chairperson	**Version**	**1.00**	**Applicable for AY 2016-17 Onwards**
Dean (Acad. Matters)	**Date of Release**	**May 2016**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Electrical Engineering

Sl.No.	Sub Code	Subject	CONTACT HOURS				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE- I	MSE- II	TA	ESE	
SEVENTH SEMESTER												
1	EL1401	High Voltage Engineering	3	0	0	3	3	15	15	10	60	3 Hrs
2	EL1402	**Lab. :** High Voltage Engineering	0	0	2	2	1			40	60	
3	EL1403	Computer Applications in Electrical Engg	3	1	0	4	4	15	15	10	60	3 Hrs
4	EL1404	**Lab.:** Computer Applications in Electrical Engg	0	0	2	2	1			40	60	
5	**Prof. Elective II**		3	0	0	3	3	15	15	10	60	3 Hrs
	EL1410	PE II: FACTS Devices										
	EL1427	PE II:Artificial Intelligence based Systems										
	EL1431	PE II:Advanced Control System										
6	EL1432	Electrical Distribution Power System	3	0	0	3	3	15	15	10	60	3 Hrs
7	EL1405	**Lab.:** Simulations in Power System	0	0	2	2	1			40	60	
8	EL1406	Industrial Training / CRT	0	0	0	0	2			100		
9	EL1407	Project Phase I	0	0	4	4	4			40	60	
		TOTAL	**12**	**1**	**10**	**23**	**22**					

EIGHTH SEMESTER												
1	EL1416	Switchgear and Protection	3	0	0	3	3	15	15	10	60	
2	EL1433	Renewable Energy Sources	3	0	0	3	3	15	15	10	60	
3	EL1434	**Lab. :**Renewable Energy Sources	0	0	2	2	1			40	60	
4	**Prof. Elective III**		3	0	0	3	3	15	15	10	60	
	EL1411	PE III : Advanced Electrical Drives										
	EL1422	PE III : Power System Operation and Control										
	EL1435	PE III : Fundamentals of Power Quality										
5	**Prof. Elective IV**		3	0	0	3	3	15	15	10	60	
	EL1424	PE IV : EHVAC-HVDC Transmission										
	EL1425	PE IV : Electrical Power Utilization										
	EL1436	PE IV : Fundamentals of Smart Grid										
6	EL1417	**Lab.:** Switchgear and Protection	0	0	2	2	1			40	60	
7	EL1418	**Lab.:** Substation Design	0	0	4	4	2			40	60	
8	EL1419	**Lab.:** Comprehensive Viva-voce	0	0	0	0	3				100	
9	EL1430	Extra Curricular Activities / Competitive Exam.	0	0	0	0	2			100		
10	EL1420	Project Phase II	0	0	8	8	8			40	60	
		TOTAL	**12**	**0**	**16**	28	**29**					

Chairperson	**Version**	**1.00**	**Applicable for AY 2016-17 Onwards**
Dean (Acad. Matters)	**Date of Release**	**May 2016**	

3rd Semester

GE 1201	Engineering Mathematics-III			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Objective	Outcome
The aim of this paper is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	• Analyze and solve problems for basic DC circuit including series and parallel circuit. • Basic concept of AC fundamental,phasor diagram ,RLC series and parallel circuit. • Three phase balanced circuit and different types of measuring instruments. • Construction,principle,equivalent circuit and calculation of efficiency and regulation for single phase transformer. • Constructional details,principle,characteristics,speed control methods of DC machine. • Construction, principle ,torque-slip characteristics and applications of 3 phase and single phase induction motor.
Mapped program outcomes: a,c	

UNIT-1: : Finite Differences (a,e) [8 hrs]
Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform (a,e) [7 hrs]
Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform (a,e) [8 hrs]
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 : Matrices (a,e) [9 hrs]
Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigen vectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation (a,e,h) [8 hrs]
Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.
Partial Differential Equations – PDE of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

UNIT-6 : Fourier Transform (a,h) [6 hrs]
Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.

3rd Semester

GE 1201	Engineering Mathematics-III			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Text books:

1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference books:

1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill.
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan

3rd Semester

EE1215	Analog Electronics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
After taking this course, the student should be able to analyze, simulate, and design single and multistage amplifiers. Design of single, multistage, and op-amp amplifier are covered in detail including analysis of biasing techniques, frequency response compensation, feedback, stability, noise, and nonlinearity	The student will be able to understand the 1) Theory of operation of BJT, its characteristics and its application as switch. 2) Small signal parameters of BJT and its applications. 3) Classification of power amplifier along with different types of feedback and applications. 4) Working and mathematical analysis of oscillator using BJT. 5) Introduction to operational amplifier, its operation and Butterworth filter. 6) Applications of operational amplifiers

Mapped Program Outcomes	a	b	c

UNIT-1: Bipolar Junction Transistors (BJT)
BJT, Theory of operation, characteristics, Biasing arrangements (CB, CE, CC modes), operating modes , Stability factor, Transistor as a switch.

UNIT-2:: Small Signal Analysis
Small signal analysis of CE, CB, CCmodes and their comparison, AC equivalent circuit, transistor equivalent circuit-CE, Hybrid equivalent model, Analysis of a transistor using h-parameter, emitter follower, RC coupled amplifier, low frequency response of an RC coupled stage

UNIT-3 :Power & Feedback Amplifier
Introduction to Power Transistors, Power amplifiers- classification as A,B, AB, C, Push pull amplifiers, Cross over distortion, Positive and Negative amplifiers- classification, feedback amplifiers, advantages and applications.

UNIT-4:Oscillator Circuits
Basic principle of sinusoidal oscillator, R-C Phase Shift and Wein Bridge oscillators, Tuned oscillators- Collpits and Hartley; Crystal oscillator

UNIT-5 : Operational Amplifier (OA)
Simple linear circuit: Inverting, non-inverting , buffer amplifier, summer integrator , differentiator, log, antilog, Multiplier, instrumentation amplifier, grounding and shielding problem in instrumentation amplifier. Precision rectifier, RMS to DC conversion, constant current and voltage sources, Sinusoidal oscillator with frequency and amplitude stabilization elementary , idea of active filter with Butterworth second order filter design procedure.

UNIT-6: Applications of Operational Amplifier
Applications of Operational amplifier for clipping, clamping, comparator circuit with non-linear components, Multiplexers, Demultiplexer, Astable, Mononstable, Bistablemultivibrator circuits using OpAmp, sample/ hold circuits, D/A and A/D conversion circuits.

Text books:

1	Electronic Principles,	A.P. Malvino,	Tata Mcgraw Hill Publications
2	Electronics : Analog & Digital	I. J. Nagrath	PHI Publication
3	Linear Application Handbook	National Semiconductors	
4	Operational Amplifiers	Dailey	Tata McGraw Hill
5	Introduction to Operational Amp	Wait	Tata McGraw Hill
6	Designing with Op- Amps	France	Tata McGraw Hill

Reference books:

1	Electronic devices and circuits	Jacob Millman, and C.C. Halkias	TMH Publications
2	Introduction to Semiconductor Materials and Devices	M. S. Tyagi	John Wiley & Sons Inc
3	Solid State Electronic Devices	Ben G. Streetman,	PHI, 5th Ed, 2001

3rd Semester

EE1216	Lab. : Analog Electronics	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

Course Objective	Course Outcome
	The student will be able to: 1. Understand different operation modes of BJT 2. Understand Small signal analysis of transistor 3. Understand the power and FDBR amplifier application 4. Understand various oscillator circuit 5. Understand various application of Operational Amplifier.

Mapped program outcomes	a	b	c	d

Practical based on above syllabus and may contain following experiments.

1) Transistor operating characteristics
2) Transistor as an amplifier in CB mode
3) Transistor as an amplifier in CE mode
4) To study the working of oscillators
5) Study of OPAMP 741 characteristics.
6) Study of OPAMP as inverting & non-inverting amplifier.
7) Study of OPAMP as integrator & differentiator.
8) Study of OPAMP as active filter.
9) Study of OPAMP as comparator.
10) Study of IC 555 as astablemultivibrator.

3rd Semester

EL1201	Network Analysis	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn: • the fundamental principles of electrical circuit analysis and to be able to extend these principles into a way of thinking for problem solving in mathematics, science, and engineering • to become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the mesh - node method. • to appreciate the consequences of linearity, in particular the principle of superposition and Thevenin - Norton equivalent circuits. • to analyze analog circuits that include energy storage elements. • to utilize Laplace transforms for circuit analysis. • to analyze four terminal networks using two-port parameters.	Upon successful completion of this course, students should be able to: 1) analyze electrical circuits including on nodal and mesh basis. 2) apply a variety of network theorems to analyze and design electrical circuits. 3) evaluate the initial and final values of current and voltage of electric circuits containing energy storage elements. 4) apply the mathematical knowledge of Laplace transforms to analyze first and second order AC and DC circuits for its steady-state and transient response. 5) synthesize a complex waveform using standard functions such as step, ramp etc. Be able to determine the time response of a circuit excited by such a complex waveform. 6) characterize the transfer function of a circuit in terms of its critical frequencies. Be able to determine the time response from pole zero plot. 7) characterize two – port networks by two-port parameters.

Mapped Program Outcomes	a	b	e	i	k	L	m

UNIT-1: Nodal Analysis of Electric Circuits

Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources - their types and characteristics, concept of equivalent sources, source transformation, concept of supernode and V – shift, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-2: : Mesh Analysis of Electric Circuits

Concept of supermesh and I – shift, mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-3 :Network Theorem

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

UNIT-4: Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform

Concept of initial and final conditions, behavior of resistor, inductor and capacitor at t = 0- and at t = 0+, procedure for evaluating initial and final conditions, analytical treatment.

Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform.

3rd Semester

EL1201	Network Analysis	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-5 : Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions

Unit step, ramp and impulse functions with and without time delay, their Laplace transform, waveform synthesis and its application to electrical networks.

Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions, time domain behavior from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-6: Two Port Parameters

Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, conditions for reciprocity and electrical symmetry in terms of two – port parameters, interconnections of two - port networks.

Text books:

1	Network Analysis	3rd Edition	M. E. Van Valkenburg	PHI Learning Private Limited
2	Engineering Circuit Analysis	8th Edition	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin	McGraw – Hill
3	Linear Circuit Analysis	2nd Edition	Decarlo, Lin	Oxford Univ. Press

Reference books:

1	Schaum's 3000 Solved Problems In Electric Circuits Book 1 & 2	1st Edition	Syed A. Nasar	McGraw - Hill
2	Schaum's Outline Series: Theory and Problems of Electric Circuits	5th Edition	Joseph A. Edminister	McGraw - Hill
3	Basic Circuit Theory	3rd Edition	Lawrence P. Huelsman	PHI Learning Private Limited

3rd Semester

EL1202	Network Analysis	L= 0	T=0	P=2	Credits=1

Evaluation Scheme	TA	ESE	Total	ESE Duration
	40	60	100	----

Minimum Eight Practical are to be performed from the following list.

1. Verification of Superposition Theorem.
2. Verification of Thevenin's Theorem.
3. Verification of Norton's Theorem.
4. Verification of Maximum Power Transfer Theorem.
5. Verification of Reciprocity Theorem.
6. Verification of compensation Theorem.
7. Determination of Transfer function of Two port network.
8. Determination of Z & Y parameters of Two port Network.
9. Study of interconnection of Two port network.
10. Study of three phase three wire star connected unbalanced load.
11. Mesh analysis of electric circuits using PSPICE.
12. Nodal analysis of electric circuits using PSPICE.

3rd Semester

EL1203	Electrical Machines -I	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
The course objective is to impart knowledge of • The basic principle of transfer of electrical power, operation, construction of 3-phase transformers, their classification, connections and phasor diagrams. • The basic principle, construction, operation, performance characteristics, steady state analysis and applications of electrical motors and induction generator.	1. Operation with and without load, evaluation of performance indices of single phase transformer and operation of auto-transformer 2. Construction, vector grouping, testing and parallel operation of three phase transformers 3. Principle, construction, types, operation of DC machines, torque development, characteristics, starting, speed control, performance and applications of d.c.motors 4. Principle, construction, operation, equivalent circuit, testing, evaluation of performance, starting and speed control of three phase induction motors. 5. Principle, operation and applications of double cage induction motors and induction generators. 6. Double revolving field theory, operation, characteristics, types, equivalent circuit of single phase induction motor..

PO	a	b	c	d	f	g	h	j

UNIT-1: SINGLE PHASE TRANSFORMER
Phasor diagram of transformer on no load and on load, Open circuit and short circuit test on 1 phase transformer, equivalent circuit of transformer, Efficiency and condition for maximum efficiency, Regulation and Efficiency using O.C. & S.C. data, Autotransformer operation, copper saving, kVA rating of autotransformer.

UNIT-2: THREE PHASE TRANSFORMER
Types of 3 phase transformers, Construction, Labeling of terminals, Vector Groups, Polarity marking & Test, O.C. and S.C test , parallel operation, All day efficiency.

UNIT-3 D.C. GENERATOR:
Characteristics and applications of different types of D.C. Generators, Building of Emf in D.C. Shunt generator, Armature reaction, cross and demagnetizing armature reactions, remedies to overcome armature reaction, commutation, straight line commutation, inter-poles, compensating winding.

UNIT-4:D.C. MOTOR:
Characteristics and applications of various types of D.C. Motors, Starting of D.C. Motors, Speed control of Series and Shunt motors, Losses and Efficiency in D.C. Motors, Condition for maximum efficiency.

UNIT-5 THREE PHASE INDUCTION MOTOR
Equivalent circuit, No load and blocked rotor tests and determination of parameters of equivalent circuit, concept of circle diagram, Losses and efficiency. Starting, Speed control, Crawling and cogging

3rd Semester

EL1203	Electrical Machines -I	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6:THREE PHASE INDUCTION MOTOR (Contd.)

Double cage induction motor: principle, construction, torque slip characteristics. Induction Generator: principle, isolated operation, double fed induction generator, applications.

SINGLE PHASE INDUCTION MOTOR

Double field revolving theory, Split phase principle, Capacitor start and capacitor start and run motors, shaded pole motor, Equivalent circuit, O.C. & S.C. Tests on 1 phase induction motors

.

Text books:

1	Electrical Machines	**2nd -1993**	Dr. P. K. Mukherjee and S. Chakravarti	Dhanpat Rai Publications (P) Ltd
2	Electrical Machines	**3rd -2010**	I.J.Nagrath and Dr. D.P.Kothari	Tata McGraw Hill
3	Electric Machines		Ashfaq Husain	Dhanpat Rai Publications (P) Ltd.

Reference books:

1	D.C.Machines	Langsdorf	
2	Electrical Machines and Transformers	Nasser Syed	
3	Laboratory manual for Electrical machines	Dr. D.P. Kothari and Prof. B.S. Umre	S.CHAND

3rd Semester

EL1204	Electrical Machines – I	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

Course Objective	Course Outcome
•	The student will be able to understand the 1. Circuit connections, selections of measuring instruments ans thir position in the circuit to determine the circuit quantities 2. Evaluation of performance indices, equivalent circuit parameters and variation of the performance on loading of single phase and three phase transformance, induction motors and DC shunt motors 3. Magnetizing characteristics of the DC Generator, Critical Field resistance and speed of the machine 4. Various methods of speed control of DC shunt motor and three phase wound rotor induction motor

Mapped program outcomes	a	b	c	f	g	h	j

Minimum Eight Practical are to be performed out of the following :-

Sr. No.	Name of Experiments
1	To perform load test on 1-phase transformer to determine its efficiency and voltage regulation.
2	To perform Open Circuit and Short Circuit tests on a 1-phase transformer to evaluate efficiency and voltage regulation.
3	To perform back to back test on two identical 1-phase transformers.
4	To study conversion of a 2-winding transformer into an autotransformer.
5	To study phasing out and polarity marking of a 3-phase transformer.
6	To study voltage and current relations in a 3-phase, Delta-Star connected transformer.
7	To perform Open Circuit and Short Circuit test on a 3-phase transformer.
8	To plot magnetization characteristic of a DC generator.
9	To study speed control of a DC shunt motor by varying -- (a) field excitation and (b) armature voltage
10	To perform load test on a DC shunt motor.
11	To study measurement of slip of a 3-phase induction motor by different method.
12	To study control of a 3-phase slip-ring induction motor by -- (a) variation of a rotor resistance and (b) varying supply voltage
13	To perform load test on a 3-phase induction motor by indirect loading.
14	To perform load test on a 3-phase induction motor by direct loading.
15	To perform No-Load and Blocked rotor tests on a 3-phase induction motor.
16	To perform No-Load and Blocked rotor tests on a 1-phase induction motor.
17	To study Induction generator operation.

3rd Semester

EL1205	Electrical Measurement & Instrumentation	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
Students will be able to understand the operation of different electrical instrument used for measurement of electrical and non-electrical parameters and measurement of resistance, inductance or capacitance using various bridges. CT and PT applications.	The student will be able to understand 1. Basic knowledge of electrical measurement and measurement of low medium and high resistance, principle and application of DC and AC of resistances. 2. Different measuring instruments and methods of measurement of inductance and capacitance. 3. Methods of measurement of active and reactive power and energy. 4. Concept of different transducers and sensors. 5. Different methods of measurement of pressure and temperature. 6. Methods of measurement of static and dynamic characteristics of instrument for nonelectrical quantities like strain, force, torque, acceleration, flow and Generalized theory of instrument transformer. .

Objectives: To study measuring instruments and instrumentation techniques.

Mapped Program Outcomes	a	c	d	h	j

UNIT-1:MEASURING INSTRUMENTS
Units and Standards, Necessity of electrical measurements, Loading effect of instruments.
Measurement of Resistance - Classification, measurement of low (Ammeter-Voltmeter method & Kelvin's double bridge method), medium (wheatstone bridge & substitution method) and high resistances (loss of charge method and megger).
Earth resistance - earth tester.
A.C. potentiometer - Principle and application.

UNIT-2:MEASUREMENT OF INDUCTANCE AND CAPACITANCE
General theory of AC bridges and phasor diagrams , sources and detectors for AC bridges, Study of Maxwell, Hay's, Wein, Schering bridges.

UNIT-3 :MEASUREMENT OF POWER AND ENERGY
Measurement of active and reactive power in polyphase circuits using dynamometer type instrument, Effect of power factor on wattmeter reading.
Measurement of Energy in single and polyphase circuits using induction type integrating instruments, Errors in power and energy measurements, testing of energy meter, Digital Energy meter.

UNIT-4: Generalized Instrumentation, Transducers and Sensors
Generalized instrumentation system, Characteristic of measurement system.
Transducer: Definition, Classification, Specification, Displacement, velocity, torque Transducer, Resistive, Inductive, Capacitive Transducer , Piezoelectric Transducer.

UNIT-5 :Measurement of pressure and temperature
Types of **pressure and Force** measurement device, Elastic members (Bellow, Bourdone tube, diaphagram), low pressure measurement (Pirani gauge)
Temperature measurement : Introduction to Resistance Temperature Detector (RTD) ,Thermistor (Construction, resistance – temp characteristics) application , Thermocouple : Principle of operation and its application

3rd Semester

EL1205	Electrical Measurement & Instrumentation	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6: Instrumentation in Industry

Industrial instrumentation - Introduction to industrial instrumentation, Static & Dynamic Characteristics of instruments, Introduction to measurement Strain, Acceleration & Flow.

Instrument transformers –Generalized theory of C.T. & P.T, Derivation of formulae for C.T., Errors in current Transformers.

Text books:

1	Electrical Measurements and Measuring Instruments	**7th -2008**	A.K. Sawhney	DhanpatRai Publications (P) Ltd
2	Measurement Systems, Applications and design		E. O. Deoblin	
3	Electronic Instrumentation for Engineering Measurement	**1987**	W. D. Cooper	**PHI**
4	Instrumentation Devices and Systems	**1992**	Rangan	**TMH**
5	Instrumentation	1991	NakraChoudhary.	**TMH**

Reference books:

1	A course in Electrical & Electronics Measurement and Instrumentation	**7th -2008**	A.K Sawhney	DhanpatRai Publications (P) Ltd
2	Electrical measurements		Rajendra Prasad	

3rd Semester

EL1206	Electrical Measurement & Instrumentation	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

Course Objective	Course Outcome
	The student will be able to understand 1) Measure resistance, capacitance, and inductance using AC and DC bridges 2) Calibrate single phase energy meter 3) Determined the characteristics of RTD,themistor,pressure and transducer 4) Measure the active and reactive power using different types of method

Mapped program outcomes	a	b	d	j

Minimum Eight Practical are to be performed out of the following:-

1. To measure high resistance using loss of charge method.
2. To measure low resistance using Kelvins' double bridge.
3. To measure inductance using Maxwell's inductance capacitance bridge.
4. To measure inductance using Anderson's bridge.
5. To measure three phase power using two wattmeter method.
6. To measure electrical energy using electromechanical energy meter.
7. Determination of self inductance using Owen's bridge.
8. Testing of single phase induction type energy meter.
9. Measurement of reactive power in balanced three phase ac circuit using single wattmeter.
10. Study of Pressure gauge.
11. Study of Strain gauge.
12. To measure Torque using sensors.
13. To study first order response of filters- (i) High pass filters (ii) Low pass filters (iii) Notch filter.
14. Study of an instrumentation amplifier.
15. Study of Cathode Ray Oscilloscope.
16. Draw the characteristics of LVDT.
17. Measurement of distance by ultrasonic transducers.
18. Draw the characteristics of RTD, Thermo couple and Thermistor.

4th Semester

GE 1204	Advanced Mathematical Techniques	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
The objective of this paper is to study numerical methods and their methods of solution and statistics and probability with simple applications and to introduced fuzzy sets and logics	1. Students are able to solve algebraic and transcendental equations and compute n variables in simultaneous equations. 2. This topic covers the alternative techniques to solve various types of differential equations. 3. Students are proficient to design linear programming problems; methods to get optimum solution of it related to multiple variables and simplify it using graphical solution. 4. The facts of probability are used to understand the most probable behavior of various systems. 5. The unit is used to determine mathematical expectation for the random variables define in real life problems and make available analytical techniques for getting standard deviation, dispersion etc. 6. This unit gives an overview of fuzzy set theory to deal and design problems related to fuzzy chips and fully automatic control system.

Mapped program outcomes	a	c

UNIT-1: (a,e) [9 hrs]
NUMERICAL METHODS FOR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Errors in numerical calculation, Errors in series approximation. Rounding of error solutions of algebraic and transcendental equations. Iteration method, Bisection method, False position method, Newton Rapphson method and their convergence
NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss -Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2: (a,e) [8 hrs]
NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4th order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. Numerical methods of solving 1st order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques (a,h) [6 hrs]
Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 (a,h,k) [7 hrs]
Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

UNIT-5: (a,h,k) [8 hrs]
Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 (a,h,k) [6 hrs]
FUZZY SETS AND FUZZY LOGIC ; Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

4th Semester

GE 1204	Advanced Mathematical Techniques			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	10	60	100		3 Hrs

Text books:

1	Computer based Numerical and Statistical Techniques	Paperback First edition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition(2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference books:

1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers

4th Semester

EL1207	Electrical Machines -II	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Mapped Program Outcomes	a	b	d	i	l	m

Course Objective	Course Outcome
To make student aware about • The basic principle, construction, operation, performance characteristics and steady state and transient analysis of synchronous machines. • The principle, construction, operation, control and applications of special electric motors.	The student will be able to understand : 1) the principle, construction and operation of synchronous generator. 2) steady state behavior of synchronous generators. 3) synchronization, parallel operation, effect of variable excitation and stiffness of synchronous generators. 4) the principle, starting, operation on variable load and excitation & performance evaluation of synchronous motor. 5) the behavior of synchronous machine under transient & unbalanced conditions and determination of machine parameters under steady, transient and unbalanced states. 6) Principle, operation and applications of Special motors like A.C.series, Repulsion, Hysteresis, Reluctance and Universal motors.

Mapped program outcomes	a	b	c	d	f	g	h	j

UNIT-1: Three Phase Synchronous Generator
Introduction, Constructional features of cylindrical and salient pole rotor machines, introduction to armature winding and field winding, MMF of armature winding, induced EMF with and without harmonics.

UNIT-2: Steady State Operation of Three phase synchronous generators
Effect of loading on terminal voltage, Armature reaction, Effect of load power factor on armature reaction, concept of synchronous reactance, Phasor diagram on load, regulation by Direct loading, Emf method, Load characteristics, External Characteristic, zero power factor characteristics (ZPFC),construction of potier triangle.

UNIT-3: Parallel Operation
Conditions of synchronization of generator with another generator and or Infinite busbars, Parallel operation, Load sharing between parallel connected generators. Effect of variable excitation and power input on generator operation.

UNIT-4:Synchronous Motor
Principle of operation, Methods of starting, phasor diagram, expression for torque, Excitation Emf, load/torque angle, Effect of variable excitation and load on motor operation, V and inverted V curves, Concept of synchronous condenser, Power Angle Characteristic of Synchronous machines with and without armature resistance. Expression for electromechanical power developed, losses and efficiency in synchronous machines.

UNIT-5 : Transient Behaviour
Short circuit ratio, unbalanced Loading, Sequence Component, Sudden 3-phase short circuit, Constant flux linkage theorem, Transient and sub–transient reactances, Time constants and equivalent circuit diagram, role of damper winding in both generator and motor operation. Experimental determination of steady state & transient parameters

UNIT-6: Introduction to Special Machine
Repulsion motor, AC series motor, Universal motor, Reluctance motor, permanent magnet synchronous motor.

Text books:

1	Electrical Machines	2nd -1993	Dr. P. K. Mukherjee and S. Chakravarti	Dhanpat Rai Publications (P) Ltd
2	Electrical Machines	3rd -2010	I.J.Nagrath and Dr. D.P.Kothari	Tata McGraw Hill
3	Alternating Current Machines	1st -1983	M.G. Say	**CBS Publishers**
4	Electrical Machinery	7TH -2008	P.S.Bhimbra	
5	Electrical Machinery	1ST-1985	A.E.Fitzgerald, C.Kingsley, S.D.Umens	**Mc Graw Hill**
6	Electric Machines	2nd -2008	Ashfaq Husain	Dhanpat Rai Publications (P) Ltd.

4th Semester

EL1208	Lab. : Electrical Machines – II	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

Course Objective	Course Outcome
•	The student will be able to understand the 1) Laboratory setup for measurement of circuit quantities and selection of measuring instruments 2) Evaluate voltage regulation of an alternator by direct and indirect methods 3) To determine the d &q axes, reactances of salient pole alternator under normal, sub-transient and unbalanced load conditions 4) Synchronization of an alternator with infinite bus-bars by lamp methods 5) Effect of change in excitation on performance asynchronous motor delivering constant load

Mapped program outcomes	a	b	c	g	h	j

Minimum eight practical are to be performed out of the following:-

Sr. No.	Name of Experiments
1	To determine voltage regulation of an alternator by direct loading.
2	To determine voltage regulation of an alternator by synchronous impedance method.
3	To plot external characteristics of synchronous generator at different power factor loads.
4	To perform slip test on a 3-phase synchronous machine.
5	To study synchronization of a 3-phase alternator with infinite bus-bars.
6	To determine sub-transient reactances of synchronous machine.
7	To determine negative sequence reactance of a 3-phase synchronous machine.
8	To determine zero sequence reactance of a 3-phase synchronous machine.
9	To observe armature voltage and current waveforms of a 3-phase alternator during slip-test on C.R.O.
10	To plot V and inverted V curves of a 3-phase synchronous motor.

4th Semester

EL1209	**Signals & Systems**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
To make the student conversant with the analysis of the signal and how to represents the periodic and non-periodic signals.	The student will be able : 1) To classify signals and systems and analyze continuous and discrete time signals. To understand the properties of LTI system 2) To Interpret periodic signals and representing them by using Fourier series.ToInterpret continuous and discrete time signals in frequency domain and to summaries properties of Fourier transform. 3) To do the time and frequency characterization of signals and systems. 4) to understand the Laplace and Z-transform

UNIT-1: Signals and Systems

Continuous-Time and Discrete-Time Signals. Transformations of the Independent Variable. Exponential and Sinusoidal Signals. The Unit Impulse and Unit Step Functions. Continuous-Time and Discrete-Time Systems. Basic System Properties.

Linear Time - Invariant Systems

Discrete-Time LTI Systems: The Convolution Sum. Continuous-Time LTI Systems: The Convolution Integral. Properties of Linear Time-Invariant Systems. Causal LTI Systems Described by Differential and Difference Equations. Singularity Functions.

UNIT-2: Fourier Series Representation of Periodic Signals

The Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous-Time Periodic Signals. Convergence of the Fourier Series. Properties of Continuous-Time Fourier Series. Fourier Series Representation of Discrete-Time Periodic Signals. Properties of Discrete-Time Fourier Series. Fourier Series and LTI Systems. Filtering. Examples of Continuous-Time Filters Described by Differential Equations. Examples of Discrete-Time Filters Described by Difference Equations.

UNIT-3 : The Continuous-Time Fourier Transform

Representation of Aperiodic Signals: The Continuous-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Continuous-Time Fourier Transform. The Convolution Property. The Multiplication Property. Systems Characterized by Linear Constant-Coefficient Differential Equations.

The Discrete-Time Fourier Transform

Representation of Aperiodic Signals: The Discrete-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Discrete-Time Fourier Transform. The Convolution Property. The Multiplication Property. Duality. Systems Characterized by Linear Constant-Coefficient Difference Equations.

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UNIT-4: Time & Frequency Characterization of Signals and Systems

The Magnitude-Phase Representation of the Fourier Transform. The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Time-Domain Properties of Ideal Frequency-Selective Filters. Time- Domain and Frequency-Domain Aspects of Non - ideal Filters. First-Order and Second-Order Continuous-Time and Discrete-Time Systems.

Sampling

Representation of a Continuous-Time Signal by Its Samples: The Sampling Theorem. Reconstruction of a Signal from Its Samples Using Interpolation. The Effect of Under - sampling : Aliasing. Discrete-Time Processing of Continuous-Time Signals. Sampling of Discrete - Time Signals.

4th Semester

EL1209	**Signals & Systems**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-5 : The Laplace Transform

The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. System Function Algebra and Block Diagram Representations. The Unilateral Laplace Transform.

UNIT-6: The Z-Transform

The z-Transform. The Region of Convergence for the z-Transform. The Inverse z-Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the z-Transform. Analysis and

Characterization of LTI Systems Using z-Transforms. System Function Algebra and Block Diagram Representations. The Unilateral z-Transform**.**

Text books:				
1	Signals and Systems	2nd Edition, 2013	Alan V. Oppenheim, Alan S. Willsky, with S. Hamid	PHI Learning Private Limited.
Reference Book				
1	Signals & Systems	2nd Edition., 2005	Simon Haykin and Van Veen	Wiley
2	Signals, Systems and Transforms	3rd Edition, 2004	C. L. Philips, J.M.Parr and Eve A.Riskin	Pearson education
	Schaum's Outlines of Signals and Systems	3rd Edition, 2002	Hwei P. Hsu	McGraw Hill
4	Linear Systems and Signals	2nd Edition	B.P. Lathi	Oxford University Press

4th Semester

EL1210	Lab.: MATLAB Programming	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

Course Objective	Course Outcome
To make the student familiar with the application of MATLAB using programming and simulink.	1. The inbuilt functions, keywords, concepts of drawing and using the various toolbars in SCILAB programming. 2. To design the matrix operation and mesh analysis which generally using in mathematical operation. 3. The various conditions like for loop, while loop and if else loop which are used in decision making statement. 4. The RL series circuit which is the basic concept in basic engineering. 5. The differential equations used in mathematical operation. 6. The design of 2-D and 3-D plots.

Mapped program outcomes	b	c	j

Minimum eight practical are to be performed from the following:-
List of Experiments

1. Program to demonstrate the script file and elementary matrix manipulations
2. Program to demonstrate indexing of matrices.
3. Program to create function and calling functions
4. Program to solve linear differential equations
5. Write a function that returns the two roots of a quadratic equation, given the three arguments a, b and c. Test the function from the command line
6. Write a function that returns the mean and standard deviation of a vector of numbers (input vector). While Matlab supplies the mean() and std() functions, try just using the sum() and length() functions.
7. Write a function that reverses the order of letters in a string, and returns the new string.
8. Use the eval() Matlab function to evaluate strings such as:
   exp1 = '5*6 + 7';
   Note this, and feval(), is very useful for dynamic programming
9. Use a cell array to store a list of expressions, stored as strings. Then use eval() and a for loop to iterate over the expressions and evaluate them.
10. Create the vector 0:pi/20:2*pi and use it to sample the sin() function. Plot the results and edit the figure window to put labels on the figure. Save the figure (.fig) and export a .jpg file.
11. Use the meshgrid() function to sample a 2 dimensional input space between 0 and 2p, then use the data to sample the function sin(x_1)*cos(x_2). Plot the results using the mesh() function.
12. Create a GUI that prompts the user for a number and then displays double that number next to the entered value.
13. Start Simulink and using a sin() **source** and a **scope sink**, view the signal over 10 seconds.
14. Change the frequency of the sin() source and again compare the results. Next change the simulation length.
15. Build the first order system H(s) = 1/(1+3s) in the model and pass a sin() signal through the system. Make sure you run the simulation for a long enough time for the transients to die down and the system to settle. Replace the first order system with the second order system, what is the difference when the system settles down H(s) = 1/(1+2s+s^2).
16. We need to simulate the resonant circuit and display the current waveform as we change the frequency dynamically.

4th Semester

EL1211	Electrical Machine Design	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
1) To gain the knowledge about the different materials and their properties required for construction of electrical machine. 2) To find out the dimension of various parts of the AC machine. 3) **To impart complete knowledge about each and every aspect of design of electrical machines viz., Induction motor, Transformer and Synchronous machine** 4) The course also provides the students with an ability to understand the step by step procedure for the complete design of electrical machines .	1. The student will be able to select proper material for design of a machine and proper machine for specific application. 2. The student will be able to understand the design of main dimensions and other major part of single and three phase transformer. 3. The student will be able to understand the effect of designed parameters on the performance parameters of transformers. 4. The student will be able to understand the design details of stator of Induction motor. 5. The student will be able to understand the design details of rotor of Induction motor and the performance of motor from design data. 6. The student will be able to understand the design of main dimensions of synchronous machine depending on type of rotor and selection of proper machine for specific application.They will also be able to understand different cooling methods for synchronous machines.

Mapped Program Outcomes	a	b	c	e	f	g	i	j

UNIT-1:
Review of material used in construction of electrical machines
Magnetic material such as amorphous, ferrite etc. Classification of insulating materials depending upon permissible temperature rise, properties of transformer oil, standard specifications, C.M.R. and short time of machines, Heating and cooling characteristics.

UNIT-2:
Transformer design : Main Dimensions
Output equation, equation for voltage per turn for power and distribution transformer, core design, overall dimensions of single phase and three phase transformer.

UNIT-3
Transformer design : Performance Characteristics
Resistance and leakage reactance of winding for concentric cylindrical and sandwich type winding, estimation of no load current , method of cooling and cooling tank design.

UNIT-4:
Induction motors: Stator Design
Total loading, specific loading on the machine, output equation, main dimension, estimation of axial lengths and air gap diameter based on different design criterion, estimation of number of slots, area of slot, stator teeth and stator core dimensions, length of mean turn, stator winding.

UNIT-5
Induction motor rotor design
Air gap length, no. of rotor slots, cage rotor and wound rotor , Design of rotor bar and slots, design of end ring, design of wound rotor, rotor teeth and rotor core design, Calculation of no load current, stator and rotor resistance and other performance characteristics for design data.

4th Semester

EL1211	Electrical Machine Design	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6:
Synchronous machines
Types of synchronous machines, Output equation , specific loadings, Design of salient pole (Main dimensions, length of air gap, shape of pole face, armature design) and turbo alternators (Main dimensions , length of air gap, stator and rotor design), Effect of SCR on machine performance, ventilation of synchronous generator, cooling circuit design, Hydrogen and water as cooling media.

Text books:				
1	Performance and Design of A.C. Machine		M.G. Say.	
2	Electrical Machine Design	**5th-1984**	A.K. Sawhney	Dhanpat Rai & Sons, Delhi
3	Electrical Machine Design		Balbir Singh	Brite Student Publication, Pune
4	Power Transformers		S.B.VasuBinsky	
5	Electrical Machine Design	**2nd-1990**	M.V. Deshpande.	**Wheeler**
6	Electric Motor Drives: Modeling, Analysis, and Control	1st edition, 2001	R. Krishnan	Prentice Hall

4th Semester

EL1213	Electric and Magnetic Fields	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
To educate the student in static electric and magnetic fields. To make them aware about various laws of electromagnetic & electrostatic fields.	The student will be able to : 1) Use vector conversion in different coordinate systems. 2) Apply various laws in the analysis of electrostatic and electromagnetic systems. 3) Understand the physical basis for the functioning of circuit elements 4) Apply boundary conditions. 5) Familiar with the four Maxwell's equations used in static and dynamic fields. 6) Understand the concept of uniform plane-wave propagation and electromagnetic power density flow in lossless medium.

Mapped Program Outcomes	a	c	e	i	l	m

UNIT-1:Vector Analysis
Scalars and vectors, vector algebra, the Cartesian coordinate system , the scalar and vector field, the dot product, the cross product, Cylindrical coordinate system, Spherical coordinate system.

UNIT-2:Coulomb's Law and Electric Field Intensity; Electric Flux Density, Gauss's Law, and Divergence
Coulomb's Law, electric field intensity, types of charge distributions, electric field due to line charge density, surface charge density, and volume charge density, streamlines and sketches of fields. Concept of electric flux, electric flux density, Gauss's Law, application of Gauss's Law to symmetrical charge distributions, application of Gauss's law to differential volume element, divergence, Maxwell's first equation in electrostatics, the vector operator $\overline{\nabla}$ and the Divergence theorem.

UNIT-3Energy and Potential; Conductors, Dielectrics, and Capacitance
Energy expended in moving a point charge in an electric field, potential difference and potential, the potential field of a point charge, line charge density and surface charge density, the potential field of a system of charges, potential gradient, the dipole, energy density in the electrostatic field, Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, the method of images, semiconductors, the nature of dielectric materials, boundary conditions for perfect dielectric materials, capacitance, several capacitance examples.

UNIT-4:Poisson's and Laplace's Equations
Poisson's and Laplace's equations, Uniqueness theorem, examples of the solution of Laplace's equation (involving one variable only).

UNIT-5 Steady Magnetic Field; Magnetic Forces, Materials, and Inductance
Biot – Savart law, magnetic field due to infinitely long current filament, finite length current filament, Ampere's circuital law, magnetic field due to coaxial cable, uniform sheet of surface current, solenoid, toroid, curl and its physical interpretation, Stoke's theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, Force on a moving charge, force on a differential current element, force between differential current elements, force and torque on a closed circuit, nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, potential energy and forces on magnetic materials, inductance and mutual inductance.

UNIT-6: Time-Varying Fields and Maxwell's Equations, Uniform Plane Wave
Faraday's Law, derivation of Maxwell's equations in point form and integral form, displacement current and its physical interpretation, concept of retarded potentials, Maxwell's equations in phasor form, wave equations, uniform plane waves, solution of wave equation in free space, perfect dielectric, lossy dielectrics and good conductor, skin effect and skin depth, Poynting vector.

4th Semester

EL1213	Electric and Magnetic Fields	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

1	Engineering Electromagnetics	7th Edition	W.H. Hayt J. A. Buck	McGraw Hill Publication.
2	Schaum's Outline Series: Theory and Problems of Electromagnetics	2nd Edition	Joseph A. Edminister	Schaum's outline Series of Engineering
3	Principles of Electromagnetics	**4th-2007**	Matthew N.O.Sadiku	Oxford University Press

Reference books:

1	Applied Electromagnetic	**1978**	Plonus M. A.	**MGH**
2	Electromagnetics	**1998**	Kraus J. D.	**MGH**
3	Fundamentals of Electromagnetics with MATLAB	2nd Edition	Karl E. Lonngren, Sava V. Savov, Randy J. Jost	Scitech Publishing Inc.

4th Semester

EL1212	Electrical Engineering Workshop	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	TA	ESE	Total	ESE Duration
	40	60	100	--

Course Objective	Course Outcome
This practical will allow to handle different electrical daily use equipment used by electrical engineer. Concept of illumination from design point is also studied. House wiring concept will also be understood by student.	The student will be able to : 1. Identify and understand basic concept of various electrical components. 2. Understand basic construction of various laboratory electrical equipments. 3. Perform basic maintenance and troubleshooting of household equipments,energy saving etc. 4. Understand the operating principle of major electrical devices and actual operation of devices like induction motor. 5. An ability to identify, formulate and solve hardware engineering problems..

Mapped Program Outcomes	a	b	c	H	j

Practical based on following topics :-

1. Study the construction, working & circuit of the following: Fluorescent lamp (tube light).
2. Make the tube light connection and to measure the following: Power factor of the circuit, Voltage across the choke, Power drawn by the circuit form the supply to draw phasor diagram for the circuit.
3. Importance of wire joints, mechanism of failure of joint, methods of minimizing joint failures. Importance of lugs in joints, bus bars, methods of reducing the contact/joint resistance, How to join the dissimilar metal joints, Use of multimeter and megger.
4. (a) Study the different types of wires and wiring accessories.
   (b) To make the house wiring for the following : House wiring having 3 fans, 2 tube lights, one – 3 pin socket, and one lamp showing the earthing of each appliance.
5. Make the circuit for staircase wiring.
6. Assemble and disassemble a table fan & ceiling fan, to learn about their nature of winding, No. of poles and starting capacitor, to draw winding diagrams and phasor diagram.
7. Study the various types of earthing for electrical appliances/systems, Practice of earthing.
8. Study the construction & working of single-phase transformer & design a small single-phase transformer of given rating.
9. Transformer winding & assembly, Basic motor winding.
10. Testing of motors (AC & DC).
11. Insulation measurement and testing of megger.

5th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course outcomes:
	1) It will help for rational selection of goods and services. 2) It helps to prepare students being a businessman how to deal with various production constrain. 3) To make use of these concepts while performing the entrepreneurial operations. 4) Provide idea about national income accounting. 5) Helps to create awareness about functioning of financial institutions and taxation system. 6) It provides knowledge about international economics.

Mapped Program Outcomes	f	j

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

5th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

5th Semester

EL1301	Electrical Power System I	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course outcomes:
To calculate the basic parameters of transmission line of power systems. To know the power flow through transmission lines under different circumstances.	student will be able to understand the 1. Basic terminology and components of power system from generation to load centre. And also representation of components in per unit system 2. Transmission line parameters like inductance 3. Transmission line parameters like capacitance. 4. Theory of feeders, real and reactive power flow in power system. 5. Theory of types of insulators, construction and grading methods of cables. **6.** Transmission line with respect to its efficiency and regulation for short, medium and long transmission line.

Mapped Program Outcomes	a	b	c	j

UNIT 1: Introduction to power system
Structure of Electrical Power System, use of high voltage, idea about substation, classification, Indoor, outdoor substation, symbols for equipment used in substation, concept of real, reactive and complex power.
Per unit system: Representation of power system elements, models and parameters of generator, transformer and transmission lines, Numericals.

UNIT 2: Inductance of transmission line
Constants of transmission line, flux linkages, inductance of single phase two wire line, inductance of 3 phase overhead line, self GMD and mutual GMD,Numericals

UNIT 3: Capacitance of transmission line
Electric Potential, Capacitance of single phase 2 wire line, capacitance of 3 phase overhead line, Symmetrical and unsymmetrical spacing Numericals.

UNIT 4: Distribution system and Load flow analysis
Types of distribution system, comparison, Feeders and distributors, Numericals on DC and AC distribution
Y Bus formation, Illustration of active and reactive power transmission, Introduction to load flow studies in multi bus system (SLFE).

UNIT 5: Insulators and Cables
Types, Potential distribution over suspension insulator string, String efficiency, Numericals on string efficiency.
CABLES:
Construction, classification, insulation resistance, capacitance, Dielectric stress, economical size, Grading of cables, Numericals.
Philosophy of real and reactive power control, Load frequency and automatic voltage excitation voltage control of turbo alternator, Speed governing system of turbo generator.

UNIT 6: Transmission Systems
Short, medium (Nominal T and Nominal Π method) and Long line, Voltage regulation & efficiency of power transmission lines using simple series equivalent representation, ABCD parameters of transmission lines.

5th Semester

EL1301	Electrical Power System I	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Power System		S.Chand	V.K.Mehta
2	Electrical Power Systems	5th edition	CBS	Ashfaq Hussain
3	Modern Power System Analysis	3rd -2008	Tata McGraw Hill	I. J. Nagrath and D.P. Kothari

Reference books:				
1	Elements of Power system analysis	4th - 1982	MGH	W. D. Stevenson
2	Electrical Power system	3rd -2005	New Age International	C.L Wadhwa

5th Semester

EL1302	Power Electronics	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course outcomes
This subject will help student to understand the basics of power electronics. This subject covers SCR's, MOSFET, UJT, IGBT. Concept of rectification, inversion and commutation is explained	The student will be able to understand the 1. Working of Thyristor, its characteristics, triggering circuits and ratings. 2. The working of various single phase power converters configurations based on thyristor They will also understand significance of series and parallel connections of SCR. 3. Working of various three phase power converters configurations and will also be able to design it.They will also understand the working and design of various 3 phase converter configuration. 4. The protection circuits of thyristors and force commutated devices such as MOSFET, IGBT. 5. Basic concepts of operation of dc-dc converters in continuous and discontinuous modes and will able to analyze them. 6. The single and three phase inverters, different modulation techniques, harmonics and their mitigation. They will also be able to design inverters.

Mapped Program Outcomes	a	b	c

UNIT 1: Power Semiconductor Devices
SCR and its characteristics, Gate characteristics, SCR turn off, ratings, Triggering circuits and opto-couplers.

UNIT 2: **Single Phase Line Commutated Converters**
Series and parallel connections of SCRs, Single phase line commutated converters, single pulse converter, two pulse mid-point converter, single phase bridge converter, effect of source inductance, effect of freewheeling diode, single phase half controlled rectifier cyclo converter (single phase)

UNIT-3: Three **Phase Line Commutated Converters**
Three phase three pulse converter, three phase bridge converter, speed control of dc motors (with single phase rectifier).

UNIT-4: Forced Commutated Semiconductor Devices and Protection
Characteristic and working of MOSFET, Gate turn off thyristor and insulated gate bipolar transistor, protection of SCR, gate circuit protection, over voltage and over current protection, snubber circuit design.

UNIT-5: D.C. Choppers
Principles of step down chopper, step up chopper classification, Control strategies, time ratio control and current limit control Impulse commutated and resonant pulse choppers, Multiphase choppers, Application of choppers.

UNIT-6: Single Phase and Three Phase Bridge Inverters
Single phase and three phase bridge inverters, Output voltage control, Harmonics in output voltage waveforms, Harmonic attenuation by filters, Harmonic reduction by pulse width modulation techniques, analysis of single pulse width modulation, working of current source inverters, applications.

5th Semester

EL1302	Power Electronics	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics Circuit's Devices and Applications	3rd Edition,2004	M.H.Rashid	Prentice Hall Limited
2	Power Electronics		D.Y.Shingare	Electrotech Publication Engineering Series

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics	1981	C.W.Lander	McGraw Hill
2	Thyristors and their Applications	2nd Edition 2002	Dr.M.Ramamoorty	East West Press
3	Thyristors and their Applications		Dr.G.K.Dubey, Doralda Sinha and Joshi	New Age International
4	Power Electronics	1989	Ned Mohan, T.M.Undeland, and W.P.Robbins	John Wiley and Sons

5th Semester

EL1303	Lab. : Power Electronics	L= 0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			40	60	100	

Course Outcomes:

Students shall be able to understand practically

1. Different characteristics of various power semiconductor devices such as Thyristors, TRAIC and MOSFET
2. The effect on performance of UJT relaxation oscillator by changing the various parameters.
3. The responses for various firing angles in single phase half wave bridge controlled rectifier. He will also able to compare the theoretical and practical values of output voltages.
4. The performance of cycloconverter and series inverter for various firing angles.
5. The performance of electrical drives based on first quadrant drive.

Mapped program outcomes	a	c	d	g	h	j

S.N	TITLE
1	To plot V_t – I_t characteristic of SCR
2	To study UJT as a relaxation oscillator
3	To study method of forced commutation of SCRs
4	To determine holding and latching current of SCR.
5	To study four modes of triac.
6	To study control circuit and parallel inverter.
7	Study of Ott filter
8	Study of three phase bridge converter

5th Semester

EL1304	Power Station Practice	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course outcomes:
To explain different sources of energy and methods of conversion to electrical energy. Economics of generation, starting with the load survey to the fixation of tariffs by the electric utilities. Similarly excitation methods, tariff methods are also explained.	Student will be able to understand the 1) Power System economics, sources of power and various factors related to generation. 2) Mechanical, electrical and cost related factors of thermal power station. 3) Hydrology, stream flow, related curves reservoir capacity, constructional features and governing characteristics of turbine and hydro generators. 4) Principle of nuclear energy, material, types of nuclear reactor, breeder reactor, location, material for moderator and control rods, cost economics. 5) Voltage control method of AC generators and tariff. 6) Steam and hydro Turbines, classification. Method of reducing rotor speed, governing of turbines and study of condensers.

Mapped program outcomes	a	b	c	d	e	f	j

UNIT-1: Introduction & Power System Economics

Sources of Electrical energy- Coal, oil and natural gas, water power, nuclear fission and fusion, their scopes and potentialities for energy conversion.

Generation- Different factors connected with a generating station, connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity and utilization factor, load curve, load duration curve, load survey, base load and peak load station, advantages of interconnection.

UNIT-2: Thermal Station

Thermal Station- Choice of site, location, size and number of units, general layout, major equipments, essential and non-essential auxiliaries, electric supply to auxiliary, cost of generation, effect of different factors on costs.

UNIT-3: Hydro Station

Hydro station:- Hydrology, stream flow, flow duration curve, power duration curve, mass curve, reservoir capacity, Water Power equation (Numerical), type of hydro power plants and their field of use, pumped storage plant and their utility, surge tanks, governing characteristics of turbine and hydro generators, Combine steam and hydro power plant.

UNIT-4: Nuclear Power Station

Nuclear Station- Working Principle of nuclear Power Plant, energy, material, types of nuclear reactor, breeder reactor, location, material for moderator and control rods, cost economics.

5th Semester

EL1304	Power Station Practice	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-5: Voltage Control of AC Generators and Tariff

Automatic voltage regulating action, Excitation, AC and DC excitation (construction and working principle)

Tariff-Objective, Types of Tariff (Numerical), economical choice of tariff.

UNIT-6: Turbines and Condensers for Thermal and Hydro Generators

General study of steam and hydro Turbines, classification. Internal losses in turbine Method of reducing rotor speed, governing of turbines.
Condenser: Different types of condensers. Construction and principles of working of Condenser. Advantages of condenser in steam power plant, Requirement of condensing plant.

Text Books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Generation of Electrical Energy	**4TH- 2003**	B. R. Gupta	S.CHAND
2	Thermal Engineering		R.S.Khurmi J.K.Gupta	S.CHAND

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Elements of power stations design	**3rd- 1986**	M.V. Deshpande	WHEELER
2	Energy Conversion and Power Generation		L.D.Agrawal and G.K. Mittal	
3	Electrical Power Stations		Car.	
4	Generating Stations		Lowels.	

5th Semester

EL1316	OE I : Renewable Energy Generation Systems	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
This subject introduce the different renewable energy sources to the students. Students get knowledge of Electric Power generation by wind, solar, small hydro.	1. Basic aspects of renewable energy supply presenting fundamental characteristics of the resource base (solar radiation, wind energy, geothermal, etc.) and principles of related technical systems (photovoltaic, wind, hydroelectric power generation, etc.).Fundamentals of fuel cells. 2. Solar radiation geometry , basic concepts of solar energy to heat conversion, different types of solar energy collectors with different applications. 3. Concepts of wind energy conversion system, types of WECS and their connection with the grid. 4. Basics of geological process, tapping geothermal energy, biomass energy resources and its conversion processes. 5. Basic concept of Mini & Micro hydro-plants with site selection criteria. 6. Basic concepts of energy from ocean including tidal and wave energy with focus on conversion cycles from ocean energy to electrical energy.

Mapped program outcomes	a	b	c	d	e	f	j

UNIT-1: **Introduction**
Fundamentals of Renewable / Non-renewable Energy Sources, Renewable Energy sources, Renewable Energy Potential in India, Renewable Energy Sources and their sustainable development. Storage methods for renewable energy sources

UNIT-2: **Solar Energy**
Principles, scope and applications, solar radiation, its measurement & prediction, flat plate collectors-design & theory, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Solar cells, thermal storage, street lighting, solar power generation.

UNIT-3: Wind Energy
Introduction, Historical development, Wind energy resources, sites identification, blade element theory, aero-foil design, component of wind energy conversion system, wind turbine generator classification, and windmill and wind electrical generator, Advantages, disadvantages, economics and present status of wind energy generation systems, grid connection of wind energy.

UNIT-4: Geothermal Energy and Biomass Energy
Introduction, history of geothermal resources, basics of geological process, dry rock and hot aquifer analysis, geothermal exploration, geothermal well drilling and fluid extraction, utilization of geothermal resources, geothermal heat pump, site of geothermal energy in India. Biomass energy resources and conversion processes, urban waste to energy conversion.

UNIT-5: Mini & Micro hydro-plants
Introduction, Classification of water turbines, hydroelectric system, essential components of hydroelectric system, system efficiency, advantages and disadvantages of hydroelectric system, present Indian power scenario of mini-micro hydro.

5th Semester

EL1316	OE I : Renewable Energy Generation Systems	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6: Ocean Energy

Ocean thermal energy conversion (OTEC), Open cycle and closed cycle OTEC, Ocean wave energy conversion, tidal energy conversion. Introduction of Fuel cells.

Text Books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Non Conventional Sources of Energy	**4th edition**	G.D.Rai	Khanna Publisher
2	Energy Technology:Nonconventional Renewable and Conventional	,	S. Rao and B.B Parulekar	Khanna Publisher New Delhi

Reference books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Solar Energy : Principles of Thermal collection and storage	**3rd edition,1994**	S.P.Sukhatme,J.K.Nayak	Tata McGraw Hill
2	Wind and Solar Power System		M. R. Patel	CRC Press, New York
3	Renewable Energy Sources Basic Principles and Applications		G. N. Tiwari and M. K. Ghoshal	Narosa Publishing House,New Delhi

5th Semester

EL1320	**OE I :** Electrical Machines and their Applications	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
This subject introduce the applications of different machines and commonly used drives.	1. Principle, construction, operation, testing, performance evaluation and application of Single Phase Transformer. 2. Construction, operation, performance of autotransformer, copper saving and kVA rating as compared to two winding transformer. 3. Principle, construction, winding connection, vector grouping, parallel operation and application of three phase transformer. 4. Principle, construction, operation and speed control of DC motors. 5. Principle, construction, operation, performance, starting and speed control of three phase induction motor and its operation as a generator. 6. Principle, construction, types, performance of single phase induction motor and special motors like stepper motor and BLDC motor. 7. Principle, construction, operation and performance of three phase synchronous generator and motor. 8. Criteria for selection of suitable motors.

Mapped Program Outcomes	a	b	c	e	h	i	k	l

Unit 1: Introduction to Drives and Speed Control:
Classification of Drives, brief idea about commonly used drives (AC and DC) drives in industry, speed- torque characteristics of different drive motors, their behaviour under starting and running conditions.

Unit 2:
Need of starter, Starting methods, Braking and Speed Control of AC and DC motors.

Unit 3: Selection Criterion for Drive Motors:
Criterion for selection of motors, Duty Cycle, Power Rating for Continuous and Intermittent Duty Cycles, Environment and Enclosures, Transmission System, Insulation Classes.

Unit 4: Single Phase transformer
Review of Principle, constant flux machine, losses, efficiency etc., Operation on load (Phasor diagrams), Voltage regulation, effect of load power factor on regulation, Application of Single phase transformer in Electronic circuitry, autotransformer, welding transformer, furnace transformer.

Unit 5: Three Phase Transformer.
Concept of three phase transformer, Comparison between unit and bank of single phase transformer, connections, All Day Efficiency, application in power system.

Unit 6: Special Machines:
Brushless DC motor: - Principle, construction , operation, converter for BLDC, rotor position sensor (Hall Sensor), Stepper motor: types, slewing, torque-speed characteristics, stepper motor converter, Universal motor, applications Applications of three phase and single phase induction motors in cement industry, steel rolling mill, textile mill, etc.

5th Semester

EL1320	OE I : Electrical Machines and their Applications	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books

S.N	Title	Year/Edition	Author	Publisher
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric Drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

Reference Books:

Sr. No.	Title	Year/Edition	Author	Publisher
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2	Fundamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

5th Semester

EL1321	OE I : Testing and Maintenance of Electrical Equipment's	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
To adopt various testing and maintenance procedures for electrical equipments by providing effective insulation to enhance their life and working condition	1) Terminologies used in IE Act for maintaining the electrical safety in workplace ,procedures to be adopted before and after get in contact with the electrical shock,reasons and remedial actions to be adopted. 2) To understand the various electrical equipment testing methods such as routine,type and special tests also preventive maintenance techniques to be adopted to avoid the breakdown maintenance 3) To understand the various tests to be conducted on various electrical machines such as routine,type and special tests to avoid the breakdown maintenance 4) Classification of various insulating materials as per IS Standards and its use base on IS and IE Code 5) Various tests to be conducted on the transformer and its associated equipments 6) Designing of electrical machine foundation,alignment and behaviour of rotating machine during loading and unloading
Mapped program outcomes:a,b,c,d,e,g,h,i,j	

Unit 1: Safety & Prevention of Accidents
Definition of terminology used in safety; safety, hazards, accident, major accident hazard, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don'ts for substation operators as listed in IS Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.

Unit 2: General Introduction
Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing a) Direct, b) Indirect, c) Regenerative. Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.

Unit 3: Testing & maintenance of rotating machines
Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992. Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968. Brake test on DC Series motor.

Unit 4: Testing & maintenance of Insulation
Classification of insulating materials as per I.S. 8504(part III) 1994, factors affecting life of insulating materials, measurement of insulation resistance & interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot.

5th Semester

EL1321	OE I : Testing and Maintenance of Electrical Equipment's	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit 5: Testing & maintenance of Transformer
Listing type test, routine test & special test as per I.S. 2026-1981.
Procedure for conducting following tests:
Measurement of winding resistance, no load losses, & no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028 (part-III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 & 3 phase transformer, load sharing calculations (numerical).

Unit 6: Installation
Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992. Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.

Text Books:			
S. N.	Author	Title	Publisher
01.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol - I	Media Promotors & Publisher Ltd. Mumbai
02.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol - II	Media Promotors & Publisher Ltd. Mumbai

Reference Books:			
S. N.	Author	Title	Publisher
01.	B. L. Theraja	Electrical Technology Vol I to IV	S. Chand & Co., New Delhi
02.	C. J. Hubert	Preventive Maintenance Hand Books & Journals	----------

5th Semester

ET1329	Microprocessors	L= 4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
1) To learn the microprocessor applications in electrical engineering. 2) To understand principle of microprocessor chip working. 3) To study Interfacing with memory and other peripherals	1) Architecture of 8085 Microprocessor and basic instruction sets. 2) Branching Instructions and sub routines and develop assembly language programs. 3) Timing diagrams, Delay routines, Interrupts and Serial communication. 4) Interfacing of 8085 processor with memory IC and input output devices. 5) Interfacing of 8085 processor with off chip devices. 6) DMA Controller and programmable interval timer.

Mapped Program Outcomes	a	b	c	d	f	g	i	j

UNIT-1: **Memory devices**
Memory devices, RAM, ROM, Introduction to Intel's 8085 Architecture, Flag register, Instruction set, Addressing modes, assemblers, hand coding.

(7 Hours)

UNIT-2: Programming Instructions
Branching instruction, Simple programmes, stack, PUSH, POP Instructions, CALL/RETURN instruction & Subroutines- simple & nested programmes, Programmes using Subroutines.

(8 Hours)

UNIT-3: Timing Diagrams
Timing Diagrams, Timing Diagram of instruction. Delay programmes, Serial data transfer, Interrupts - concept and structure in 8085 Interrupt service routine, advanced instructions & Programming of 8085A.

(7 Hours)

UNIT-4: Interfacing of Microprocessor
Complete signal description of 8085, interfacing memory devices interfacing I/O devices. Methods of data transfer- serial, parallel synchronous and asynchronous. IN/OUT instructions. Hardware considerations bus contention, slow memory interfacing.

(8 Hours)

UNIT-5: Hardware interfacing and Handshaking
Simple hardware interface to 8085 of standard latches & buffers as I/O ports. Architecture and interface of 8255 & 8085. Handshaking concepts. Interfacing of multiplexed keyboard/ display interface and assembler directives. Interfacing of ADC & DAC, stepper motor Interface with 8085.

(8 Hours)

UNIT-6: Architecture and Interface
Architecture and interface of 8253 with & 8085, Different modes of 8253. Architecture and interface of 8257 with & 8085, Different modes of operation of 8257, Application of microcontroller.

(7 Hours)

Text Books

1	Programming and Interfacing 8085	Gaonkar
2	Programming of 8085	D.V. Hall

Reference Books

1	Microprocessor & Interfacing Manual , Intel Perpheral	Barry Brey

		1.01	May 2017	Applicable for AY 2017-18 Onwards
Chairperson	Dean (Acad. Matters)	Version	Date of Release	

5th Semester

ET1330	Lab. : Microprocessors	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	CA	ESE	Total	ESE Duration
	40	60	100	2 Hours

Course Objective	Course Outcomes
	Students shall be able to : 1. Learn various instructions of 8085 its addressing modes, size and hand coding. 2. Develop assembly language programming using arithmetic and logical instructions from instructions set of 8085 3. Understand assembly language programming using Subroutings instructions from instructions set of 8085 4. Interface various peripherals with 8085 processor and its programming

Mapped program outcomes	a	c	d	f	j

Expt. No.	Name of Experiment
1.	Write Assembly Language Program (ALP) to add 16 bit numbers 1324 H & 4532 H.
2.	Write Assembly Language Program (ALP) to add two 08 bit BCD numbers 78 + 45 & store result in memory 2150 H.
3.	Write Assembly Language Program (ALP) to subtract two 08 bit BCD numbers78 – 45 store result in memory 215 H.
4.	X & y are two 32 bit numbers present in memory from address 2150 H & 2300 H. Write ALP to add these two 32 bit binary numbers & store result in memory from address 2710 H.
5.	Ten 8 bit binary number are present in memory from address 2340 H. Write ALP to transfer this number to destination memory from address 2400 H.
6.	Twelve 8 bit binary numbers are present in memory from address 2540 H. Write ALP to transfer this number to destination memory from address 2548 H.
7.	Ten 8 bit binary nos. are present in memory from address 2200 H. Write ALP to transfer this number to destination memory from address 2190 H in reverse order.
8.	Fifteen 8 bit binary numbers are present in memory from address 2200 H. Write ALP to transfer this number to destination memory from address 2190 H in reverse order.
9.	Fifteen 8 bit binary numbers are present in memory from address 2340 H. Write ALP to find greatest number in data block & store result in memory at the end of data block.
10.	Ten 8 bit binary numbers are present in memory from address 2345 H. Write ALP to find smallest number in a data block & store result in memory at end of block.
11.	Write ALP to convert 8 bit BCD to binary number.
12.	Write ALP to convert 8 bit binary number to BCD number.

5th Semester

EL1318	Lab. : Electronics Engineering Workshop	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Course Objective	Course Outcomes
To expose printed circuit board (PCB) design, fixing of components on PCB, testing of components and circuits	1. This course gives the basic introduction of electronic hardware systems. 2. It provides hands-on training with familiarization, identification, testing, assembling, dismantling of various components. 3. Student can identify the active and passive electronic components 4. Testing of electronics components like Resistor, Capacitor, Diode, Transistor, UJT and JFET using multimeter. 5. PCB fabrication and repairing such systems by making use of the various tools and instruments available in the Electronics Workshop.

Mapped program outcomes	a	b	c	d	f	i	j

Practical based on following topics :-

Minimum eight practical based on following are to be set up :-

S.N	TITLE
1	Design and fabrication of PCB
2	Design of voltage regulators
3	Design of different timers using operational amplifiers.
4	Study and testing of diodes
5	Study and testing of transistors
6	Study and testing of MOSFET, IGBT
7	Study and testing of Thyristor, power diodes
8	Study and testing of power transistors
9	Study and testing of operational amplifiers, LEDs.ICs etc

6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
Principle of Management	To familiarize the students with the basic concepts and principles of management. The students should clearly understand the definitions of different areas of management. This course will facilitate students to understand and describe specific theories related to perception, motivation, leadership. This will help the students to demonstrate effective management skill by knowing the various functions of management like planning, organising, directing, coordinating and controlling.
Legal Aspects of Management	The present course aims at familiarizing the students with various legal aspects of business, contract, partnership and companies. It aims at providing a rich fund of contemporary knowledge, time tested principles, basic concepts, emerging ideas and practices in the field of law in a comprehensive way.
Human Resource Management	The objective of this course is to endow the student with a broad perspective on themes and issues of Human Resource Management, Human Resource Development, Training and Development activities, Job Analysis, Performance Appraisal, disciplinary and grievance procedure. It will help the students to build up and refine decision making skills so that they can help organizations effectively manage employee relations.
Project Management	The course is intended to develop the knowledge of the students in the management of projects, special emphasis will be provided on project formulation as also on various tools and techniques for project appraisal and control so that they are able to draft the project proposal in any area of management and evaluate the projects.
Marketing Management	This course intends to provide an experienced-based approach to marketing concept and its practical application. The course is designed to enable the students to learn the basic of marketing, customer behaviour, marketing research & sales promotion. Topics of the syllabus shall be addressed and discussed from an application oriented perspective
Financial Management	The present course aims at familiarizing the participants with the skills related to basic principles, tools and techniques of financial management. This will help the students to demonstrate their skill in understanding the budgets and budgetary control, balance sheet, and profit and loss statement.

Mapped program outcomes :	a	b	c	f	g	h	i	j

6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1: Principles of Management
Evolution of Management Thought : Scientific, Classical, Neo Classical and Modern Theory of Management, Defintion Meaning and Concept of Management, Functions of Managment : Planning, Organizing, Directing Coordinating and Controlling. Motivation Theory, Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, Types of Partners, Right and Duties of Partners, Registration and Dissolution of firm, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Directors : Powers and duties, Winding up of the Company

UNIT-3: Human Resource Management
Human Resource Management-Meaning, Nature and Scope, Principles of HRD, Human Resource Planning, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Discipline and Grievance Procedure.

UNIT-4 Project management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Project Management, Tools and Techniques of Project Management, SWOT Analysis, Project Risk Analysis, Project cost, Project Planning, Project Control, Network techniques - Introduction and Use of CPM &PERT for planning.

UNIT-5 Marketing Management:-
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Rural Marketing, Marketing Environment, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

UNIT-6 Financial Management:-
Definition & Functions of Finance department, Sources of finance , Financing organizations, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

TEXT BOOKS:

1. S.C.Saxena, Business Management and Administration, Sahitya Bhawan Publication
2. P. Subba Rao, Management -- Theory and Practice (Text and Cases) (Himalaya Publication)
3. Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
4. P.S Rao , Essentials of Human Resource Managemen & IR, Himalaya , Mumbai
5. Avraham Shtub and Jonathan F. Bard, Project Management: Processes, Methodologies, and Economics (2nd Edition)
6. Kotler, Keller, Koshy & Jha, Marketing Management, Pearson, New Delhi
7. R.K. Sharma, Shashi K Gupta, Management Accounting,. Kalyani Publishers.

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6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

TEXT BOOKS FOR REFERENCE:

1) Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2) Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3) Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4) C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,

5) Lock, Gower - Project Management Handbook
6) Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7) Rajan Saxena: Marketing Management, Tata McGraw Hill.
8) Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9) Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10) Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11) Khan M Y - Financial Services (Tata Mc Graw Hill, 1998)

6th Semester

EL1306	Control System	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objectives	Course Outcomes
This is a first course in feedback control of dynamic systems. The main goal is to introduce and familiarize students with dynamic systems modeling and analysis techniques that can be employed on a large variety of engineering systems. Being an interdisciplinary course, students will learn: 1 the role of a control engineer in multi- disciplinary teams. 2 to apply the knowledge gained in basic mathematics, physical sciences and engineering courses to derive mathematical models of typical engineering processes. 3 to use transfer function and state space models for control system analysis in time and frequency domain. 4 the basic concepts of proportional, integral, and derivative (PID) control. 5 the importance of stability in control systems and the various methods to determine it. 6 to construct root locus plot and frequency response plots such as polar plot, Bode plot, Nyquist plot etc.	Upon successful completion of this course, students should be able to: 1.Identify the basic elements and structures of feedback control systems. 2.understand the use of block diagram and signal flow graph as a modeling tool. Be able to manipulate block diagrams for systems of interconnected components. 3. develop models (differential equations, transfer functions, state space,) for a variety of dynamic physical systems. 4. understand the role of feedback in control systems. 5. have a good understanding of the response characteristics of basic first- and second-order dynamic systems. Be able to correlate time-domain responses with damping ratio and pole locations. 6. have an introductory knowledge of PID controllers. Be able to design PID controllers to meet simple specifications. 7. understand BIBO stability and its connection with pole locations. Be able to use Routh's criterion for absolute and relative stability analysis. 8.evaluate transfer function, stability and time response of control systems using state space techniques. 9. construct and recognize the properties of root-locus and its role in the analysis of control systems. 10. obtain frequency response indices. Be able to draw frequency response plots such as polar plot, Bode plot etc.

UNIT I : Introduction to Control Systems: History of control system, Basic Components of Control System, Open loop control and close loop control with examples, classification of control systems.

Transfer Function, Block Diagram and Signal Flow Graph : Transfer function and gain, Order of a system, block diagram algebra & reduction techniques, signal flow graph, its constructions and Mason's gain formula.

Mathematical Modelling of physical systems: Mathematical modelling of physical system such as – electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic etc., Analogous systems.

UNIT II: Characteristics of Feedback Control Systems : Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback.

UNIT III:Time Domain Analysis of Control Systems: Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady

6th Semester

EL1306	Control System	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

state error (e_{ss}) analysis, static error constants and system type, dominant poles, Approximation of high order systems by low order systems, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

UNIT IV: **Stability of Linear Control Systems :** Concept of stability, stable, unstable and marginally stable system, Absolutely stable and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh-Hurwitz stability criterion with special cases, relative stability analysis.

State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form, solution of state equations, state transition matrix, its properties and computation.

UNIT V: Root LocusTechnique : Definition, magnitude and angle criteria, properties of root locus, construction rules for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s)H(s).

UNIT VI: Frequency domain analysis of control systems: Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response, polar plot, inverse polar plot, bode plot, all pass and minimum – phase system, experimental determination of transfer function, log magnitude versus phase plot.

Stability in Frequency domain : Principle of argument, Nyquist stability criterion, Assessment of relative stability using Nyquist criterion, concept of gain margin and phase margin and its computation using polar plot and log magnitude versus phase plot. Constant M and constant N circles, Nicholas chart.

Text books:

1	Control system Engineering	5TH Edition	I. J. Nagrath & M. Gopal	New Age International
2	Automatic control systems	7th Edition	B. C. Kuo	PHI Learning Private Limited

Reference Books:

1	Sigma Series: Control Systems	1st Edition	Ashok Kumar	McGraw - Hill
2	Control systems :Principles and Design	4th Edition	M. Gopal	McGraw - Hill
3	Modern Control Engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited

6th Semester

EL1307	Lab.: Control System	L=0	T=0	P=2	Credits=1

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

The student will be able to understand the

1) Transducer Based System
2) Servo Mechanism
3) Transient Analysis of the System
4) The Stability of the System for Open Loop and Closed System.
5) Time Domain Specifications Of First and Second Order System.
6) Plotting of Root Locus and Bode Plots and Analyzing Relative Stability.

Mapped Program Outcomes	a	b	c	d	f	h	j

Practical based on above syllabus are to be covered.

S.N	TITLE
1	To study transient response of a second order system.
2	Study of Stepper Motor
3	Study of Potentiometer as an Error Detector.
4	To study the Speed Torque Characteristic of AC Servo Motor
5	To study the Frequency Response of RLC network
6	To study the Synchros : a) To plot the characteristic of synchro transmitter. b)To plot the characteristic of synchro receiver
7	Study of synchro as an error detector
8	Study of DC Position Servo Mechanism
9	Verification of Root Locus using MATLAB
10	Verification of Bode Plot using MATLAB
11	To Study Effect of Type of System on Steady State Error
12	PID Controller

6th Semester

EL1308	**Electrical Power System II**	**L= 3**	**T=1**	**P=0**	**Credits=4**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
After learning basic concepts of power system this subject explain functioning of power system with balance, unbalanced condition. Concept of faults, stability, grounding and economics of power system is also explained.	The student will be able to understand the 1) Symmetrical component transformation and sequence networks. 2) Symmetrical fault analysis with various faults with and without pre fault load currents. 3) Unsymmetrical fault analysis with and without fault impedance for various faults using symmetrical components. 4) Steady state and transient stability analysis of power system. 5) Economic operation of power system and representation of transmission loss using loss formula co-efficient. 6) Concept of Neutral grounding, shunt and series compensation of power system.
Mapped Program Outcomes:a,b,c,d,e,f,g,l,j	

UNIT-I: Symmetrical Fault Analysis
Define fault & its causes, effect of fault on power system, purpose of fault analysis, assumptions made for fault analysis, transient in a series R-L circuit, short circuit analysis on synchronous machine at no-load & loaded condition, selection of circuit breaker & its short circuit MVA calculation, current limiting reactors.

UNIT-II: Symmetrical Component:-
Introduction, α-operator, symmetrical components of an unbalanced Three phase system, symmetrical components of voltage & current phasors, zero sequence components of voltage & current, power in terms of symmetrical components, phase shift in star-delta transformers, sequence network for fault calculation, sequence impedances of transmission line & synchronous machines, zero sequence networks of transformers, assembly of sequence networks of power system.

UNIT-III: Unsymmetrical Fault Analysis
Assumptions made for unsymmetrical fault analysis, sequence voltages of a generator, sequence voltages at a fault point, general procedure for analysis of various fault with and without fault impedance for Line to Ground (L-G), L-L-G, L-L, Open conductors faults analysis using symmetrical components.

UNIT-IV: Power System Stability
Stability of power system:-Steady state, Dynamic and Transient stability definition, Dynamics of synchronous machine, swing equation, swing equation for machines swinging coherently and Non-Coherently. Power angle equation, Steady state stability studies.
Transient stability studies: - Swing curve, Equal Area criterion for transient stability, Application of equal area criterion for different disturbances. Solutions of swing equation by point by point method. Methods of improving transient stability.

UNIT-V: Economic operation of power system
Introduction, incremental fuel cost, economic dispatch neglecting transmission losses, transmission loss as a function of plant generation, general loss formula, and optimum load dispatch considering transmission losses.

6th Semester

EL1308	**Electrical Power System II**	**L= 3**	**T=1**	**P=0**	**Credits=4**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-VI: System Neutral Grounding & Reactive Power Compensation

Neutral Grounding: - Introduction to neutral grounding, methods of neutral grounding, peterson coil grounding.
Compensation: - Series & shunt compensation, location of series capacitors, protective schemes for series capacitors, problem associated with series capacitors, Static VAR system with its different schemes.

Text Books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Electrical Power System	**5TH edition 2007**	Ashfaque Hussain	**CBS**

Reference books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Elements of Power System Analysis	4th-1984	W. D. Stevenson	Tata McGraw Hill
2	Modern Power System analysis	4th -2011	I. J. Nagrath & D. P. Kothari	Tata McGraw Hill
3	Electrical Power System	3rd-2005	C. L. Wadhawa	NEW AGE INTERNATIONAL

6th Semester

EL1309	Electrical Drives	L= 4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
After studying Electrical machines this subject elaborates applications of different machines in industry. Characteristics under starting, running braking and speed control of different motors are explained. Programmable logic controller, contactors, tractions is also explained.	1) Principle of drive, its classification, brief application and it's characteristics like speed-torque characteristics under starting, running and braking condition. 2) Select motor rating, flywheel effect, power capacity of common drive for continuous and intermittent periodic load. 3) Magnetic circuit and control circuit using ac/dc contactor and relays for starting and braking of ac/dc motor. 4) Basic idea of programmable logic controller and their application for control of motor. 5) And analyze the performance and suitability of motors used in ac/dc traction, traction performance, and control and braking. 6) Use of digital and analog control of motor in electrical drives using digital processors.
Mapped Program Outcomes: a,b,c,d,e,i,j	

UNIT-1: **Introduction to Drives and Speed Control**
Definition of a Drive, Classification of Drives, Brief idea about drives commonly used in industries, Speed-torque characteristics of common drive motors (DC and AC), Characteristics of Drives under starting and running, Types of braking, Speed Control of AC and DC motors.

UNIT-2: **Selection of motors**
Selection of motors and bearings of motor: Power capacity for continuous and intermittent periodic duties, Flywheel effect, Duty cycles of motor, transmission, enclosure systems for drives.

UNIT-3 AC and DC contactor and relays
AC and DC contactor and relays: Limit Switches, Lock out contactor, magnetic structure, operation, arc interruption, Contactor rating, H.V. Contactor, control circuit for automatic starting and braking of DC motor and three phase induction motor, Control panel design for Motor Control Centre(MCC).

UNIT-4: Programmable Logic Controllers
Programmable Logic Controllers (PLC), programming methods, Ladder programming with few examples, Applications of PLC's in electrical drives.

UNIT-5: Traction motors

Traction motors: Motors use in AC/DC traction and their performance and desirable characteristics, requirement and suitability of motor for traction duty, Speed time characteristics of train, Traction motor control. Series parallel control with numerical method, Starting and braking of traction motor.

6th Semester

EL1309	**Electrical Drives**	**L= 4**	**T=0**	**P=0**	**Credits=4**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6: Digital speed control of Electric motors

Digital speed control of Electric motors, comparison with Analog method of speed control, Block Diagram arrangement for microprocessor based speed control of AC/DC motor, Flowcharts and algorithms for speed control and speed reversal of motor. Digital signal processors (DSP's) for drive control.

Text Books:				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	A Course in Electrical Power	**1st-2005**	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Magnetic control of motors	Industrial New York 1947	Heumann	Chapman and Hall
3	Introduction to Programmable Logic Controllers	3rd Edition, 2008.	Gary Dunning	Cengage Learning

Reference books:				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Modern Electric Traction	**4th -2005**	H. Pratap	Dhanpat Rai and Company
2	Modern utilization of traction motor	2003	J.B. Gupta	
3	A Textbook of Electrical Technology Volume III Transmission, Distribution, Utilization		B.L.Theraja, A.K.Theraja	S.Chand

6th Semester

EL1310	**Lab.: Electrical Drives**	**L= 0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Course Outcomes:

The students will be:

1. Able to understand different types of starter and their working
2. Able to understand different types AC and DC contactor
3. Able to understand different types limit switch, sensor
4. Basic knowledge of PLC and ladder logic programming

Mapped Program Outcomes	**a**	**d**	**j**

Expt.No.	**Name of Experiment**
1	To study the operation of Limit Switches and Sensors
2	To start an Induction Motor with a Star Delta Starter
3	Study of the ALLEN BRADLEY M-1200 Programmable Logic Controller
4	Write a Program to Start and Stop a Motor using a Programmable Logic Controller
5	Write a Program to Implement an OR Gate and a AND gate on a Programmable Logic Controller
6	Write a Program to implement an Up counter using the Programmable Logic Controller
7	To start an Induction Motor with a Star Delta Starter Using a Programmable Logic Controller program
8	To study the Bitwise Shifting of numbers on a Programmable Logic Controller.

6th Semester

EL1311	PE-I: Advanced Power Electronics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
To study soft switching and various soft switched converters, Multilevel inverters, Pulse Width modulation with different modulation strategies are covered.	1) To gain the knowledge of semi conductor devices regarding their structure and operation. 2) Concept of converters which uses the special switching techniques. 3) Operation of different multilevel and hybrid multilevel inverter topologies. 4) Various types of modulation techniques, their significance, implementation and applications. 5) Causes, effects and remedies of different power quality problems. 6) Various types of harmonics, their measuring indices and elimination methods.
Mapped Program Outcomes: a,b,c,d,f,j	

UNIT-1: Power Semiconductor Devices

Power Semiconductor Devices: Metal Oxide Turn off thyristor (MTO), Metal oxide Controlled Thyristor (MCT), Emitter Turn off Thyristor (ETO), Static Induction Thyristor (SIT). Injection enhanced gate transistors (IEGT), integrated gate commutated thyristor (IGCT).

UNIT-2: Hard Switched and Soft Switched Converters

Hard Switched and Soft Switched Converters: Load Resonant Converters, Series, Parallel & Hybrid Loaded Converters, Resonant Switch Converter, Zero Current, Zero Voltage switched Resonant Converter, DC-DC Resonant link inverters, Hybrid resonant link inverters.

AC Voltage Controller: Single phase and three phase controllers, Voltage Regulators.

UNIT-3: Multilevel Inverters

Multilevel Inverters: Diode Clamped Inverters, Flying Capacitor Inverters, Cascaded multilevel Inverters and Hybrid Cascaded Inverter. Introduction to latest multilevel inverter topologies.

UNIT-4: Modulation Techniques

Modulation Techniques: Pulse Width Modulation, Selective Harmonic Elimination (SHM), Space Vector Pulse Width Modulation (SVPWM), Random PWM.

UNIT-5: Power Quality

Power Quality: Overview, Definition, Sources of Pollution, Power quality Problems, Rapid Voltage Fluctuations, Voltage Unbalance, Voltage Dips and Voltage Swells and Short Duration Outages.

UNIT-6: Harmonics

Harmonics: Effects within power system, Interference with Communication Harmonic Measurements and Elimination of Harmonics.

Text Books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics	1989	Ned Mohan, T.M. Undeland and W.P. Robbins	John Wiley and Sons,Inc
2	Power Electronics Circuit's Devices and Applications	3rd Edition 2004	M.H. Rashid	Prentice Hall India
3	Power Electronics and AC Drives	2003	B.K. Bose	Pearson Education

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Semiconductor Circuits	1984	S.B. Dewan and Straughen	John Wiley and Sons, Inc.

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6th Semester

EL1322	PE-I: Optimization Techniques	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
To make the students aware of various optimization methods applicable to different systems and processes to maximize the output with minimum input.	1) Basic concepts of optimization and formulation of an optimization problem in standard form, classification of optimization problems and applications to various technical and non-technical real life problems. 2) Various conventional classical techniques to solve an optimization problem with and without constraints. 3) Concept of linear programming standard form of linear programming problems and various methods to get solution of those problem. 4) Application of various non-linear techniques to solve one dimensional non linear programming problems. 5) Concepts of unconstraint non linear programming and methods to solve such problems. 6) Constraint optimization techniques to solve non linear programming problems with constraints.
Mapped Program Outcomes: a,b,c,d,e,g,h,l,j	

UNIT-1: **Introduction**
Concept of optimization, Engineering applications of optimization, Statement of optimization problem, classification of optimization problems, optimization techniques.

UNIT-2: **Classical Optimization Techniques**
Single variable optimizations, multivariable optimization with no constraints and equality & inequality constraints, solution using Lagrangian multipliers, Kuhn – Tucker Conditions.

UNIT-3: Linear Programming (Simplex method)
Application of linear programming. Standard form & geometry of linear programming problems, definitions & theorems, solution of system of linear simultaneous equations,

UNIT-4: Non – Linear Programming - I
Brief Introduction, Characteristics of Non – linear programming techniques, Classification of Non – Linear Programming methods, Unimodal Function, Introduction to One dimensional Non – linear optimization Problem

UNIT-5: Non – Linear Programming - II
Introduction to Unconstrained and Constrained Non – linear optimization Problems, Random Jumping Method, Univariate method, Sequential linear programming, Zoutendijk's method (only algorithm).

UNIT-6: Genetic Algorithm
Evolution in nature-Fundamentals of Evolutionary algorithms-Working Principles of Genetic Algorithm Selection, Crossover and Mutation-
Particle Swarm Optimization
Introduction, Computational Implementation of PSO, Simple Numericals

6th Semester

EL1322	PE-I: Optimization Techniques	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

TEXT BOOKS

S.N.	TITLE	EDITION	AUTHOR	PUBLISHER
1	Engineering Optimization: Theory & practice	Fourth Edition	S.S. Rao	John Willey Publication
2	Modern optimization techniques with applications in Electric Power Systems	2012	Soliman Abdel Hady, Abdel Aal Hassan Mantawy	Springer,

REFERENCE BOOKS

S.N.	TITLE	EDITION	AUTHOR	PUBLISHER
1	Operations Research: An Introduction	Eighth Edition	Taha, H.A	Prentice Hall of India
2	Engineering Optimization : Methods and Applications	Second Edition (Wiley India Edition)	A.Ravindran, K. M. Ragsdell, G. V. Reklaitis	John Wiley Publication
3	Power System Optimization	2nd Edition, 2010	D.P.Kothari and J.S.Dhillon	PHI learning private limited
4	Multi objective optimization using Evolutionary Algorithms	2008	Kalyanmoy Deb	John Wiley and Sons
5	Optimization for Engineering Design	first edition,1988	Kalyanmoy Deb	Prentice hall of India

6th Semester

EL1323	**PE-I: Electrical Installation**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
To understand and design the methods used in electrical installation for commercial building and the tools used for it as per IE and IS Standards	1) Design and calculate the electrical requirements for a specific residential building with emphasis on the National Electrical Code. 2) Installation requirements for non metallic sheathed cable, armoured cable and their circuit according to NEC. 3) Design and calculate the electrical requirements for a specific commercial building with emphasis on National Electric code. 4) Understand various types of sub stations ,their ratings,equipments used,protective equipments used as per NEC. 5) Calculate the fault levels of various locations in sub station,use of various protections to limit thefaults ,types of earthing. 6) Testing procedure used for distribution transformers as per NEC.
Mapped Program Outcomes: a,b,c, e,i,j	

UNIT 1:
Load forecasting, regression analysis, numerical based on linear and exponential trends, Electrical installation for domestic, commercial and industrial consumers, calculation of connected load, selection of transformers, switchgears, cables and wires, single line diagram, special provisions for high rise buildings (IER-50-A), earthing requirements, megger and earth tests, use of earth leakage circuit breakers (special reference to be given to IER 2 (i, n, o, p, v, aa, aaa, aq, aqq, ar, av).

UNIT 2: Cables: PVC and XLPE cables, their construction in brief, current ratings, specifications, derating factors, megger and continuity test.
Overhead distribution lines upto 33 kV, Line apparatus and basic construction, clearances, selection of AAC and ACSR conductors, voltage drop calculations, Selection of Insulators, earthing requirements. (Special reference to be given to IER 77, 79, 80, 81, 87, 89, 90, 91, 92)

UNIT 3: Illumination Design:
Definitions, polar curves, simple calculations, working principles of fluorescent, sodium vapour and mercury vapour lamps, Capacitors and power factor improvement: Determination of rating and location of capacitors, calculation of payback period for additional capacitors.

UNIT 4: Substations:
Single line diagram, plan, elevation and clearances for 11 kV pole mounted, 11 kV plinth mounted (upto 1000 kVA and above 1000 kVA), 33 kV (upto 2500 kVA and above 2500 kVA) substations. Single line diagram for substation with two transformers in parallel, specifications of isolators, lightening arrestors, horn gap fuses, D.O. fuses, circuit breakers, instrument transformers, power transformers, LV HRC fuses, LV circuit breakers, (Special reference to be given to IER 31, 33, 35, 43, 44, 47, 48, 50, 51, 54, 58, 64, 64A, 67 and IS3043)

UNIT 5:
Determination of fault levels of various locations in substation, use of current limiting reactors, philosophy of protective relaying, overcurrent, earth fault, REF protection, earth leakage protection, OTI, WTI, Buchholz relays, Firefighting equipments, restoration of a person affected by electric shock, Earthing: types, measurement of earth resistance.

6th Semester

EL1323	**PE-I: Electrical Installation**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT 6:
Site testing of transformers (Visual, pre-commissioning tests like megger, magnetic balance, turns ratio), testing of oil, operational test for Buccholz, OTI, WTI, alarm and trip functions.

TEXT BOOKS				
S. N.	**Title**	**Year/Edition**	**Author**	**Publisher**
1	Electric Power		Soni, Gupta, Bhatnagar	Dhanpat Rai Publication
2	Electrical Installation Design		Jain, Bajaj	Laxmi Publication

REFERENCE BOOKS

S. N.	Title	Year/Edition	Author	Publisher
1	Electric Power Distribution Systems		Pabla	McGraw Hill
2	Electrical Substation		S. Rao	Khanna Publication
3	Electrical Engineering handbook		C.L.Wadhwa	
4	IER (Latest edition)			

6th Semester

EL1324	OE II: Electrical Energy Audit and Safety	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
Understand various operating characteristics of electrical equipments,its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving and its global impact	1) Types of energy sources, energy consumption pattern, and method of energy conservation and salient features of electricity act 2003. 2) Basics of electricity tariff thermal energy and its conversion 3) Types and need of energy management and audit, substitute of fuel and energy available, types of energy audit instruments and its use 4) Elements of energy monitoring and targeting various techniques used to measure the energy consumption 5) The terminologies of global environments concerns (UNFCC,COP,CDM and PCF) 6) The various hazards due to improper use of electricity ,safety practices which minimizes the risk against electrical hazards

UNIT-1: **Energy Scenario**
Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.

UNIT-2: **Basics of Energy and its various forms**
Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT-3 : **Energy Management & Audit**
Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

UNIT-4: Energy Monitoring and Targeting
Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).

UNIT-5: Global environmental concerns
United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

UNIT-6: Electrical Safety
Primary hazards associated with electricity. Control measures and safety-related work practices to minimize the risk associated with electrical hazards. Response procedures in the event of electrical shock or fire.

Text books:				
1	Principles of Energy Conservation	1991	Archie, W Culp	McGraw Hill
2	Energy management handbook	8th Edition	Wayne C. Turner	John Wiley and Sons
3	Bureau of Energy Efficiency Study material for Energy Managers & Auditors Examination	--	---	Bureau of Energy Efficiency www.beeindia.in
Reference books:				
1	Handbook on Energy Audits and Management		Amit Kumar Tyagi	TERI

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6th Semester

EL1325	**OE II: Utilization of Electrical Energy**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
To understand the basic principle of electrical heating, welding, illumination, refrigeration and air conditioning, fans, pumps, compressors and digi sets.	On completion of this course, students will be able to 1. understand working of various electric heating equipment 2. understand electric welding methods and its operation 3. understand nature of light and design various lighting schemes and fittings in use 4. Understand operation of refreigeration , AC system 5. figure-out the different schemes of traction schemes and its main components. Design a suitable scheme of speed control for the traction systems 1) understand economics of various power generating units, tariff

UNIT 1: Electric Heating:

i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat Types & application of electric heating equipment's, transfer of heat.

ii) Resistance Ovens: General constructions, design of heating elements, efficiency & losses, radiant heating.

iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating.

iv) Dielectric heating: Principle and application.

v) Arc furnace: Direct & indirect arc furnace, power supply, characteristics & control.

UNIT-2: **Electric Welding:**

i) Importance, Advantages & Disadvantages of welding, classification of welding processes.
ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding.
iii) Electric arc welding: carbon arc welding, metal arc welding, submerged arc welding, Welding positions, Types of welding electrodes
iv) Ultrasonic welding, electron beam welding, laser beam welding.

UNIT-3: Illumination:

Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.

UNIT-4: Refrigeration & Air conditioning:

Terminology, refrigeration cycle, refrigeration systems (Vapour compression, vapour absorption), domestic refrigerator, water cooler, desert cooler.

Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.

6th Semester

EL1325	**OE II: Utilization of Electrical Energy**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-5: Electric Traction
Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipments (collector gear for overhead equipments, conductor-rail equipment)Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve

UNIT-6: Economics of Power Generation, Electric Power Supply and Utilization
Terms and Definitions, base load and peak load, selection of power plant equipment (boilers, prime-movers, size and number of generating units), economics in plant selection, economics of hydroelectric power plant, economics of combined hydro and steam power plant, performance and operating characteristics of power plants, power plant useful life, tariff for electrical energy, objective and requirements of tariff, general tariff forms, comparison between private generating plant and public supply.

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
2	Art and Science of Utilization of Electrical Energy		H Pratap	Dhanpat Rai & Sons, Delhi
3	Utilization of Electrical Power		R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International
3	Utilization of Electrical Energy		E.Openshaw Taylor	Orient Longman

6th Semester

EL1312	**Lab.: Simulation in Power Electronics & Drives**	**L= 0**	**T=0**	**P=2**	**Credits= 1**

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Practical based on Power Electronics Circuits are to done using software.

Course Objective	Course Outcomes
To understand Power electronics and Drives through various software available for power electronics.	Students shall be able to understand practically the 1) Use of semiconductor devices for realizing uncontrolled and controlled rectifiers. 2) The implementations of inverters without and with PWMs 3) The working and implementation of multilevel inverter and the modulation control 4) The inverter fed AC drive with open loop control.
Mapped Program Outcomes:	a,b,c,d,g,h,j

Expt.No.	Name of Experiment
1	To study half wave uncontrolled rectifier
2	To study half wave controlled rectifier
3	To study full wave controlled rectifier
4	To study single phase H-bridge inverter(withoutPWM)
5	To study three phase bridge inverter(180 degree mode)
6	To study sinusoidal pulse width modulation(APOD,POD and IPD)
7	To study single phase H-bridge inverter using SPWM
8	Introduction to multilevel inverter and implementation of 3 and 5 level inverter
9	To study voltage sag on distribution system using symmetrical fault
10	To study inverter fed induction motor

6th Semester

EL1319	**Seminar**	**L= 0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	0	100	100	

7th Semester

EL1401	High Voltage Engineering	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
	The student will be able to understand the 1) Breakdown process of dielectrics including the gas, liquid and solid state dielectrics and solids explaining the physical process of breakdown - based on the Townsend, Paschen's law, Streamer theory. 2) Mechanism of lighting, characteristics of switching over voltages and protection of transmission lines with various types of lightening arresters. 3) Phenomenon of travelling waves on HV transmission line which may be incident, reflected, transmitted, attenuated or distorted during propagation. 4) Generation of high DC and AC Voltages, high impulse voltages, switching surges and impulse current.. 5) Measurement of high AC and DC voltages, impulse voltage, high frequency and impulse current. 6) Non destructive and high voltage testing of electrical apparatus.
Mapped Program Outcomes: b,d,f,j	

UNIT-1: **Breakdown Mechanism in Dielectrics**

Ionisation process : Townsend's criterion for breakdown, Break-down in electro-negative gases, Time -lag for breakdown, Streamer theory for breakdown in gases, Paschen's law, Breakdown in non-uniform fields, corona discharges and introduction of corona, post breakdown phenomenon and applications, practical considerations in using gases for insulation purposes, vacuum insulation, liquid as insulators, conduction and breakdown in pure and commercial liquids. Intrinsic electromechanical and thermal breakdown. Breakdown of solid dielectric in practice, breakdown in composite dielectric.

UNIT-2: **Lightning and switching over voltages**

Mechanism of lightning types of strokes, parameter and characteristics of lightning strokes, characteristics of switching surges; power frequency over voltages, control of over voltages due to switching. Protection of lines by ground wire, protection by Lightning Arrester (LA), gap type and gapless LA, selection of LA ratings, Surge absorbers.

UNIT-3: Travelling Waves and Insulation Co-ordination

Travelling waves on transmission lines, classifications of lines, attenuation and distortion of travelling waves, reflection and transmission of waves, behaviour of rectangular waves at transition points. Introduction to insulation co-ordination and associated terms, impulse wave-form, introduction to Basic Insulation Level (BIL), Reduced BIL and Switching Impulse Level (SIL).

7th Semester

EL1401	**High Voltage Engineering**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-4: Generation of High Voltage and Currents

Generation of High D.C. voltages by rectifiers, voltage doubler and multiplier circuits (Derivation not required) electrostatic machines. Generation of high ac voltage by cascade transformers, resonant transformers. Generation of high impulse voltages: Standard impulse wave shapes, analyses of model and commercial impulse generation circuits, waveshape control, Marx Circuit, tripping and control of impulse generation, generation of switching surges, generation of impulse current.

UNIT-5: Measurement of High Voltage and Current

Measurement of high AC and DC voltages by micro ammeter, generating voltmeters, resistance and capacitance potential dividers, series impedance voltmeter, Capacitive Voltage Transformer (CVT), Magnetic type potential transformers, electrostatic voltmeter, peak reading AC voltmeters, sphere gap arrangement, measurement of impulse voltage by potential dividers and peak reading voltmeters. Measurement of High AC/DC currents: Measurement of high frequency and impulse current by resistive shunts (Bifiliar strip shunt only).

UNIT-6: Non Destructive and High Voltage Testing of Electrical Apparatus

Non-destructive testing : Measurement of DC Resistivity, measurement of dielectric constant and loss-factor (low and power frequency only), Schering bridge for high voltage circuits, for high dissipation factor for three terminal measurements, transformer ratio arm bridges, partial discharge measurements by straight detector, balance detectors, calibration of detectors, discharge detection in power cables. High voltage testing: Testing of insulators, bushings, isolators, circuit breakers, cables, transformers, lightning arresters and power capacitors.

Text books:

SN	Name	Edition	Author	Publisher
1	EHV AC Transmission	2nd	Begamudre	New Age international Publisher
2	High Voltage Engineering	3rd -2006	M. S. Naidu and V. Kamaraju	Mc GrawHill Publisher
3	High Voltage Engineering	1st -1994	C.L. Wadhwa	New Age international Publisher

Reference books:

1	Advances In High Voltage Engineering		M.Haddat and Warne	

7th Semester

EL1402	Lab. : High Voltage Engineering	L= 0	T=0	P=2	Credits=1

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Mapped PO: b,c,f,i,j

Course Outcomes:

1) The main equipment in high voltage laboratory like HV transformer, sphere gap, control panel of transformer, cascade transformer and impulse voltage generator.
2) To measure the breakdown voltage between sphere gap, string insulator, pin insulator, puncture voltage and transformer oil.
3) To Measure Resistivity, Dielectric constant, tan δ of Oil Sample in Laboratory by using Three Terminal Oil Test Cell.
4) To Measure the condition of corona gap and horn gap which is applied generally in substation and transmission line during fault condition.
5) To observe the waveform in the CRO and measure the breakdown voltage between cascade transformer, impulse voltage generator (MARX circuit).
6) General study of cable fault locator.

Following practical based on Syllabus can be performed.

1) Study of High Voltage Laboratory Equipments.

2) Calibration of Panel Voltmeter by Sphere Gap.

3) Study of Corona.
4) Study of Movement of arc in horn gap.

5) Flash over voltage test: 11 kV pin type insulator.

6) Determination of string efficiency of suspension insulator.

7) Determination of breakdown voltage for transformer oil sample.

8) Determination of breakdown voltage for solid insulator.

9) Study of Cable Fault locator.
10) Measurement of Resistivity of Transformer oil.

11) Measurement of dielectric constant of transformer oil.

12) Measurement of Loss Angle of transformer oil.

13) Study of 100 kV AC/ 140 kV DC test set and calibration of Panel Voltmeter by Sphere gap.

14) Study of 150 kV, 225 Joules Impulse Generator and test on Pin type Insulator.

7th Semester

EL1403	Computer Applications in Electrical Engineering	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
This subject exposes the students to mathematical foundational concepts necessary in the field of Electrical Engineering such as 1) Load flow 2) Short circuit studies 3) Transient stability studies	1) Study of basics of incidence, network matrices and graph theory. 2) Formation of algorithms of bus impedance and bus admittance for single phase network. 3) Algorithm for formation of 3 phase bus impedance matrices without mutual coupling. 4) Calculations to find fault current and voltages for 3 phase network considering different types of fault. 5) Modelling and transient stability studies using different numerical methods with elementary computer programming. 6) Different methods of load flow studies.
PO:a,b,c,d,e,f,g,h,i,j	

UNIT-1: **Incidence and network matrices**
Incidence and network matrices: - Graph incidence Matrices, Primitive network, formation of network matrices by singular transformations.

UNIT-2: **Algorithm for single phase network**
Algorithm for formation of Bus Impedance and Bus Admittance matrix for system without mutual coupling.

UNIT-3: Three Phase Networks
Three Phase Networks: - Three phase balance network elements with balanced and unbalanced excitation incidence and network matrices for three phase element Algorithm for formation of three phase bus impedance matrices without mutual coupling.

UNIT-4: Short circuit studies
Short circuit studies: Three phase network short circuit calculations using bus impendence matrix for balanced and unbalanced faults. Computer programme for short circuit studies on simple system.

UNIT-5: Transient stability studies
Transient stability studies: Modelling of synchronous machine, power system network for transient stability studies. Numerical solution of swing equation by modified Euler and Runge Kutta 4th order method. Elementary computer programme for the transient stability study.

UNIT-6: Load Flow Studies
Load Flow Studies: Power system load flow equation, solution technique: Gauss Seidal , Newton Raphson and fast decoupled technique with and without (voltage) control buses. Representation of tap changing and phase shifting transformers. Elementary load flow programmes.

Text Books:

SN	TITLE	EDITION	AUTHOR	PUBLICATION
1	Computer Methods in Power Systems	1st 1968	Stag and El – Abiad	Mc Graw Hill
2	Elements of Power System Analysis	1982	William D.Stevenson	Mc Graw Hill

Reference Books

SN	TITLE	EDITION	AUTHOR	PUBLICATION
1	Computer Analysis in Power System	1982	R.N.Dhar	Mc Graw Hill
2	Modern Power System Analysis	3rd-2006	D.P.Kothari and I.J.Nagrath	TMH

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7th Semester

EL1404	Lab.: Computer Applications in Electrical Engineering	L= 0	T=0	P=2	Credits=1

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Course Outcomes:

The students will be able to understand
1. Basics of programming.
2. Write and debug programs for some power system problems.
3. Develop a skill of lifelong learning to solve Electrical problems by programming

Mapped PO: a,b,c,d,g,i,j

List of Experiments:

1. Write a program to find Bus Incidence Matrix.
2. Write a program to find Basic Cutset, Basic Closed Loop, Branch path incidence matrix.
3. Write a program to obtain Y_{bus} by Singular Transformation.
4. Write a program to find Z_{bus} by building algorithm method.
5. Write a program to obtain Y_{bus} by building algorithm method.
6. Write a program to determine fault current & faulted bus voltage for three phase to ground fault.
7. Write a program to determine fault current & faulted bus voltage for single phase to ground fault.
8. Write a program to plot swing curve by using Euler's method

7th Semester

EL1410	PE II: FACTS Devices	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
To understand the problems and constraints related with stability of large interconnected systems and to study their solutions using different FACTS Controllers, Shunt (SVC,STATCOM),Series (TCSC,GCSC,SSSC),Series Shunt(UPFC),Series Series(IPFC)	1) Concepts of FACTS, importance of controllable parameters in power system and benefits of FACTS controllers. 2) Design and implementation of shunt compensator with different control strategies. 3) Structure, operating principle and characteristics of different series controllers along with their implementation and applications. 4) Structure and operation of voltage and phase angle regulator in power system. 5) Combined series –shunt controllers with various operating modes. 6) Causes, effects, remedies and mitigation techniques for various power quality problems. 7) Concepts of FACTS, importance of controllable parameters in power system and benefits of FACTS controllers. **Mapped PO:a,b,c,d,f,j**

UNIT-1: **Flexible AC Transmission Systems (FACTS)**
FACTS concept and General System Consideration, Transmission interconnections, Flow of power in an AC System, factors affecting the Loading Capability, power flow and Dynamic Stability Consideration of Interconnected Transmission. Importance of controllable Parameters, FACTS Controller. HVDC and FACTS.

UNIT-2: **Static shunt compensators**
SVC and STATCOM, Objectives of Shunt Compensation, Methods of Controllable Var Generation, Static Var Compensators SVC and STATCOM,Control scheme for SVC and STATCOM ,Comparison between STATCOM and Static Var System (SVS).

UNIT-3: Static Series Compensators
GCSC, TSSC, TCSC and SSSC, Objectives of series Compensation, Variable Impedance Type Series compensators, Switching Converter Type Series Compensators, Control Schemes for GCSC,TSSC,TCSC and SSSC, External (System) Control for Series Reactive Compensators

UNIT-4: Static Voltage and Phase Angle Regulators
TCVR and TCPAR, Objectives of Voltage and phase angle regulators, Approaches to Thyristor Controlled Voltage Regulators (TCVR) and Thyristor Controlled Phase Angle Regulators (TCPAR), Switching Converter- Based Voltage and Phase Angle regulators, Hybrid Phase Angle Regulators.

UNIT-5: Shunt-Series Compensators:UPFC
Shunt series Compensators UPFC, Operating modes of UPFC, Basic control system for P and Q control, Comparison of UPFC to Series Compensators and Phase angle regulators.

UNIT 6: **Other FACTS Controllers**

Series –series compensators IPFC,Basic structure and operation,Thyristor controlled braking resistor

7th Semester

EL1410	**PE II: FACTS Devices**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

1	Understanding FACTS	2001	Naryan G Hingorani and Laszlo Gyigyi	Standard Publishers
2	FACTS : Controllers in Power Transmission & Distribution	1st Edition, 2007	K. R. Padiyar	New Age International
3	Thyristor based FACTS controller for electrical transmission systems	1st Edition 2002	R. Mohan Mathur, Rajiv K Verma	Wiley

Reference books:				
1	Flexible AC Transmission System [FACTS]		Edited by Yong Hua Song and Johns	IEEE Press

7th Semester

EL1427	**PE II: Artificial Intelligence based Systems**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Learning Objectives	Learning Outcomes
Student will understand The concept of fuzzy logic and neural network The basic concepts and mathematical models of fuzzy and neural network are covered	The student will be able to understand the 1) Basic principles of Fuzzy logic, its need and formulate and solve fuzzy logic based decision making problems. 2) Design aspects of fuzzy control. 3) Principles of neural networks, its need and solve classification and pattern recognition problems 4) Concepts of recurrent associative memories. 5) Basics of Neural network based control systems.

Mapped program outcmes: a,b,c,d,h,j

UNIT-1: **Introduction:-**
Fundamental concepts of fuzzy systems
1. Fuzzy sets, Approximate reasoning Representing set of rules.
2. Fuzzy knowledge based (FKBC) parameters. Introduction rule and data base inference engine, choice of fuzzification and defuzzification processes.

UNIT-2: **Nonlinear fuzzy control**
Introduction, Control problem, FKBC as nonlinear transfer element, types of FKBC.

UNIT-3: Adaptive Fuzzy control
Introduction, design and performance evaluation, main approach to design.

UNIT-4: Artificial Neural Network
1. Fundamental concept of ANN.
2. Model of artificial neural network (ANN), Learning & adaptation learning rules.

Feed forward networks:
Classification Model, features & decision, regions, Minimum distance classification, perceptron, delta learning rules for multi perceptron layer, generalized learning rules, back propagation algorithm, back propagation training, learning factors.

UNIT-5: Recurrent networks
Mathematical foundation of discrete time & gradient type Hopfield networks, transient response & relaxation modeling.

UNIT-6: Associative memories, self-organizing networks and Neural Control

Basic concept & recurrent associative memory, Bi-directional associative memory, Hamming net & MAXNET Unsupervised learning of clusters, , feature mapping, self-organizing feature maps, Basics of Neural Network Control, Predictive Control.

7th Semester

EL1427	**PE II: Artificial Intelligence based Systems**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text Books

1	Introduction of Artificial Neural Networks	1992	Jacek Zurada	JPH
2	An Introduction to Fuzzy Control	2010	D. Drianko	Springer
3	Design of Neural Networks	2nd edition	Hagen,Demuth,Beale	Cengage Learning,ISBN-10:0-9717321-1-6,ISBN-13:978-0-9717321-1-7

Reference Books:				
1	Neural Network & Fuzzy Systems	1992	Bart Kosko	Prentice Hall of India
2	Neural Networks	2009	Simon Haykin	(Maxwell) Macmillan Canada Inc.) Comprehensive Foundation
3	Fuzzy sets: Uncertainty & information	1988	Klir & Folger	Prentice Hall of India
4	MATLAB Toolbox			

7th Semester

EL1431	PE II: Advanced Control System	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
This subject elaborate concept of compensation in control system. Compensation design is explained. Optimal control and sample data control system is also discussed in this subject	1) Concept of lag and lead compensator design in time and frequency domain. 2) State variable approach with solution of state models and concepts of controllability, observability and state variable feedback. 3) Optimal control problems with transfer function approach. 4) Introduction of nonlinear system and stability analysis using describing function approach. 5) Phase plane method for stability analysis using isocline and delta methods. 6) Introduction of sample data control system, Stability analysis with Z transforms and solution of discrete time systems.

Mapped program outcomes	a	b	c	d	f	h	j

UNIT-1: **Compensation**
Compensation: - Review of performance Analysis of type O, type 1 & type 2 systems. Need for compensation. Performance Analysis of Compensators in time & frequency domain, Bode Plots and Design of Compensators.

UNIT-2: Design of PID Controller:
Fixed configuration design, theory of PI, PD and PID control in time domain and frequency domain, Zeigler Nichol's method of PID tuning.

UNIT-3: State variable Feedback
Design by State variable Feedback: Review of state variable representations. Solution of state equation Controllability & observability, Design of State Feedback.

UNIT-4 : Non Linear control system (NLCS)
Non Linear Control System: Types of non-linearities, characteristics of NLCS. Inherent & intentional non-linearities. Describing function method for Analysis Describing functions of some common non-linearities. Stability analysis. Limit cycles & stability of limit cycles.

UNIT-5 : Phase -Plane Method
Phase -Plane Method: Singular points stability from nature of singular points Construction of trajectory by Isocline and Delta Method Computation of time.

UNIT-6: Sample Data control System (SDCS)
Sample Data control System; - Representation of SDCS, Sample and Hold Circuit Z-Transform, Inverse Z-Transform & solution of difference equation "Z" & "S" domain relationship. Stability by Bi-linear transformation & Jury's test. Discretization of continuous time state equation.

Text books:				
1	Control Systems Analysis	4th edition	2008	I.J.Nagrath,M.Gopal
2	Modern Control Theory			M.Gopal

Reference books:			
Control Systems			Kutsohiko Ogata
Automatic Control Systems	Seventh Edition		B C..Kuo
Modern Control System		2003	B.C.Kuo
Optimal Control			Kirk

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7th Semester

EL1432	**Electrical Distribution Power System**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
Student will be able to understand the various Aspects of distribution system **Mapped Program Outcomes: a,b,d,f,j**	The student will be able to understand the 1) The factors which affect the performance of distribution system, nature of load, its growth and forecasting. 2) Types of feeders, its loading, causes of unbalance, fault isolation, System restoration. 3) Distribution line parameter, supports and the causes and effects of voltage drop in distribution line 4) Different method Reactive power compensation Benefits of power factor improvement. 5) To decide optimal location of substation 6) Problems with existing distribution systems and function of substation automation system

UNIT-1: **Load Forecasting**

Introduction, Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor, load & load characteristics, load and load duration curve, relation between load and loss factor, load curve and diversified demand, load modeling,load growth and forecasting.

UNIT-2: **Distribution Feeders:**

Introduction, Primary and secondary distribution, Radial and loop types, Distribution substation location and planning, Feeder loading and voltage drop considerations, Voltage drop in feeder with different loading, Engineering considerations for voltage levels and loading, causes of unbalance and unequal drops, common faults in feeders, fault location, fault isolation, restoration.

UNIT-3: Overhead lines and Cables

Introduction, Line parameters, Overhead lines, insulators and supports, cables, Insulation resistance, Voltage drop and power loss in conductors, voltage drop in ac single phase distribution system, voltage drop computation based on load density, voltage drop in underground cable distribution.

UNIT-4: Reactive power compensation and applications of capacitors

Introduction, advantages and benefits of power factor improvement, power factor improvement using capacitors: mathematical calculations, location of capacitors, application of capacitor banks for power factor improvement, sub harmonic oscillations and ferro resonance due to capacitor banks, optimum power factor for distribution system.

UNIT-5: Substation & Metering, instrumentation & Tariffs

Introduction, substation types, substation components, equipment and layouts, substation location and size, Grounding, earth connection and earthing system, measurement of power, measurement of energy, maximum demand and trivector meter, automatic meter reading (AMR), AMR systems, substation instrumentation, tariffs and billing.

UNIT-6: Distribution automation (DA) & SCADA

Problems with existing distribution systems, need for distribution automation, distribution automation, feeder automation, communication requirements for DA. Remote terminal unit (RTU), Block diagram of SCADA, Components of SCADA, Functions of SCADA, SCADA applied to distribution automation, Advantages of DA through SCADA,DA integration mechanisms, Functions of substations automation systems, state and trends of substation automation.

7th Semester

EL1432	**Electrical Distribution Power System**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books				
1	Electrical power Distribution Systems	2009	V. Kama Raju	Tata Mcgraw Hill Education Private Ltd., New Delhi
2	A Text Book of Electric Power Distribution Automation	1st Edition, 2010	Dr. M. K. Khedkar And Dr. G. M. Dhole,.	University Science Press

Reference books:				
1	Electric Power Distribution	4th edition, 1997	A.S.Pabla	Tata Mc Graw-Hill Publishing Company
2	Electrical Distribution System	1st Edition,2013	Dr.H.P.Inamdar	Electrotech Publication

7th Semester

EL1405	Lab.: Simulations in Power System	L= 0	T=0	P=2	Credits=1

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Students shall be able to understand practically the
1) Use of MATLAB tools for realizing the power system problems and solutions.
2) Implementation of the distribution and transmission systems with various loads and its effects.
3) Application of capacitor bank for voltage regulation, power factor improvement and for mitigating other power quality problems.
4) Effects of faults on the power system.
5) Calculation of different powers, power factor and other power system parameters.

Mapped Program Outcomes	a	b	c	d	g	h	j

SN	TITLE
1	To study analysis of active and reactive power of distribution system
2	Analysis of power factor of distribution system
3	Analysis of harmonic distortion in distribution system
4	Analysis of transient condition of system when circuit breaker is at load side
5	Voltage regulation of non-stiff distribution system
6	To study shunt capacitor compensation
7	To study Ferranti effect
8	Use of surge arrestor in transmission system

Text books:				
1	Power System Analysis	2nd Edition, 2002	Hadi Saddat	Mc GrawHill
2	MATLAB Programming for Engineers	2nd Edition, 2002	S. J. Chapman	Bookware Companion Series, Thomson Brooks/Cole, Thomson Asia Pte. Ltd., Singapore
3	MATLAB and Simulink for Engineers	1st Edition, 2012	Agam Kumar Tyagi	Oxford University Press
4	MATLAB and its applications in Engineering	2009	R. K. Bansal, A. K. Goel and M. K. Sharma	Pearson Education

Reference books:		
1	Matlab Simulink manual	Mathwork
2	Sim Power system toolbox manual	Mathwork

7th Semester

EL1406	**Industrial Training / CRT**	**L= 0**	**T=0**	**P=4**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	100		100	

7th Semester

EL1407	**Project Phase-I**	**L= 0**	**T=0**	**P=4**	**Credits=4**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

8th Semester

EL1416	Switchgear and Protection	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
Students will understand 1.The theory and applications of the main components used in power system Protection. 2.Tthe protection systems used for electric machines, transformers, bus bars, Transmission lines. 3. The theory, construction, and applications of main types of circuit breakers. 4. To design the feasible protection systems needed for each main part of a power system. **Mapped Program Outcomes : a,b,c,d,e,f,g,h,i,j**	The student will be able to understand the 1) Fundamentals of protection system. 2) Overcurrent protection for medium voltage line with overcurrent and directional Overcurrent relay. 3) Theory of distance protection 4) Concept of static relays and circuit breakers 5) Application of different types of transformer And busbar protection in industry. 6) Application of different types of generator and Induction motor protection in industry.

UNIT-1: **Introduction**

General Philosophy of Protective Relaying:- Protective Zones. Primary Protection, Back up protection. Primary and Local Back Up. Selectivity, Fuse (wire and HRC).

UNIT-2: **Overcurrent Protection**

Medium voltage Line Protection: Overcurrent relaying, directional overcurrent relays.

UNIT-3: Distance protection

High voltage line Protection: - Distance relays, carrier distance schemes, Unit carrier schemes.

UNIT-4: Static relays:

Introduction to static relays: Comparison of static and electro-mechanical relays, two input amplitude and phase comparators and their duality, Generation of various distance relay characteristics using above comparators.
Circuit breakers

Switchgear : Circuit breakers Arc interruption theory, recovery and Restriking voltage ,RRRV, breaking of inductive & capacitive currents, C. B. rating, different media of arc interruption, overview of oil circuit breakers, Air blast, SF6 and vacuum breakers.

UNIT-5: Equipment Protection

Equipment Protection: Principles of differential relaying, protection, transformers and busbars by differential relaying and other relays. Miniature circuit breakers, moulded case circuit breaker, release, earth leakage circuit breaker.

UNIT-6: Equipment Protection

Protection of Generators & Induction Motors.

8th Semester

EL1416	**Switchgear and Protection**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text Books				
1	Protection and Switchgear	2012	R.P.Maheshwari, Nilesh G.Chothani, Bhavesh Bhalija	Oxford University Press
2	Switchgear and Protection	2003	S.R.Bhide and Y.G. Paithankar	PHI
3	Power System Protection and Switchgear	2007	Badri Ram	TMH.
4	Switchgear and Protection	**1990**	S. S. Rao Khanna	
Reference books				
1	The Art and science of protective relaying	**1992**	Russel, Mason	Wiley Eastern
2	Computer relaying for power system	2009	Arun G. Phadke and JamesThorpe	S John Wiley

8th Semester

EL1433	Renewable Energy Sources	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes

UNIT-1
Introduction
Introduction to Renewable Energy Sources, Primary and Secondary Energy Sources, Comparison of Conventional and Non-Conventional Energy Sources, Prospects of RES in global and Indian Context, Introduction to Energy from Bio – mass, Geothermal Energy, MHD Power Generation

UNIT-2
Solar radiation & its Measurement
Solar constant, Solar radiation at earth's surface, Beam and Diffused Solar Radiation, Insolation, Attenuation of Beam Radiation, Absorption and Scattering, solar radiation geometry, Day Length, Local Solar Time, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surfaces, Numericals
Solar Energy Collectors
Physical principles of the conversion of solar radiation into heat, flat plate collectors, transmissivity of cover systems, energy balance equation and collector efficiency, concentrating collectors, comparison of concentrating and flat plate collectors, selective absorber coatings, Numericals on Flat Plate Collectors only

UNIT-3
Applications of Solar Energy
Photovoltaic solar energy conversion:- Introduction, Equivalent Structure of PV cell, Series – Parallel combination, Partial shading, Introduction to DC – DC converter, solar MPPT, Grid converters and control
Introduction and working principle of **Solar ponds,** Solar water heating, solar thermal heat conversion, solar pumping, solar cooking

UNIT-4:Wind Energy
Basic principles of wind energy conversion, Power in the wind, Numericals based on Power Calculations, Lift and Drag, site selection considerations, basic components of wind energy conversion systems (WECS), classification of WEC systems, Wind Energy Collectors, Horizontal and Vertical Axis Wind Machines and their comparison (No Numerical or Derivative or Analytical part), generating system,

UNIT-5: Applications of Wind Energy
Application of wind energy, On – land and off – shore applications, Stand alone and Grid Connected Applications, Fixed (Single speed and Two speed) and variable speed (Wound rotor, SCIG) wind turbines, Introduction to soft starters, Reduced and full capacity converters and wind MPPT, Introduction to control mechanism

8th Semester

EL1433	Renewable Energy Sources	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6: Ocean and Tides

Energy from oceans

Ocean thermal electric conversion (OTEC), Claud& Anderson cycles, evaporators, Bio-fouling, hybrid cycle.

Energy from tides

Introduction, basic principles of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, Single and Double Basin Arrangement, estimation of energy & power in simple single basin tidal system, advantages and limitations of tidal power generations, Numericals on Single Basin Systems only

8th Semester

Energy & power from waves

Introduction to Wave energy conversion devices, Floats, High Level Reservoir Wave Machine, Dolphin type Wave power machine

Small scale hydroelectric power generation

Introduction, Classification of Small Hydro Power Stations depending upon capacity and head, Turbines and Generators for Small Scale Hydro Electric Power Generation, Advantages and limitations

Text books:

SN	TITLE	YEAR	AUTHOR	PUBLICATION
1	Non – Conventional Energy Sources, 5th edition, 10th Reprint	2013	G. D. Rai	Khanna Publisher, New Delhi
2	Solar Photovoltaic's: Fundamentals, Technologies and Applications	2011	Chetan Singh Solanki	PHI Learning Publications, 2nd Edition
3	Non-conventional Energy Resources	2006	B. H. Khan	Tata McGraw Hill

Reference Books:

SN	TITLE	YEAR	AUTHOR	PUBLICATION
1	Solar Energy : Principles of Thermal collection and storage	1994	S. P. Sukhatme and J. K. Nayak	Mcgraw Hill Publishing Company Limited, New Delhi
2	Energy Technology :Nonconventional, Renewable and Conventional		S. Rao and B.B. Parulekar	Khanna Publisher, New Delhi
3	Wind and Solar Power System		M. R. Patel	CRC Press, New York.

8th Semester

EL1434	**Lab. :Renewable Energy Sources**	**L= 0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Practical's will be based on Syllabus:
1) To plot V-I characteristics of a single PV module.
2) To plot V-I characteristics of a series connected PV modules.
3) To plot V-I characteristics of a parallel connected PV modules
4) To study the effect of tilt angle on power output of module.
5) To study the effect of shadow on power output of solar PV module.
6) To study the solar based battery charger
7) To study the wind based battery charger
8) To study the hybrid wind and solar based charger
9) To study the biogas generation plant model set up at YCCE Campus
10) To study the box type solar cooker
11) To study solar water heater in natural convection and force convection mode
12) Study of Hydroelectric Power Plant
13) To design home solar PV system.

It is expected to conduct 8 to 10 experiments in a session

8th Semester

EL1411	PE III : Advanced Electrical Drives	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcomes
1) To study the converter and Chopper control of DC drives. 2) To study the semiconductor based control of Induction and Synchronous motors. 3) To learn the basics of Switched reluctance motor and Brushless DC motor. 4) To Study the non-conventional and renewable energy based drives .	The student will be able to understand the 1) Dynamics of Electrical drives and its energy conservation. 2) Various control techniques for DC Drives and study of current harmonics. 3) Induction motor drives and its variable frequency control using scalar and vector control 4) Starting,braking and control of synchronous motor drives using various power electronic devices. 5) Various special motors like BLDC,Stepper motor ,switched reluctance motor. 6) Control of traction motor by using Semiconductor Converter Controller

Mapped Program Outcomes	a	b	c	d	e	f	i	j

UNIT-1: Introduction to Electric Drives
Dynamics of electric drives and control of electric drives. Energy conservation in electric drives.

UNIT-2: D.C. Drives
Controlled rectifier fed D.C. drives, single phase and three phase rectifier control of Separately excited D.C. motor; Dual Converter control of separately excited D.C. motor; Power factor, supply harmonics and ripples in motor current; Chopper controlled of separately excited dc motor; chopper control of series motor; source current harmonics.

UNIT-3: Induction Motor Drives
Stator voltage control, V/f control, static rotor resistance control, slip power recovery schemes, variable frequency control using voltage source inverter. Current sources inverter and cyclo converter, Introduction to vector control of Induction motor.

UNIT-4: Synchronous Motor Drives
Starting and Braking of Synchronous motor; variable frequency control; self-controlled synchronous motor drive employing load commutated thyristor inverter , Introduction of Cyclo-converter control of Synchronous motor; starting of large synchronous motors.

UNIT-5: Special Motors Drives
Brush less dc motor, stepper motor switched reluctance motor drives and eddy current drives. Introduction to solar and battery powered drives.

UNIT-6: Traction Drives
DC and AC traction drives, semiconductor converter controlled Drives; 25 KV AC traction using semi conductor converter controlled DC motor; DC traction using semiconductor chopper controlled dc motors; polyphase AC motors for traction drives.

8th Semester

EL1411	**PE III : Advanced Electrical Drives**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text Books

1	Fudamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
2	Modern Electric Traction	2003	H.Pratap	Dhanpatrai & Company
3	Electric drives concepts and applications	2005	V.Subramaniam	Tata McGraw Hill
4	Electric Motor Drives	2001	R. Krishnan	Prentice Hall India

Reference books:				
1	Electrical Machines Drives and Power Systems	6th edition 2008	Theodore Wildi	Pearson Education

8th Semester

EL1422	PE III : Power System Operation and Control	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
The student will understand the economic aspects of power system operation, methods of power frequency control, economic dispatch control, reactive power control and voltage control.	The students will able to understand 1) System characteristics curves and concept of load dispatching. 2) Concept of load forecasting and unit commitment. 3) Load frequency control of single area and two area network. 4) Theory of economic load dispatch and solution with iterative method. 5) Control of reactive power and compensation equipment used for transmission line. 6) Theory of voltage control and different methods of voltage control.

Mapped Program Outcomes	a	b	j

UNIT-1: **Economic Aspects**
Introduction, system load characteristics curves-chronological load curves-load duration curves-energy time curves load factor utilization factor-diversity factor- coincidence factor- demand factor- reserve requirements installed reserve- spinning reserve- cold reserve- hot reserve – operational restrictions, load dispatching.

UNIT-2: **Pre requisite of Load Dispatching**
Load forecasting- components of system load- classification of base load- forecasting of the base load by method of least square fit introduction to unit commitments unit commitment using priority ordering.

UNIT-3: Load Frequency Control (LFC)
Introduction, necessity of maintaining frequency constant, Load frequency Control, Governor Characteristics of single Generator, Adjustment of Governor Characteristic of Parallel Operating Unit, LFC (P-f control) Q-V Control, Generator Controller (P-f control & Q-V controllers), P-f control versus Q-V control, Dynamic Interaction between P-F and Q-V Loops, Speed-Governing System, Control Area Concept, Incremental Power Balance of Control Area, Requirements of the Control Strategy, Integral control, Concept of two area.

UNIT-4: Economic Dispatch Control
Incremental cost curve- co-ordination equations with loss included (No derivation of B_{mn} coefficient) solution of co-ordination equations using B_{mn} co-efficient by iteration method Base point & participation factors- Economic dispatch controller added to LFC.

UNIT-5: Reactive Power Control
Introduction, objective of load compensation, theory of load compensation, uncompensated transmission line, compensated transmission line, shunt compensator, series compensator, basic relationship for power flow control, Sub synchronous resonance, comparison of different types of compensating equipment for transmission systems,

UNIT-6: Voltage Control
Introduction, necessity of voltage control, generation and absorption of reactive power, location of voltage control equipment, methods of voltage control, rating of synchronous phase modifier.

8th Semester

EL1422	**PE III : Power System Operation and Control**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text Books:				
1	Power System Operation and control		S. Sivanagarju and G. Srinivasan	Pearson Publisher
2	Power System Stability and control		P. Kundur	TMH Publisher
3	Electrical Power system		C. L. Wadhwa	
4	Economic Operation of power system studies		L. K. Kirchmayer	Wiley Eastern India, New Delhi
5	Power System Analysis Operation and Control	3rd Edition, 2010	Abhijit Chakrabarti, Sunita Halder	PHI Learning Pvt. Ltd.

Reference books:				
1	Power Generation, Operation and control	2nd Edition	A. J. Wood and B.F. Woolenberg	John Wiley & Sons

8th Semester

EL1435	**PE III : Fundamentals of Power Quality**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
Students will understand the various power quality issues, harmonics, filter designs and power quality improvements using custom power devices.	The students will able to understand 1) Various power quality issues, their causes and impacts on customer equipments. 2) The classification of voltage sags, effect of fault on voltage sag and impact of voltage sag on different instrument. 3) The causes of harmonics, effects and solutions to mitigate harmonics in system. 4) Working of passive, active and hybrid power filters and will able to design the filters. 5) Different voltage sag detection methods, reference theory, network configuring theory. 6) Working, control strategies and applications of different custom power devices

Mapped Program Outcomes	a	b	c

UNIT-1: **Overview and definition of power quality**
Overview and definition of power quality (PQ): Sources of pollution and regulations, Power quality problems: rapid voltage fluctuations voltage unbalance, Voltage dips and voltage swells, Short duration outages, long duration variations, power acceptability curves.

UNIT-2: **Voltage sag analysis**
Definitions Voltage sag analysis: Sag caused by motor starting, Sag caused by utility fault clearing, Sag magnitude and duration calculations, RMS voltage, calculation in single phase systems, Computers, AC and DC drives etc. performance in presence of sag.

UNIT-3: Harmonics
Harmonic Distortion: Power system harmonics: Harmonic analysis, Harmonic sources and their effects, the static converters, Transformer magnetization and non – linearities, Arc furnaces, Fluorescent lighting. Introduction to power converters, Fourier analysis, Total harmonic distortion, rms & average value calculation, Effects of harmonic distortion and Flickers.

UNIT-4: Filter Design
Filters: passive filters, active filters, hybrid filter design and working principles.

UNIT-5: Analysis and Conventional Mitigation Methods
Analysis: Extraction of fundamental sequence components, reference theories, voltage sag reduction, harmonic reduction, introduction to network configuring devices.

Unit 6: **Power Quality Improvement using custom power devices** Custom Power Devices: Introduction to custom power devices, Dynamic Voltage Restorer (DVR) , Distribution Static Compensator (DSTATCOM) and Unified Power Quality Conditioner (UPQC), Control strategies, status of application of custom power devices.

8th Semester

EL1435	**PE III : Fundamentals of Power Quality**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	Electrica Power Systems Quality	2nd edition.	R. C. Dugan, M. F. Mcgranaghan	McGraw-Hill
2	Power Quality		C. Sankaran	CRC Press
3	Understanding Power Quality Problems: Voltage sag and interruptions	2002	M. H. Bollen	John Willey

Reference books:				
1	Power System Harmonics	2nd edition, 2003	J. S. Arillaga	Wiley
2	Power Quality Enhancement using custom power devices	2002	Arindam Ghosh	Kluwer Academic Publishers

8th Semester

EL1424	PE IV : EHVAC-HVDC Transmission	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
The student will understand the various aspects of transmission system, systems for power flow control, design parameters of filters and layout of HVDC power plant	The student will be able to understand the 1. Power handling capacity and concept of voltage gradient of EHVAC Transmission systems 2. Electrostatic and electromagnetic fields and corona effect. 3. The configuration, design and comparison of EHVAC-HVDC Transmission systems and analysis of HVDC power transmission. 4. Control of HVDC Converter. 5. Design of Harmonic filters and reactive power configuration. 6. The HVDC Circuit breaker and concept of HVDC substation protection .

Mapped Program Outcomes	a	b	c	f	j

UNIT-1: P**ower handling and voltage gradient**
1) Power handling capacities of EHV AC transmission lines.
2) Voltages gradients: Electric field of point charge, sphere gap line-charge. Single and three phase lines, and bundled conductors. Maxwell's potentials coefficients.

UNIT-2: **Electrostatic and electromagnetic fields of EHV lines & corona**
1) Electrostatic and electromagnetic fields of EHV lines, electric shock and Threshold current , calculation of electrostatic field of A.C. lines (3 phase single and double circuit lines only). Effect of high electrostatic field.
2) Corona: Types, critical disruptive voltages, Factors affecting corona, Methods for reducing corona power loss (empirical formula), corona current waveform, audible noise and radio interference.

UNIT-3: HVDC Power transmission
DC Power transmission technology: Introduction, comparison of AC and DC Transmission, application of DC transmission, Description of DC transmission system, configuration, planning for HVDC transmission, types of DC link. Introduction to HVDC light, Earth electrode and earth returns. Introduction, objectives, location and configuration, resistance of electrodes, means of reducing earth electrode resistance.

UNIT-4: Analysis of HVDC converters
Analysis of HVDC converters: Pulse number, choice of converter configuration, simplified Graetz circuit, converter bridge characteristics, characteristics of twelve pulse converter Power flow control in HVDC system :- Constant current. Constant voltage, constant ignition and excitation angle control, control characteristics.

UNIT-5: Harmonic Filters &Reactive power compensation
Harmonic Filters :- Introduction, Filters, surge capacitors and damping circuits, shunt filters, series filters, AC filters, design of AC filters and tuned filters, double frequency and damped filters, cost considerations and ratings.
Harmonics on D.C side of converters. DC Harmonics filters. - Reactive power requirement of HVDC converters, substations.

UNIT-6: HVDC circuit breakers
HVDC circuit breakers: - Introduction, construction and principle of operation. Interruption of DC current, application of MRTB, Type of HVDC circuit breaker, capability and characteristics of HVDC circuit breakers

8th Semester

EL1424	**PE IV : EHVAC-HVDC Transmission**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:				
1	EHV AC & HVDC Transmission & Distribution	**3rd-2006**	S. Rao	Khanna
	EHV AC Transmission	2nd	Begamudre	New Age international Publisher
2	Power system Stability and Control	**2nd - 2006**	P. Kundur	Publisher
3	HVDC Transmission Systems		J. Arrilaga	**Publisher**

Reference books:				
1	HVDC Power Transmission System	**1st-2002**	K.R. Padiyar	Publisher

8th Semester

EL1425	PE IV : Electrical Power Utilization	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes
Student will understand. The knowledge about energy utilization .The application of electrical energy such as lightning, heating welding, fans and pumps.	The student on completion will be able to understand 1) Types of electric heating techniques, their field of application, relative advantages and limitations. 2) Types of electric welding techniques, their field of application, relative advantages and limitations, defects in welding, new advancements in welding technology. 3) Basic concepts of illumination, various types of lamps along with their light characteristic and field of application. They will be able to design illumination system for various criterions. 4) Basic refrigeration cycle, VCRS and VARS, various types of air conditioning systems and its use as per requirement. 5) Difference between fans and blowers with respect to its characteristics , various energy saving methods to be used. They can classify pumps with respect to its characteristic and field of application. 6) Classification of compressors, application of compressors as per requirement of compressed air. They will understand basics of DG system, its major components, working under different conditions and energy saving opportunities in DG system

Mapped Program Outcomes	a	c	d	e	f	i	j

UNIT-1: **Electric Heating**
Introduction, Advantages of electric heating, modes of heat transfer, methods of electric heating, resistance heating, arc heating, arc furnaces, induction heating, dielectric heating, infrared and radiant heating.

UNIT-2: **Electric Welding:**
Definition, welding process, resistance electric welding, electric arc welding, submerged arc welding, MIG welding, Ultrasonic welding, laser beam welding, welding of various metals, underwater welding, defects in welding, testing of welding joints.

UNIT-3: Illumination :
Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.

UNIT-4: Refrigeration & Air conditioning:
Terminology, refrigeration cycle, refrigeration systems (Vapor compression, vapor absorption), domestic refrigerator, water cooler, desert cooler.
Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective Temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.

8th Semester

EL1425	**PE IV : Electrical Power Utilization**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-5: Fans & Pumps:
Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportunities.
Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system.

UNIT-6: Compressors and DG Sets:
Compressors: Compressor types, Compressor efficiency, Compressed air system components.
Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets.

Text books:				
1	Utilization of Electric Energy		E. Openshaw Taylor	Orient Longman
2	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
3	Art and Science of Utilization of Electrical Energy		H Partap	Dhanpat Rai & Sons, Delhi
4	Utilisation of Electrical power	1st Edition, 2006	R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:				
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International

8th Semester

EL1436	PE IV : Fundamentals of Smart Grid	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objectives	Course Outcomes

UNIT-1: Introduction to Smart Grid :
Introduction to smart grid, Comparison between Present grid and Smart grid, Motivation for use of smartgrid, computation intelligence, Communication Standards, Environment and Economics

UNIT-2: : Power System Enhancement
Power System enhancement using smart grid, Energy Independence and Security, General view of the Smart grid market drivers, Function and role of stakeholder, Smart grid based performance measures, Functions of smart grid components

UNIT-3 :Smartgrid Communications :
Communication and measurement, Monitoring, PMU, Smart meters, Measurement technologies, GIS and Google mapping tools, multi agent technology, microgrid and smartgrid comparison.

UNIT-4: Performance Analysis Tools for Smartgrid Design
Congestion management effect, load flow for smart grid design, Static Security assessment (SSA) and contingencies, Contingencies and their classification, contingency studies for smart grid.

UNIT-5 : Computational Tools for Smartgrid Design
Introduction to computational tools, Decision support Tools (DS), Hybridizing optimization techniques and applications to the smartgrid, Computational Challenges.

UNIT-6: Renewable Energy and Storage :
Sustainable energy options for the smartgrid, Penetration and variability issues associated with sustainable energy technology, Demand-response issue,

Text books:

	TITLE	YEAR	AUTHOR	PUBLICATION
1	Smart Grid: Fundamentals of Design and Analysis		James Momoh	Wiley
2	Smart Grid: Technology and Applications	March 2012	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama	Wiley

Reference books:

1	Smart Grid: Technology and Applications	March 2012	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama	Wiley

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Chairperson	Dean (Acad. Matters)	Version	Date of Release	

8th Semester

EL1417	**Lab.: Switchgear and Protection**	**L= 0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Mapped Program Outcomes	**a**	**b**	**c**	**d**	**e**	**g**	**j**

Course outcomes:

The students will be able to understand

7. Relay setting and co-ordination of relay.
8. Secondary injection testing and setting of relays.
9. Recent tools in protection system

List of Practicals:

1) To plot the characteristic of IDMT relay ICM 21N.
2) To plot the characteristic of directional relay with calculation of maximum torque angle.
3) To plot the characteristic of reactance relay.
4) To plot the characteristic of impedance relay.
5) To plot the characteristic of fuse wire.
6) To study the differential protection of single phase transformer.
7) To plot characteristics of numerical relay MC61C.
8) To study the undercurrent & overcurrent relay.
9) To study the harmonic restraint effect on differential relay.
10) To plot the characteristic of earth fault relay.
11) To study undervoltage relay.
12) To study air circuit breaker.
13) Study of MICOM P430
14) To plot characteristics of MCB
15) To study operation of BMR
16) To study operation of ELCB
17) Study of (quasar) intelligent panel meter
18) Study of relay test set

8th Semester

EL1418	**Lab.: Substation Design**	**L= 0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	CA	ESE	Total	ESE Duration
(% Weightage)	40	60	100	2 Hours

Course Objectives	Course Outcomes
The student will understand different aspects of substation design that is layout drawing, earthing Drawing, lighting drawing and cable wiring.	The students will be able to understand 1. Single line diagram of substation with rating of different equipments, types of relays required and their settings 2. Draw plan of equipments and panels mounted in a substation. 3. Design earthing system of a substation.

Mapped Program Outcomes	a	b	c	f	g	h	i	j

Practical based on following topics may be performed.

1) One Line diagram

2) Switchyard and control panel layout for 132 and 11 kV substation.
3) Lighting layout of substation and switchyard.

4) Substation earthing.

Text books:				
1	Handbook of Electrical Power Distribution	2nd Edition	Gorti Ramamurthy	University Press
2	Electric Power Distribution	4th edition, 1997	A.S. Pabla	Tata Mc Graw-Hill Publishing Company

8th Semester

EL1419	**Comprehensive Viva-voce**	**L= 0**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			100		100	

8th Semester

EL1430	**Extra-Curricular Activities / Competitive Exam**	**L= 0**	**T=0**	**P=0**	**Credits=2**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			100		100	

8th Semester

EL1420	**Project Phase-II**	**L= 0**	**T=0**	**P=8**	**Credits=8**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
			40	60	100	

Dean (Acad)
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College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2014
3 to 8 Semester
Electronics Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Electronics Engineering

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE-I	MSE-II	TA	ESE	
THIRD SEMESTER												
1	GE1201	Engineering Mathematics - III	3	1	0	4	4	15	15	10	60	3
2	EE1201	Electronic Devices	3	1	0	4	4	15	15	10	60	3
3	EE1202	**Lab:** Electronic Devices	0	0	2	2	1			40	60	
4	EE1203	Digital Circuits	4	0	0	4	4	15	15	10	60	3
5	EE1204	**Lab:** Digital Circuits	0	0	2	2	1			40	60	
6	EE1205	Electronic Measurement & Instrumentation	3	0	0	3	3	15	15	10	60	3
7	EE1206	**Lab:** Electronic Measurement & Instrumentation	0	0	2	2	1			40	60	
8	EL1201	Network Analysis	3	1	0	4	4	15	15	10	60	3
9	EL1202	**Lab:** Network Analysis	0	0	2	2	1			40	60	
			16	**3**	**8**	**27**	**23**					
FOURTH SEMESTER												
1	GE1204	Advance Mathematical Techniques	3	1	0	4	4	15	15	10	60	3
2	EE1207	Electromagnetic Fields	3	1	0	4	4	15	15	10	60	3
3	EE1208	Electronic Circuit Analysis	3	1	0	4	4	15	15	10	60	3
4	EE1209	**Lab:**Electronic Circuit Analysis	0	0	2	2	1			40	60	
5	EL1217	Control System Engineering	4	0	0	4	4	15	15	10	60	3
6	EE1210	Microprocessor & Interfacing	3	0	0	3	3	15	15	10	60	3
7	EE1211	**Lab:**Microprocessor & Interfacing	0	0	2	2	1			40	60	
8	EE1212	Simulation Laboratory	0	0	2	2	1			40	60	
			16	**3**	**6**	**25**	**22**					

Chairperson	**Dean (Acad. Matters)**	**1.00**	**May 2015**	**Applicable for AY 2015-16 Onwards**
		Version	**Date of Release**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Electronics Engineering

S no.	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE - I	MSE - II	TA	ESE	
FIFTH SEMESTER												
1	GE1311	Fundamental of Management	3	0	0	3	3	15	15	10	60	
2	EE1301	Analog Communication	4	0	0	4	4	15	15	10	60	3 Hrs
3	EE1302	**Lab.:** Analog Communication	0	0	2	2	1			40	60	
2	EE1306	Signals and Systems	3	1	0	4	4	15	15	10	60	3 Hrs
4	EE1308	Analog Integrated Circuit & its Application	3	1	0	4	4	15	15	10	60	3 Hrs
5	EE1309	**Lab.:** Analog Integrated Circuit & its Application	0	0	2	2	1			40	60	
6	**Professional Elective-I**		3	0	0	3	3	15	15	10	60	3 Hrs
	EE1304	PE I: Power Electronics										
	EE1305	PE I: Advanced Instrumentation										
	EE1307	PE I: Switching Theory & Finite Automata										
	EE1324	PE I: Computer Organisation										
7	EE1310	**Lab.:** Electronics workshop	0	0	2	2	1			40	60	
8	EE1311	Seminar	0	0	2	2	1			100		
9	**Open Elective-I**		3	0	0	3	3	15	15	10	60	3 Hrs
	EE1320	OE I: Data Acquisition & Signal Conditioning										
	EE1322	OE I: Microporcessor & Microcontroller										
	EE1323	OE I: Consumer Electronics										
Total			**19**	**2**	**8**	**29**	**25**					

SIXTH SEMESTER

1	GE1312	Fundamental of Economics	3	0	0	3	3	15	15	10	60	3 Hrs
2	EE1303	Transmission Lines & Wave Guides	4	0	0	4	4	15	15	10	60	
3	EE1314	Digital Signal Processing	3	1	0	4	4	15	15	10	60	
4	EE1315	**Lab.:** Digital Signal Processing	0	0	2	2	1			40	60	
5	EE1316	Digital System Design	3	1	0	4	4	15	15	10	60	3 Hrs
6	EE1317	**Lab.:** Digital System Design	0	0	2	2	1			40	60	
7	EE1326	Microcontroller & Interfacing	3	1	0	4	4	15	15	10	60	
8	EE1327	**Lab.:** Microcontroller & Interfacing	0	0	2	2	1			40	60	
9	**Open Elective-II**		3	0	0	3	3	15	15	10	60	3 Hrs
	EE1328	OE II: Fuzzy Logic & Neural Network										
	EE1329	OE II: Basics of Analog and Digital Communication										
	EE1330	OE II: Biomedical Instrumentation										
Total			**19**	**3**	**6**	**28**	**25**					

Chairperson	**Version**	**1.00**	**Applicable for AY 2016-17 Onwards**
Dean (Acad. Matters)	**Date of Release**	**May 2016**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Electronics Engineering

S no.	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration
			L	T	P	Total		MSE - I	MSE - II	TA	ESE	
SEVENTH SEMESTER												
1	**Professional Elective-II**		3	1	0	4	4	15	15	10	60	3 Hrs
	EE1401	PE II: Embedded Systems										
	EE1403	PE II: Digital CMOS Circuits										
	EE1405	**PE II:** Algorithm & Data Structures										
2	**Lab Professional Elective-II**		0	0	2	2	1	40			60	
	EE1402	**Lab. :** PE II: Embedded Systems										
	EE1404	**Lab. :** PE II: Digital CMOS Circuits										
	EE1406	**Lab. :** PE II**:** Algorithm & Data Structures										
3	EE1407	Electronics Circuit Design	3	1	0	4	4	15	15	10	60	3 Hrs
4	EE1408	**Lab. :**Electronics Circuit Design	0	0	2	2	1			40	60	
5	EE1409	Digital Communication	3	0	0	3	3	15	15	10	60	
6	EE1410	**Lab.:** Digital Communication	0	0	2	2	1			40	60	
7	EE1434	RF & Microwave	4	0	0	4	4	15	15	10	60	
8	EE1435	**Lab.:** RF & Microwave	0	0	2	2	1			40	60	
9	EE1412	Project Phase-I	0	0	4	4	4			40	60	
10	EE1413	Industrial Training / CRT	0	0	0	0	2			100		
		Total	**13**	**2**	**12**	**27**	**25**					
EIGHTH SEMESTER												
1	**Professional Elective-III**		3	0	0	3	3	15	15	10	60	3 Hrs
	EE1414	PE III: Computer Communication Network										
	EE1415	PE III: Operating System Concepts										
	EE1436	PE III: RADAR Enginneering										
	EE1437	PE III: Micro Electro Mechanical Systems										
	EE1439	PE III: Display Technology										
2	**Professional Elective-IV**		4	0	0	4	4	15	15	10	60	3 Hrs
	EE1417	PE IV: Soft Computing										
	EE1419	PE IV: Analog VLSI Design										
	EE1427	PE IV: Digital Image Processing										
	EE1423	PE IV: Object Oriented Programming										
3	**Lab:Professional Elective-IV**		0	0	2	2	1	n		40	60	
	EE1418	**Lab. :** PE IV: Soft Computing										
	EE1420	**Lab. :** PE IV: Analog VLSI Design										
	EE1428	**Lab. :** PE IV: Digital Image Processing										
	EE1424	**Lab. :** PE IV: Object Oriented Programming										
4	**Professional Elective-V**		3	0	0	3	3	15	15	10	60	3 Hrs
	EE1416	PE V: Biomedical Instrumentation & its Applications										
	EE1421	PE V: Optical Communication										
	EE1425	PE V: Wireless Communication										
	EE1438	PE V: Mechatronics										
5	EE1433	**Lab.:** Electronics Design Automation	0	0	2	2	1			40	60	
6	EE1430	Comprehensive Viva-voce	0	0	0	0	3				100	
7	EE1431	Extra/Co-Curricular / Competitive Examinations	0	0	0	0	2			100		
8	EE1432	Project Phase-II	0	0	8	8	8			40	60	
		Total	**10**	**0**	**12**	**22**	**25**					

Chairperson	**Version**	**1.01**	**Applicable for AY 2017-18 Onwards**
Dean (Acad. Matters)	**Date of Release**	**Dec. 2017**	

3rd Semester

GE1201	Engineering Mathematics-III			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Objective	Outcome
The aim of this paper is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	1. With the completion of this syllabus students will be familiar with Laplace ,Z-transform and their methods of solutions and partial differential equation with simple applications and essential concepts of optimization techniques and use these mathematical techniques in variety of technical, business, industry optimization problems.

UNIT-1: : Finite Differences (a,e) [8 hrs]

Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform (a,e) [7 hrs]

Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform (a,e) [8 hrs]

Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 :Matrices (a,e) [9 hrs]

Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigenvectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation (a,e,h) [8 hrs]

Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.

Partial Differential Equations – PDE of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

UNIT-6 : Fourier Transform (a,h) [6 hrs]

Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.

Text books:

1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference books:

1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John wiley& Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John wiley& Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill.
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune VidyarthiGrihaPrakashan

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

3rd Semester

EE1201	Electronic Devices	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Course Outcomes
• The purpose of this course is to present a clear consistent picture of the internal physical behaviour of many electronic devices so that their studies of electronic circuit and system will be meaningful. • The purpose of this course is to introduce to the students the basics of biasing transistor circuits, feedback amplifiers, rectifiers, & analyzing different two terminal devices.	Students will 1. Understand the working of PN junction diodes, circuit applications and special purpose diodes. 2. Understand the basic working of BJT, configurations and circuit applications. 3. Understand the stability concept of BJT. 4. Understand the basic working of FET and MOSFET with biasing techniques. 5. Understand the frequency analysis of BJT and circuit applications. 6. Understand the amplification using FET.

Unit I: Overview of Diodes:
PN junction diode, Clipping, Clamping, Rectifier, Junction-Diode Characteristics, The Current Components in a p-n Diode, The Volt-Ampere Characteristics, The Temperature Dependence of the Characteristics, Diode Resistance, Junction-Diode Switching Times, Breakdown mechanisms of Zener Diodes, Tunnel Diode, Schottky Barrier(Hot-Carrier) Diodes, Varactor (Varicap) Diodes.

(7 Hours)

Unit II: The bipolar Junction Transistor:
Transistor Current Components, The Transistor as an Amplifier, Transistor Construction, The Common-Base Configuration, The Common-Emitter Configuration, The CE Cutoff region, The CE Saturation Region , Typical Transistor –Junction Voltage Values, Common-Collector Configuration, Analytical Expressions for Transistor Characteristics, Maximum Voltage Rating.

(7 Hours)

Unit III: Transistor Biasing and Stabilization:
The Operating Point, Bias Stability, Self-Bias, Emitter Bias with voltage divider, Stabilization against Variations in I_{co}, V_{BE}, and β, Collector-Current Stability, Thermal Runaway, Thermal Stability, Bias Compensation Thermistor and Sensistor Compensation.

(6 Hours)

Unit IV: FET and MOSFET:
Field-effect Transistors, The Junction Field-effect Transistor, The Pinch-off Voltage V_p, The JFET Volt-Ampere Characteristics, MOSFET Device Structure and Physical Operation of MOSFET, Derivation of the I_D versus V_{DS}Relationship, Characteristics of the MOSFET, Biasing the FET, The FET as a Voltage-Variable Resistor, MOSFET biasing by Fixing V_{GS} ,Biasing by Fixing $V_G$and Connecting a Resistance in the Source, Biasing Using a Drain-to-Gate Feedback Resistor, Biasing Using a Constant-Current Source.

(7 Hours)

Unit V: The Transistor at Low Frequencies:
Graphical Analysis of the CE Configuration, Transistor Hybrid Model, Analysis of a Transistor Amplifier Circuit Using h Parameters, The Emitter Follower with & without Emitter resistance, Linear Analysis of a Transistor Circuit, Miller's Theorem and its Dual, Cascading Transistor Amplifiers, Simplified Common-Emitter Hybrid Model.

(7 Hours)

Unit VI: FET Amplifier:
MOSFET Amplifier, Basic FET Amplifier Configuration, Common-Source Amplifier, Common-Drain (Source-Follower) Amplifier, Common-Gate Configuration, Small signal equivalent circuits. (6 Hours)

Text Books:
1) Integrated Electronics, MillManHalkias, Tata McGraw Hills 3rd reprint, 2007.
2) Microelectronics Circuits, Sedra Smith, Oxford Uni. Press, sixth edition.

Reference Books:
1) Electronic Devices and Circuits Theory, BoyleStad, Nashelsky, Prentice Hall of India.
2) Power Electronics, Muhammad H. Rashid, 3rd edition, Pearson, 2006.
3) Microelectronics Circuit Analysis and Design, Donald Neaman, 4th Edition, McGraw Hills, 2010.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

3rd Semester

EE1202	Lab.: Electronic Devices	L = 0	T = 0	P = 2	Credits= 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ The purpose of this course is to study basic concepts, DC circuits, AC circuits, semiconductors, semiconductor devices, power supply, bipolar and field effect transistor amplifiers, frequency response of amplifier and Power devices.	1. Graduates will have a fair practical knowledge about the working of PN junction diodes and zener diodes. 2. Graduates will understand the basic working rectifiers and biasing of transistors. 3. Graduates will understand the Working of FET & MOSFET. 4. Graduates will understand the fundamentals of amplifiers & power devices.

Expt. No.	Name of Experiment
1	To plot the V- I characteristics of PN junction diode (Silicon and Germanium) and perform simulation in Microcap.
2	Zener shunt regulator and perform simulation in Microcap.
3	Half wave and full wave rectifier with and without capacitive filter and perform simulation in Microcap.
4	To plot I/P & O/P Characteristics of Common Base Transistor Configuration. Find I/P& O/P Resistance and Current Gain.
5	To plot I/P & O/P Characteristics of Common Emitter Transistor Configuration. Find I/P& O/P Resistance and Current Gain.
6	Fixed Bias circuit of transistor.
7	Self Bias circuit of transistor
8	The Drain and Transfer characteristics of Field Effect Transistor (FET) in CS mode.
9	The Drain and Transfer characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET) in CS mode.
10	Frequency response of Feedback Amplifier.

3rd Semester

EE1203	Digital Circuits	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

• The purpose of this course is to develop a strong foundation of digital electronics. • Understand concepts of combinational and sequential circuits. • Analyze the synchronous and asynchronous logic circuits.	Students will be able to 1. Simplify combination logic circuits using Boolean algebra. 2. Understand and demonstrate the various codes and illustrate the application of logic family 3. Simply and exhibit the methods to solve logical functions using K-map and Quine McClauskey methods 4. Understand combination logic circuits used in various digital systems. 5. Design and analyze Synchronous and Asynchronous sequential Circuits. 6. Design and demonstrate sate machines.

Unit I:
Logic gates, Switching Algebra & simplification of Boolean expressions, Boolean algebraic theorems, DeMorgan's theorem, SOP, POS, Canonical forms of Boolean expression. Implementations of Boolean expressions using logic gates, Functions & its implementation using Multiplexer, Demultiplexer, Encoder, Decoder.

(8 Hours)

Unit II:
Error detection and correction, Parity codes, Hamming's code. Representation of negative numbers, BCD arithmetic, Floating-point representation, Introduction to Logic families & their characteristics such as Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin, Timing.

(7 Hours)

Unit III:
Minimization methods: Karnaugh map, QuineMcClauskey methods, incompletely specified functions, Static & Dynamic Hazards in combinational circuits.

(6 Hours)

Unit IV:
Design ofArithmetic circuits: Half & Full adders, Half & Full Subtractions, Multi-bit parallel adders Carry Propagate adder & Carry Look ahead adder, Comparators, Multi-bit Application designs, Formation of switching functions from word statements, ALU & Combinational circuits design using MSI and LSI chips.

(8 Hours)

Unit V:
Sequential circuits: Concept of Timing & Clocking: Rise time, fall time, Clock skew, Edge & Level triggers, Binary cell, Latches and flip-flops: RS-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF's, Excitation & Truth Table, Flip-flop conversions, Shift registers. Introduction to Synchronous, Counters: Ring counter, Johnson counter, Ripple counter,Design of synchronous counter: single mode and multi-mode counters

(6 Hours)

Unit VI:
Classification of synchronous machines, Design of synchronous sequential machines using Moore & Mealy circuits: Sequence detector, State diagram, State reduction (Method of Partitioning) and implementation. Asynchronous sequential Circuits.

(8 Hours)

Text Books:
1) Digital Circuits & Microprocessors, Hebert Taub, McGraw Hill, 1988.
2) Switching Theory & Finite Automata, ZviKohavi, McGraw Hill, 2nd edition, 2004.

Reference Books:
1) Modern Digital Electronics ,RP Jain, Tata McGraw Hill, 3rd Edition
2) Fundamentals of Logic Design, C.H.Roth, Public Work & Services,3rd edition 2007.
3) Engg Approach to Digital Design, Fletcher, Prentice Hall of India 1993.
4) Digital Design, M. Morris Mano, Third Edition, Prentice Hall of India,4th edition 2008.

3rd Semester

EE1204	Lab.: Digital Circuits	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ Student will understand basic digital circuit design and testing on breadboard using digital ICs and Electronic Components. ➢ Student will understand digital components and circuits characteristics, analysis and interpretation.	1. Students will be aware of Digital IC's and it's experimentation. 2. Students will be able to design and evaluate circuit performance on breadboard. 3. The student will be able to analyze and interpret more experiments relating to theoretical knowledge received during lecture hours.

Expt. No.	Name of Experiment
1	Display the voltage transfer characteristics of logic gates and find the following characteristics a) Noise margin s of a gate. b) Propagation delay of a gate.
2	Verify the Truth table for the basic logic gates and universal gates.
3	Verify Boolean Expression using Basic Logic Gates.
4	To verify Multiplexer and Demultiplexer functionality.
5	To Implement Boolean function using multiplexer/demultiplexer.
6	To Implement BCD to Seven segment Display combinational circuit.
7	To Implement & verify Half adder and full adder circuit.
8	To Implement & verify Half subtractor and full subtractor circuit.
9	To Implement & Verify 4bit binary adder circuit.
10	To verify the truth table of Master-slave J-K flip-flop.
11	To Design 2/3/4 bit binary synchronous/asynchronous counter.
12	To Design Finite State Machine using decoder IC.
13	Mini Project.

3rd Semester

EE1205	Electronic Measurement & Instrumentation	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The primary aim of this subject is to acquaint the students with the basic principles of measuring instruments and show how each of them can be exploited for the measurement of large number of variables.	Student will able to 1. Identify the various methods for measurement of resistance, capacitance and inductance. 2. Identify & apply specific electronics instrumentation and measurement system. 3. Use the different types of meters like digital multimeter, LCR meter. 4. Define usage of transducers, sensors, DAC / ADC, signal generator systems 5. Understand the concept of signal conditioning 6. Understand the concept of virtual instrumentation

UNIT I:
Introduction, Traceability of standards, Important terms in measurement such as accuracy, precision, sensitivity, Types of errors & their sources, Importance of calibration, Instrument calibration standards, Static & dynamic characteristics of measurement system, AC & DC Bridges.

(7 Hours)

UNIT II:
Amplified DC meters, AC Voltmeter, TRUE/RMS voltmeter, Electronic Multimeter, Digital Multimeter, Digital Voltmeter, Q-meter, LCR meter, Power & Voltage measurement.

(6Hours)

UNIT III:
AF Generator, Pulse Generators, Signal Generator, Function Generator, Sweep Frequency Generator, Wave analyzer, Spectrum analyzer, Digital logic analyzer Distortion analyzer, Frequency and time measurement.

(7 Hours)

UNIT IV:
Strain Gauges, Load Cells, Proximity sensors, Light Sensors, LVDT, Digital optical encoder, Selection of sensors, Classification of transducers, transducers actuating mechanisms, resistive, capacitive, and inductive transducers, thermoelectric & photoelectric transducers.

(7 Hours)

UNIT V:
General Measurement system components, process adopted in signal conditioning, amplification & electrical signal conditioning, Functions of signal conditioning equipments, AC/DC Conditioning systems, Amplification: overview of types of amplifiers, attenuators and filters, Generalized data acquisition system: single channel and multi-channel, Data conversion: ADC, DAC.

(7 Hours)

UNIT VI:
Concept of Virtual Instrumentation, Introduction & Basics of Virtual Instrumentation Programming, Concept of Sub VI, and Introduction to DAQ Card to build sensor application: Temperature measurement. Transducer application: strain measurement. Overview of Instrument driver model, types of Instrument drivers.

(6 Hours)

Text books:
1. Measurement Systems: Application & Design, Ernest O. Doebelin ,Fifth Edition, TATA McGRAW HILL Edition56'.
2. Elements of Electronic Instrumentation and Measurement, Joseph J. Carr, Third Edition, Pearson Education.

Reference books:
1. Electrical & Electronic measurement & Instrument, A. K. Sawhney, DhanpatRai& Co.,18th edition 2008.
2. Modern Electronic Instrumentation and Measurement Techniques, Albert D. Helfrick, William D. Cooper, Prentice Hall of India Publication.
3. Sensors, transducers &LabVIEW: an Application approach to Virtual Instrumentation, Barry E. Paton, Bernard M. Goodwin ,PHI Publication.
4. Instrumentation Devices &System,C.S.Ranga , McGraw Hill,1992.
5. Learning with Labview, Robert Bishop ,Pearson education,2005.
6. Theory & Design for Mechanical Measurement, Richard S. Figliola, Donald S. Beasley, 4th Edition,1991.

3rd Semester

EE1206	Lab.: Electronic Measurement & Instrumentation	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
1. To learn basic measurement concepts and related instrumentation requirement as vital ingredients of electronics.	1. Students will be able to identify the various methods for measurement of R, L & C. **2.** Graduate will be able to use the different types of measuring instruments. 3. Will able to demonstrate the practical based on virtual instrumentation.

Expt. No.	Name of Experiment
1	To measure the medium resistance using Wheatstone bridge method.
2	To measure the low resistance using Kelvin's Double Bridge method.
3	To measure the inductance using Maxwell's inductance capacitance bridge method.
4	To measure the capacitance using Schering Bridge method.
5	To measure the value of unknown resistance using Post Office Box Trainer kit.
6	Virtual instrumentation based Digital Multimeter using NI ELVIS kit.
7	Virtual instrumentation based Oscilloscope and a Function Generator using NI ELVIS kit.
8	Virtual instrumentation based Variable Power Supply and Impedance Analyzer using NI ELVIS kit.
9	Measurement of parameters like temperature using LABVIEW.
10	Study of Cathode ray Oscilloscope.

3rd Semester

EL1201	Network Analysis	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
➢ To understand basic of circuits elements and energy sources ➢ To know the fundamental theory and mathematics for the analysis of electrical circuits.	Upon successful completion of this course, students should be able to: 1. Analyze electrical circuits with nodal analysis. 2. Analyze electrical circuits with Mesh analysis. 3. Apply network theorems to analyze electrical circuits. 4. Evaluate the initial and final values of current and voltage of electric circuits and to know basic of Laplace Transform. 5. Understand Laplace Transform of various types of signals and able to determine the time response from pole zero plot. 6. Apply the concept of two – port networks to find different two-port parameters.

UNIT-1: Nodal Analysis of Electric Circuits
Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources - their types and characteristics, concept of equivalent sources, source transformation, concept of supernode and V – shift, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-2:: Mesh Analysis of Electric Circuits
Concept of supermesh and I – shift, mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, meshanalysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-3 :Network Theorem
Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

UNIT-4: Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform
Concept of initial and final conditions, behavior of resistor, inductor and capacitor at t = 0- and at t = 0+, procedure for evaluating initial and final conditions.
Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements.
Time response of electrical network with and without initial conditions by Laplace transform.

UNIT-5 : Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions
Unit step, ramp and impulse functions with and without time delay, their Laplace transform.
Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions.

3rd Semester

EL1201	Network Analysis	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6: Two Port Parameters

Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, conditions for reciprocity and electrical symmetry in terms of two – port parameters.

Text books:

1	Network Analysis	3rd Edition	M. E. Van Valkenburg	PHI Learning Private Limited
2	Engineering Circuit Analysis	8th Edition	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin	McGraw – Hill
3	Linear Circuit Analysis	2nd Edition	Decarlo, Lin	Oxford Univ. Press

Reference books:

1	Schaum's 3000 Solved Problems In Electric Circuits Book 1 & 2	1st Edition	Syed A. Nasar	McGraw - Hill
2	Schaum's Outline Series: Theory and Problems of Electric Circuits	5th Edition	Joseph A. Edminister	McGraw - Hill
3	Basic Circuit Theory	3rd Edition	Lawrence P. Huelsman	PHI Learning Private Limited

3rd Semester

EL1202	Lab. : Network Analysis	L= 0	T=0	P=2	Credits=1

Evaluation Scheme	TA	ESE	Total	ESE Duration
	40	60	100	----

Minimum Eight Practical are to be performed from the following list.

Expt. No.	Name of Experiments
1.	Introduction To PSPICE Software.
2.	Verification of Kirchhoff's law.
3.	Perform nodal analysis on complex electrical circuits
4.	Perform mesh analysis on complex electrical circuits.
5.	Verification of Superposition Theorem.
6.	Verification of Thevenin's Theorem.
7.	Verification of Norton's theorem.
8.	Verification of Maximum power transfer theorem.
9.	Determinations of Transfer function of Two port network.
10.	Determination of Z & Y parameters of Two port Network.

4th Semester

GE 1204	Advanced Mathematical Techniques			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	10	60	100		3 Hrs

Objective	Outcome
The objective of this paper is to study numerical methods and their methods of solution and statistics and probability with simple applications and to introduced fuzzy sets and logics	With the completion of this syllabus students will be familiar with study numerical methods and their methods of solutions and fuzzy sets and logics with simple applications and essential concepts of probability and statistics and use these mathematical techniques to provide the solution to variety of technical, business, industry optimization problems.

UNIT-1: [9 hrs]

NUMERICAL METHODS FOR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Errors in numerical calculation, Errors in series approximation. Rounding of error solutions of algebraic and transcendental equations. Iteration method, Bisection method, False position method, Newton Rapphson method and their convergence

NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss -Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2: [8 hrs]

NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4th order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. Numerical methods of solving 1st order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques (a,h) [6 hrs]

Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 [7 hrs]

Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

UNIT-5: [8 hrs]

Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 [6 hrs]

FUZZY SETS AND FUZZY LOGIC ; Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

Text books:				
1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition(2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference books:				
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

4th Semester

EE1207	Electromagnetic Fields	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
➢ The primary aim of this subject is to provide the students of engineering with a clear and logical presentation of basic concepts and principles of electromagnetic. ➢ To understand the basic laws applicable to electric and magnetic field.	Students will understand and analyze concept of 1. Vector calculus and coordinate system. 2. Electrostatics. 3. Energy and potential. 4. Static Magnetic Field. 5. Time varying Magnetic field 6. Understand concept of wave theory.

Unit I:
Orthogonal coordinate systems: Cartesian, cylindrical, spherical and transformations, Gradient of a Scalar Field, Divergence of a Vector Field, Curl of a Vector Field, Laplacian Operator, Irrotational and solenoidal field.
(7 Hours)

Unit II:
Coulomb's law, Electric field intensity for different charge distribution, point, line surface, volume, Concept of electric flux, Gauss's law, Application of Gauss's law: Some Symmetrical Charge Distributions, Differential Volume element, Divergence, Maxwell's First equation (Electrostatics), The Vector Operator▼ and the Divergence Theorem.
(7 Hours)

Unit III
Energy & Potential: Energy Expended in Moving a Point charge in an Electric Field, The Line Integral, Definition of Potential Difference and Potential, Potential field of a point charge, Potential field of a System of charges :Conservative Property, Potential Gradient, The Dipole, Energy Density in the Electrostatic Field. Poisson's and Laplace's equation and its examples of solutions, Uniqueness of electrostatic solution.
(7 Hours)

Unit IV
Biot-Savart's law and applications to infinite and finite current filament, Ampere's Circuital law and applications to line charge, coaxial transmission cables, uniform current sheet charge, solenoid, toroid, Stoke's Theorem, Magnetic flux and magnetic flux density, Scalar and vector magnetic potential.
(8 Hours)

Unit V:
Faraday's law, Maxwell's equations for static and time varying fields with physical significance, displacement current, Magnetic Boundary conditions.
(7 Hours)

Unit VI:
Uniform plane wave, wave propagation in free space, in dielectric, Poynting's Theorem and Wave Power, Propagation in Good Conductors: Skin Effect. Reflection & Refraction of Electromagnetic waves.
(7 Hours)

Textbook:
1) Engineering Electromagnetics,Seventh Edition, William H. Hayt, Tata McGraw – Hill,2006 reprint.
2) Electromagnetics , J D Kraus, McGraw – Hill,3rd edition 1984.

References:
1) Electromagetism: Theory and application, AshutoshPramanik, Prentice Hall,2nd edition august 2009.
2) Elements of Electromagnetis, M. N. O. Sadiku, Oxford Press ,4th edition 2007.
3) Field and Wave Electromagnetics, David K. Cheng, Second Edition, Addison Wesley.

4th Semester

EE1208	Electronic Circuit Analysis	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
➢ To understand Transistor parameters at high frequency and the small signal equivalent circuit of amplifiers employing devices like BJT, MOSFET, etc. ➢ To develop circuit analysis capabilities using Network Theory principles. ➢ To analyze various feedback amplifiers for signal gains, input and output impedances etc. ➢ Introduction to design insights offered by circuit analysis skills.	Students will understand the 1. High frequency analysis of BJT, MOSFET. 2. Types of amplifier, frequency response and analysis. 3. Feedback topology and analysis. 4. Differential amplifier, AC and DC analysis. 5. Power amplifier stages, distortions and circuit applications. 6. Oscillators and analysis.

UNIT I:
Review of low frequency small signal h-parameters, The Hybrid-pi model of common emitter BJT amplifier, Various Hybrid-pi parameters, Single stage CE Transistor Amplifier Response, Gain Bandwidth Product, Unity Gain Frequency f_T of a transistor, Introduction to MOSFET parameters, Common Source Equivalent Circuit, High frequency model of MOSFET and Unity Gain frequency f_T.

(7 Hours)

UNIT II:
Classification of Amplifiers, Distortion in Amplifiers, Bode Plots, Single and two pole transfer functions, 3dB frequencies, Step and Pulse Response, Squarewave Testing of Amplifiers, High frequency Response of Single and Two Stage CE amplifiers, Miller Approximation of interacting stages, Introduction to Noise in Amplifiers.

(8 Hours)

UNIT III:
General Feedback Structure, Various properties of Negative and positive Feedback, Basic Feedback Topologies, Voltage, Current, Trans Conductance, Trans Resistance Amplifiers, Analysis of Voltage-Series, Voltage-Shunt, Current- Shunt and Current series feedback amplifiers, Effect of feedback on amplifier bandwidth, Method of analysis of Feedback Amplifiers.

(8 Hours)

UNIT IV:
Differential Amplifier, configurations, DC & AC Analysis, Differential amplifier using swamping resistor, constant current bias, current mirror, cascaded differential amplifier.

(7 Hours)

UNIT V:
Classification of Output Stages, Class A, Class B, and Class AB output stages, Power Efficiency, Power Dissipation, Cross-Over Distortion in Class AB Circuits, Class A Transformer Coupled Power Amplifier, Design with Darlington Matched Pairs for Class AB Power Stage, Harmonic Distortion due to Large Signal operation, Thermal Resistance and Heat Sinks.

(8 Hours)

UNIT VI: Oscillators: LC & RC, Barkhausen's criterion, classification of oscillators, RC phase shift oscillators, Wein bridge, LC,Hartley, colpitts, crystal Oscillators.

(7 Hours)

Text Book:
1) Integrated Electronics, MillmanHalkias, Tata McGraw Hills, 43rd reprint, 2007.
2) Op-amps and linear integrated circuits, R. A. Gayakwad, 3rd edition, PHI, 1995.

Reference books:
1. Microelectronics Circuits, Sedra Smith, Oxford Uni. Press.
2. Electronics Devices and Circuits Theory, Boyle Stad, Nashelsky, Prentice Hall of India.

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4th Semester

EE1209	Lab.: Electronic Circuit Analysis	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ To deduce the external characteristics of each device which allow students to exploit the device as a circuit element and to determine its large signal (non-linear) behavior. ➢ To analyze and features many different devices and circuits.	1. Students will able to determine the h-parameter of transistors. 2. Students will able to determine the frequency response of amplifier with and without feedback. 3. Students will able to determine the distortions in amplifiers. 4. Students will able to determine the voltage regulator using different regulator devices.

Expt. No.	Name of Experiment Experiments based on hardware and simulation.
1	Evaluation of Small Signal Parameters: BJT, MOSFET, Output & Transfer Characteristics of Enhancement MOSFET.
2	Frequency Response of Single Stage RC Coupled CE Amplifier.
3	Two Stage Direct Coupled Amplifier with Voltage Series Feedback.
4	Positive Feedback Amplifier: evaluation of Gain & Phase Margin.
5	Demonstration of Amplitude and Phase Distortion in Amplifiers.
6	Transformer Coupled Class A Power Amplifier.
7	Class B Push Pull Power Amplifier: Cross Over Distortion and Efficiency.
8	Class AB Power Amplifier with Class A Driver Stage.
9	Series Voltage Regulator: Line and Load Regulation.
10	Improved Series Voltage Regulator with Pre-Regulator.
11	Variable Voltage Regulator using 3-Terminal Monolithic Regulator.
12	RC Phase shift oscillator.

4th Semester

EL1217	Control System Engineering	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objectives	Course Outcomes
This is a first course in feedback control of dynamic systems. The main goal is to introduce and familiarize students with dynamic systems modeling and analysis techniques that can be employed on a large variety of engineering systems. Being an interdisciplinary course, students will learn: 1 the role of a control engineer in multi-disciplinary teams. 2 to apply the knowledge gained in basic mathematics, physical sciences and engineering courses to derive mathematical models of typical engineering processes. 3 to use transfer function and state space models for control system analysis in time and frequency domain. 4 the basic concepts of proportional, integral, and derivative (PID) control. 5 the importance of stability in control systems and the various methods to determine it. 6 to construct root locus plot and frequency response plots such as polar plot, Bode plot, Nyquist plot etc.	Upon successful completion of this course, students should be able to: 1. Identify the basic elements and structures of feedback control systems. 2. understand the use of block diagram and signal flow graph as a modeling tool. Be able to manipulate block diagrams for systems of interconnected components. 3. develop models (differential equations, transfer functions, state space,) for a variety of dynamic physical systems. 4. understand the role of feedback in control systems. 5. have a good understanding of the response characteristics of basic first- and second-order dynamic systems. Be able to correlate time-domain responses with damping ratio and pole locations. 6. have an introductory knowledge of PID controllers. Be able to design PID controllers to meet simple specifications. 7. understand BIBO stability and its connection with pole locations. Be able to use Routh's criterion for absolute and relative stability analysis. 8. evaluate transfer function, stability and time response of control systems using state space techniques. 9. construct and recognize the properties of root-locus and its role in the analysis of control systems. 10. obtain frequency response indices. Be able to draw frequency response plots such as polar plot, Bode plot etc.

UNIT I : Introduction to Control Systems: History of control system, Basic Components of Control System, Open loop control and close loop control with examples, classification of control systems.
Transfer Function, Block Diagram and Signal Flow Graph : Transfer function and gain, Order of a system, block diagram algebra & reduction techniques, signal flow graph, its constructions and Mason's gain formula.
Mathematical Modelling of physical systems: Mathematical modelling of physical system such as – electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic etc., Analogous systems.

UNIT II: Characteristics of Feedback Control Systems :Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback.

UNIT III:Time Domain Analysis of Control Systems: Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (e_{ss}) analysis, static error constants and system type, dominant poles, Approximation of high order systems by low order systems, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

4th Semester

EL1217	Control System Engineering	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT IV: **Stability of Linear Control Systems :** Concept of stability, stable, unstable and marginally stable system, Absolutely stable and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh-Hurwitz stability criterion with special cases, relative stability analysis.

State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form, solution of state equations, state transition matrix, its properties and computation.

UNIT V: Root LocusTechnique : Definition, magnitude and angle criteria, properties of root locus, construction rules for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s)H(s).

UNIT VI: Frequency domain analysis of control systems: Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response, polar plot, inverse polar plot, bode plot, all pass and minimum – phase system, log magnitude versus phase plot.
Stability in Frequency domain : Principle of argument, Nyquist stability criterion, Assessment of relative stability using Nyquist criterion, concept of gain margin and phase margin and its computation using polar plot and log magnitude versus phase plot.

Text books:

1	Control system engineering	5IH Edition	I. J. Nagrath& M. Gopal	New Age International
2	Automatic control systems	7th Edition	B. C. Kuo	PHI Learning Private Limited

Reference books:

1	Sigma Series: Control Systems	1st Edition	Ashok Kumar	McGraw - Hill
2	Control systems : Principles and design	4th Edition	M. Gopal	McGraw - Hill
3	Modern control engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited

4th Semester

EE1210	Microprocessor &Interfacing	L= 3	T =0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
➢ To understand the architecture, programming concept and addressing modes of Intel 8085A ➢ To understand various interfacing concepts like 8255,8253,8259,ADC etc. for designing Microprocessor based applications	Students 1. Will understand the architecture of 8085 microprocessor 2. Will understand mnemonics and programming logic 3. Will interface I/O devices and apply knowledge of ADC, DAC, Stepper motor interfacing & programming. 4. Will design the Circuit where the applications of timer and counter are used. 5. Will develop the technique of interrupt I/O technique 6. Will develop the circuit where the serial communication is used

Unit I
Intel 8085A Architecture pins, Generation of control signals, Demultiplexing of Address and Data bus Memory mapping, absolute and linear decoding.
(7 Hours)

Unit II
Instruction set, addressing modes, timing diagram, flag register branching instructions, stack related instructions, programming, and Call instructions Delay programming.
(7 Hours)

Unit III
PPI 8255,Architecture ,command word register ,I/O and BSR modes Interfacing and programming for keyboard ,keyboard matrix,7 segment display,7 segment displays in multiplexed mode ,ADC,DAC ,Stepper motor.
(7 Hours)

Unit IV
PIT 8253 different modes, interfacing and programming. Real time clock design, Design of interrupt alarm system.
(7 Hours)

Unit V
Interrupt structure of 8085, RIM AND SIM instructions generation of RST n instructions, management of interrupt requests from 8 different I/O devices.PIC 8259 Interfacing with 8085, cascade mode, ICWS OCWS, programming.
(7 Hours)

Unit VI
8251 USART block diagram and pins, Mode select command byte, control select command byte status register, interfacing and programming.
(7 Hours)

Text Book:
1) Microprocessors and Interfacing; 2E; D. V. Hall; McGraw Hill.

Reference Books:
1. Microprocessor: Architecture, Programming & applications with 8085; Ramesh S.Gaonkar; Penram International Publication, 5th Edition.
2. Microcomputer systems: the 8086/8088 family: architecture, programming, and design; Yu-cheng Liu, Glenn A. Gibson; Prentice-Hall.
3. The 8051 Microcontroller and Embedded systems , Muhammad Ali Mazidi , J.G. Mazidi, 2nd edition Pearson Education, Prentice Hall of India

4th Semester

EE1211	Lab.: Microprocessor & Interfacing	L = 0	T = 0	P = 2	Credits= 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
1. To understand the concept and addressing modes of Intel 8085A 2. To understand various interfacing concepts like 8255,8253,8259,ADC etc. for designing Microprocessor based applications	1. Graduates will understand architectural details of microprocessors 2. Will be able to demonstrate the microprocessor based system design 3. Will be able to interface various devices with microprocessor

Expt No.	Name of the Experiment
1	To determine the opcodes,addressing modes, no of bytes the instructions required
2	Add data bytes in the block
3	Determine the maximum data bytes in a block
4	To find no of negative data bytes in the block
5	Replace the leading zeros with blanks
6	Find the length of ASCII String
7	Compare two strings of ASCII charecters
8	Add two multiple byte binary nos
9	Adc interface
10	Dac interface

4th Semester

EE1212	Simulation Laboratory	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
1. To acquaint student with various computing schemes using mathematical software tools.	1. Graduates will be able to understand the concept of Mathematical modeling of systems. 2. Will be able to apply concept of Mathematical modeling for various applications. 3. Graduates will be able to understand the concept circuit analysis & designing using SPICE programming.

Unit I:
Introduction: matrix creation and matrix operations, Matrix arithmetic, linear equations, eigen values, singular values, and matrix factorizations, Basic data structures: two-dimensional matrix and multidimensional array (plus scalar, vector, and empty matrices), Data types: numeric, logical, characters, dates, structures, cell arrays, function handles, Programming components: principal building blocks, programming- variables, keywords, special values, operators, expressions, regular expressions, comma-separated lists, control statements, symbols.

Unit II:
Scripts and functions, Making calls to calls to functions, handle argument data, and use function handles, Data import Export: import and export of data, including text, spreadsheet, graphics, and audio/video files, Error Handling: error checking in programs, and identify, handle, and possibly recover from errors that occur, Using message identifiers to better identify the source of an error, and selectively display or ignore warning messages. Improving performance and memory usage: Profiling.

Unit III:
Data visualization. Graphics: Plotting Tools, Data Exploration tools, Annotating Graphs, Basic Plotting Commands, Creating specialized plots, Mesh, surface, feather plot, pie chart, bar graph, shading techniques, Printing and exporting, Figure and axes properties. Creating Graphical User Interface: Creating GUI, Laying out GUIs and Setting Properties, Programming GUI, GUI applications.

Unit IV:
Control system analysis- LTI Models, Operations on LTI models, Model analysis tools. Signal Processing Toolbox- vector and matrix representation of signals, generation of periodic and aperiodic waveforms, sequences (impulse, step, and ramp), impulse response, frequency response, zero-pole analysis.

Unit V:
Spice fundamentals, various circuit analysis methods, Spice device models, Data visualization.

5th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
Principle of Management	To familiarize the students with the basic concepts and principles of management. The students should clearly understand the definitions of different areas of management. This course will facilitate students to understand and describe specific theories related to perception, motivation, leadership. This will help the students to demonstrate effective management skill by knowing the various functions of management like planning, organising, directing, coordinating and controlling.
Legal Aspects of Management	The present course aims at familiarizing the students with various legal aspects of business, contract, partnership and companies. It aims at providing a rich fund of contemporary knowledge, time tested principles, basic concepts, emerging ideas and practices in the field of law in a comprehensive way.
Human Resource Management	The objective of this course is to endow the student with a broad perspective on themes and issues of Human Resource Management, Human Resource Development, Training and Development activities, Job Analysis, Performance Appraisal, disciplinary and grievance procedure. It will help the students to build up and refine decision making skills so that they can help organizations effectively manage employee relations.
Project Management	The course is intended to develop the knowledge of the students in the management of projects, special emphasis will be provided on project formulation as also on various tools and techniques for project appraisal and control so that they are able to draft the project proposal in any area of management and evaluate the projects.
Marketing Management	This course intends to provide an experienced-based approach to marketing concept and its practical application. The course is designed to enable the students to learn the basic of marketing, customer behaviour, marketing research & sales promotion. Topics of the syllabus shall be addressed and discussed from an application oriented perspective
Financial Management	The present course aims at familiarizing the participants with the skills related to basic principles, tools and techniques of financial management. This will help the students to demonstrate their skill in understanding the budgets and budgetary control, balance sheet, and profit and loss statement.

Mapped Program Outcomes:

5th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1: Principles of Management
Evolution of Management Thought : Scientific, Classical, Neo Classical and Modern Theory of Management, Defintion Meaning and Concept of Management, Functions of Managment : Planning, Organizing, Directing Coordinating and Controlling. Motivation Theory, Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, Types of Partners, Right and Duties of Partners, Registration and Dissolution of firm, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Directors : Powers and duties, Winding up of the Company

UNIT-3: Human Resource Management
Human Resource Management-Meaning, Nature and Scope, Principles of HRD, Human Resource Planning, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Discipline and Grievance Procedure.

UNIT-4 Project management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Project Management, Tools and Techniques of Project Management, SWOT Analysis, Project Risk Analysis, Project cost, Project Planning, Project Control, Network techniques - Introduction and Use of CPM &PERT for planning.

UNIT-5 Marketing Management:-
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Rural Marketing, Marketing Environment, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

UNIT-6 Financial Management:-
Definition & Functions of Finance department, Sources of finance , Financing organizations, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

TEXT BOOKS:

1. S.C.Saxena, Business Management and Administration, SahityaBhawan Publication
2. P. SubbaRao, Management -- Theory and Practice (Text and Cases) (Himalaya Publication)
3. Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
4. P.S Rao , Essentials of Human Resource Managemen& IR, Himalaya , Mumbai
5. AvrahamShtub and Jonathan F. Bard, Project Management: Processes, Methodologies, and Economics (2nd Edition)
6. Kotler, Keller, Koshy&Jha, Marketing Management, Pearson, New Delhi
7. R.K. Sharma, Shashi K Gupta, Management Accounting,.Kalyani Publishers.

5th Semester

GE1311	**Fundamentals of Management**	**L= 3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

TEXT BOOKS FOR REFERENCE:

1) Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2) Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3) Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4) C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,

5) Lock, Gower - Project Management Handbook
6) Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7) RajanSaxena: Marketing Management, Tata McGraw Hill.
8) Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9) Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10) Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11) Khan M Y - Financial Services (Tata McGraw Hill, 1998)

5th Semester

EE1301	Analog Communication	L= 4	T = 0	P = 0	Credits =4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
➢ To Study different modulation techniques. ➢ To understand transmitter &receivers communication systems. ➢ To learn the concept of PPM, PAM, PWM & PCM. ➢ To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students will be able to 1. Demonstrate and analyze various amplitude modulation techniques. 2. Demonstrate and analyze various angle modulation techniques. 3. Understand various types of receivers in communication system. 4. Analyze various types of noise in communication system and investigate noise parameters. 5. Understand pulse modulation techniques. 6. Study antenna theory with its various types.

UNIT-1:
Amplitude Modulation: Need for modulation, mathematical Analysis, modulation index, frequency spectrum, power requirement of AM, DSB-SC, Balanced Modulator for carrier suppression, SSB, Methods of SSB Generation, ISB, VSB transmissions, Generation of AM system.

(7 Hours)

UNIT-2:
Angle Modulation: Frequency Modulation (FM), mathematical Analysis, modulation index, frequency spectrum, power requirement of FM, narrowband & wideband FM, noise triangle in FM, pre-emphasis & de-emphasis techniques, phase modulation, noise reduction characteristics of angle modulation, FM Transmitter.

(8 Hours)

UNIT-3
Receivers: Basic receiver (TRF), Super heterodyne receiver, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AM detectors, FM discriminators, AGC technique, double-spotting effect.

(7 Hours)

UNIT-4
Noise: External Noise, internal Noise, Noise Calculations, Addition of Noise due to several sources, Addition of Noise due to several amplifiers in cascade, Noise in reactive circuits, Definition of Noise figure, signal to noise ratio, calculation of noise figure, Noise figure from equivalent resistance, Noise Temperature.

(8 Hours)

UNIT-5:
Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Pulse code modulation

(8 Hours)

UNIT-6:
Introduction to antenna, radiation in spaceTerms&definitions in antenna, effects of ground on antennas, antenna with parabolic reflectors, Horn antenna,Yagi antenna

(7 Hours)

Text books:				
1	Electronic Communication System	Fourth Edition, 1999	Gorge Kennedy	Tata McGraw-Hill
2	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons
3	Modern Television Practice	Third Edition,2007	R.R.Gulati	New Age International publishers

5th Semester

EE1301	Analog Communication	L= 3	T = 0	P = 0	Credits =3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Television & Video Engineering	2001	Dhake Arvind M	Tata Mgraw Hill

5th Semester

EE1302	Lab. : Analog Communication	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objective	Outcome
To Demonstrate all the types of modulation and demodulation methods. To perform Double side band and single side band modulation system. To analyze pulse modulation and digital modulation techniques.	Students 1. Will be able to demonstrate different modulation techniques & the ability to calculate power & current in modulation techniques. 2. Will be able to demonstration the demodulation techniques. 3. Will be able to perform the time division multiplexing.

Expt. No.	Name of Experiment
1	To verify the Generation of Amplitude Modulation using transistor. Calculate modulation index for different values of modulating amplitude.
2	To verify the Generation of Amplitude Demodulation using Envelop Detector.
3	To verify the Generation of Frequency Modulation using IC 8038 function generator.
4	To perform Frequency Demodulation using IC 565 PLL.
5	Generation of SSB-SC using balanced modulator.
6	Generation of SSB-SC using balanced de-modulator.
7	Generation of DSB-SC.
8	Generation of PWM signal using IC 555.
9	To perform Pulse Width Demodulation
10	Generation of PPM signal using IC 555.
11	Generation of Pulse Position Demodulation.
12	Generation of Pulse Amplitude Modulation using IC 555 & IC 4016.
13	To perform Time Division Multiplexing (TDM).

5th Semester

EE1306	Signals & Systems	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
➢ The objective of this course is to have an introduction to approaches of signals & systems analysis with an increased emphasis on the frequency response and Analysis of system with continuous signal and discrete time signal. ➢ To enable the students to understand the fundamentals of Signals, their Time & Frequency characteristics.	Students will be able to 1. Identify and categorize continuous time signals & systems. 2. Analyze periodic continuous time signals in frequency domain. 3. Analyze aperiodic continuous time signals in frequency domain. 4. Analyze continuous time signals in complex plane. 5. Understand sampling and reconstruction process and classify discrete time signals & systems. 6. Analyze periodic and aperiodic discrete time signals & systems in frequency domain.

UNIT-1:
Continuous time signals (CT signals), Step, Ramp, Pulse, Impulse, Exponential, Classification of CT signals- Periodic and Aperiodic, random signals, CT systems, Classification of systems - Linear Time invariant systems, Convolution integral, correlation.

(8Hours)

UNIT-2: The Response of LTI Systems to Complex Exponentials, Fourier Series Representation of Continuous-Time Periodic Signals, Convergence of the Fourier Series. Properties of Continuous-Time Fourier series, Filtering. Examples of Continuous-Time Filters Described by Differential Equations.

(7 Hours)

UNIT-3:
The Continuous-Time Fourier Transform, Representation of Aperiodic Signals: The Continuous-Time Fourier Transform, The Fourier Transform for Periodic Signals, Properties of the Continuous-Time Fourier Transform, Systems Characterized by Linear Constant-Coefficient Differential Equations.

(8 Hours)

UNIT-4:
The Laplace Transform, The Region of Convergence for Laplace Transforms, The Inverse Laplace Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the Laplace Transform, Analysis and Characterization of LTI Systems Using the Laplace Transform, System Function Algebra and Block Diagram Representations, The Unilateral Laplace Transform, State equations and Matrix.

(7 Hours)

UNIT-5 –
Discrete-Time Processing of Continuous-Time Signals, Sampling Theorem, Reconstruction, Aliasing of signal, discrete time signals (DT signals)-Classification of DT signal, classification of DT system, Convolution sum, correlation.

(8 Hours)

UNIT-6:
Fourier series Representation of Discrete-Time Periodic Signals, Properties of Discrete-Time Fourier series, Fourier series and LTI Systems, Examples of Discrete-Time Filters Described by Difference Equations, The Discrete-Time Fourier Transform**,** Representation of Aperiodic Signals: The Discrete-Time Fourier Transform, The Fourier Transform for Periodic Signals, Properties of the Discrete-Time Fourier Transform, Systems Characterized by Linear Constant-Coefficient Difference Equations, State variable equation and Matrix.

(7 Hours)

5th Semester

EE1306	Signals & Systems	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

1	Signals and Systems	2/E, 1996	Alan V. Oppenheim, Alan S. Willsky, with S. Hamid	Prentice Hall
2	Digital signal processing –Principles, algorithms and applications	3rd Edition, 1996	J. G. Proakis, D. G. Manolakis	PHI

Reference books:

1	Outline of Signals and Systems	1st, 1995	HweiHsu,Schaum's	McGraw-Hill
2	Signals & Systems	2nd Edition, 2002	Simon Haykin and Van Veen	Wiley
3	Signals & Systems Analysis Using Transformation Methods & MAT Lab	2003	Robert	TMH
4	Signals, Systems and Transforms	3rd Edition, 2004.	C. L. Philips, J.M.Parr and Eve A.Riskin	Pearson education
5	Signals & Systems	2001.	I. J. Nagrath, S.N.Sharan, R.Ranjan, S.Kumar	

5th Semester

EE1308	**Analog Integrated Circuits and its Application**	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
➢ The objective of this course is to analyze and design a wide variety of operational amplifier / integrated circuits based applications and to have a firm grasp of basic principle of these to adapt to a changing technology as the new devices appear on the market.	Students will be able to 1. Acquire knowledge of the fundamentals and internal structure of the operational amplifier. 2. Acquire knowledge about noise & the different Parameters of the operational amplifier. 3. Analyze and design the linear applications of the operational amplifier. 4. Analyze and design active Butterworth filters using operational amplifier. 5. Analyze and design the non-linear applications of the operational amplifier. 6. Understand the working and applications of DAC and ADC.

UNIT-1:
OPERATIONAL AMPLIFIER FUNDAMENTALS: Amplifier Fundamentals, Ideal Op-Amp, OPAMP parameters, Basic Op-Amp Configurations: Open loop, Feedback in OPAMP circuit: Inverting, Non-inverting, voltage follower.
(8 Hours)

UNIT-2:
OP AMP LIMITATIONS- STATIC and DYNAMIC: Simplified Op Amp Circuit Diagram, Input Bias and Offset Current, Input Bias and Offset voltages, input offset error Compensation, open loop and closed loop response, Transient response, gain bandwidth product (GBP) & its effect, frequency compensation. OPAMP Noise : Noise properties, Sources of noise, Noise Dynamics, Noise in OPAMP.
(7 Hours)

UNIT-3
LINEAR APPLICATIONS : Summer, difference amplifier, integrator, differentiator, Current-to-Voltage Converter, Voltage-to-CurrentConverter, Instrumentation Amplifiers, Instrumentation Applications, Transducer, Bridge amplifiers.
(7 Hours)

UNIT-4:
ACTIVE FILTERS: Transfer function, first order filter, Standard second order response, higher order filter, KRC Filters, Multiple feedback filters, second order Butterworth filter design.
(8 Hours)

UNIT-5
NONLINEAR CIRCUITS: Precision Rectifiers, Voltage Comparators, Comparator Applications, Peak Detectors, Schmitt Triggers: Inverting & Non-inverting, Sample-and-Hold Circuits, clipper, clamper, Log/Antilog amplifiers, PLL WAVEFORM GENERATORS, Sinusoidal Oscillators, multivibrators, monolithic timers, triangular wave generator.
(7 Hours)

UNIT-6:
D-A AND A-D CONVERTERS: Performance Spécifications, D-A Converters (DACs), A-D Converters (ADCs), D-A Conversion Techniques, A-D Conversion Techniques.
(8 Hours)

Text books:				
1	Design with Operational Amplifiers and Analog Integrated Circuits	3rd Edition	Sergio Franco	McGraw-Hill

Reference books:				
1	Linear Integrated Circuits	3rd Edition	D. Roy Chaudhuri, Shail Jain	New Age International
2	Linear Integrated Circuits	S. Salivahanan, V. S. Bhaaskaran		TMH

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5th Semester

EE1309	Analog Integrated Circuits and its Application Laboratory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objective	Outcome
➢ The purpose of the course is to teach students how to build circuits on bread boards using operational amplifier IC, resistors, capacitors and diodes and how to use digital multimeters, signal generators, frequency meters and oscilloscopes to test these circuits. ➢ In addition, students must learn to write well-organized reports.	Students 1. Will be able to construct breadboard circuits. 2. Will be able to use standard electronic test equipment such as oscilloscopes, function generators, digital multimeters and power supplies. 3. Will be able to analyze a circuit and compare theoretical performance to actual performance. 4. Will be able to present an organized written engineering analysis on electronic testing of a circuit.

Expt. No.	Name of Experiment
1	IC 741 OP-AMP as a inverting amplifier / non-inverting amplifier with frequency response.
2	Different OPAMP parameters: CMRR, Slew rate of OP-AMP.
3	IC 741 OP-AMP as a Integrator.
4	IC 741 OP-AMP as a Differentiator.
5	IC 741 OP-AMP as a Low pass filter.
6	IC 741 OP-AMP as a High pass filter.
7	OP-AMP IC 741 as AstableMultivibrator.
8	OP-AMP IC 741 as a MonostableMultivibrator.
9	OP-AMP IC 741 as a Schmitt trigger.
10	Instrumentation amplifier.
11	Precision Rectifier.
12	ADC/ DAC.

5th Semester

EE1304	PE I : Power Electronics		L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To make familiar with the SCR & other power devices. ➢ To study power controller, various techniques of improving power factor, different methods of commutation. ➢ To understand uncontrolled and controlled converters. ➢ To describe function of various types of an inverter. ➢ To explain operation of choppers.	Students 1. Will be able to study the characteristics of various devices. 2. Will understand how the semiconductor devices are used as a converter and how they satisfy the requirement of load. 3. Will help to develop the concept of resonant inverter. 4. Will come to know that a dc chopper can be used as a dc transformer to step up or step down a fixed dc voltage.

UNIT-1:
Power Semiconductor Diodes and Circuits, control Characteristics of power devices, power modules, power diodes, reverse recovery, series, shunt connected diodes, Diode Rectifiers-single phase, three phase rectifiers, bride rectifiers, design of rectifiers.

(8 Hours)

UNIT-2:
Power Transistors, Switching characteristics of BJT, Power MOSFETs, IGBTs, limitations, Power Thyristors.

(7 Hours)

UNIT-3
Pulse-width Modulated Inverters: Principle, single phase, multiple phase, PWM Forced commuted inverters, current source inverters, design of inverter, DC-DC Converters, Step up, stepdown, SMPS, thyrister Choppers, design of choppers.

(8 Hours)

UNIT-4:
Resonant Pulse Inverters-Series, parallel, resonant inverters, Class E resonant inverter, Zero voltage/current Switching resonant inverter, Multilevel Inverters.

(7 Hours)

UNIT-5
Controlled Rectifiers: phase control converter, single phase, three phase converters, power factor improvement, AC Voltage Controllers. Principle of ON-OFF control, Phase control, Single phase controllers, three phase controllers, cyclo-converters.

(8 Hours)

UNIT-6:
Power Supplies, SMPS, SMAC power supplies, power factor conditioning Gate Drive Circuits- Protection of Devices and Circuits Snubber, reverse recovery transients, protection devices varisters, Introduction to AC and DC drives.

(7 Hours)

Text books:

1	Power Electronics:Circuits,Devices and Applications	2nd edition 1993	M. Rashid	PHI

Reference books:

1	Power Electronics and its application	2nd Edition 2004	Alok Jain	Penram International Publishing Pvt Ltd

5th Semester

EE1305	PE I : Advanced Instrumentation	L= 3	T = 0	P = 0	Credits =3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ This course is intended for exposing the students to some of the advanced topics in instrumentation. Topics covered are humidity, time & voltage measurement, smart sensors, common instrument interfaces, and basics of biomedical instrumentation.	Students will be able to 1. Understand different electrical transducers. 2. Understand basics of digital measurement. 3. Understand and Classify different liquid level measurement techniques. 4. Describe voltage measurement digitally and its applications. 5. Learn different networking standards for programmable instruments. 6. Understand the basics of Biomedical Instrumentation.

UNIT-1:
Measurement of Humidity: dry and wet bulb psychrometer, different methods of moisture measurement, Measurement of density, liquid density measurement–gas densitometers, Conductivity measurement, Smart sensors-block diagram, Smart transmitter, Recent trends in sensor technology, Semiconductor sensors, Film sensors-MEMS-Nanosensors.
(7 Hours)

UNIT-2:
Time measurement using digital techniques, Small time interval measurement, Periodic time, Time interval between two events defined by voltage levels, time constant, Phase measurement, Capacitance measurement, Quality factor of a ringing circuit Frequency measurement using digital techniques, Ratio of two frequencies, High frequency, Power system frequency deviation, Low frequency, Time reciprocating circuit, Peak frequency.
(8Hours)

UNIT-3
Level Measurement: Glass techniques coupled with photoelectric readout system, Float type level indication, Different schemes, Level switches, level measurement using displacer and torque tube, Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors. Introduction to digital transducers.
(7 Hours)

UNIT-4:
Voltage measurement using digital techniques, Input circuits of digital voltmeter, auto zero circuit, bipolar operation, buffer circuit, protection, auto ranging, tracking method, Ratiometric Measurements, Applications, Measurement of modulation index, Q of a coil (any one method), Noise in instrumentation systems, electromagnetic interference, methods of noise coupling, noise sources, grounding.
(8 Hours)

UNIT-5
Common Instrument Interfaces – RS232C, USB, General Purpose Interface Bus (GPIB), Standard Commands for Programmable Instrumentation (SCPI), PLC,SCADA
(7 Hours)

UNIT-6:
Introduction of Biomedical Instrumentation &measurements, Bioelectric potentials, examples (ECG, EEG), Blood pressure measurements, indirect measurement, sphygmomanometer, direct measurement techniques, Recent trends in biomedical instrumentation
(8 Hours)

Text books:				
1	Principles of Industrial Instrumentation	3rd ed, 1996	D. Patranabis	Tata McGraw Hill
2	Medical Instrumentation Application and Design	3rd ed, 1998	J. G. Webster	John Wiley & Sons
3	Senors and transducers	2nd ed.2003	D. Patranabis	PHI Learning Pvt. Ltd

5th Semester

EE1305	PE I : Advanced Instrumentation	L= 3	T = 0	P = 0	Credits =3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:				
1	Digital Measurement Techniques	2nd ed, 2004	T. S. Rathore	Narosa Publishing House
2	Introduction to Biomedical Equipment Technology	4th ed, 2001	J. J. Carr and J. M. Brown	Pearson Education

5th Semester

EE1307	PE I : Switching Theory & Finite Automata	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To acquaint students with various sequential logic design methods, Analysis of logic circuits and optimization techniques to minimize gate count. ➢ To acquaint students with fault diagnosis, threshold logic, analysis and design of sequential machines.	Students will be able to 1. Understand and Synthesis multilevel logic networks. 2. Design and analyze the faults models. 3. Design and analyze the synchronous sequential circuits. 4. Design and analyze the asynchronous sequential circuits. 5. State assignments for optimization of finite state machines. 6. Identify and test the sequential machines with experiments.

UNIT-1:
Multi-level logic synthesis, Technology-independent synthesis, Technology mapping, Threshold logic for nanotechnologies, Introductory concepts, Synthesis of threshold networks.

(8Hours)

UNIT-2:
Testing of combinational circuits, Fault models, Structural testing, *IDDQ* testing, Delay fault testing, Synthesis for testability, Testing for nanotechnologies.

(7 Hours)

UNIT-3
Introduction to synchronous sequential circuits and iterative networks, Sequential circuits: introductory example, The finite-state model: basic definitions, Memory elements and their excitation functions, Synthesis of synchronous sequential circuits, An example of a computing machine, Iterative networks, Capabilities, minimization, and transformation of sequential machines,The finite-state model: further definitions, Capabilities and limitations of finite-state machines, State equivalence and machine minimization, Simplification of incompletely specified machines.

(8Hours)

UNIT-4:
Asynchronous sequential circuits,Modes of operation, Hazards, Synthesis of SIC fundamental-mode circuits, Synthesis of burst-mode circuits.

(7 Hours)

UNIT-5
Structure of sequential machines:Introductory example, State assignments using partitions, The lattice of closed partitions, Reduction of the output dependency, Input independency and autonomous clocks, Covers and the generation of closed partitions by state splitting, Information flow in sequential machines, Decomposition, Synthesis of multiple machines.

(8 Hours)

UNIT-6:
State-identification experiments and testing of sequential circuits**,** Experiments, Homing experiments, Distinguishing experiments, Machine identification, Checking experiments, Design of diagnosable machines, Alternative approaches to the testing of sequential circuits, Design for testability, Built-in self-test (BIST).

(7 Hours)

Text books:				
1	Switching & Finite Automata Theory	Third Edition 2010	Zvi Kohavi, Niraja K. Jha	Cambridge University Press
2	Fundamentals of Digital Logic With VHDL Design	Second Edition, 2007	Stephen Brown	TMH
Reference books:				
1	Digital System Design using VHDL	Fifth Edition, 1998/2007	C.H.Roth	PWS
2	Digital logic testing and simulation	Second Edition, 2000	Alexander Miczo	John Wiely& Sons

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5th Semester

EE1324	PE I : Computer Organisation	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ Acquire knowledge of various Computer architecture. ➢ To understand Processor level design, controller design of processor. ➢ To understand memory organization of computer. ➢ To Learn about DMA operation, parallel processing architecture.	Students will be able to 1. Identify the various hardware design level components of a computer system. 2. Investigate the methods required for processor organization and representation of information. 3. Understand the various hardware control unit design 4. Understand the basic organization of the memory. 5. Acquire the knowledge of the input/output mechanisms used to connect computers to their external environments. 6. Understand importance of instruction pipelining for enhancing processor performance

UNIT-1:
Register Level Design – General characteristics, Description, Languages, Combinational and sequential components, Design methods, Processor Level design- components, design techniques.
(7 Hours)

UNIT-2:
Processor Design- Processor organization, information representation, number Formats. Instruction sets – Instruction formats, instruction types, multiplication & division ALU design, Floating Point arithmetic, IEEE 754 floating point formats.
(8 Hours)

UNIT-3
Control design – Instruction sequencing, interpretation, Hard-wired control-Design methods, multiplier and CPU control unit, Micro programmed control – Basic concepts, minimizes microinstruction size, multiplier control unit, Micro programmed Computers – CPU control unit,.
(8 Hours)

UNIT-4:
Memory organization – Device characteristics, RAM, Serial access memories, virtual memory, concept of cache & associative memories.
(7 Hours)

UNIT-5
System Organization – Local and long distance communication input-output systems, Interrupt, DMA, introduction to parallel processing.
(8 Hours)

UNIT-6:
Concept of parallel processing, Pipelining, vector processors, introduction of RISC architecture, Date Flow architecture.
(7 Hours)

Text books:

1	Computer Architecture and organization	Third Edition, 1997	Jhon.P. Hayes	McGraw-Hill Companies

Reference books:

1	Computer organization	Fifth edition, 2001	Carl Hammacher	McGraw-Hill Science
2	Structured computer and Organization	Fifth edition, 2005	Andrew S. Tanenbaum	PHI
3	computer organization and microprogramming	First edition, 1972.	CHU, YAOHAN	Prentice Hall
4	Computer System Architecture	Third Edition ,1992	M.Morris Mano	Prentice Hall

5th Semester

EE1311	Electronics Workshop	L = 0	T = 0	P = 2	Credits = 2

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcome
➢ To Acquaint Students with basic Electronics workshop practices like, identification of components, operate and control various machines, repair, troubleshooting , and Circuit Design Methods. ➢ To create interest in Hardware Technology. ➢ Student will understand Project Implementation and testing with proper report writing.	Students 1. Will able to identify different Electronics Components. 2. Will be able to do mini project to enhance their practical Knowledge. 3. Will be able to do Artwork, printing, Etching & drilling of PCB 4. Will be able `to work in a teamwork

Expt. No.	Name of Experiment
1	Study of Passive Elements : Resistors, Capacitors, Inductors etc.
2	Study of Active Elements : Diodes, Transistors, Thyristors, Power Supplies etc.
3	Study of Electronic Transformers.
4	Study of Wires, Cables etc.
5	Study of Interconnect Components: Electromechanical Switches, Solid state relays, Optocouplers etc.
6	Study of Speakers and Microphones.
7	Study of Electronic Circuit Protection Components: Fuses, Circuit Breakers, Zener Diodes etc.
8	Electronics Mini Project : Selection, Estimation, PCB layout design, Fabrication, Soldering, Testing, Troubleshooting , Results , Report etc.
9	Interconnect components: Solid state Relays ,Coaxial RF connectors, Mechanical switches for electronic Circuits.
10	Electronic Circuit Protection: Snubber Capacitor (IGBT Protection), Thermisters, Discrete Semiconductor, Over voltage Protection, Over Current Protection.
11	Study of LTCC (Low Temperature co -fired Ceramic Tapes, Niobium Oxide Capacitors, EDLC (Electronic Double Layer Carbon) Super Capacitors.
12	Study of Chip Resistors, Line feed Resistors (Surge Resistors Networks).

5th Semester

EE1311	Seminar		L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation		ESE		Total	ESE Duration
	100		00		100	

OBJECTIVES: To develop technical presentation skill through Seminar based on Mini-Project work carried out in subject **EE310 / EE719Electronics Workshop Laboratory.**

5th Semester

EE1320	OE I : Data Acquisition & Signal Conditioning	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques.	Students 1. Will be able to identify the basic model of data acquisition system. 2. Will understand the various methods and attributes of signal conditioning. 3. Will understand the various types of data acquisition hardware. 4. Will understand the serial data communication standards. 5. Will understand different standards for connection of different programmable instruments 6. Will be introduced to various IEEE standards.

UNIT-1:
Definition of data acquisition and control, Fundamentals of data acquisition, Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.

(8 Hours)

UNIT-2:
Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.

(7 Hours)

UNIT-3
Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.

(7 Hours)

UNIT-4:
Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection.

(8 Hours)

UNIT-5
IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).

(7 Hours)

UNIT-6:
Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.

(8 Hours)

Text books:		
1	Data Acquisition for Instrumentation and Control Systems	John Park and Steve Mackay

Reference books:				
1	Electronic Analog Digital Conversion	1st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1st Edition , 1993	B. S. Sonde	Tata McGraw Hill

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5th Semester

EE1322	**OE I : Microprocessor & Microcontroller**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
To understand the architecture, programming and addressing modes of Intel 8085 and 8051 To study the instruction set and programming of 8085 and 8051 To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085 and 8051. 2. Will demonstrate the ability to identify, Formulate and design program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor and microcontroller in their respective field.

UNIT-1:
Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.

UNIT-2:
Architecture of 8085 Intel microprocessor, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization.

UNIT-3
Addressing mode, Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses. Interrupts-Interrupt structure of 8085, Programs based on instructions.

UNIT-4:
Salient features of microcontroller 8051, Architecture of 8051, Pins diagram of 8051, SFRs of 8051, Addressing modes, Instruction set, Simple programs based on arithmetic, logical operations, BCD arithmetic, bit manipulations. Reset Circuit of 8051.

UNIT-5
Advanced instructions, delay programs. Interfacing of LED, 7 segment display, switches, LCD display interfacing Matrix Keyboard interfacing.

UNIT-6:
Different modes of timer/Counters, applications of timer, Interfacing of ADC & DAC.Serial Communication.

Text books:

1	Programming & Interfacing 8085	Ramesh Gaonkar	Penram Publication
2	8051 Microcontroller	Kenneth Ayala	Penram Publication

Reference books:

1	8085 Microprocessor	Ajit Pal	Tata Mc-Graw Hill
2	0000 to 8085	ShridharGhosh	PHI
3	The 8051 Microcontroller & Embedded System	M. A. Mazidi, J. G. Mazidi	Pearson

5th Semester

EE1323	**OE I : Consumer Electronics**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To give knowledge and competencies regarding consumer electronic equipments.	Students will be able to 1. Understand the knowledge of the safety aspects in the field of Electrical and Electronics products. 2. Analyze the basics of Audio Systems. 3. Analyze the basics of Video Systems 4. Know about current trends in mobile and wireless technologies. 5. Understand the basics of refrigeration cycle and cooling system. 6. Know the recent trends in Processors and computer peripherals.

Unit -I
Standards and Safety norms:Electronics and Electrical safety norms and standards, Electronic products covered under compulsory registration

Unit -II
Audio Systems:Sound Recording and reproduction, Hi-Fi Sound System, Audio Mixers, Graphics Equalizers, Public Address System.

Unit -III
Video Systems:Color fundamentals, Luminance and Chrominance signal , Color camera, digital television systems.

Unit IV
Wireless Technology & Mobile phones:Mobile Phones, various wireless technologies, Introduction to 3G, WiFiTechnology, GSM

Unit -V
Air conditioner and Refrigerators:Fundamentals, Refrigeration cycles, compressors, home automation

Unit -VI
Computers:Recent microprocessor, Pentium family architecture and salient features , Recent Memories technologies (RAM, HDD), Computer peripherals

Text Books:

1. S.P. Bali, "Consumer Electronics", Pearson Education, First Edition
2. B. R. Gupta, VandanaSinghal, "Consumer Electronics", S. K. Kataria& Sons, 2006
3. J.S. Chitode, "Consumer Electronics", Technical Publication,
4. for unit-I Electronics Standards of India *www.**electronics**tds.gov.in*
5. Related internet sites

6th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1:Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

UNIT-4: National income accounting:
Concepts of GDP and GNP,Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

6th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher,2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

6th Semester

EE1303	Transmission Lines and Wave Guides	L= 4	T =0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To enable the students, to have a fair knowledge about the theory and problems of EM wave transmission through waveguides and transmission line. ➢ To lay a strong foundation on the theory of transmission line. ➢ To avail deep knowledge and mathematical analysis of Radiation of EM wave, Classification of different types of waveguides and their characterization.	Students will be 1. Able to study the fundamentals of transmission line theory. 2. Aware of the propagation characteristics of electrical waves in telephone cable as an application of transmission lines. 3. Aware of the different parameters and constraints in high frequency transmission of information. 4. Derive and understand Electromagnetic equations for TE, TM and TEM wave for parallel plane waveguide and will do characterization for it. 5. Derive and understand Electromagnetic equations for TE, TM and TEM wave for rectangular waveguide and will do characterization for it. 6. Derive and understand Electromagnetic equations for TE, TM and TEM wave for circular waveguide and will do characterization for it.

UNIT-1:
TRANSMISSION LINE THEORY :Different types of transmission lines , Definition of Characteristic impedance ,The transmission line as a cascade of T-Sections Definition of Propagation Constant, General Solution of the transmission line , The two standard forms for voltage and current of a line terminated by an impedance , physical significance of the equation and the infinite line , The two standard forms for the input impedance of a transmission line terminated by an impedance , meaning of reflection coefficient , wavelength and velocity of propagation.

(8 Hours)

UNIT-2:
Waveform Distortion: Distortion less transmission line, The telephone cable, Inductance loading of telephone cables, Input impedance of lossless lines – reflection on a line not terminated by Zo, Transfer impedance reflection factor and reflection loss, T and ∏ Section equivalent to lines.

(7 Hours)

UNIT-3
LINE AT RADIO FREQUENCIES: Standing waves and standing wave ratio on a line , One eighth wave line , The quarter wave line and impedance matching , the half wave line, The circle diagram for the dissipation less line , The Smith Chart , Application of the Smith Chart , Conversion from impedance to reflection coefficient and vice-versa. Impedance to Admittance conversion and vice versa, Input impedance of a lossless line terminated by impedance, single stub matching and double stub matching.

(8 Hours)

UNIT-4:
GUIDED WAVES: Waves between parallel planes of perfect conductors, Transverse electric and transverse magnetic waves, characteristics of TE and TM Waves, Transverse Electromagnetic waves, Velocities of propagation, component uniform plane waves between parallel planes, Attenuation of TE and TM waves in parallel plane guides, Wave impedances.

(7 Hours)

UNIT-5
RECTANGULAR WAVEGUIDES: Transverse Magnetic Waves in Rectangular Wave guides ,Transverse Electric Waves in Rectangular Waveguides ,characteristic of TE and TM Waves , Cutoff wavelength and phase velocity , Impossibility of TEM waves in waveguides , Dominant mode in rectangular waveguide ,Attenuation of TE and TM modes in rectangular waveguides , Wave impedances , characteristic impedance ,Excitation of modes.

(8 Hours)

6th Semester

EE1303	Transmission Lines and Wave Guides	L= 4	T =0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-6:

CIRCULAR WAVE GUIDES AND RESONATORS: Bessel functions, Solution of field equations in cylindrical co-ordinates , TM and TE waves in circular guides wave impedances and characteristic impedance ,Dominant mode in circular waveguide ,excitation of modes.

(7 Hours)

Text books:				
1	Networks, Lines and Fields	2003	J.D.Ryder	PHI
2	Electro Magnetic Waves and Radiating System	2003	E.C. Jordan and K.G.Balmain	PHI
3	Transmission lines and wave guides		L.Ganesan,S.S.Sreeja Mole	
Reference books:				
1	Fields and Waves in Communication Electronics	2003	Ramo, Whineery and Van Duzer	John Wiley
2	Field and Waves in Electromagnetism	1989	David K.Cheng	Pearson Education

6th Semester

EE1314	Digital Signal Processing	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
➢ This course will provide solid foundations of discrete time signal processing fundamental concepts, Transform domain analysis, Mathematical analysis of FIR and IIR filter design.	1. Students will be able to design and compute Discrete Fourier transform and convolution of discrete time signals. 2. Students will be able analyze Z transform and determine region of convergence of discrete time signals. 3. Students will be able to construct structures for the realization of discrete Time system. 4. Students will be able to design and evaluate IIR filter design. 5. Students will be able to develop and evaluate FIR filter design. 6. Students will be able to discuss and interpret fundamental of DSP processors.

UNIT-1:
The Discrete Fourier Transform Computation of DFT, Properties of DFT, Finding convolution of long data sequences, FFT algorithms, Decimation in time, Decimation in Frequency, radix-n algorithms.

(7 Hours)

UNIT-2:
Z Domain Analysis: The z-Transform, The Region of Convergence for the z-Transform, The Inverse z-Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the z-Transform, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, The Unilateral z-Transform.

(7 Hours)

UNIT-3
Filter Realization: Structures for the realization of discrete Time system: structure for FIR system, Structure for IIR system, state space system analysis and structures

(7 Hours)

UNIT-4:
IIR filter Design: Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Butterworth and Chebyshev filter, Spectral transformations.

(7 Hours)

UNIT-5
FIR Filter Design: FIR filter design using windowing techniques, Frequency sampling technique.

(7 Hours)

UNIT-6:
Fundamentals of DSP Processor: Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory , Multi-ported memory , VLIW architecture, Pipelining , Special Addressing modes in P-DSPs, On chip Peripherals, Computational accuracy in DSP processor, Architecture of TMS320C6X.

(6 Hours)

Text books:

1	Discrete time signal processing	2nd edition, 1999	V. Oppenheim, R, W, Schafer	PHI
2	Digital signal processing – Principles, algorithms and applications	3rd Edition ,1996	J. G. Proakis, D. G. Manolakis	PHI
3	Digital Signal Processors, Architecture, Programming and Applications	2002	Venkataramani, Bhaskar	Tata McGraw Hill

6th Semester

EE1314	Digital Signal Processing	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Reference books:

1	Digital signal processing- A computer based approach	2nd Edition, 2002	S. K. Mitra	Tata McGraw Hill
2	Digital signal processing- A practical approach	2nd Edition,2001	E. C. Ifeachor, B. W. Jarvis	Pearson Education
3	Introduction to DSP	1989	Johny R Johnson	PHI
4	Theory and applications of digital signal processing		Lawrence R. Rabiner and Bernard Gold	PHI

6th Semester

EE1315	Lab. : Digital Signal Processing	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
➢ This lab aims at understanding of MATLAB in signal processing. ➢ Mathematical analysis of DSP using MATLAB ➢ Designing of DSP algorithms and filters using MATLAB. ➢ Programming a DSP chip for applications like filtering signal etc.	Students 1. Can solve signal processing based numerical using MATLAB. 2. Will develop DSP algorithm using MATLAB and test it for mathematical database. 3. Will design FIR and IIR filter and evaluate its characteristics. 4. Will program a DSP chip(TMSC6711) to filter signals and other signal processing application using MATLAB and code composer studio.

Expt. No.	Name of Experiment
1	To generate and plot discrete time signals.
2	Compute linear convolution and correlation of discrete time signals.
3	To plot pole zero plot of a discrete time signal and comment on stability of a system.
4	To find inverse Z transform and find its ROC of a signal, determine system is causal or not.
5	To compute DFT and IDFT of discrete time signals.
6	Compute linear and circular convolution using DFT / IDFT method.
7	To realize digital filter and convert from one form to another.
8	Write a program for FIR filter design.
9	Write a program for IIR filter design.
10	Study of DSP starter Kit (TMS 320c611dsk),
11	To implement High pass filter on DSP processor.

6th Semester

EE1316	Digital System Design	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To develop ability to use a hardware description language, simulation, and a logic synthesis tool in the design of digital circuits ➢ To design and model digital circuits with VHDL at behavioral, structural, and RTL levels . ➢ To develop test benches to simulate combinational and sequential circuits.	1. Students will able to understand the design methodologies 2. Students will understand different modeling styles of VHDL 3. Students will design the basics of synchronous sequential logic and finite state machines. 4. Students will develop a formal testbench for various combinational and sequential logic circuits. 5. Students will able to incorporate different building blocks in the design of a digital system 6. Students will able to realize functions using programmable logic devices

UNIT-1: **Hardware Descriptive Language:**
Introduction to HDL, Design Flow, Design Methodologies, HDL History, Capabilities, Hardware Abstraction, Basic Terminology, Model Analysis, Comparison between VHDL and Verilog. Basic VHDL Elements: Identifiers, Data Objects, Data Types, Operators.

UNIT-2: **Dataflow Modeling:**
Concurrent Signal Assignment Statements, delta delay model, multiple drivers, block statement, concurrent assertion statement. Structural Modeling: Component Declaration, component Instantiation, resolving signal values

UNIT-3:**Behavioral Modeling**:
Behavioral Modeling, Entity declaration, architecture body, Various Sequential Statements and Constructs, multiple processes, postponed processes. Finite-State Machines: Modeling and Simulation of Moore and Mealy FSMs. Supporting Constructs: Generics and Configuration, Subprograms and Overloading, Operator overloading, Package declaration, package body, design Libraries, visibility.

UNIT-4: **Advanced Features**
Structural Modelling, Generate statements, type conversions, guarded signals, attributes aggregate targets. Model Simulation: Writing a Test Bench, Simulation, Use of text file for input and output, Hardware Modeling Examples.

UNIT-5 **Combinational Logic Design:**
Combinational Logic Design with PLDs/FPGAs: Adders/Subtractions, ALU, Multipliers, Shifters. Sequential Logic Design with PLDs/FPGAs: Synchronous Sequential Circuits, Asynchronous Sequential Circuits. Introduction to Verilog: Basic elements, an overview.

UNIT-6: **Programmable Devices**:
XILINX, ALTERA logic families-CPLD / FPGA architecture, logic module, switching technology, I/O cells, Programmable interconnect. Design flow for different design styles.

Text books:

1	A VHDL Primmer	3rdEdition ,1998.	Bhasker	Prentice Hall
2	Digital System Design using VHDL	2nd Edition,2007	Charles. H.Roth	CL-Engineering
3	VHDL-Analysis &Modelling of Digital Systems	2nd Edition, 1997	Navabi Z	McGraw Hill
4	VHDL-IV Edition	4th Edition,2002.	Perry	TMH
5	Fundamentals of Digital Logic with VHDL Design	2nd Edition, 2005.	Brown and Vranesic	TMH

Reference books:

1	Applications Specific Integrated Circuits	1997	Michael John & Sebastian Smith	Addison-Wesley Professional

6th Semester

EE1317	Lab. : Digital System Design	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
➢ The student will acquire knowledge of computer-aided design tools for design of complex digital logic circuits. ➢ The student will learn to analyze the results of logic and timing simulations and to use these simulation results to debug digital systems.	Student 1. Will be able to model, simulate, verify with hardware description language. 2. Will be able to design and prototype with programmable logic. 3. Will learn the modular design style to create large digital logic circuits. 4. Will able to create and simulate basic circuit modules (or macros) using VHDL.

Expt. No.	Name of Experiment
1	Write a VHDL code for Basic gates.
2	Write a VHDL Dataflow code for Half Adder, Half Subtractor.
3	Write a VHDL Dataflow code for 4:1 MUX, 2:4 Decoder, 1:4 DEMUX.
4	Write a VHDL Dataflow code for 1-bit, 2-bit Comparator.
5	Using Selected Signal Assignment, write VHDL code for 4:1 MUX, 2:4 Decoder, Full Adder.
6	Using Conditional Signal Assignment, write VHDL code for 4:1 MUX, 2:4 Decoder, Full Adder.
7	Write Behavioural VHDL code for sr latch.
8	Write Behavioural VHDL code for d latch.
9	Write Behavioural VHDL code for 4-bit Shift register, 4-bit counter.
10	Experiment based on Structural Modeling
11	Using Generate Statement Write VHDL code for 8 Bit Carry Look Ahead Adder using FA.
12	Write VHDL Code for Sequence Detector using MOORE M/C
13	Write VHDL Code for Sequence Detector using MEALY M/C

6th Semester

EE1326	Microcontroller & Interfacing	L=3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
1. To understand the architecture, programming concept and addressing modes of Intel 8051. 2. To understand various interfacing concepts like LCD, RTC, ADC etc. for designing microcontroller based applications.	1. Will understand architectural details of microcontrollers 8051 2. Will be able to understand the assembly language programming concept 3. Apply the knowledge of timer in real time. 4. Apply the knowledge of serial communication and interrupts in real time design. 5. Design the system with LCD Interfacing, RTC Interfacing. 6. Develop the system with data acquisition.

Unit I:
Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51, Hardware Overview, Addressing modes, Instruction set and Assembly language programming Programs using look up table.
(8 Hours)

Unit II:
Loop, Jump and Call instructions, Bit manipulation, 8051 I/O programming, Delay Programs. I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming.
(7 Hours)

Unit III:
8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access, Timer programming in assembly and C: Various modes of operation, SFR related to timer operation.
(8 Hours)

Unit IV:
Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs. 8051 interrupts, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt.
(7 Hours)

Unit V: I
Interfacing and programming for LCD, Interfacing RTC, EEPROM using I2C Bus and programming.
(7 Hours)

Unit VI:
Interfacing of ADC, DAC, stepper motor and PS2 keyboard and programming
(8 Hours)

Text Books:
1) The 8051 Microcontroller and Embedded systems , Muhammad Ali Mazidi , J.G. Mazidi, 2nd edition Pearson Education, Prentice Hall of India.
2) 8051 Microcontrollers programming and practice By Mike Predcko.
3) The 8051 Microcontroller Architecture, programming and Applications By Kenneth Ayala, Penram India publication.
4) Advanced Microprocessors and Peripherals , A. K. Ray, K. M. Bhurchandi, Second edition, Tata McGraw Hill, 2000.

Reference Book:
1) Intel or Atmel MCS 51 Family Microcontrollers Data Sheets.

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6th Semester

EE1327	**Lab. Microcontroller and Interfacing**	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
1. To understand the architecture, programming and addressing modes of Intel 8051. 2. To study the instruction set and programming of 8051. 3. To understand various interfacing concepts and circuits necessary for various applications.	Students 1. Will be able to understand the concept of Controller, architecture of 8051. 2. Will demonstrate the ability to identify, formulate and design program for an assigned task. **3.** Will be able to interface & program peripheral devices.

Expt. No.	Name of Experiment
1	Add data bytes in a internal RAM.
2	Convert single digit Hex number to its ASCII equivalent
3	Find the maximum data byte in a block
4	Data block transfer.
5	Find three number of negative data bytes in a block.
6	Convert BCD to its binary equivalent.
7	Generate a saw tooth waveform using DAC.
8	Read Analog signal from channel 2 of ADC and store it to internal RAM.
9	Rotate stepper motor into clockwise and counter clockwise direction
10	Generate square waveform from pin no P 1.2 of 8051
11	Display character on LCD.

6th Semester

EE1328	OE II : Fuzzy Logic & Neural Network	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To make the students well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. ➢ To make the students able to identify the complex problems in conventional structures, obtain intelligent acceptable solutions for these problems using soft computing techniques and take the necessary corrective action in the light of ongoing events.	Students 1. Aare able to define the concept of fuzziness and compare with crisp logic 2. Can define, describe and analyze uncertainty, unpredictability and vagueness using fuzzy logic concepts. 3. Are able to control process in automated way using fuzzy controllers 4. Are able to compare the concept of Artificial neurons with the biological neurons and define different learning processes. 5. Are able to design and solve pattern recognition and classification problems using different learning methods 6. Are able to evaluate and solve optimization problem using Genetic algorithm.

UNIT-1:
Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets

(8 Hours)

UNIT-2:
Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations

(7 Hours)

UNIT-3 :
Fuzzy controllers: an overview with applications, applications of fuzzy logic

(8 Hours)

UNIT-4:
Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning

(7 Hours)

UNIT-5:
Brief introduction to single layer and multilayer perceptions, ADALINE and MADALINE, feed-forward networks, back propagation networks and applications.

(8 Hours)

UNIT-6:
Radial basis function network, Self organizing feature map and applications

(7 Hours)

Text books:				
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications
Reference books:				
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI
2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Fuzzy Logic with engineering applications,	3rd Edition,	Timothy Ross,	Wiley Publication
4	Principles of Soft Computing	, 2nd Edition,	S. N. Sivanandanam and S. N. Deepa,	Wiley Publication

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

6th Semester

EE1329	OE II : Basics of Analog and Digital Communication Systems	L= 3	T = 0	P = 0	Credits =3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To Study of amplitude, frequency & phase modulation. ➢ To learn the concept of PPM, PAM, PWM & PCM & delta modulation. ➢ To understand the operation of digital modulation techniques.	Students 1. Will Recognize and utilize latest analogue and digital communication technologies. 2. Will understand fundamental concepts & limits in information theory in the context of digital communication theory. 3. Will demonstrate different modulation techniques. 4. Will be able to explain digital modulation techniques for transmitting digital data. 5. Will be able to describe various types of transmitters & receivers in communication system. 6. Will be able to describe various Source coding and channel coding

UNIT-1: Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.

(7 Hours)

UNIT-2:Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.

(8 Hours)

UNIT-3Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing.

(8 Hours)

UNIT-4Basic digital Modulation System, Channel capacity, PCM, ADPCM, Delta Modulation, ADM.

(7 Hours)

UNIT-5Digital Modulation techniques: ASK, FSK, PSK, BPSK,QPSK, MSK, DPSK, BFSK,

(8 Hours)

UNIT-6 Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.

(7 Hours)

Text books:				
1	Electronic Communication System	Fourth Edition, 1999	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications		SymonHykin	Wiley, 1988
Reference books:				
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

6th Semester

EE1330	OE II : Biomedical Instrumentation	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ This course is intended for exposing the students to basics of biomedical instrumentation.	Students 1. Will learn the basic concepts of biomedical instrumentation. 2. Will be introduced to transducers and will learn about biomedical transducers 3. Will learn measurement techniques which involved in processes such as cardiovascular measurements. 4. Will also learn techniques in x-rays, EMG, etc 5. Will learn techniques and practices for patient care 6. Will learn about the history and use of computers in biomedical instrumentations.

UNIT-1:
Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.

UNIT-2:
Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers

UNIT-3 :
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers

UNIT-4:
Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG

UNIT-5 :
Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators, Electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments.

UNIT-6:
Computers in biomedical instrumentation, digital computer, Telemedicine concept, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry.

Text books:				
1	Biomedical Instrumentation & Measurement		By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	PHI

Reference books:				
1	Handbook of Biomedical Instrumentation		R.S.Khandpur	TMH
2	Bioelectronic Measurement		Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering		Jacobson and Webster	PHI
4	Introduction to Biomedical Equipment Design		Carr and Brown	John Wiley
5	Biomedical Digital Signal Processing		Tompkins	

Chairperson		Version	1.02	Applicable for AY 2018-19 Onwards
Dean (Acad. Matters)		Date of Release	Nov. 2018	

7th Semester

EE1401	PE II : Embedded System	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To understand the concept of Embedded System, ARM Architecture & RTOS. ➢ To understand different functional blocks like ADC, DAC, RTC,I2C etc. ➢ To understand device programming concepts.	Students will 1. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.. 2. Become aware of the architecture of the ARM processor 3. Developed programmed based on ARM architecture. 4. Analyze various examples of embedded systems based on ARM processor. 5. Design real time embedded systems using the concepts of RTOS. 6. Understand different communication protocol.

UNIT-1:
Introduction to ARM, Advantages of architectural features of ARM Processor, Processor modes, Register organization, Exceptions and its handling, 3/5- stage pipeline ARM organization.
(7 Hours)

UNIT-2:
Memory and memory-mapped I/Os, ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs.
(8 Hours)

UNIT-3
ARM floating point architecture, Memory buses: AMBA, ASB, & APB. Architectural support for system development.
(7 Hours)

UNIT-4:
DMA Architecture, *Memory Hierarchy, memory size and speed, on-chip memory, caches, cache design, memory management.*
(8Hours)

UNIT-5
Architectural support for operating system, RTOS issues, µCOS-II and embedded Linux features, the shared Data Problem, Software Architectures (Round Robin, Round Robin with Interrupts, Function Queue Scheduling,),Selecting a software Architecture, Introduction to RTOS :tasks and task states, tasks and data, semaphores and shared data, message queues, mailboxes and pipes, events, RT Linux.
(7 Hours)

UNIT-6:
Case for Real Time Operating System, Embedded ARM applications such as USB interface, Bluetooth, Ethernet.
(8 Hours)

Text books:				
1	ARM System–on-chip Architecture	2nd edition, 2000	Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2002.	Craig Hallabaugh	Addison-Wesley Professional
3	ARM System Developer's Guide: Designing and Optimizing	2005	Sloss Andrew N, Symes Dominic & Wright Chris	Morgan Kaufman Publication

Reference books:	
1	Technical references on www.arm.com.
2	Web base resources for RTOS and µCOS.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

7th Semester

EE1402	PE II : Lab.. : Embedded system	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcome
➢ To familiar with RARM7 software & KITS. ➢ To enhance the ability of logical thinking so that student will be design an algorithm and program for a specific task .	Student 1. Will be able to understand different instruction used in programming. 2. Will be able to design Effective algorithm design for specific experiment. 3. Will be perfume experiments on different peripheral devices like LCD, Seven segment, GSM, etc.

Expt. No.	Name of Experiment (Any Ten)
1	To swap data byte
2	To perform addition, subtraction of 16 bit number
3	To find larger of a two numbers.
4	To perform factorial of a given number
5	To perform ON/OFF LED and show status of LED on LCD
6	To display number from 0 to 9 on seven segment display.
7	To ON/OFF LED using Switch.
8	To rotate a stepper motor in clockwise & anti-clock wise direction with equal delay.
9	To Perform experiment on DAC of LPC2103
10	To read ADC and display value on LCD.
11	To find 1's complements of a given number.
12	Study of RTOS
13	Write device driver for UART.
14	Modify scheduler in such a way that it will assign highest priority to keypad.
15	To read values from RTC and display on LCD.
16	To send SMS to any mobile number.
17	Interface pen drive for writing predefined file.

7th Semester

EE1403	PE II :Digital CMOS circuits	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
1. To introduce the students to the fundamentals of CMOS circuits. 2. To learn the modeling of circuits, circuit characterization and performance extraction. 3. To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. 4. To give basic understanding of Layout rules.	1. Students will learn the basics of MOS Circuits and the various MOS Process Technologies. 2. Students will design the physical layout of standard and compound Gates. 3. Students will demonstrate the ability to design a system, component or process as per needs and specifications. 4. Students will analyze inverter design, characteristics and applications. 5. Students will identify and analyze performance parameters of CMOS Circuits. 6. Students are expected to design circuits using different CMOS styles and also to do analysis on complex logic structures.

UNIT-1:
Introduction of MOSFETs:MOS Physics, NMOS Enhancement Transistor, MOS Transistor Operations, PMOS Enhancement Transistor, Regions of Operations, Threshold Voltage, MOS Device Equations, Small Signal Modeling of MOSFETs.

(7 Hours)

UNIT-2:
Physical Structure and Fabrication of CMOS IC : Integrated Circuit Layers, MOSFETs, CMOS Layers, Overview of Silicon Processing, N-Well Process, P-Well Process, Basic Physical Design of Simple Logic Gates, Stick Diagram, Euler's Path, Twin Tub Process, Silicon on Insulator (SOI) Process, Latch-up Effect.

(8 Hours)

UNIT-3:
Logic Design With MOSFETs: Ideal Switches and Boolean Operations, MOSFETs as Switches, Basic Logic Gates in CMOS, Compound Gates in CMOS, Transmission Gate Circuits (TG), Pass Transistor, Multiplexers.

(7 Hours)

UNIT-4:
MOS inverter Characteristics: Resistive load inverter, Inverters with n type MOSFET load, CMOS inverter, Principle of operation, DC characteristics, Tristate Inverter, Noise Margin, Introduction to Bi-CMOS Inverter.

(8 Hours)

UNIT-5 :
Analysis of CMOS Logic Gates: MOS Device Capacitance, Switching Characteristics, Rise Time, Fall Time, Propagation Delay, Power Dissipation in CMOS, Charge Sharing, Fan-in, Fan-out, Combinational circuit design, static CMOS, Ratioed Logic circuits, sequential circuit, Latches and Flip Flops.

(7 Hours)

UNIT-6:
Advanced Techniques in CMOS Logic Circuits: Complex Logic Structures, Complementary Static CMOS, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, CMOS Pass Transistor Logic and Flip-Flops.

(8 Hours)

Text books:				
1	Introduction to VLSI Circuits and Systems	First Edition	John P. Uyemura	Wiley Publication
2	Principle of CMOS VLSI Design	2nd Edition, 1994	Neil H. E. Weste, K. Eshraghian	Addison Wesley VLSI Series

Reference books:				
1	CMOS VLSI Design	3rd Edition, 2005	Pucknell , K. Eshraghian	Prentice Hall
2	CMOS Digital Integrated circuits Analysis and Design	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici	TataMcGraw Hill

7th Semester

EE1404	PE II : Lab. : Digital CMOS Circuits	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

OBJECTIVES	OUTCOMES
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	STUDENTS 1. Will learn the basics of MOS Circuits and learn the various MOS Process Technologies. 2. Will learn the physical layout of standard and compound Gates 3. Will demonstrate the ability to design a system, component or process as per needs and specifications. 4. Are expected to design circuits using different CMOS styles and also to do analysis on CMOS structures

Expt. No.	Name of Experiment
1	Design of CMOS Inverter using DSCH2 Tool.
2	Gate Level Analysis of 2-Input NAND & NOR Gate.
3	Implement the Following Function using Compound Gates. $F2=\overline{(A+B+C)*D*(E+F)}$
4	Design Half Adder using NAND Gates.
5	Design 2:1 Multiplexer using NAND Gates.
6	Design 2:4 Decoder using NAND Gates.
7	Draw Layout of CMOS Inverter Microwind.
8	Draw Layout of 2-Input NAND Gate using Microwind.
9	Draw Layout of 2-Input NOR Gate Microwind.
10	Draw Layout of Half Adder Microwind.
11	Draw Layout of 2:1 Multiplexer Microwind.

7th Semester

EE1405	PE II : Algorithm & Data Structure	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
1. To Study different Programming Aspect 2. To understand performance of System as per Time and Space Tradeoff. 3. To learn the Various Data Structure 4. To learn basics of Algorithm	Students will be able to 1. Demonstrate and analyze various Clauses techniques. 2. Demonstrate various operation on data Structure 3. Understand various types Data Structure 4. Study various types Algorithm 5. Analyze Performance of System. 6. Study the trade off method

UNIT-1:
Introduction to Algorithms, Basics of Algorithm, Sub Algorithms, Procedures and Functions, Analysis ofAlgorithms, Time and Space Complexity, Programming aspects with respect to structured programming, Top down and bottom Up Approach.

UNIT-2:
Arrays, Operations, Types, Representation of 1D, 2D arrays in memory, Sparse Matrices, Sorting, Quick Sort, Merge Sort, Insertion, Radix, Selection and Bubble Sort, Searching , Linear, Binary Search, Hashing and collision Handling mechanism.

UNIT-3:
Stack , Fundamentals, Operations, Push , Pop , Applications of Stacks, Evaluation of Expressions,Recursion, Stack Machines and Multiple Stacks, Queues, Operations, Add , Delete, Types of Queues ,Priority Queues, Circular Queue, Dequeue.

UNIT-4:
Fundamentals of singly, Doubly, Circular, Linked Stacks and Queues, Examples of Linked List, CircularLinked List, Doubly Linked List and Dynamic Storage Management, Garbage Collection, Compaction andApplications of Linked List, Operations of Polynomials, Generalized Linked List.

UNIT-5:
Basic Terminology , Binary Tree Traversals, Threaded Storage Representation, Binary Search Tree,Applications of Tree, Preliminary Treatment of AVL Trees, B-Trees, B+ Trees, Heap Sort.

UNIT-6:
Basic Terminology, Graph Representation, Matrix, List, Multi-List, Graph Traversals, Breath First Search,Depth First Search, Minimum Cost Spanning Trees, Shortest Path Algorithm, Topological Sort, Critical Path.

Text books:
1 Data Structures and Program, Design in C Second Edition Kruse, Leung and Tondo, PHI
2 Fundamentals of Data Structures,Fifth Edition ,Ellis Horowtiz and SartajSahaniGalgotia,Publications,

Reference books:
1 An Introduction to Data Structures with Applications, Second Edition Tremblay & Sorenson, TMH
2 Data Structures, SchuamSeries,Fifth Edition Seymour Lipschutz, G.A. V. Pai,TMH

7th Semester

EE1406	PE II : Lab. : Algorithm & Data Structure	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ To verify the fundamental data structures and algorithms, to have good command of algorithmic techniques, their applications and complexity.	Students 1. Will understand Algorithm and their Applications. 2. Will understand the use of Data Structures in Computer Programming. 3. Will get exposure to Practical Computer Programming Concept.

Expt. No.	Name of Experiment
1	Write a program on control Structure & Statements
2	Write a program on If –else structure
3	Write a program on Case Statement
4	Write a program on Functions
5	Write a program on Macros
6	Write a program on Pointers
7	Write a program on Structures
8	Write a program on Linked List
9	Write a program on Doubly linked list
10	Write a program on graphs
11	Write a program on Trees
12	Write a program on Search Algorithms
13	Write a program on Stacks

7th Semester

EE1407	Electronics Circuit Design	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ This course deals with the various types of Power Supplies, Active filters, Amplifiers and their analysis. ➢ It also gives better understanding of the functions of operations and limitations of different Circuits.	Student 1. Will understand power supply issues and design 2. Will understand state of art and practical power supply design 3. Will able to design and filters 4. Will able to design amplifiers 5. Will able to design power amplifier 6. Will able to design practical wave shaping circuits

UNIT-1:
Design of Regulated Power Supplies : Series Voltage Regulator, Monolithic Voltage Regulators, Protection Circuits

UNIT-2:
Design of Switch Mode Power Amplifiers: Introduction to switch mode power supplies ,comparison linear and switch mode power supplies, Analytical techniques, Buck converter, Boost Converter, Buck-Boost Converter.

UNIT-3 :
Design of Filters :Butterworth and Chebyshev Filters, First Order and Second Order Filter, second Order LCR Resonator, Second order Active Filters Based on Inductor Replacement.

UNIT-4:
Design of Tuned &Untuned Amplifiers: Tuned Amplifier Circuits, Inductor Losses, Use of Transformers, Amplifiers with Multiple Tuned Circuits , Synchronous Tuning, Frequency Response of Amplifier, RC Coupled Amplifiers, Low-Frequency Response of an RC-Coupled Stage, Cascaded Transistor CE Stage, (8 Hours)

UNIT-5 :
Design of Power Amplifiers: Classification of Output Stage, Class A Output Stage, Class-B Output Stage, Class AB Output Stage, Class C Output Stage, Power BJTs, Variations on the Class AB Configuration, IC Power Amplifiers, Design of Heat Sinks for Power Amplifiers(7 Hours)

UNIT-6:
Design of Signal Generators and Wave Shaping Circuits :Op-Amp RC Oscillator Circuits, LC and Crystal Oscillators, BistableMultivibrators, Design of Square and Triangular Waveform using AstableMultivibrators, Design of Standardized Pulse, The MonostableMultivibrator, Precision Rectifier Circuits

Text books:				
1	Microelectronics Circuits : Theory and Applications	Fifth Edition, 2010.	Adel S. Sedra and Kenneth C. Smith	Oxford University Press
2	Millman's Electronics Devices and Circuits	Second Edition,2008	Jacob Millman, Christos C. Halkias, SatyabrataJit	Tata McGraw Hill
3	Schaum's Outline of Electronics Devices and Circuits	Third Edition 2002	Jimmie Kathey	McGraw Hill
Reference books:				
1	Design with Operational Amplifiers and Analog Integrated Circuits	Third Edition, 2002	Sergio Franco	McGraw Hill
2	Electronics Devices and Circuits Theory	1999	NasheskyBoylestead	PHI
3	Microelectronics Circuit Analysis and Design	Fourth Edition 2010	Donald A. Naemen	McGraw Hill

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Dean (Acad. Matters)		Date of Release	May 2017	

7th Semester

EE1408	Lab. : Electronics Circuit Design	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ This course deals with the various types of active filters, such as LP, HP, BP, BR, and notch filters, which is very useful in communications. It also gives better understanding of the functions of operations and limitations of different ICs and their remedies.	Students 1. Will acquire knowledge of Practical Circuit Design. 2. Will have a fair knowledge of Analysis of circuit Design. 3. Will understand the Power supplies and their design.

Expt. No.	Name of Experiment
1	Design of LPF (Butterworth Filter) First Order
2	Design of HPF (Butterworth Filter) Second Order
3	Design of Non-Ideal Differential Amplifier / Multistage
4	Design of Multistage RC Coupled Amplifiers
5	Design of Class B Amplifier(Symmetry)
6	Design of Triangular Wave Generator
7	Design of Precision Rectifier
8	Design of Step Down SMPS
9	Design of Step Up SMPS
10	Mini-project

7th Semester

EE1409	Digital Communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
This course provides compressive coverage of digital communication systems and understanding of the operation of digital modulation schemes	1. Graduates will learn waveform coding techniques. 2. Graduates will gain knowledge of fundamental concepts & limits in information theory in the context of digital communication theory. 3. Graduates will able to analyze mathematical model of digital communication systems. 4. Graduates will learn different types of digital modulation techniques. 5. Graduates will able to learn the role of coding in the reliable transmission of digital information over a noisy channel. 6. Graduates will able to learn principles of spread spectrum modulation with emphasis on direct sequence and frequency hopping techniques.

UNIT-1:
PCM, DM, ADM, DPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding.
(7 Hours)

UNIT-2:
Introduction to information theory, entropy, Huffman, Prefix code, and L-Z encoding algorithm, Rate distortion theory for optimum quantization.
(8 Hours)

UNIT-3 :
Gram-Schmitt procedure, Signal space representation of baseband and modulated signals, line coding and baseband digital transmission, Error probability and optimum receivers for AWGN channels, Matched filters.
(7 Hours)

UNIT-4:
Digital Modulation techniques, Transmitter, Receiver and signal space representation of BPSK, BFSK,QPSK, Introduction toTDM,FDM,OFDM.
(8 Hours)

UNIT-5 :
Channel capacity Review of channel coding, Linear block codes, cyclic codes convolution, encoding and decoding, distance properties, Viterbi algorithm and Fano algorithm. Trellis coded modulation methods.
(7 Hours)

UNIT-6:
Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, performance analysis, synchronization methods for spread spectrum. Application of spread spectrum, CDMA.
(8 Hours)

Text books:				
1	Digital communication	3rd Edition, 2004	John G Prokis	Springer publication
2	Digital communication	2nd Ed, 2002.	Simon Haykin	John Wiley & sons

Reference books:

1	Modern Communication systems (Principles and application)	6th Edition, 2002	Leon W. Couch	Pearson
2	Digital Communication	5th Edition, 2003.	ShanmughamK.Sam	John Wiely
3	Modern Digital & Analog Communication Systems	3rd Edition, 1999.	B.P.Lathi	Oxford university Press
4	Principles of Communication Systems	3rd Edition, 2007.	Taub Schilling	Tata McGraw Hill publication

7th Semester

EE1410	Lab. : Digital Communication	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objective	Outcome
This course gives implementation of various modulation techniques, coding, decoding & mathematical modeling using related software.	1. Students will be able to apply suitable modulation schemes and coding for various applications. 2. Students will be able to identify and describe different techniques in modern digital communications, in particular in source coding, modulation and detection, carrier modulation, and channel coding 3. Students will be able analyze Performance of spread spectrum communication system. 4. Student will be able to design communication based project.

Expt. No.Name of Experiment

Sr. No	Name of Experiment
1.	Study of sampling process (MATLAB & Simulink)
2.	Study of Pulse Coded Modulation Technique (MATLAB & Simulink)
3.	Study of Delta Modulation Technique (MATLAB & Simulink)
4.	Calculation of Entropy ,Efficiency,Average code word length,Variance for Huffman Code
5.	Gram Schimdt orthogonalization procedure for given set of signals
6.	Plot Amplitude Shift Keying, Frequency Shift Keying , Phase shift keying
7.	Design of coherent Binary Phase shift keying system
8.	Design of coherent Quaternary Phase shift keying system
9.	Design of Encoder for Cyclic Hamming Code
10.	Convolutional code generation (Time domain & Transform domain approach)
11.	Pseudo random Noise sequence generation
12.	Mini project based on simulink

EE1434	RF & Microwave	L=4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
basic concept of microwave power generators. Study of scattering matrices of transmission lines and the design of microwave filters, microwave network analysis and measurement	1. Analyze the causes of failure of conventional tubes at high frequency and the detail concept of cavity klystron amplifier, Reflex klystron 2. Study modes of operation and different types of magnetron. 3. Study transmission characteristics of Microwave passive Devices (Reciprocal and non reciprocal): 4. Analysis of microwave network. 5. Study of different types microwave measurement techniques. 6. Study of Design of microwave filters by various methods, Microwave solid state devices.

UNIT-1:
Microwave linear beam tubes (O type): High frequency limitations of conventional microwave devices, Two cavity Klystron Amplifier – Mechanism and mode of Operation, Power output and Efficiency, Applegate diagram, applications, Reflex Klystron Oscillator – Mechanism and mode of Operation Power output, efficiency, mode curve, Electronic Admittance, Modulation of Reflex Klystron; Applications, Helix TWT, BWO. Slow wave structures.

(8 Hours)

UNIT-2:
Microwave cross-field tubes (M Type): Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Power output and Efficiency, Cylindrical magnetron, parallel plate magnetron, split anode magnetron, Types of strapping, Tuning of magnetron. Applications, Numerical Problems.

(7 Hours)

UNIT-3
Microwave passive Devices (Reciprocal and non reciprocal):Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, Directional couplers, Wave guide Corners, Bends and Twists ,Attenuators, Isolators, Gyrators, Circulators, Phase shifter, Rectangular cavity resonator, Transmission line resonators.

(8 Hours)

UNIT-4:
Microwave Network Analysis: Introduction, Symmetrical Z and Y matrices for reciprocal network, Scattering matrix representation of multi port networks, comparison between [S], [Z] and [Y] matrices, Inter relationship between impedance matrix, admittance matrix and Scattering matrix, properties of scattering matrix, Scattering matrix of transmission lines, ABCD parameters with S parameters, Scattering matrix derivation for all components, Numerical Problems.

(8 Hours)

UNIT-5
Microwave measurement: Introduction, Tunable detector, Slotted line Carriage, VSWR meter, Power measurements sensor, Bolo meter sensor, power sensor, Low and High power measurement, Insertion loss and Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement. Frequency measurement, Measurement of cavity Q, Dielectric measurement, Antenna Measurement – radiation pattern, Phase and gain. Types of Microwave filters: Image parameter method, Insertion loss method.

(7 Hours)

UNIT-6
Microwave solid state devices and circuits: Microwave diodes – Gun diode – Mode of operation, Crystal diode, PIN diode –, IMPATT diodes, Application as Oscillator and Amplifiers, Varactor diode, parametric amplifier, Microwave transistors, MASER. Strip lines: Micro strip lines, parallel strip lines. Coplanar, shielded

(8 Hours)

EE1434	RF & Microwave	L=4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text books:

1	Microwave device and circuits	Third Edition, 1999	Samuel Y.Liao	Prentice Hall
2	Foundations of microwave engineering	2nd Edition, 2009	R.E. Collins	Tata Mc-Graw Hill
3	Microwave engineering	2nd Edition, 2003	R Chatterjee	Ewp publication

Reference books:

1	Microwave communication	1987	Edgar Hund, E. Hund, Bruce L. R. Smith, ,	Tata Mc-Graw Hill
2	Introduction to microwave Theory &Measurements	1st Edition, 1964.	Algie L. Lance	Tata Mc-Graw Hill
3	Microwave Engineering	First edition, 2007	Annapurna Das, Sisir. K.Das	Tata McGraw-Hill Co., Ltd.
4	Microwave	1978	Reich J.H. et al	East West Press
5	Microwaves	1995	K.C.Gupta	Wiley, Eastern Ltd

7th Semester

EE1435	Lab. : RF & Microwave	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
➢ To introduce the students, to the basics of microwave devices, microwave measurements and antennas used in communication systems.	Students 1. Will understand and gain complete knowledge about characteristics of Reflex Klystron. 2. Will study power distribution in Directional coupler, E & H plane and Magic tee. 3. Will perform frequency measurement. 4. Will differentiate parameters of antenna.

Expt. No.	Name of Experiment
1	Introduction to Microwave Components.
2	To find the frequency of reflex klystron & Determine electronic and mechanical tuning range.
3	To verify power verses repeller voltage characteristics of reflex klystron.
4	To verify frequency verses repeller voltage characteristics of reflex klystron.
5	To find attenuation of fixed attenuator and To verify the calibration of variable attenuators.
6	To verify the performance of wave-guide tees i) E-plane tee ii) H-plane tee.
7	To verify the performance of E-H plane tee (magic tee).
8	To verify the relationship among free space wavelength, cut off wavelength, guide wavelength.
9	To find the Q-factor of absorption type frequency meter and it's insertion loss.
10	To verify the performance of directional coupler i) multi hole ii) cross directional coupler.
11	To determine coupling and isolation of a three port circulator.
12	To determine the gain of pyramidal horn antenna, plot the beam pattern and find the lobe width.
13	To verify characteristics of Gunn diode.
14	To measure the small V.S.W.R. and large V.S.W.R.
15	To measure the V.S.W.R. of an unknown load, and determine impedance using smith chart.
16	To verify various MIC Components.

7th Semester

EE1412	Project phase-I	L = 0	T = 0	P = 4	Credits = 4

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

7th Semester

EE1413	Industrial Training / CRT	L = 0	T = 0	P = 0	Credits = 2

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
		100	100	

8th Semester

EE1414	PE III : Computer Communication Network	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To learn basics of data communication, wireless transmission, spread spectrum, medium access control- FDMA, TDMA & CDMA. ➢ To study TCP/IP, ARP, RARP, UDP protocols & addressing. ➢ To study network security & its applications.	Students will be able to 1. Will have understanding of reference mode for data communication & functions of all layers of OSI reference model. 2. Will have understanding of IEEE standard 802 for LAN and MAN & functions of speed LAN repeaters, hubs, bridges, fast Ethernet, Wireless LAN. 3. Will able to differentiate between various protocols of different layers & standards on data communication. 4. Will acquire knowledge of the network layer routing protocols. 5. Understand the computer networks protection mechanisms & theory of fundamental cryptography 6. Will acquire knowledge Multimedia, real time transport protocol & Web security

UNIT-1:
Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model.
(8 Hours)

UNIT-2 :
LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN
(7 Hours)

UNIT-3 :
Physical layer and data link layer: transmission media, PSTN.
Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.
(8 Hours)

UNIT-4:
Network layer and transport layer: network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways
(7 Hours)

UNIT-5:
Application layer: network security cryptography, secrete key, public key, digital signature, domain name system, electronic mail system
(8 Hours)

UNIT-6: Multimedia, real time transport protocol, e-mail security, web security, communication security, electronic mail, world wide web.
(7 Hours)

Text books:				
1	Computer Networks	3rd Edition,1996	Tanenbaum	Prentice Hall
2	Data Communications and Networking	4th edition, 2007	Behrouz a Forouzan	Tata Mc. Graw Hill
Reference books:				
1	Data and Computer Communication	8th Edition,2006	W. Stallings	Prentice Hall
2	Telecommunication switching systems and networks	2004.	T. Vishwanathan	Prentice Hall

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8th Semester

EE1415	PE III : Operating Systems Concepts		L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To Study different modulation techniques. ➢ To understand transmitter &receivers communication systems. ➢ To learn the concept of PPM, PAM, PWM & PCM. ➢ To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students will be able to 1. Demonstrate and analyze various amplitude modulation techniques. 2. Demonstrate and analyze various angle modulation techniques. 3. Understand various types of receivers in communication system. 4. Analyze various types of noise in communication system and investigate noise parameters. 5. Understand pulse modulation techniques. 6. Study antenna theory with its various types.

UNIT-1:
Computer System organization ,Architecture, Structure, Operations, Process Management, Memory Management, OS Services, User Operating System Interface, System Calls, System Programs

(8 Hours)

UNIT-2:
Process Concept, Scheduling, Operations, Scheduling Criteria, Scheduling Algorithms, Tread Scheduling, Multiple Processor Scheduling

(7 Hours)

UNIT-3 :
Synchronization, Critical Section Problem, Semaphores, Deadlocks, System Models, Characterization, Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance

(8 Hours)

UNIT-4:
Memory Management Strategies, Swapping, Continuous Memory Allocation, Paging, Segmentation , Virtual Memory Management, Demand Paging, Page Replacement, Trashing,

(7 Hours)

UNIT-5 :
File System Concept, Access Methods, Directory and Disk Structure, Mounting, Sharing, Mass Storage Structure, Disk Attachment, Scheduling, RAID Structure

(8Hours)

UNIT-6:
Protection and Security , Domain of Protection, Access Matrix, Access Control, Language based Protection, Security Problem, System and Network Threats, Cryptography as Security Tool

(7 Hours)

Text books:				
1	Operating System Concepts	Eigth Edition, 2012	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	John Wiley & Sons (ASIA) Pvt. Ltd
2	Modern Operating Systems	2003.	Andrew S. Tanenbaum	Prentice Hall of India Pvt. Ltd
Reference books:				
1	Operating Systems	2002	Harvey M. Deitel	Pearson Education Pvt. Ltd
2	Operating System	4th Edition, 2003	William Stallings	Prentice Hall of India
3	An Introduction to Operating Systems, Concepts and Practice	2003	Pramod Chandra P. Bhatt	PHI,

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8th Semester

EE1436	PE III : RADAR ENGINEERING	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
To familiarize with basic principles of Radar Engineering that is essential for defense and core industry.	Students can understand 1. Basic principles of radars. 2. Moving target detection 3. Different kinds of target tracking techniques 4. Radar receiver system 5.Basic radar measurements 6.Radar Transmitter System

UNIT-I
INTRODUCTION:
Simple form of Radar Equation, Radar Block Diagram and Operation,
Radar Frequencies and Applications, RADAR EQUATION: Detection of Signals in noise, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF, System Losses.

(8 Lectures)

UNIT-II
MTI AND PULSE DOPPLER RADAR: Introduction, Principle, Delay Line Cancellers, DOPPLER Filter banks, digital MTI processing, moving target detector, Pulse Doppler Radar.

(7 Lectures)

UNIT-III
TRACKING RADAR:
Tracking with Radar, Monopulse Tracking, conical scan and sequential lobing, tracing accuracy, low angle tracking,tracking in range, Comparison of Trackers.

(8 Lectures)

UNIT-IV
DETECTION OF RADAR SIGNALS IN NOISE: Introduction, Matched Filter Receiver, detectors, automatic detectors, integretors, constant false alarm rate receivers, the radar operator, signal management.

(7 Lectures)

UNIT-V
Information from radar signals: Introduction, basic radar measurements, theoretical accuracy radar measurements, ambiguity diagram, pulse compression, target recognition.

(7 Lectures)

UNIT-VI
RADAR Transmitter: Introduction, linear beam power tubes, magnetron, RADAR RECEIVERS: RECEIVERS noise figure, superheterodyne receiver.

(6 Lectures)

TEXT BOOKS:
1. Merrill I. Skolnik, "Introduction to Radar Systems", 3rd Ed., McGraw-Hill, 2003.
2. Simion. Kingsley, "Understanding Radar Systems", Standard Publishing, 1999.
REFERENCES:
1. Byron. Edde, "Radar Principles, Technology, Applications", Pearson education, 2007.
2. G.SasiBhushanaRao, "Microwave and Radar Engineering", Pearson education, 2013.

8th Semester

EE1437	PE III : MICRO ELECTRO MECHANICAL SYSTEMS	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• Standard microfabrication techniques and the issues surrounding them • 2. Major classes, components, and applications of MEMS devices/systems and to demonstrate an understanding of the fundamental principles behind the operation of these devices/systems • 3. Microfabrication techniques and applications to the design and Manufacturing of an MEMS device or a microsystem • 4. Foster interest for further study	Students: 1. Will demonstrate the ability to understand working principles of currently available micro sensors, actuators used in Microsystems. 2. Will apply scaling laws that are used extensively in the conceptual design of micro devices and systems. 3. Will understand the basic principles and applications of micro-fabrication processes, such as photolithography, ion implantation, diffusion, oxidation, CVD, PVD, and etching. 4. Will understand RF MEMS components 5. Will understand Physical Micro sensors 6. Will understand the recent advancements in the field of MEMS and devices.

UNIT I
Introduction to MEMS: Benefits of Miniaturization, Types of MEMS: Optical MEMS, Bio- MEMS, RF- MEMS, Microfludics, Success Stories, Pressure sensor, Accelerometer, Micro-mirror TV Projector

UNIT II
Microfabrication and Micromachining: Integrated Circuit Processes, Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA), MEMS Device fabrication using Bulk Micromachining

UNIT III
Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Device fabrication using Surface Micromachining example, Microcantilever fabrication

UNIT IV
RF MEMS Devices: Capacitor, Inductor, Switches, and antennas, RF MEMS components in communications, space and defense applications

UNIT V
Physical Micro sensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors

UNIT VI
Microactuators: Classification of microactuators, Electrostatic, Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors.

TEXT BOOKS:
1. Micro and Smart Systems: Ananthasuresh, G. K., Vinoy, K. J., Gopalakrishnan, S., Bhat, K. N., and Aatre, V. K., Wiley-India,NewDelhi, 2010.

REFERENCE BOOKS:
1. VLSI Technology, Sze S.M. (ed),McGraw Hill
2. RF MEMS and Their Applications: Vijay Varadan, K. J. Vinoy, K. A. Jose, Wiley, 2002.

8th Semester

EE1439	PE III : Display Technology	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To provide the fundamental knowledge for understanding concepts of different display technologies related to manufacturing techniques and materials selection	Gradates will. 1. Identify different display technologies and manufacturing processes. 2. Learn practical knowledge of display technologies 3. Analyze properties of Luminescence materials. 4. Explore design parameters for displays and analyze matrix addressing. 5. Comprehend the fundamentals of backlight unit technologies. 6.Be able to design and elaborate applications of displays

UNIT-I

Overview of display industry, information capacity of displays, introduction to different flat panel display technologies.Fundamentals of Photometry, including luminance and brightness, Colorimetry: visual basis of colorimetry, psychophysical experiments to quantify color, CIE colorimetry.

UNIT-II

Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, driving power, efficiency, speed, memory and storage, degradation, resolution, addressability, physiological factors, and measurement instrumentation.

UNIT-III

Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, processes responsible for the transfer of energy in luminescent materials, chemistry and preparation of luminescent materials, and emission properties of the prepared materials.

UNIT-IV

Basics of matrix addressing of displays: active and passive matrix.Technical discussion of display technologies: LEDs, OLEDs, LCDs, Active matrix TFT back planes for OLED and LCD displays. Other displays and associated technologies.

UNIT-V

Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.).

UNIT-VI

Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes.

Text books

1. W. Mara, Liquid crystal flat panel displays: manufacturing science & technology. Springer Science & Business Media, 2012.
2. Introduction to Flat Panel Displays, Jiun-Haw Lee, David N. Liu, Shin-Tson Wu, Wiley Publications.

Reference Books

1. R. H. Chen, Liquid crystal displays: fundamental physics and technology. John Wiley and Sons, 2011.
2. Fundamentals of Solid- State Lighting: LEDs, OLEDs and their Applications in Illumination and Displays, Vinod Kumar, Khanna, CRC Press.

8th Semester

EE1417	PE IV : Soft Computing	L= 4	T = 0	P = 0	Credits =4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To make the students well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. ➢ To make the students able to identify the complex problems in conventional structures, obtain intelligent acceptable solutions for these problems using soft computing techniques and take the necessary corrective action in the light of ongoing events.	Students 1. Are able to define the concept of fuzziness and compare with crisp logic 2. Can define, describe and analyze uncertainty, unpredictability and vagueness using fuzzy logic concepts. 3. Are able to control process in automated way using fuzzy controllers 4. Are able to compare the concept of Artificial neurons with the biological neurons and define different learning processes. 5. Are able to design and solve pattern recognition and classification problems using different learning methods 6. Are able to evaluate and solve optimization problem using Genetic algorithm.

UNIT-1:
Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conorms.
(8 Hours)

UNIT-2:
Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations
(7 Hours)

UNIT-3 :
Fuzzy controllers, Defuzzification Methods, applications of fuzzy logic in pattern recognition and image processing,
(8 Hours)

UNIT-4:
Introduction of neural networks, learning methods, perceptrons, perceptron training algorithm, single layer perceptron, multiplayer perceptron, neural network architectures, ADALINE, MADALINE
(7 Hours)

UNIT-5 :
LMS algorithm, Back propagation algorithm, RBF networks, self-organizing feature maps, Applications of ANN
(8 Hours)

UNIT-6:
Introduction of Soft Computing Methods, Fundamentals of Genetic Algorithms, Encoding, Fitness function, Genetic modeling, Applications of GA.
(7 Hours)

Text books:				
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications		S. Rajsekharan, VijayalaxmiPai,	Prentice Hall
3	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

Reference books:				
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	Prentice Hall
2	Introduction of Artificial Neural Networks	1999.	Jacek Zurada	Pws Pub Co
3	Principles of soft computing		S.N.Sivanandam, S.N.Deepa	Wiley India Ed.
4	Fuzzy Logic with engineering applications,	3rd Edition,	Timothy Ross,	Wiley Publication

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8th Semester

EE1418	PE IV : Lab.:Soft Computing	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
• To make the students well acquainted with Soft computing techniques, especially Fuzzy logic, Neural networks and Genetic algorithm. • To make the students able to identify the complex problems in conventional structures, obtain intelligent acceptable solutions for these problems using soft computing techniques and take the necessary corrective action in the light of ongoing events.	Students 1. Can define, describe and analyze uncertainty, unpredictability and vagueness using fuzzy logic concepts. 2. Are able to find solution to automation problems through fuzzy logic controllers. 3. Are able to introduce intelligence in conventional structure using neural networks and solve pattern recognition and classification problems. 4. Are able to determine optimized solutions for some problems using concepts of Genetic algorithm.

Expt. No	Name Of Experiment
1	Write a program to Implement of fuzzy set operation.
2	To Study various defuzzification techniques.
3	To Study fuzzy inference system.
4	To study fuzzy logic controller using fuzzy logic toolbox.
5	Write a program to study different Activation Functions
6	To perform classification using McCulloch and Pitts's Neuron Model
7	To design neural network using unsupervised Learning Rules
8	To design neural network using supervised Learning Rules .
9	Write a program to implement back propagation learning algorithm..

8th Semester

EE1419	PE IV : Analog VLSI Design		L= 4	T = 0	P = 0	Credits =4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To understand small signal modeling of MOS transistor, Perform analysis of single stage amplifiers, analyze amplifiers based on frequency response calculation and working principle of one stage , two stage operational amplifiers	Student will able to 2. Design small signal model of MOS transistor & understand SPICE Model 3. Perform analysis of single stage amplifiers with or without load. 3. Calculate small signal parameters of differential amplifier. 4. Design current mirrors as bias element. 5. Design single stage amplifiers in frequency domain 6. Analyze Performance parameters of CMOS op amp

Unit I:Basic MOS Device Physics:
Threshold voltage, Derivation of I/V characteristics, second order effects, MOS device capacitance, MOS small signal models, MOS SPICE models.
(6 hours)

Unit II:Single stage amplifiers:
Basic concept, common source, common source stage with resistive load, CS stage with source degeneration, source follower, common gate.
(7 hours)

Unit III: Differential amplifiers:
Single ended & differential operation, Basic differential pair, qualitative and quantitative analysis, Common mode response
(6 hours)

Unit IV:
Passive and active current mirrors:
Basic current mirror,Cascode current mirror, Active current mirror,common mode properties
(6 hours)

Unit V: frequency response of amplifiers:
Miller effect, association of poles with node, common source stage , source follower, common gate stage
(7 hours)

Unit VI: Operational amplifiers:
Performance parameters, one stage op amp, Two stage op amp, Gain boosting, Noise in op amp
(6 hours)

Text books:				
1	Design of Analog CMOS Integrated circuits	Ninteenth reprint 2010	BehzadRazavi	Mc-graw-Hill

Reference books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

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8th Semester

EE1420	PE IV : Lab. : Analog VLSI Design	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

OBJECTIVES	OUTCOMES
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To learn the modeling of circuits, circuit characterization and performance extraction. ➢ To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of various analyses of differential amplifiers. ➢ 5. To give basic understanding of non linear circuits such as comparator design.	STUDENTS 1. Will learn the basics of MOS Circuits. 2. Will be able to simulate MOS devices and CMOS circuits with SPICE: AC, DC,Transients. 3. Will learn the various MOS Process Technologies. 4. Will be able to design an electrical component or system to meet desired needs. 5. Will be able to design and analysis of analog circuits. 6. Will be able to design and analysis of basic analog functional module designs such as current mirrors, active load, biasing circuits

Expt. No.	Name of Experiment
1	NMOS characteristic :- Vds Vs ID for various values of Vgs.
2	PMOS characteristic :- Vds Vs ID for various values of Vgs.
3	Current source using current mirror :- DC analysis
4	Common Source amplifier:- AC analysis Transient analysis
5	Common Drain amplifier:- AC analysis Transient analysis
6	Differential Amplifier :- AC analysis Transfer curve (Vin Vs Vout, DC condition)
7	Op-Amp Design: AC analysis Transient analysis DC analysis
8	SPICE simulation of basic analog circuits, Analog Circuit simulation Verification of layouts.
9	Basic CMOS Comparator Design
10	Source Coupled Pair Differential Amplifier

8th Semester

EE1427	PE IV : Digital Image Processing	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
The principal objective is to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field.	1. Graduates will learn the basic concepts of image processing and concepts of digital geometry that help in understanding the image processing operations. 2. Graduates will learn image enhancement techniques in spatial domain. 3. Graduates will learn image enhancement techniques in frequency domain. 4. Graduates will understand fundamental concepts of image segmentation. 5. Graduates will understand fundamental concepts of image restoration. 6. Graduates will understand fundamental concepts of image compression and storage techniques.

UNIT-1:
Digital image fundamentals : Digital Image through scanner, digital camera, Concept of gray levels, Gray level to binary image conversion, Sampling and quantization, Relationship between pixel, Imaging Geometry.
(8 Hours)

UNIT-2:
Image Transforms: 2-D FFT, Properties, Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform.
(7 Hours)

UNIT-3 :
Image enhancement : Point processing, Histogram processing, Spatial filtering and its frequency domain interpretation. Enhancement in frequency domain, Image smoothing, Image sharpening.
(8 Hours)

UNIT-4:
Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.
(7 Hours)

UNIT-5 :
Image Restoration: Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.
(8 Hours)

UNIT-6:
Image compression: Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.
(7 Hours)

Text books:				
1	Digital Image processing	2nd Edition, 2002	R.C. Gonzalez & R.E. Woods	Wesley/ Pearson education
2	Fundamentals of Digital Image processing	1989.	A.K.Jain	PHI
Reference books:				
1	Digital Image processing using MAT LAB	2004	Rafael C. Gonzalez, Richard E Woods and Steven L.	PEA,
2	Digital Image Processing	3rd Edition,2004.	William K. Pratt	John Wilely
3	Fundamentals of Electronic Image Processing	SPIC/IEEE Series,1996	Arthur R. Weeks	PHI

8th Semester

EE1428	PE IV : Lab. : Digital Image Processing	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcome
➢ The principal objective is to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field.	STUDENTS 1. Will learn the basic concepts of image processing, concepts of digital image geometry. 2. Will learn image enhancement techniques in spatial and frequency domain. 3. Will also learn image segmentation. 4. Will also learn image compression and restoration techniques.

Expt. No	Name Of Experiment
1	To Explore statistical properties of Image & displaying histogram & profile.
2	Histogram modification
3	Image smoothing operations
4	Pseudo coloring of gay level images
5	Edge detection
6	Segmentation using threshold
7	Region based segmentation
8	Image Transforms
9	Image Compression
10	Image Segmentation

8th Semester

EE1423	PE IV : Object Oriented Programming	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• The course aims is to introduce the students to Object Oriented Programming Concepts. • Demonstrate mastery of object oriented programming concepts: inheritance, polymorphism, and operator overloading. • To teach efficient storage mechanisms of data for an easy access • Demonstrate mastery of pointers, iterators, memory management including object creation and destruction.	Students will be able to 1. Will learn the basic concepts of Object Oriented Programming. 2. Will perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs. 3. Will design program using the concept of Inheritance, Polymorphism, Overloading 4. Can choose the appropriate data structure and algorithm design method for a specified application. 5. students will be able to use linear and non linear data structures like stacks, queues , linked list etc. 6. Understand advanced features of C++ specifically stream I/O, templates and Exception Handling.

UNIT-1:
Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP.

(8 Hours)

UNIT-2:
Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators, Expressions and Control Structures, Pointers, Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Friend and Virtual Functions.

(7 Hours)

UNIT-3 :
Classes and Objects, Constructors and Destructors, Operator overloading, Type of Constructors, Function Overloading, Inheritance, Types of Inheritance Virtual Functions and Polymorphism.

(8 Hours)

UNIT-4:
Definition of a data structure, Primitive and Composite data types, Asympotic notations, Arrays, Operations of Arrays, Order lists, Stacks, Applications of Stack, Infix to Postfix Conversion, Recursion, Queues, Operations of Queues.

(7 Hours)

UNIT-5 :
Singly linked list, Operations, Doubly linked list, Operations, Trees and Graphs: Binary tree, Tree traversal; Graph, Definition, Types of Graphs, Traversal (BFS & DFS), Dijkstra`s algorithm

(8 Hours)

UNIT-6:
Files, classes for file stream operations, Opening, Closing and Processing files, End of file detection , File pointes, Updating a file , Error Handling during file operations, Command line arguments, Templates, Exception Handling.

(7 Hours)

Text books:				
1	Object Oriented programming with C++	4th Edition,2008	E. Balagurusamy	TMH
Reference books:				
1	Object Oriented Programming in Microsoft C++	Third Edition, 2003	Robert Lafore	Galgotia publication
2	Fundamental of data structure in C++	2002.	E. Horowitz and S.Shani	Galgotia Pub
3	Computer algorithms	1998.	Horowitz, S.Shani and S.Rajasekaran	Galgotia Pub Pvt Ltd

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8th Semester

EE1424	PE IV : Lab. : Object oriented programming	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
➢ The course aims is to introduce the students to Object Oriented Programming Concepts memory management including object creation and destruction, and parameter passing in C++ .	Students 1. Will understand Algorithm and their Applications. 2. Will understand the use of Data Structures in Computer Programming. 3. Will get exposure to Practical Computer Programming Concept.

Expt. No.	Name of Experiment
1	Write a function using variables as arguments to swap the values of a pair of integers.
2	Write a program to read the ballot & count the votes cast for each candidate using an array, variable count. In case, a number read is outside the range 1 to 5, the ballot should be considered as a ' spoilt ballot' and the program should also count the number of spoilt ballot.
3	Write a program to read a matrix of size m*n from the keyboard and display the same on the screen.
4	Write a macro that obtains the largest of three numbers.
5	As the practical 4, using inline function. Test the function using the main program.
6	Define a class to represent a bank account including the following members:- Data Members, Member function to display the name and balance.
7	Modify the class and the program of practical 6 for handling 10 customers.
8	Create 2 classes OM and DB which store the value of distance. DM store distances in meters and cm and DB in feet and inches. Write a program that can read values for the class objects and add 1 object OM with another object of DB. Use a friend function to carry out the addition operation the object that stores the results may be a DM object or a DB object, depending upon the units in which the results are require. The display should be in the format of feet and inches or meters and cms depending on the object on display.
9	Write a program for maintaining the inventory of books that are being sold at the shop the Design a system using a class called books with suitable member functions and constructors. Use new operator in constructor to allocate memory space require.
10	Define a class string that could work as a user defined string type include constructors that will enable us to create an .un-initialized string String s1; :/ string with length 0 And also to initialize an object with string constant at the time of creation like String s2("well done"); . Include a function that adds two strings to make a third string.
11	Create a class float that contains 2 float data member. Over load all the 4 arithmetic operators so that do operate on the objects of float.
12	Define 2 classes POLAR and RECTANGLE to represent points in the POLAR and RECTANGLE systems. Use conversion routines to convert from one system to the other.
13	Exercise on file handling

8th Semester

EE1416	PE V: Biomedical Instrumentation& its Applications	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
This course is intended for exposing the students to basics of biomedical instrumentation.	Students 1. Will learn the basic concepts of biomedical instrumentation. 2. Will be introduced to transducers and will learn about biomedical transducers 3. Will learn measurement techniques which involved in processes such as cardiovascular measurements. 4. Will also learn techniques in x-rays, EMG, etc 5. Will learn techniques and practices for patient care 6. Will learn about the history and use of computers in biomedical instrumentations.

UNIT-1:
Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.

UNIT-2:
Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers

UNIT-3 :
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement.

UNIT-4:
Electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers.

UNIT-5:
Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMGpacemakers, defibrillators, Electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments, Methods of accident prevention.

UNIT-6:
Telemedicine, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry, Hospital Information System, Computer Networks in Health care.

Text books:

1	Biomedical Instrumentation & Measurement	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	PHI

Reference books:

1	Handbook of Biomedical Instrumentation	R.S.Khandpur	TMH
2	Bioelectronic Measurement	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	Jacobson and Webster	PHI
4	Introduction to Biomedical Equipment Design	Carr and Brown	John Wiley
5	Biomedical Digital Signal Processing	Tompkins	

8th Semester

EE1421	PE V: Optical communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ This course will provide understanding for applying optical fiber technology to sophisticated modern telecommunication systems. ➢ To understand the fundamental behavior of the individual optical components, describes their interactions with other devices in an optical fiber. ➢ To measure & analyze different measurements, parameters & properties of optical fiber.	Student 1. Will learn the basic elements of optical fiber. 2. Will understand the different kinds of losses, signal distortion in optical wave g gra 3. Will able to al structures, LA 4. Will learn the suc receiver operation & performance. 5. Will understand the operational principal of WDM, SONET, measurement of attenuation, dispersion, refractive index profile in optical fibers. 6. Will be able to classify various operational principal and used to measurements optical source characteristic.

1.02 Nov. 2018 Applicable for AY 2018-19 Onwards

UNIT-1: INTRODUCTION TO OPTICAL FIBERS

Evolution of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi modefibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure.

(8 Hours)

UNIT-2:SIGNAL DEGRADATION IN OPTICAL FIBERS

Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers, Mode Coupling, Design Optimization of SM fibers, RI profile and cut-off wavelength.

(7 Hours)

UNIT-3 : FIBER OPTICAL SOURCES

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency and LED power, Modulation of a LED, Laser Diodes , Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes structures and radiation patterns, Single Mode lasers, Modulation of Laser Diodes, Temperature effects, Fabry Perot cavity Quantum laser

(8 Hours)

UNIT-4: FIBER OPTICAL RECEIVERS

PIN and APD diodes , Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise ,Comparison of Photo detectors, Fundamental Receiver Operation, Error Sources, Receiver Configuration, Probability of Error, The Quantum Limit, Noise Effects on System Performance, Eye diagram.

(7 Hours)

UNIT-5 : DIGITAL TRANMISSION SYSTEM

Introduction of fibers cables, Fiber Splicing and connectors, Operational Principals of WDM, SONET, LAN 1000 baseSX, LX and Passive Components, Optical TDM.

(8 Hours)

UNIT-6:MEASUREMENT IN OPTICAL FIBERS

Attenuation, Time domain dispersion and Frequency domain dispersion, OTDR, NA measurement Refractive index profile and optical source characteristic measurements.

(7 Hours)

Text books:				
1	Optical Fiber Communication	3rd edition, 1999.	Gerd Keiser	McGraw-Hill Science/Engineering /Math
2	Optical Communication, Principles and Practice	2nd Edition,1994	J.Senior	Prentice Hall of India

Reference books:				
1	Optical Communication System	2001	J.Gower	Prentice Hall of India
2	Fiber-Optic Communication System	Third Edition, 2009.	GovindAgrawal	John Willy & Sons

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

8th Semester

EE1425	PE V : Wireless Communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
➢ To develop a strong theoretical background involving the evolution and future of wireless communication systems. ➢ To develop a detailed technical knowledge of current practice in wireless systems and networks.	Students Will be able to 1. Acquire knowledge of evolution of mobile communication. 2. Understand cellular concept in mobile communication system. 3. Differentiate fading technique. 4. Explain need and different methods for enhancing the quality of communication. 5. Classify different system & standard in mobile communication system. 6. Compare wireless network current practice in wireless systems.

UNIT-1:
Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications Mobile Radio Systems around the world. Examples of Wireless Communication Systems, Comparison of common wireless communication systems, trends of cellular radio and personal communications, Second generation (2G) cellular Networks, Third generation (3G) cellular Networks, wireless local loops and LMDS.

(8 Hours)

UNIT-2:
The Cellular Concept: Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system.

(7 Hours)

UNIT-3 :
Mobile Radio Propagation- Large & Small Scale Path Loss & Fading: Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling. Small Scale Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types Of Small Scale Fading, Rayleigh &Rician Distribution.

(8 Hours)

UNIT-4:
Equalization & Diversity: Fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver.

(7 Hours)

UNIT-5 :
Wireless Systems and Standards: GSM- global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard (IS-95).

(8 Hours)

UNIT-6:
Wireless Networking: Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signalling, Signalling System No. 7.An Example of SS7,SIP-Global Cellular Network Interoperability.

(7 Hours)

Text books:				
1	Wireless Communication – Principles and practice	2nd edition, 2002	T S. Rappaport	Prentice Hall PTR, upper saddle river, New Jersey
2	Mobile Communications – Design fundamentals	2nd edition, 1997	William C. Y. Lee	John Willey

Reference books:				
1	Wireless digital communication : modulation & spread spectrum applications	1995.	KamiloFeher	Prentice Hall PTR; Har/Dis edition
2	Wireless and Cellular Communication	3rd Edition,2005	W .C .Y. Lee	McGraw Hill
3	The Mobile Radio Propagation channel	2nd Edition, 2000	J.D. Parson	John Willey

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

8th Semester

EE1438	PE V : Mechatronics	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• Understand the basic concepts of Mechatronics • To understand the control and instrumentation in Industry • Understand the design and development process in Production Industry	Students will be introduced to : 1. Mechatronics key elements 2. sensor and transducer 3. Actuating device 4. Signal, system and controls 5. Closed loop controllers: Continuous and discrete process 6. Advanced application in Mechatronics

UNIT-I
Introduction: Mechatronics key elements, design processes and issues, Modeling and simulation of physical system, electrical system, Mechanical translation- rotation system, electromechanical coupling

UNIT-II
Sensor and transducer: Introduction to sensor and transducer, sensor for motion, position measurement, force, torque, tactile sensor and flow sensor, temperature sensing device, ultrasonic sensor, range sensor, active vibration control

UNIT-III
Actuating device: Direct current motor, permanent magnet stepper motor, fluid power actuation, fluid power design element, piezoelectric actuators. Transducer signal conditioning and device for data conversion

UNIT-IV
Closed loop controllers: Continuous and discrete process, control modes, two step mode, proportion mode, derivative control, integral control, PID controller, digital controller, control system performance, Programmable controllers.

UNIT-V
Input/output systems: Interfacing, input/output addressing, interface requirements, peripheral interface adapters, serial communications interface and examples of interfacing problems.

UNIT-VI
Advanced application in Mechatronics: Case studies in mechatronics system design.

TEXT BOOKS:
1. DevdasShetty and Richard A. kolk, Mechatronics system design, Thomson Asia Pvt. Ltd, second reprint, 2001

REFERENCE BOOKS:
1. W.Bolton, Mechatronics, Pearson education Asia, third Indian reprint 2001 , Additional Reading:
2. David G. Alciatore and Michael B.hisland, Introduction to Mechatronics and measurement system, Tata McGraw hill, second edition,2003.

8th Semester

EE1433	Lab. Electronic Design Automation	L = 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Expt. No.	Name of Experiment
1	Study of Device model using SPICE.
2	DC circuit analysis.
3	Transient analysis.
4	AC circuit analysis.
5	Analysis of Diode circuits.
6	Bipolar junction transistors.
7	Field effect transistors.
8	Op-Amp Circuits.
9	SMPS/SWITCHING CIRCUIT.

Text books:				
1	Introduction to PSpice using OrCAD for circuits and Electronics	Third edition, 2003.	Muhammad H.Rashid	Prentice Hall

Reference Website:	
1	http://bwrc.eecs.berkeley.edu/classes/icbook/spice/

8th Semester

EE1430	Comprehensive Viva-voce	L = 0	T = 0	P = 0	Credits =2

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
		100	100	

8th Semester

EE1431	Extra -Curricular / Competitive Exam	L = 0	T = 0	P = 0	Credits = 2

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
		100	100	

8th Semester

EE1432	Project Phase -II	L = 0	T = 0	P = 8	Credits = 8

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor ofEngineering

SoE & Syllabus 2014

3 to 8 Semester

Electronics & Telecommunication Engineering

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE-I	MSE-II	TA	ESE	
III SEMESTER												
1	GE1201	Engg. Mathematics-III	3	1	0	4	4	15	15	10	60	3
2	ET1201	Electronic Devices	3	1	0	4	4	15	15	10	60	3
3	ET1202	**Lab:** Electronic Devices	0	0	2	2	1			40	60	
4	ET1203	Digital Circuits	3	1	0	4	4	15	15	10	60	3
5	ET1204	**Lab:** Digital Circuits	0	0	2	2	1			40	60	
6	ET1205	Electronic Measurement and Instrumentation.	3	1	0	4	4	15	15	10	60	3
7	ET1206	**Lab:** Electronic Measurement Instrumentation	0	0	2	2	1			40	60	
8	EL1201	Network Analysis	3	1	0	4	4	15	15	10	60	3
Total			**15**	**5**	**6**	**26**	**23**					

IV SEMESTER												
1	GE1204	Advance Mathematical Techniques	3	1	0	4	4	15	15	10	60	3
2	ET1207	Electromagnetic Fields	3	1	0	4	4	15	15	10	60	3
3	ET1208	Electronic Circuit Analysis	3	1	0	4	4	15	15	10	60	3
4	ET1209	**Lab:** Electronic Circuit Analysis	0	0	2	2	1			40	60	
5	EL1217	Control Systems Engineering	4	0	0	4	4	15	15	10	60	3
6	ET1210	Microcontroller and applications	4	0	0	4	4	15	15	10	60	3
7	ET1211	**Lab:** Microcontroller and applications	0	0	2	2	1			40	60	
8	ET1212	Simulation **Lab**	0	0	4	4	2			40	60	
Total			**17**	**3**	**8**	**28**	**24**					

		1.00		Applicable for AY 2015-16 Onwards
Chairperson	Dean (Acad. Matters)	Version	Date of Release	

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B.E. SCHEME OF EXAMINATION 2014

Electronics and Telecommunication Engineering

S. N.	Sub Code	Subject	Contact Hours				CR	% Weightage			ESE Duration
			L	T	P	Total		MSEs	TA	ESE	
FIFTH SEMESTER											
1	[illegible]	[illegible]	3	[illegible]	[illegible]	3	3	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	**Lab.:** [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
4	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	**Lab.:** [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
6	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
8	**Prof. Elective I**		3	[illegible]	[illegible]	3	3	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
9	**Lab. Prof. Elective I**		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
	[illegible]	**Lab.: PE I:** [illegible]									
	[illegible]	**Lab.: PE I:** [illegible]									
	[illegible]	**Lab.: PE I:** [illegible]									
	[illegible]	**Lab.: PE I:** [illegible]									
10	**Open Elective I**		3	[illegible]	[illegible]	3	3	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
SIXTH SEMESTER											
1	[illegible]	[illegible]	3	[illegible]	[illegible]	3	3	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	**Lab.:** [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
4	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	**Lab.:** [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
7	**Prof. Elective II**		3	[illegible]	[illegible]	3	3	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
8	**Lab. Prof. Elective II**		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
	[illegible]	**Lab. : PE II :** [illegible]									
	[illegible]	**Lab. : PE II :** [illegible]									
	[illegible]	**Lab. : PE II :** [illegible]									
	[illegible]	**Lab. : PE II :** [illegible]									
	[illegible]	**Lab. : PE II :** [illegible]									
9	**Open Elective II**		3	[illegible]	[illegible]	3	3	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]									
	[illegible]	[illegible]									
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		
Total			**19**	**2**	**8**	**29**	**25**				

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Chairperson		**Version**	**1.02**	**Applicable for AY 2019-20 Onwards**
Dean (Acad. Matters)		**Date of Release**	**Nov. 2019**	

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B.E. SCHEME OF EXAMINATION 2014

Electronics and Telecommunication Engineering

S. N.	Sub Code	Subject	Contact Hours				CR	% Weightage			ESE Duration
			L	T	P	Total		MSEs	TA	ESE	
SEVENTH SEMESTER											
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	**Lab.:** [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	**Lab. :** [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
5	**Professional Elective-III**		3	[illegible]	[illegible]	3	3	3[illegible]	[illegible]	[illegible]	3[illegible]
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
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6	**Lab.:Professional Elective -III**		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
	[illegible]	**Lab. :PE III :** [illegible]									
	[illegible]	**Lab. :PE III :** [illegible]									
	[illegible]	**Lab. :PE III :** [illegible]									
	[illegible]	**Lab. :PE III :** [illegible]									
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
EIGHTH SEMESTER											
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	3[illegible]
[illegible]	[illegible]	**Lab.:** [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	3[illegible]
[illegible]	[illegible]	**Lab.:** [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
[illegible]	**Professional Elective IV**		3	[illegible]	[illegible]	3	3	3[illegible]	[illegible]	[illegible]	3[illegible]
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
[illegible]	**Professional Elective V**		3	[illegible]	[illegible]	3	3	3[illegible]	[illegible]	[illegible]	3[illegible]
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
	[illegible]	[illegible]									
[illegible]	**Lab.: Professional Elective V**		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
	[illegible]	**Lab.: PE V :** [illegible]									
	[illegible]	**Lab.: PE V :** [illegible]									
	[illegible]	**Lab.: PE V :** [illegible]									
	[illegible]	**Lab.: PE V:** [illegible]									
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3			[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]				

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Chairperson		**Version**	**1.02**	**Applicable for AY 2019-20 Onwards**
Dean (Acad. Matters)		**Date of Release**	**Nov. 2019**	

III Semester

GE 1201	Engineering Mathematics-III			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Objective	Outcome
The aim of this paper is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	• With the completion of this syllabus students will be familiar with Laplace ,Z-transform and their methods of solutions and partial differential equation with simple applications and essential concepts of optimization techniques and use these mathematical techniques in variety of technical, business, industry optimization problems.

UNIT-1: : Finite Differences (a,e) **[8 hrs]**
Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform (a,e) **[7 hrs]**
Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform (a,e) **[8 hrs]**
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 : Matrices (a,e) **[9 hrs]**
Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigen vectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation (a,e,h) **[8 hrs]**
Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.
Partial Differential Equations – PDE of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

UNIT-6 : Fourier Transform (a,h) **[6 hrs]**
Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.

Text books:

1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference books:

1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill.
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan

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III Semester

ET1201	Electronic Devices		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objective Students will be able to	Course Outcomes Students will be able to
1. Understand working principle of diodes, its terminal characteristics. Its use diode in clipping, clapping and rectifier circuits. Enlist different diodes and explain their characteristics. 2. Understand the physical operation of the BJT and its use as a circuit element. 3. Model transistor in different modes and utilize it in the analysis and design of transistor circuit. 4. Develop high degree of familiarity with FET and MOSFET, its physical structure, terminal characteristics and circuits model.	1. Understand the characteristics of the diode and the diode's application in electronic circuit 2. Design amplifier circuits and its practical application. 3. Analyze different configuration according to input and output characteristics of BJT. 4. Understand the basic circuit application of MOSFET and analyze its characteristics. 5. Understand stability & concept of load line.

Course Outcomes	Mapped PO									
	a	b	c	d	e	f	g	h	i	j
Understand the characteristics of the diode and the diode's application in electronic circuit	√	√	√	√						√
Design amplifier circuits and its practical application.	√	√	√	√						√
Analyze different configuration according to input and output characteristics of BJT.	√	√	√	√						√
Understand the structure of MOSFET and analyze its characteristics.	√	√	√	√						√
Understand stability & concept of load line	√	√	√	√						√

Unit - I **8Hrs**

Ideal Diode, Terminal Characteristics of Junction Diode. Modeling of diode forward characteristic, Diode Resistance, Physical operation of diodes.

Unit – II **7Hrs**

Rectifier Circuits, Limiting & Clamping Circuits,
Special types of diode: The Tunnel Diode, Photodiode, Light-Emitting Diodes, Schottky Diodes, Varactor (Varicap) , Diodes
Breakdown mechanisms of Zener Diodes, zener shunt regulator, , Clipping and Clamping circuits Working principle and applications of:

Unit – III **7Hrs**

BJT device structure and operation-, operation in active and saturation mode, Ebor-Moll model
Current voltage characteristics: Transistor Current Components, CE configuration, The Common-Base Configuration, Common-Collector Configuration, Ratings of transistor: breakdown voltages, Transistor as an amplifier and transistor as switch, switching times.

Unit – IV **7Hrs**

Field-effect Transistors, The Junction Field-effect Transistor, The Pinch-off Voltage Vp, The JFET Volt-Ampere Characteristics, The FET as a Voltage-Variable Resistor.

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III Semester

ET1201	Electronic Devices		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

MOSFET Device Structure and Physical Operation of MOSFET, Derivation of the ID versus VDS Relationship, Complementary MOS, Operating the MOS Transistor in the Sub-threshold Region, Finite Output Resistance in Saturation, Characteristics of the MOSFET ,The Role of the Substrate--The Body Effect, Temperature Effects, Breakdown and Input Protection

Unit – V **8Hrs**

Transistor Biasing The Operating Point, Bias Stability, Self-Bias, Stabilization against Variations in Ico, VBE, AND β, Collector-Current Stability, Thermal Runaway.

MOSFET Biasing by Fixing VGS ,Biasing by Fixing VG and Connecting a Resistance in the Source, Biasing Using a Drain-to-Gate Feedback Resistor, Biasing Using a Constant-Current Source.

Unit – VI **8Hrs**

BJT at Low frequency , hybrid pi model, the T model, common emitter amplifier, Analysis of a Transistor CE Amplifier , Simplified Common-Emitter , Simplified Calculations for the Common-Collector Configuration, The Common-Emitter Amplifier with an emitter Resistance.

MOSFET low frequency Small signal operation and models, voltage gain, trans-conductance, MOSFET amplifiers: Common Source CS amplifier, Common Source CS amplifier with source resistance. Common Drain CD amplifier or source follower, comparison

Resources :

Textbooks :

1	Microelectronics Circuits	5Th Edition2010-01-07	Sedra Smith	Oxford Uni. Press
2	Electronic Devices and Theory	9th. Edition May 2010	BoyleStad, Nashelsky	PHI

Reference books:

1	Integrated Electronics	7th edition 2009	illMan Halkias	Tata McGraw Hills
2	Power Electronics circuits and applications		3rd edition ,	M. Rashid

III Semester

ET1202	Lab.: Electronic Devices	L = 0	T = 0	P = 2	Credits= 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Learning Objective Students will be able	**Course Outcomes** Students will be able to
1. To Plot the VI characteristics of diode and transistors. 2. To expose the student with particle awareness of the components like diode, transistor (BJT, FET) and study of their characteristics with different applications. 3. Design, build and test biasing networks for diode, BJT, and FET 4. To provide students basic experimental experiences in physical operations and circuit applications of semiconductor devices. 5. To develop the skills in simulation and design of microelectronic circuits using Pspice.	1. Understand Functioning of CRO, multi-meter, function generator, power supply, components, bread-board etc. 2. Understand Characteristics of PN junction diode, zener diode, BJT and FET 3. Design and analysis of circuits like half wave/ full wave rectifier, amplifier. 4. Perform DC analysis of different biasing techniques.

Course Outcomes	**Mapped PO**									
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**
1. Understand Functioning of CRO, multi-meter, function generator, power supply, components, bread-board etc.	√			√		√	√	√		√
2. Understand Characteristics of PN junction diode, zener diode, BJT and FET	√	√	√	√	√	√	√	√		√
3. Design and analysis of circuits like half wave/ full wave rectifier, amplifier.	√	√	√	√	√	√	√	√		√
4. Perform DC analysis of different biasing techniques.	√	√	√	√	√	√	√	√		√

Sr. No.	**Ten Experiments Based on**
1	Characteristics of PN junction diode (Silicon and Germanium)
2	Zener shunt regulator
3	half wave and full wave rectifier
4	I/P & O/P Characteristics of Common Base Transistor Configuration.
5	I/P & O/P Characteristics of Common Emitter Transistor Configuration
6	Fixed Bias circuit of transistor.
7	Self Bias circuit of transistor
8	The Drain and Transfer characteristics of Field Effect Transistor (FET)
9	The Drain and Transfer characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET)
10	Voltage Doubler Circuit

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III Semester

ET1203	Digital Circuits		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objective Students will be able	Course Outcomes Students will be able to
1. To learn and Understand concept of Digital logic, binary codes and error correction, detection codes, 2. To explore Boolean Algebra fundamentals, and Boolean equations optimization methods 3. To design and analyze combinational as well as Sequential logic circuits. 4. To understand concepts of memory, timing issues in MSI circuits. 5. To design Synchronous, Asynchronous sequential logic circuits and Finite state machines	1. Apply knowledge of binary codes and Boolean algebra to the analysis and design of digital logic design. 2. Identify, formulate, and solve combinational logic design problems. 3. Design sequential logic circuits using flip-flop such as shift register, counters. 4. Design finite state machine sequence detectors, different arithmetic logic designs using MSI, LSI chips. 5. Design a digital system components or process required for VHDL programming.

Course Outcomes	Mapped PO									
	a	b	c	d	e	f	g	h	i	j
1. Apply knowledge of binary codes and Boolean algebra to the analysis and design of digital logic design.	√	√		√	√					√
2. Identify, formulate, and solve combinational logic design problems	√	√		√	√					√
3. Design sequential logic circuits using flip-flop such as shift register, counters.	√	√		√	√					√
4. Design finite state machine sequence detectors, different arithmetic logic designs using MSI, LSI chips.	√	√	√	√	√					√
5. Design a digital system components or process required for VHDL programming.		√	√	√	√					√

Unit - I **7Hrs**

Introduction to Logic families & their characteristics. Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin, Timing issues, CMOS inverter.

Binary arithmetic using one's and two's complement, BCD & Gray code arithmetic, Canonical forms, DeMorgan's Theorem, Switching algebra & simplification of Boolean expressions , Implementations of Boolean expressions using logic gates.

Unit – II **8Hrs**

Minimization methods such as Karnaugh map, Quine Mcclauskey methods. Incompletely specified functions, Formation of switching functions from word statements,

Unit – III **7Hrs**

Functions & implementation using Multiplexer, Demultiplexer, Encoder, Decoder. Combinational circuit analysis, Combinational circuits design using MSI and LSI chips.

Unit – IV **7Hrs**

Design of Arithmetic circuits: Half & Full adders, Half & Full Subtractions, Multibit parallel adders Carry Propagate adder & Carry Look ahead adder, BCD Adder, Comparators, Multi bit Application designs, ALU, Static & Dynamic Hazards, Introduction to PAL, PLA, CPLD, FPGA.

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III Semester

ET1203	Digital Circuits		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit – V **8Hrs**

Timing & Clocking: Rise time, fall time, Clock skew, Edge & Level triggers. Need for sequential circuits, Binary cell, Latches and flip-flops. RS-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF's, Excitation & Truth Table, Flip-flop conversions, Shift registers

Unit – VI **7Hrs**

Synchronous and Asynchronous sequential Circuits. Counters Design, Ring counters, Classification of synchronous machines, Analysis of Synchronous Sequential circuits, Design of synchronous sequential machines (Moore & Mealy). State diagram, State reduction and minimization, Sequence detectors

Resources :

Text books :

1 Digital Design 3rd edition 2007-06-15 M. Morris Mano, Pearson PH
2 Switching Theory & Finite Automata 3rd edition 2007 Zvi Kohavi Tata Mgraw Hill

Reference books:

1 Digital Circuits & Microprocessors 5th edition, 2004 Hebert Taub Mc Graw Hill
2 Fundamentals of Digital Logic with VHDL Design2nd Edition, 2007 Stephen Brown & Zvonko Vranesic TMH
3 Engg Approach to Digital Design 1st edition (February 19, 1997) W. Fletcher PHI

III Semester

ET1204	Lab.: Digital Circuits	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	2 Hrs

Course Learning Objective Students will be able	Course Outcomes Students will be able to
1. To learn the basic methods for the design of digital circuits 2. To provide the fundamental concepts used in the design of digital systems.	After completion of the lab course the students will be able to 1. Design combinational and sequential logic circuits from given word statement. 2. Implement the developed logic on bread board and verify the truth table obtained. 3. Design combinational and sequential logic circuits using simulation tool 4. Design and analyze digital logic problems.

Course Outcomes	Mapped PO									
	a	b	c	d	e	f	g	h	i	j
1. Design combinational and sequential logic circuits from given word statement.	√	√	√	√		√	√	√		√
2. Implement the developed logic on bread board and verify the truth table obtained.	√	√	√	√		√	√	√		√
3. Design combinational and sequential logic circuits using simulation tool	√	√	√	√	√	√	√	√		√
4. Design and analyze digital logic problems.	√	√	√	√	√	√	√	√		√

Sr. No.	Ten Experiments Based on
1	Combinational Logic design 4 to 5 experiments
2	Interface of TTL-CMOS, CMOS-TTL
3	Design of Combinational Logic using MSI chips
4	Timing characterization of Flip flops
5	Synchronous & Asynchronous Counter Design
6	Design of Sequence Detector using FSM

III Semester

ET1205	Electronic Measurement & Instrumentation		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objective Students will be able	Course Outcomes Students will be able
1. To study different bridges and calculate the value of different components. 2. To understand the concept of different types of meters, display device structure and its working. 3. To learn the working principles of different types of sensor and transducers with its applications. 4. To understand the concept of data conditioning system	1. An ability to identify and remove errors 2. Analyze the bridge circuits for the measurement of different electrical quantities. 3. Ability to utilize different types of volt meters. 4. Able to explain the working of generators, spectrum analyzers, transducers & conditioning system

Course Outcomes	Mapped PO									
	a	b	c	d	e	f	g	h	i	j
1. An ability to identify and remove errors	√			√						√
2. Analyze the bridge circuits for the measurement of different electrical quantities.	√	√		√	√					√
3. Ability to utilize different types of volt meters.	√	√		√	√					√
4. Able to explain the working of generators, spectrum analyzers, transducers & conditioning system.	√	√	√	√	√					√

Unit - I **7Hrs**

Introduction, standards, Static & dynamic characteristics of measurement system, need of calibration, Types of errors & their sources, limiting errors & Statistical analysis

Unit – II **8Hrs**

AC & DC Bridges DC bridges - Wheatstone bridge, sensitivity of Wheatstone bridge, Kelvin's bridge.
AC bridges – Inductance measurement- Maxwell's Induction bridge , Maxwell's Induction capacitance bridge, Hays Bridge, Anderson's bridge, Owen's bridge, Capacitance measurement- Schering bridge, De-sauty's bridge, Frequency measurement- Wien bridge.

Unit – III **7Hrs**

Amplified DC meters, AC Voltmeter, TRUE/RMS voltmeter, Electronic Multimeter, Digital Multimeter, Digital Voltmeter, Q-meter, LCR meter, dual trace CRO, Dual beam CRO, Digital Storage Oscilloscope, Recorders-Strip chart, X-Y.

Unit – IV **7Hrs**

AF Generator, Pulse characteristics, Pulse Generators, Function Generator, Sweep Frequency Generator, Wave analyzer, Spectrum analyzer, logic analyzer, Distortion analyzer.

Unit – V **7Hrs**

Definition, Classification of transducer, Selection of Transducer, Resistive transducer- Potentiometer, RTD, Thermistor, Strain Gauges, strain gauge Load Cells, Inductive transducer- self generating type- electromagnetic ,electrodynamic, eddy current, Passive type - variable inductance, Mutual Inductance, LVDT capacitive transducers- Variable area, variable distance, Piezoelectric Transducer, thermoelectric (Thermocouple), photoelectric transducers, Proximity sensors, Digital optical encoder, Light sensor. Electromagnetic flow met er.

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III Semester

ET1205	Electronic Measurement & Instrumentation		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Unit – VI **7Hrs**

Signal conditioning and its necessity, Functions of Signal conditioning, AC/DC Conditioning systems, Instrumentation Amplifier, Data conversion: ADC & its types , DAC, Generalized data acquisition system: single channel, multi-channel and modular DAS..

Resources :

Text books:

1. Modern Electronic Instrumentation and Measurement Techniques 2007 Edition Albert D. Helfrick William D. Cooper PHI Publication
2. Electrical and electronics Measurement and Instrumentation 4th Edition 2005 A. K. Sawhney Dhanpat Rai & Co.

Reference books:

1 Elements of Electronic Instrumentation and Measurement Third Edition Joseph J. Carr Pearson Education.
2 Electrical and electronic Measurement 1st Edition 2008 R. K. Rajput PHI Publication
3 Electronics Measurement 1st Edition 2011 U.S.Shah Tech-Max Pub.
4 Transducers & Inst 2nd Edition 2008 DVS Murthy PHI Publication

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III Semester

ET1206	Lab.: Electronic Measurements & Instrumentation	L=0	T=0	P=2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Learning Objective Students will be able	Course Outcomes Students will be able to
To learn basic measurement concepts and related instrumentation requirement as a vital ingredients of electronics.	1. Students will be able to know the functions of CRO. 2. By using different bridges they can calculate the different values of components.

Course Outcomes	Mapped PO									
	a	b	c	d	e	f	g	h	i	j
Students will be able to know the functions of CRO.	√			√		√	√	√		√
By using different bridges they can calculate the different values of components.	√			√		√	√	√		√

Sr. No.	Ten Experiments based on
1.	Measurement of Temperature using DAQ and LABVIEW..
2.	Determination of unknown Resistance using Ammeter Voltmeter method, Loss of Charge method, Wheatstone Bridge , Kelvin's bridge Method.
3.	Determination Of Unknown Inductance Using Maxwell's Inductance Bridge Method, Hay's Bridge.
4.	shearing bridge to determine the Unknown value of capacitance.
5.	LCR and Q meter.
6.	Grounding & Shielding of Electronics Devices & Instruments, Human Safety
7.	Additional controls of CRO.
8.	Virtual instrumentation based Digital Multimeter., Oscilloscope and a Function Generator, Variable Power Supply and Impedance Analyzer.

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III Semester

EL1201	Network Analysis	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective	Course Outcome
The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn: • the fundamental principles of electrical circuit analysis and to be able to extend these principles into a way of thinking for problem solving in mathematics, science, and engineering • to become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the mesh – node method. • to appreciate the consequences of linearity, in particular the principle of superposition and Thevenin – Norton equivalent circuits. • to analyze analog circuits that include energy storage elements. • to utilize Laplace transforms for circuit analysis. • to analyze four terminal networks using two-port parameters.	Upon successful completion of this course, students should be able to: 1) analyze electrical circuits including on nodal and mesh basis. 2) apply a variety of network theorems to analyze and design electrical circuits. 3) evaluate the initial and final values of current and voltage of electric circuits containing energy storage elements. 4) apply the mathematical knowledge of Laplace transforms to analyze first and second order AC and DC circuits for its steady-state and transient response. 5) synthesize a complex waveform using standard functions such as step, ramp etc. Be able to determine the time response of a circuit excited by such a complex waveform. 6) characterize the transfer function of a circuit in terms of its critical frequencies. Be able to determine the time response from pole zero plot. 7) characterize two – port networks by two-port parameters.

Mapped Program Outcomes	a	b	e	i	k	L	m

UNIT-1: Nodal Analysis of Electric Circuits

Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources – their types and characteristics, concept of equivalent sources, source transformation, concept of supernode and V – shift, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-2: : Mesh Analysis of Electric Circuits

Concept of supermesh and I – shift, mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-3 :Network Theorem

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

UNIT-4: Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform

Concept of initial and final conditions, 12ascade12r of resistor, inductor and capacitor at t = 0- and at t = 0+, procedure for evaluating initial and final conditions, analytical treatment.
Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform.

UNIT-5 : Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions

Unit step, ramp and impulse functions with and without time delay, their Laplace transform, waveform synthesis and its application to electrical networks.
Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of

III Semester

EL1201	Network Analysis	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions, time domain 13ascade13r from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-6: Two Port Parameters

Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, conditions for reciprocity and electrical symmetry in terms of two – port parameters, interconnections of two – port networks.

Text books:

1	Network Analysis	3rd Edition	M. E. Van Valkenburg	PHI Learning Private Limited
2	Engineering Circuit Analysis	8th Edition	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin	McGraw – Hill
3	Linear Circuit Analysis	2nd Edition	Decarlo, Lin	Oxford Univ. Press

Reference books:

1	Schaum's 3000 Solved Problems In Electric Circuits Book 1 & 2	1st Edition	Syed A. Nasar	McGraw – Hill
2	Schaum's Outline Series: Theory and Problems of Electric Circuits	5th Edition	Joseph A. Edminister	McGraw – Hill
3	Basic Circuit Theory	3rd Edition	Lawrence P. Huelsman	PHI Learning Private Limited

IV Semester

GE 1204	Advanced Mathematical Techniques			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	10	60	100		3 Hrs

Objective	Outcome
The objective of this paper is to study numerical methods and their methods of solution and statistics and probability with simple applications and to introduced fuzzy sets and logics	With the completion of this syllabus students will be familiar with study numerical methods and their methods of solutions and fuzzy sets and logics with simple applications and essential concepts of probability and statistics and use these mathematical techniques to provide the solution to variety of technical, business, industry optimization problems.

UNIT-1: (a,e) **[9 hrs]**

NUMERICAL METHODS FOR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Errors in numerical calculation, Errors in series approximation. Rounding of error solutions of algebraic and transcendental equations. Iteration method, Bisection method, False position method, Newton Rapphson method and their convergence

NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss –Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2: (a,e) **[8 hrs]**

NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4th order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. Numerical methods of solving 1st order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques (a,h) **[6 hrs]**

Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 (a,h,k) **[7 hrs]**

Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

UNIT-5: (a,h,k) **[8 hrs]**

Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 (a,h,k) **[6 hrs]**

FUZZY SETS AND FUZZY LOGIC ; Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

Text books:

1	Computer based Numerical and Statistical Techniques	Paperback First edition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition(2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference books:

1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers

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IV Semester

ET1207	Electromagnetic Fields		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objective Students will be able	**Course Outcomes** Students will be able
1. To study & compare different types of co-ordinate systems 2. To understand different laws applicable for electric field and calculate electric potential. 3. To define the basic laws applicable to magnetic field. 4. To understand the current concept in conductor using Ampere's Circuital law 5. To understand the different principles of wave propagation theory.	1. Differentiate between different types of co-ordinate systems 2. Apply the concepts of electric & magnetic field intensity to solve engineering problems 3. Apply Biot –Savart law to infinite and finite current filament 4. Analyze Maxwell's equations for static and time varying fields 5. Utilize the basics of electromagnetic in field & radiating systems, UHF

Course Outcomes	**Mapped PO**									
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**
1 Differentiate between different types of co-ordinate systems	√									
2 Apply the concepts of electric & magnetic field intensity to solve engineering problems	√	√	√							√
3 Apply Biot –Savart law to infinite and finite current filament	√									
4 Analyze Maxwell's equations for static and time varying fields	√	√	√							√
5 Utilize the basics of electromagnetic in field & radiating systems, UHF	√	√	√							√

UNIT-1: **6 Hrs**

Orthogonal coordinate systems: Cartesian, cylindrical, spherical and transformations, Gradient of a Scalar Field . Divergence of a Vector Field , Curl of a Vector Field , Laplacian Operator, Irrotational and solenoidal field .

UNIT-2: **7 Hrs**

Coulomb's law , Electric field intensity for different charge distribution : point , line surface , volume , Concept of electric flux , Gauss's law and it's application to field computation in symmetric structures and non symmetric structures , Divergence theorem.

UNIT-3: **7 Hrs**

Concept of energy & work done in moving a point charge : linear and circular path , Electric scalar potential :Absolute Potential and potential difference , Conservative property of Potential field , Potential field of a system of charges : circular ring and disk Dipole moment, electric field at a distant point due to electric dipole, Electrostatic energy density. Poisson's and Laplace's equation and its examples of solutions, Uniqueness of electrostatic solution

UNIT-4: **6 Hrs**

Biot –Savart law and applications to infinite and finite current filament, Ampere's Circuital law and applications to line charge, coaxial transmission cables, uniform current sheet charge, solenoid, toroid , Stoke's Theorem Magnetic flux and magnetic flux density , Scalar and vector magnetic potential, Nature of magnetic materials , boundary conditions at interface of two magnetic fields , Potential energy.

		1.00		Applicable for AY 2015-16 Onwards
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IV Semester

ET1207	Electromagnetic Fields		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-5: **6 Hrs**

Time varying fields and Maxwell's equations : Faradays law,Displacement current,Maxwells equation in point form,Maxwells equations in integral form.

UNIT-6: **7 Hrs**

Uniform plane wave , wave propagation in free space, wave propagation in Dielectrics, Poyntings Theorem and wave equations.

Resources :

Text books:

1 Engineering Electromagnetics Seventh Edition William H. Hayt Tata McGraw – Hill.
2 Electromagnetics 4th edition 1992 J D Kraus McGraw – Hill

Reference books:

1 Electromagetism Theory and application 2nd Edition 2009 Ashutosh Pramanik Prentice Hall
2 Elements of Electromagnetis M. N. O. Sadku Oxford Press
3 Field and Wave Electromagnetics Second Edition 21 Jan 2010 David K. Cheng Addison Wesley.

IV Semester

ET 1208	Electronic Circuit Analysis		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objective Students will be able	Course Outcomes Students will be able
1. To understand Electronic Device Parameters of Amplifiers employing BJT, MOSFET. 2. To develop circuit analysis capabilities. 3. To analyse BJT Amplifiers, Oscillators. 4. To determine gain and impedances in Feedback Amplifers. 5. To estimate Gain-Bandwidth product, phase margin in Voltage Series Amplifiers 6. To calculate Line and Load Regulation in Voltage Regulators 7. To understand design insights offered by analysis skills.	1. Understand the Pi Model (π) of BJT & MOSFET at low & High frequency . 2. Analyze the high frequency response of transistor amplifiers. 3. I a high degree of familiarity with the MOSFET: its internal capacitances, single – stage amplifier configurations and basic circuit applications at high frequency. 4. Design & Analysis feedback amplifier & Oscillator Circuits. 5. Design & Analyze voltage regulator & SMPS for different application

Course Outcomes		Mapped PO									
		a	b	c	d	e	f	g	h	I	j
1	Understand the Pi Model (π) of BJT & MOSFET at low & High frequency .	√	√	√							√
2	Analyze the high frequency response of transistor amplifiers.	√	√	√							√
3	I a high degree of familiarity with the MOSFET: its internal capacitances, single – stage amplifier configurations and basic circuit applications at high frequency.	√	√	√							√
4	Design & Analysis feedback amplifier & Oscillator Circuits.	√	√	√	√						√
5	Design & Analyze voltage regulator & SMPS for different application	√	√	√	√						√

UNIT-1: **7 Hrs**

The BJT Internal capacitances and High Frequency ∏ Model, High & Low Frequency response of Common Emitter Amplifier. High Frequency MOSFET Model, The MOSFET Unity –Gain Frequency(fT). High & Low Frequency response of the CS amplifier

UNIT-2: **8 Hrs**

High frequency Response – General Considerations: determining the 3-dB Frequency f_H, Miller Theorem. The Common –Source and Common Emitter Amplifier with Active Loads, High –Frequency Response of the CS and CE Amplifiers, The Common Gate and common Base amplifier with active load**.**

UNIT-3: **8 Hrs**

The Cascode amplifier: Frequency Response of the MOS Cascode, The BJT cascade, A 17ascade current source The CS & CE Amplifier with Source resistance and Emitter resistance, The Source follower, frequency response of Source follower & Emitter Follower.

UNIT-4: **7 Hrs**

The General Feedback Structure, Various properties of Negative and positive Feedback, The Four Basic Feedback Topologies, Voltage, Current, Trans Conductance, Trans Resistance Amplifiers, The series-shunt Feedback amplifier, The series-series Feedback amplifier, The shunt-shunt Feedback amplifier, The shunt-series Feedback amplifier , RC phase shift oscillator.

		1.00		Applicable for AY 2015-16 Onwards
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IV Semester

ET1208	Electronic Circuit Analysis		L= 3	T = 1	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-5: **8 Hrs**

Classification of Output Stages, Class A, Class B, Class AB, Class C, and Class D output stages, Power Efficiency, Power Dissipation, Cross-Over Distortion in Class AB Circuits, Class A Transformer Coupled Power Amplifier, Matched Pair Transistor Class AB Power Amplifier with Class A driver Stage, Harmonic Distortion due to Large Signal operation, Thermal Resistance and Heat Sinks.

UNIT-6: **7 Hrs**

Differential & multistage amplifier:

The MOS Differential pair, Small signal operation of the MOS Differential pair: Differential Gain, CMRR, BJT Differential large Signal & small signal operation , differential amplifier with Active Load, Frequency response of the Differential amplifier, Multistage Amplifiers.

Resources :

Text books:

1	Microelectronics Circuits	4Th Edition 7 Jan 2010	Sedra Smith	Oxford Uni. Press.

Reference books:

1	Electromagetism Theory and application	2nd Edition 2009	Ashutosh Pramanik	Prentice Hall
2	Elements of Electromagnetis		M. N. O. Sadku	Oxford Press
3	Field and Wave Electromagnetics	Second Edition 21 Jan 2010	David K. Cheng	Addison Wesley.

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IV Semester

ET1209	Lab.: Electronic Circuit Analysis	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Learning Objective Students will be able to	**Course Outcomes** Students will be able to
1. The course intends to provide an overview of the principles, operation and application of the basic electronic components & circuits 2. Understand the Characteristics of the active devices. 3. To understand the frequency response of different amplifiers. 4. Analyze the feedback amplifier & calculate input & Output impedance .	After completion of the lab course the students will able to : 1. Understand parameters like Gain, BW and frequency response of amplifier. 2. Show and analyze Effect of step response on High pass and low pass circuit. 3. Analyze single stage & two stage voltage amplifiers to meet a set of given specifications. 4. Use the concept of feedback on different amplifier & Oscillator circuits. 5. Design and analyze of voltage regulator using Pspice.

Course Outcomes	**Mapped PO**									
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**I**	**j**
1. Understand parameters like Gain, BW and frequency response of amplifier.	√			√	√	√	√	√		√
2. Show and analyze Effect of step response on High pass and low pass circuit.	√	√	√	√	√	√	√	√		√
3. Analyze single stage & two stage voltage amplifiers to meet a set of given specifications.	√	√	√	√	√	√	√	√		√
4. Use the concept of feedback on different amplifier & Oscillator circuits.	√	√	√	√	√	√	√	√		√
5. Design and analyze of voltage regulator using Pspice.	√	√	√	√	√	√	√	√		√

Sr. No.	**Ten Experiments Based on**
1.	To obtain Frequency Response of single stage CE Amplifier with and without feedback
2.	To perform square-wave testing in Voltage series Amplifier
3.	To determine input and output impedance of common drain MOSFET amplifier
4.	To calculate gains Av1, Av2 and overall gain of two stage amplifier voltage series feedback
5.	To determine frequency of oscillation for RC Phase Shift Oscillator.
6.	To determine Gain Bandwidth product of Voltage Series Amplifier
7.	To determine Ri, Ro, Rf, Rof in Feedback amplifier
8.	To study Crossover distortion and calculate Efficiency in Class B Push-Pull Amplifier
9.	To study emitter follower regulator
10.	To design Series voltage regulator using ORCAD.

		1.00		Applicable for AY 2015-16 Onwards
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IV Semester

EL1217	Control System Engineering	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objectives	Course Outcomes
This is a first course in feedback control of dynamic systems. The main goal is to introduce and familiarize students with dynamic systems modeling and analysis techniques that can be employed on a large variety of engineering systems. Being an interdisciplinary course, students will learn: 1 the role of a control engineer in multi-disciplinary teams. 2 to apply the knowledge gained in basic mathematics, physical sciences and engineering courses to derive mathematical models of typical engineering processes. 3 to use transfer function and state space models for control system analysis in time and frequency domain. 4 the basic concepts of proportional, integral, and derivative (PID) control. 5 the importance of stability in control systems and the various methods to determine it. 6 to construct root locus plot and frequency response plots such as polar plot, Bode plot, Nyquist plot etc.	Upon successful completion of this course, students should be able to: 1. Identify the basic elements and structures of feedback control systems. 2. understand the use of block diagram and signal flow graph as a modeling tool. Be able to manipulate block diagrams for systems of interconnected components. 3. develop models (differential equations, transfer functions, state space,) for a variety of dynamic physical systems. 4. understand the role of feedback in control systems. 5. have a good understanding of the response characteristics of basic first- and second-order dynamic systems. Be able to correlate time-domain responses with damping ratio and pole locations. 6. have an introductory knowledge of PID controllers. Be able to design PID controllers to meet simple specifications. 7. understand BIBO stability and its connection with pole locations. Be able to use Routh's criterion for absolute and relative stability analysis. 8. evaluate transfer function, stability and time response of control systems using state space techniques. 9. construct and recognize the properties of root-locus and its role in the analysis of control systems. 10. obtain frequency response indices. Be able to draw frequency response plots such as polar plot, Bode plot etc.

UNIT I : Introduction to Control Systems: History of control system, Basic Components of Control System, Open loop control and close loop control with examples, classification of control systems.
Transfer Function, Block Diagram and Signal Flow Graph : Transfer function and gain, Order of a system, block diagram algebra & reduction techniques, signal flow graph, its constructions and Mason's gain formula.
Mathematical Modelling of physical systems: Mathematical modelling of physical system such as – electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic etc., Analogous systems.
UNIT II: Characteristics of Feedback Control Systems : Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback.

UNIT III:Time Domain Analysis of Control Systems: Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (e_{ss}) analysis, static error constants and system type, dominant poles, Approximation of high order systems by low order systems, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

UNIT IV: **Stability of Linear Control Systems :** Concept of stability, stable, unstable and marginally stable system, Absolutely stable and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh-Hurwitz stability criterion with special cases, relative stability analysis.

State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block

IV Semester

EL1217	Control System Engineering	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form, solution of state equations, state transition matrix, its properties and computation.

UNIT V: Root LocusTechnique : Definition, magnitude and angle criteria, properties of root locus, construction rules for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s)H(s).

UNIT VI: Frequency domain analysis of control systems: Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response, polar plot, inverse polar plot, bode plot, all pass and minimum – phase system, experimental determination of transfer function, log magnitude versus phase plot.
Stability in Frequency domain : Principle of argument, Nyquist stability criterion, Assessment of relative stability using Nyquist criterion, concept of gain margin and phase margin and its computation using polar plot and log magnitude versus phase plot. Constant M and constant N circles, Nicholas chart.

Text books:

1	Control system engineering	5TH Edition	I. J. Nagrath & M. Gopal	New Age International
2	Automatic control systems	7th Edition	B. C. Kuo	PHI Learning Private Limited

Reference books:

1	Sigma Series: Control Systems	1st Edition	Ashok Kumar	McGraw - Hill
2	Control systems : Principles and design	4th Edition	M. Gopal	McGraw - Hill
3	Modern control engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited

IV Semester

ET1210	Microcontroller & Applications		L= 4	T = 0	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Learning Objective Students will be able	Course Outcomes Students will be able to
1. To understand the architecture and pin functions of 8-bit microcontroller. 2. To understand the instruction set and apply this assembly language knowledge in programming the microcontroller. 3. To understand programming microcontroller in C-language. 4. To perform serial communication and explaining the concept of interrupt. 5. To understand the interfacing of LCD,RTC and EPROM peripherals with microcontroller. 6. To understand the interfacing of RTC, ADC,DAC, Stepper Motor and keyboard peripherals with microcontroller.	1. Understand 8051 microcontroller architecture 2. Effectively utilize instruction set for assembly language programming 3. Interface different on & off chip peripherals with 8051 using C language 4. Basics of 8051 can be used for robotic applications

Course Outcomes	Mapped PO									
	a	b	c	d	e	f	g	h	i	j
Understand 8051 microcontroller architecture	√									√
Effectively utilize instruction set for assembly language programming	√	√	√	√						√
Interface different on & off chip peripherals with 8051 using C language	√	√	√	√						√
Basics of 8051 can be used for robotic applications	√	√	√	√	√					√

UNIT-1: **7 Hrs.**
Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organisaton, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51. Hardware Overview. Addressing modes, Instruction set and Assembly language programming Programs using look up table**.**

UNIT-2: **6 Hrs**
Loop, Jump and Call instructions, Bit manipulation, 8051 I/O programming, Delay Programs. I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming.

UNIT-3: **6 Hrs**
8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access. Timer programming in assembly and C: Various modes of operation, SFR related to timer operation.

UNIT-4: **6 Hrs**
Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs. 8051 interrupts, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt.

UNIT-5: **5 Hrs**
Interfacing and programming for LCD, Interfacing RTC, EEPROM using I2C Bus and programming.

UNIT-6: **6 Hrs**
Interfacing of ADC, DAC, stepper motor, DC motor and servo motor and programming.

		1.00		Applicable for AY 2015-16 Onwards
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IV Semester

ET1210	Microcontroller & Applications		L= 4	T = 0	P = 0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Resources :

Text books:

1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	by Muhammad Ali Mazidi	Pearson Education Asia LPE
2	Programming and Customizing the 8051 Microcontroller		By Myke Predko	McGraw-Hill
3	The 8051 Microcontroller	**3rd** edition	By Kenneth Ayala	CENGAGE Learning
4	Microprocessor & Interfacing		: A. K. Ray, K. M. Bhurchandi.	TMH pub

Reference books:

1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets	Douglas V Hall	Tata Mc Graw Hill

		1.00		Applicable for AY 2015-16 Onwards
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IV Semester

ET 1211	Lab.: Microcontroller and Applications	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Learning Objective Students will be able	Course Outcomes Students will be able to
1. To learn assembly language to program 8051 microcontroller. 2. To study embedded C-language to program 8051 microcontroller. 3. To understand interfacing requirements of 8051 with various devices.	1. Develop assembly language programs for 8051 microcontroller. 2. Develop embedded C-language programs for 8051 microcontroller. 3. Apply the knowledge of interfacing to interface various device with 8051 microcontroller.

Course Outcomes	Mapped PO									
	a	b	c	d	e	f	g	h	I	j
Develop assembly language programs for 8051 microcontroller.	√	√		√	√	√	√	√		√
Develop embedded C-language programs for 8051 microcontroller.	√	√		√	√	√	√	√		√
Apply the knowledge of interfacing to interface various device with 8051 microcontroller.	√	√	√	√	√	√	√	√		√

Sr. No.	Ten Experiments Based on
1	Add data bytes in a internal RAM
2	Convert single digit Hex number to its ASCII equivalent
3	Find the maximum data byte in a block
4	Data block transfer
5	number of negative data bytes in a block
6	Convert BCD to its binary equivalent.
7	Generate a saw tooth waveform using DAC
8	Read Analog signal from channel 2 of ADC and store it to internal RAM
9	Rotate stepper motor into clockwise and counter clockwise direction
10	Generation of square waveform from pin no P 1.2 of 8051
11	Display character on LCD.

		1.00		Applicable for AY 2015-16 Onwards
Chairperson	Dean (Acad. Matters)	Version	Date of Release	

IV Semester

ET 1212	Simulation Laboratory	L = 0	T = 0	P = 4	Credits = 2
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Learning Objective Students will be able	Course Outcomes Students will be able to
To acquaint student with various computing schemes using mathematical software tools.	1. Demonstrate basic concepts of arithmetic operations on vectors, matrices. 2. Visualize the data, results obtained using 2D, 3D, mesh, surface plots. 3. Develop the logic given in problem statement using flow control statement and basics of tool studied.

Course Outcomes	Mapped PO									
	a	b	c	d	e	f	g	h	I	j
Demonstrate basic concepts of arithmetic operations on vectors, matrices.	√	√		√	√	√	√	√		√
Visualize the data, results obtained using 2D, 3D, mesh, surface plots.	√	√		√	√	√	√	√		√
Develop the logic given in problem statement using flow control statement and basics of tool studied.	√	√	√	√	√	√	√	√		√

UNIT-1:
Vectors, accessing elements within a vector, Basic operations on vectors
Introduction: matrix creation and matrix operations. Matrix arithmetic, linear equations, eigen values, singular values, and matrix factorizations. Basic data structures.,: two-dimensional matrix and multidimensional array (plus scalar, vector, and empty matrices.

UNIT-2:
Data types:
numeric, logical, characters, dates, structures, cell arrays, function handles Programming components: principal building blocks. programming- variables, keywords, special values, operators, expressions, regular expressions, comma-separated lists, control statements, symbols

UNIT-3
Scripts and functions. Making calls to calls to functions, handle argument data, and use function handles. Data import, Export: import and export of data. including text, spreadsheet, graphics, and audio/video files.

UNIT-4:
Data visualization. Graphics:
Plotting Tools, Data Exploration tools, Annotating Graphs, Basic Plotting Commands, Creating specialized plots, Mesh, surface, feather plot, pie chart, bar graph, shading techniques, Printing and exporting,

UNIT-5
Working with Simulink and creating graphical user interface

UNIT-6:
Design and analysis of electronic circuit: DC analysis, transient analysis, Dc sweep and frequency response.
Mesh and nodal analysis, Control system analysis- LTI Models, Operations on LTI models, Model analysis tools.

		1.00		Applicable for AY 2015-16 Onwards
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5th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Learning Objective Students Should be able to	**Course Outcomes** Students will be able to
1. Recognizes consumer's behavior and pricing.	1. Relate their buyer behavior to particular product and the pricing in the market.
2. Extrapolates an operations in market with productions constrain.	2. Examine and classify various market structure and factors of production and its role in production process.
3. Describes the national income accounting and public finance.	3. Analyze the national income accounting and the various issues related to banking, taxation, and inflation.
4. Interprets international trade and institutions.	4. Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

UNIT-1:Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

UNIT-4: National income accounting:
Concepts of GDP and GNP,Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

5th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher,2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

5th Semester

ET1301	Analog Communication	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand the fundamentals of amplitude & angle modulation schemes. 2. Learn AM and FM receivers. 3. Know the concept of Radiation & 4. Propagation of signals. 5. Study different types of noise & discrete modulation schemes	Students will be able to 1. Analyze different analog modulation techniques. 2. Evaluate different parameters of communication receivers. 3. Describe the concepts of Propagation of signals. 4. Describe and analyze different types of noise. 5. Describe and Compare types of discrete modulation scheme.

UNIT-1

Amplitude Modulation: Need for modulation, Amplitude Modulation (AM), DSB-SC, SSB, VSB and ISB transmissions, mathematical Analysis, modulation index, frequency spectrum, power requirement of these systems, AM Transmitter.

08hrs

UNIT-2

Angle Modulation: Frequency Modulation (FM), mathematical Analysis, modulation index, frequency spectrum, power requirement of FM, narrowband & wideband FM, noise triangle in FM, pre-emphasis & de-emphasis techniques, phase modulation, power contents of the carrier & the sidebands in angle modulation, noise reduction characteristics of angle modulation, FM Transmitter.

08 hrs

UNIT-3

Receivers: Basic receiver (TRF), Super heterodyne receiver, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AM detectors, FM discriminators, AGC technique, double-spotting effect.

08hrs

UNIT-4

Radiation & Propagation of signals: Mechanisms of propagation, Ground wave, space wave and sky wave propagation, duct propagation, tropospheric propagation, fading, diversity reception.

08hrs

UNIT-5

Noise: Sources of noise, shot noise, thermal noise, noise calculations, equivalent noise bandwidth, noise figure of an amplifier, effective noise temperature, calculation of noise figure for cascaded stages.

08 hrs

UNIT-6

Types of pulse modulation PAM, PWM, Generation and Demodulation of PWM, PPM, Generation and Demodulation of PPM

08 hrs.

Text books:				
1	Electronic Communication System	4th Edition-(Year: 1999)	Gorge Kennedy	Tata McGraw-Hill.
2	Digital and analog communication systems	1st edition 1979	K. Sam Shanmugam	John Wiley & Sons

Reference books:				
1	Electronic Communication Systems	Third Edition 1998	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition 2001	Frenzel	MGH.

5th Semester

ET1302	Lab. : Analog Communication	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective	Course Outcome
Students should be able to 1. Understand the fundamentals of amplitude & angle modulation schemes. 2. Learn AM and FM receivers. 3. Know the concept of Radiation & 4. Propagation of signals. 5. Study different types of noise & discrete modulation schemes	Students will be able to 1. Analyze different analog modulation techniques. 2. Evaluate different parameters of communication receivers. 3. Describe the concepts of Propagation of signals. 4. Describe and analyze different types of noise. 5. Describe and Compare types of discrete modulation scheme.

Expt. No.	Experiments based on
01	To study the Generation of Amplitude Modulation using transistor. Calculate modulation index for different values of modulating amplitude.
02	To study the Generation of Amplitude Demodulation using Envelop Detector.To study the Generation of Frequency Modulation using IC 8038 function generator.
03	To study the Generation of Frequency Modulation using IC 8038 function generator.
04	To perform Frequency Demodulation using IC 565 PLL .
05	Generation of SSB-SC using balanced modulator.
06	Generation of SSB-SC using balanced de-modulator.
07	Generation of PWM signal using IC 555 and Pulse Width Demodulation.
08	Generation of PPM signal using and Pulse Position Demodulation IC 555
09	Generation of Pulse Amplitude Modulation using IC 555 & IC 4016.
10	To perform Time Division Multiplexing(TDM).
11	To perform DSB-SC

5th Semester

ET1303	Analog Integrated Circuits	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand modern analog circuits using integrated bipolar and field effect transistor technologies. 2. Understand basic principles of analog integrated circuit for analog IC design. 3. Learn operational amplifier basics, its parameters and its applications. 4. Understand Data converters and waveform generators	Students will be able to 1. Describe, Design and analyze OP-AMP circuits. 2. Parametric analysis and Design of error compensation network. 3. Design and analyze linear and non- linear OP-AMP applications. 4. Explain special function ICs and design circuits using it..

UNIT-1OPERATIONAL AMPLIFIER FUNDAMENTALS

Amplifier Fundamentals, Ideal Op Amp, OPAMP parameters, Basic Op Amp Configurations: Open loop, Feedback in OPAMP circuit: Inverting, Non-inverting, voltage follower.

08Hrs

UNIT-2OP AMP LIMITATIONS- STATIC and DYNAMIC

Simplified Op Amp Circuit Diagram, Input Bias and Offset Current, Input Bias and Offset voltages, input offset error Compensation, open loop and closed loop response, Transient response, gain bandwidth product (GBP) & its effect, frequency compensation.

OPAMP Noise: Noise properties, Sources of noise, Noise dynamics, Noise in OPAMP

08Hrs

UNIT-3LINEAR APPLICATIONS

Summer, difference amplifier, integrator, differentiator, Current-to-Voltage Converter, Voltage-to-Current Converter, Instrumentation Amplifiers, Instrumentation Applications, Transducer Bridge amplifiers.

08Hrs

UNIT-4 ACTIVE FILTERS

Transfer function, first order filter, Standard second order response, KRC Filters, Unity Gain Filter, State Variable Filter, Switched capacitor filter, Notch Filter**,** Second Order Butterworth filter design.

08Hrs

UNIT-5NONLINEAR CIRCUITS

Precision Rectifiers, clipper, clamper, Voltage Comparators, Comparator Applications, Schmitt Triggers: Peak Detectors, Sample-and-Hold Circuits, Log/Antilog amplifiers,

WAVEFORM GENERATORS: Sinusoidal Oscillators, square wave generation, triangular wave generator, saw tooth wave generator.

08 Hrs

UNIT-6 SPECIAL FUNCTION IC'S

PLL, Monolithic timers (IC 555), Performance Specifications, D-A Converters (DACs), A-D Converters (ADCs).Voltage reference circuits

08Hrs

Text books:				
1	Design with Operational Amplifiers and Analog Integrated Circuits	3rd Edition 2003	Author: Sergio Franco	Franco - McGraw-Hill
2	Linear Integrated Circuits	3rd Edition 1996	D. Roy Chaudhuri, Shail Jain	New Age International
Reference books:				
1	Linear Integrated Circuits	5th **edition**2009	S. Salivahanan, V. S. Bhaaskaran	TMH

5th Semester

ET1304	Lab. : Analog Integrated Circuits	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to

1. Understand modern analog circuits using integrated bipolar and field effect transistor technologies.
2. Understand basic principles of analog integrated circuit for analog IC design.
3. Learn operational amplifier basics, its parameters and its applications.
4. Understand Data converters and waveform generators

Course Outcome

Students will be able to

1. Describe, Design and analyze OP-AMP circuits.
2. Parametric analysis and Design of error compensation network.
3. Design and analyze linear and non-linear OP-AMP applications.
4. Explain special function ICs and design circuits using it..

Expt. No.	Experiments based on
01	IC 741 OP-AMP as a inverting amplifier / non-inverting amplifier with frequency response.
02	Different OPAMP parameters: CMRR, Slew rate of OP-AMP.
03	IC 741 OP-AMP as a Integrator.
04	IC 741 OP-AMP as a Differentiator.
05	IC 741 OP-AMP as a Low pass filter.
06	IC 741 OP-AMP as a High pass filter
07	OP-AMP IC 741 as AstableMultivibrator.
08	OP-AMP IC 741 as a MonostableMultivibrator.
09	OP-AMP IC 741 as a Schmitt trigger.
10	Instrumentation amplifier
11	Precision Rectifier
12	ADC/ DAC

5th Semester

ET1305	Signals & Systems	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand the fundamental characteristics of signals and systems. 2. Understand signals and systems in terms of both the time and transform domains. 3. Understand the process of sampling and interpolation. 4. Develop of the mathematical skills to solve problems involving convolution, transforms and sampling.	Students will be able to 1. Classify systems based on their properties and determine the response of LTI system. 2. Analyze system properties based on impulse response and Fourier analysis. 3. Apply sampling and interpolation to sample and reconstruct signals. 4. Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.

UNIT-1 Signals and Systems

Continuous-Time and Discrete-Time Signals. Transformations of the Independent Variable. Continuous-Time and Discrete-Time Systems. Basic System Properties.

Discrete-Time LTI Systems: The Convolution Sum. Continuous-Time LTI Systems: The Convolution Integral. Properties of Linear Time-Invariant Systems. Causal LTI Systems Described by Differential and Difference Equations. Singularity Functions

09Hrs

UNIT-2Fourier Series Representation of Periodic Signals.

The Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous-Time Periodic Signals. Convergence of the Fourier Series. Properties of Continuous-Time Fourier Series. Fourier Series Representation of Discrete-Time Periodic Signals. Properties of Discrete-Time Fourier Series. Fourier Series and LTI Systems. Filtering.Examples of Continuous-Time Filters Described by Differential Equations.Examples of Discrete-Time Filters Described by Difference Equations.

07Hrs

UNIT-3Fourier Transform.

The Continuous-Time Fourier Transform. Representation of Aperiodic Signals: The Continuous-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Continuous-Time Fourier Transform. Systems Characterized by Linear Constant-Coefficient Differential Equations.

The Discrete-Time Fourier Transform**.** Representation of Aperiodic Signals: The Discrete-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Discrete-Time Fourier Transform (Parsevals Theorem, Convolution, Modulation, Hilbert Transform). Systems Characterized by Linear Constant-Coefficient Difference Equations.

09Hrs

UNIT-4 Time & Frequency Characterization of Signals and Systems.

The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Concept of Frequency Response , Group Delay , Phase Delay , Time-Domain Properties of Ideal Frequency-Selective Filters. Time- Domain and Frequency-Domain Aspects of Nonideal Filters. First-Order and Second-Order Continuous-Time Systems, Discrete-Time Systems.

Representation of a Continuous-Time Signal by its Samples: The Sampling Theorem. Reconstruction of a Signal from Its Samples Using Interpolation. Aliasing. Discrete-Time Processing of Continuous-Time Signals.

08 Hrs

5th Semester

ET1305	Signals & Systems	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT-5 The Laplace Transform.

The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. System Function Algebra and Block Diagram Representations. The Unilateral Laplace Transform.

07Hrs

UNIT-6: The Z-Transform.

The z-Transform. The Region of Convergence for the z-Transform. The Inverse z-Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the z-Transform. Analysis and Characterization of LTI Systems Using z-Transforms. System Function Algebra and Block Diagram Representations. The Unilateral z-Transform

08 Hrs

Text books:				
1	Signals and Systems	2nd Edition 1996	Alan V. Oppenheim, Alan S. Willsky, with S. Hamid	2/E, Publisher: Prentice Hall.
2	Schaum's Outline of Signals and Systems.	4th edition 2002	Hwei Hsu,	McGraw-Hill
Reference books:				
1	Principles of Signal Processing and Linear Systems	First edition	B. P. Lathi	Oxford University Press
2	Signals & Systems	2nd Edition. 2005	Simon Haykin and Van Veen, Wiley	TMH
3	Signals & Systems Analysis Using Transformation Methods & MAT Lab	; 1st edition 2003.	Robert	Publisher: McGraw-Hill Companies
4	Signals, Systems and Transforms	3rd Edition, 2004.	C. L. Philips, J.M.Parr and Eve A.Riskin	Pearson education
5	Signals & Systems		J. Nagrath, S.N.Sharan, R.Ranjan, S.Kuma	TMH

5th Semester

ET1306	Electronics Workshop	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Learn identifications, operation & testing of passive and active electronic components and devices.
2. Understand identification and Testing of wires, cables, connectors and interconnected components.
3. Understand PCB designing process, soldering process, testing and troubleshooting of electronic circuits

Course Outcome
Students will be able to
1. Identify and test passive and active electronic components and devices.
2. Identify and Test wires, cables, connectors and interconnected components.
3. Construct mini project and troubleshoot it.

Expt. No.	Experiments based on
01	To study Analog and Digital Multimeter.
02	To study Passive electronic components.
03	To study Active electronic components.
04	To identify and Test wires, cables and connectors.
05	To study Operation, Identification and Testing of Interconnected components.
06	To study Operation and Testing of microphones and speakers.
07	To construct a Fixed voltage regulated power supply.
08	To perform Bread board execution of the mini project.
09	PCB layout designing and fabrication.
10	Testing and Fault rectification in mini project.

5th Semester

ET1307	PE I : Algorithm & Data Structures	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Learn the concepts of object oriented programming using C++. 2. Understand the fundamentals of file handling, streams and formatting I/O operations. 3. Study various data structures and abstract data types. 4. Study concepts of dictionaries; skip list, hashing and search trees.	Students will be able to 1.Describe fundamental concepts of Object Oriented Programming 2. Develop programs for Various types of data structures. 3. Analyze Skip-list, hashing and search trees.

UNIT-1:
software evolution, need for OOP, Overview of OOP Principles- Encapsulation, Inheritance, Polymorphism. C++ class overview- class definition, objects, class members, access control, class scope, constructors and destructors, inline functions, static class members, this pointer, friend functions, dynamic memory allocation and deal location (new and delete).

06Hrs

UNIT-2:
Function overloading, operator overloading, generic programming-function and class templates, Inheritance basics, single inheritance and multiple inheritance, base and derived classes, different types of inheritance, base class access control, virtual base class, function overriding, run time polymorphism using virtual functions, abstract classes.

06Hrs

UNIT-3 :
Streams basics, Stream classes hierarchy, console i/o, formatted I/O, manipulators, file streams, opening and closing of files, exception handling mechanism.

06Hrs

UNIT-4:
Algorithms, performance analysis-time complexity and space complexity, Review of basic data structures-the list ADT, stack ADT, queue ADT, implementation using template class in C++, implementation using template class, priority queues-definition, ADT, heaps, definition, insertion and deletion, application-heap sort, disjoint sets-disjoint set ADT, disjoint set operations.

06Hrs

UNIT-5:
Skip lists and Hashing: Dictionaries, linear list representation, skip list representation, operations- insertion, deletion and searching, hash table representation, hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison of hashing and skip lists**.**

06 Hrs

UNIT-6:
Binary search trees, definition, ADT, implementation, operations- Searching, insertion and deletion, Balanced search trees- AVL trees, definition, height of an AVL tree, representation, operations-insertion, deletion and searching. Red –Black trees-representation, insertion, deletion, searching Splay trees- introduction, the splay operation

06 Hrs

5th Semester

ET1307	PE I : Algorithm & Data Structures	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text books:				
1	Data structures, Algorithms and Applications in C++	2nd edition August 2004	S. Sahni	University press (India) pvtltd , Orient Longman pvt. ltd.
2	Data structures and Algorithms in C++	2nd Edition.	Michael T. Goodrich, R. Tamassia and D. Mount	John Wiley and Sons.
Reference books:				
1	Data structures and Algorithm Analysis in C++	second edition.	Mark Allen Weiss	Pearson Education ltd
2	Data structures using C and C++	second edition 2003	Langsam, Augenstein and Tanenbaum	PHI
3	C++ primer	3rd edition 2000	S.B.Lippman	Pearson education ltd.
4	Problem solving with C++, The OOP	Fourth edition	W.Savitch	Pearson education.
5	Data structures and algorithms in C++	3rd Edition	Adam Drozdek, Thomson	

5th Semester

ET1308	Lab. : PE I : Algorithm & Data Structures	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective	Course Outcome
Students should be able to 1. Learn the concepts of object oriented programming using C++. 2. Understand the fundamentals of file handling, streams and formatting I/O operations. 3. Study various data structures and abstract data types. 4. Study concepts of dictionaries; skip list, hashing and search trees.	Students will be able to 1.Describe fundamental concepts of Object Oriented Programming 2. Develop programs for Various types of data structures. 3. Analyze Skip-list, hashing and search trees.

Expt. No.	Experiments based on
01	Study of control Structure & Statements
02	Study of If –else structure
03	Study of Case Statement
04	Study of Functions
05	Study of inheritance
06	Study of polymorphism
07	Study of Structures
08	Study of Linked List
09	Study of Stacks
10	Study of queues
11	Study of Trees

5th Semester

ET1309	PEI : Object Oriented Programming	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Learn the basic concepts of Object Oriented Programming. 2. Understand the concepts of function, class, object and operator overloading. 3. Understand the fundamentals of data structures: lists, stacks, queues, trees, graphs. 4. Learn concepts of file handling, template, exception handling and command line arguments.	Students will be able to 1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects. 2. Develop C++ programs using OOPs concepts. 3. Design and develop C++ programs for implementing data structures using array and linked list. 4. Implement the concept of file handling, template and exception handling to develop the software.

UNIT-1:
Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP.
Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators. Expressions and Control Structures, Pointers, Arrays.

06Hrs

UNIT-2:
Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Recursion, Classes and Objects, Constructors and Destructors.

06Hrs

UNIT-3:
Operator overloading, Function Overloading, Inheritance, Types of Inheritance , Polymorphism, Friend and Virtual Functions.

06Hrs

UNIT-4:
Definition of a data structure, Primitive and Composite data types, Asympotic notations, Operations of Arrays, Order lists, Stacks, Applications of Stack, Infix to Postfix Conversion, Queues, Operations of Queues.

06Hrs

UNIT-5:
Singly linked list, Operations, Doubly linked list, Operations, Trees and Graphs: Binary tree, Tree traversal; Graph, Definition, Types of Graphs, Traversal (BFS & DFS), Dijkstra`s algorithm.

06 Hrs

UNIT-6:
Files – classes for file stream operations – Opening, Closing and Processing files – End of file detection – File pointes – Updating a file – Error Handling during file operations – Command line arguments – Templates – Exception Handling.

06 Hrs

Text books:				
1	Object Oriented programming with C++	3rd. EditionYear: 2008	E. Balagurusamy	TMH.
2	Object Oriented Programming in Microsoft C++	4th EditionDate: 2002	Robert Lafore	Galgotia
Reference books:				
1	Fundamental of data structure in C++	5th Edition 2005	E. Horowitz and S.Shani	Galgotia Pub.
2	Computer algorithms	2nd Edition1998	Horowitz, S.Shani and S.Rajasekaran	Galgotia Pub. Pvt Ltd

5th Semester

ET1310	Lab. : PE I: Object Oriented Programming	L= 0	T = 0	P = 2	Credits =1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to

1. Learn the basic concepts of Object Oriented Programming.
2. Understand the concepts of function, class, object and operator overloading.
3. Understand the fundamentals of data structures: lists, stacks, queues, trees, graphs.
4. Learn concepts of file handling, template, exception handling and command line arguments.

Course Outcome

Students will be able to

1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Develop C++ programs using OOPs concepts.
3. Design and develop C++ programs for implementing data structures using array and linked list.
4. Implement the concept of file handling, template and exception handling to develop the software.

Expt. No.	Experiments based on
01	Implement the concept of Class and its data members and member functions.
02	Implement the Class with arrays of Objects.
03	Implement the concept of function overloading and operator overloading.
04	Implement the concept of passing object as a function argument.
05	Implement the concept of friend function.
06	Implement the concept of constructor and its type.
07	Implement the concept of dynamic constructor.
08	Implement the concept of object pointers.
09	Implement the concept of inheritance.
10	Implement the concept of each access specifiers (Private, Public and Protected)
11	Implement the concept of run time polymorphism.
12	Implement the concept of Files.
13	Implement the concept of command line arguments.
14	Implement the concept of function templates.
15	Implement the concept of exception.
16	Implement the concept of multiple catch
17	Implement the concept of Class templates.
18	Implement the concept of Link list
19	Implement the concept of tree
20	Implement the concept of graph.

5th Semester

ET1311	PE I : Discrete Structures	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand the algorithms of various logic and proofs. 2. Learn recursive algorithm with different applications. 3. Learn the concept of discrete probability. 4. Study the various tree traversal methods.	Students will be able to 1. Analyze the concept of logic and proofs. 2. Apply discrete mathematics to develop recursive algorithms. 3. Design and solve various problems of discrete probability theory. 4. Analyze graphs, tree and group theory concepts used in computer science 5. Design and analyze network models related to transport network and pumping network

UNIT-1:
LOGIC AND PROOFS & The LANGUAGE OF MATHAMATCS :
Propositions, conditional propositions and logical equivalence, quantifiers, proofs, resolution proofs, mathematical induction ,,sets, sequences and strings, number system, relations , equivalence relations , matrices of relations, relational databases , functions .

06Hrs

UNIT-2:
ALGORITHMS :
Introduction, Notation for algorithms ,The Euclidean algorithm, Recursive Algorithms , Complexity of Algorithms , Design and Analysis of an Algorithm , Analysis of Euclidean Algorithm , Encryption and decryption, The RSA Public – Key Cryptosystem.

06 Hrs

UNIT-3
COUNTING METHODS AND THE PIGEONHOLE PRINCIPALE
Basic Principles, Permutation and Combination , Algorithms for Generating Permutations and Combinations , Introduction to Discrete Probability, Discrete Probability Theory , Generalized Permutation and Combinations , Binomial Coefficients and Combinatorial Identities , The Pigeonhole Principle.

06 Hrs

UNIT-4:
RECURRENCE RELATIONS & GRAPH THEORY
Introduction , Solving Recurrence Relations , Application to the Analysis of Algorithms, Paths and Cycles , Hamiltonian Cycle and the Traveling Salesperson Problem , A Shortest Path Algorithm, Representations of Graphs , Isomorphism's of Graphs , Planer Graphs.

06 Hrs

UNIT-5
TREES
Introduction ,Terminology and Characterization of Trees, Spanning Trees, Minimal Spanning Trees, Binary Trees, Tree Traversal ,Decision Trees and the minimum Time for Sorting, Isomorphisms of Trees, Game Trees.

06**Hrs**

UNIT-6:
NETWORKS MODELS
Introduction, A Maximal Flow Algorithm, The Max Flow , Min Cut Theorem, Matching, Boolean algebras and combinatorial circuits, properties of combinatorial circuits, Boolean functions and synthesis of circuits.

06**Hrs**

Text books:				
1	DISCRETE MATHAMATICS	5th Edition 2002	RICHARD JOHNSONBAUGH	Pearson Education

5th Semester

ET1312	Lab. : PE I: Discrete Structures	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Understand the algorithms of various logic and proofs.
2. Learn recursive algorithm with different applications.
3. Learn the concept of discrete probability.
4. Study the various tree traversal methods.

Course Outcome
Students will be able to
1. Analyze the concept of logic and proofs.
2. Apply discrete mathematics to develop recursive algorithms.
3. Design and solve various problems of discrete probability theory.
4. Analyze graphs, tree and group theory concepts used in computer science
5. Design and analyze network models related to

Expt. No.	Experiments based on
01	Write a program to print truth table for XY+Z.
02	Write a program to prove Demorgan's theorem.
03	Write a program to swap two integers.
04	Write a program to calculate factorial using recursive method.
05	Write a program to find the probability of event.
06	Write a program to find the recurrence relation.
07	Write a program to sort the given numbers in ascending order using sorting.
08	Write a program to find GCD of two integers.
09	Write a program to find the Fibonacci series.
10	To study polymorphism of trees.
11	To study maximal flow algorithm.

5th Semester

ET1336	PE I : Advanced Microprocessor & Peripherals	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand the architectural details and pin configuration of 8086 microprocessor 2. Discuss the various addressing modes available in 8086 3. Explain the operation performed by various instructions of 8086 4. Study the interrupt structure of 8086 5. Understand interfacing of memory ICs and various peripherals with 8086	Students will be able to 1. Describe architecture of 8086 2. Describe and compare various instructions according to their addressing modes 3. Develop assembly language programs using the instruction set of 8086 4. Explain the function of various interrupts associated with 8086 5. Interface memory ICs and develop programs for interfacing various peripherals with 8086

UNIT-1:
Introduction to 16 bit microprocessor family, architecture of 8086 & 8088, ,segmentation, memory organization, pipelining, comparison& 8086 with 8088

06Hrs

UNIT-2:
Signal description, fetch read & write cycle, minimum mode system, Maximum mode of 8086, read and write machine cycle, Addressing modes of instruction, assembler directives

06 Hrs

UNIT-3
Instruction set of 8086/8088, assembly language programming of 8086/8088

06 Hrs

UNIT-4:
Interrupt structure of 8086, Interfacing memory with 8086/8088, interfacing buffers & latches.

06 Hrs

UNIT-5
Interfacing of 8086 with 8255, ADC, DAC, 8253/8254, 8251.

06Hrs

UNIT-6:
Interfacing of 8086 with 8259, 8279 and 8237.

06 Hrs

Text books:				
1	Advanced Microprocessor & Peripherals	Second edition	Ray, Bhurchandi	McGraw Hill
Reference books:				
	16 bit Microprocessors		Triebel& A. Singh.	
	8086/88 Family Architecture, Interfacing & Programming		D.V. Hall	TMH.

5th Semester

ET1337	Lab. : PE I : Advanced Microprocessor & Peripherals	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to

1. Understand the architectural details and pin configuration of 8086 microprocessor
2. Discuss the various addressing modes available in 8086
3. Explain the operation performed by various instructions of 8086
4. Study the interrupt structure of 8086
5. Understand interfacing of memory ICs and various peripherals with 8086

Course Outcome

Students will be able to

1. Describe architecture of 8086
2. Describe and compare various instructions according to their addressing modes
3. Develop assembly language programs using the instruction set of 8086
4. Explain the function of various interrupts associated with 8086
5. Interface memory ICs and develop programs for interfacing various peripherals with 8086

Expt. No.	Experiments based on
01	Perform basic arithmetic operations.
02	Transfer data bytes present in one memory to another.
03	Find Smallest / largest number from a data block
04	Count number of even & odd data bytes in a given array
05	Convert BCD number into its equivalent hexadecimal number
06	Solve equation using shift and add method
07	Convert the data string to equivalent 2's compliment
08	Transfer an array of data bytes from source memory to destination memory using string instructions.
09	Search a byte in an array of data bytes present in memory by using string instructions.
10	Compare two data blocks using string instructions

5th Semester

ET1331	OE I : Microcontroller & Embedded Systems	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objectives

Students should be able to

1. Understand the architecture and pin functions of 8 bit microcontroller.
2. Study the assembly language instruction set.
3. Understand programming microcontroller in c language.
4. Understand interfacing of on and off chip peripherals with 8051 microcontrollers.

Course Outcomes

Students will be able to

1. Explain 8051 microcontroller architecture.
2. Develop assembly language program.
3. Develop embedded C language program.
4. Interface 8051 microcontroller to solve real life problems

UNIT-1

Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51. Hardware Overview. Addressing modes, Instruction set.

06 Hrs

UNIT-2

Assembly language programming,Loop, Jump and Call instructions, Bit manipulation, 8051 I/O programming, Delay Programs. I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming

06Hrs

UNIT-3

8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access. Timer programming in assembly and C: Various modes of operation, SFR related to timer operation.

06Hrs

UNIT-4

Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs. 8051 interrupts, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt

06 Hrs

UNIT-5

Interfacing and programming for LCD, Interfacing RTC, EEPROM using I2C Bus and programming.

06 Hrs

UNIT-6

Interfacing of ADC, DAC, stepper motor, DC motor, Servo motor.

06Hrs

Text books:

1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	by Muhammad Ali Mazidi	Pearson Education Asia LPE
2	8051 Microcontrollers programming and practice		By Mike Predcko	S.Chand
3	The 8051 Microcontroller Architecture, programming and Applications		By Kenneth Ayala	Cengage Learning

Reference books:

1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets		Douglas V Hall	Tata McGrawHill

5th Semester

ET1333	OE I : Principles of Communication Engineering	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Understand various modulation and demodulation techniques of analog and digital modulation.
2. Describe and determine the performance of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel.
3. Understand various multiple access techniques in wire and wireless communication
4. To learn the basic of satellite communication and elements of optical fibre transmission

Course Outcome

Students will be able to

1. Describe analog and digital communication systems and various modulation schemes.
2. Analyze error correcting codes, including block codes.
3. Explain multiple access techniques in wire and wireless communication.
4. Explain the different application of satellite communication and optical communications

UNIT-1

Frequency spectrum of EM waves, their properties, wave propagation, Noise, Types of noise ,source, noise figure calculation.

06 Hrs

UNIT-2

Need for modulation, Basic scheme of a modern communication system, Derivation of expression for an amplitude modulated wave. Carrier and side band components.Modulation index.Spectrum and BW of AM Wave.Relative power distribution in carrier and side bands.Working principles and typical application as Square Law Modulator, Ring Modulator.

06Hrs

UNIT-3

Expression for frequency modulated wave and its frequency spectrum (without Proof and analysis of Bessel function) Modulation index, maximum frequency deviation and deviation ratio, BW ofFM signals, Carson's rule. Need for pre-emphasis and de-emphasis, Comparison of FM and AM in communication systems, Varactor diode modulator, Derivation of expression for phase modulated wave, modulation index, comparison with frequency modulation.

06Hrs

UNIT-4

Principles of demodulation of AM wave using diode detector circuit; Basic principles of FM detection using slope detector, Foster-Seeley discriminator, Ratio detector.

06Hrs

UNIT-5

Radio receivers: Basic functions of radio receiver, Characteristics of radio receiver, Block diagram of AM radio receiver and FM radio receiver.

06 Hrs

UNIT-6:

Pulse Modulation: PAM,PWM,PPM (waveforms and applications),Comparison of PAM, PWM, PPM
Digital Modulation: Sampling theorem, PCM , DM-ASK, FSK, PSK.

06 Hrs

Text books:				
1	Electronics Communication		Kennedy	Tata McGraw Hill, New Delhi
2	Radio Engineering		GK Mittal	Khanna Publishers, New Delhi
3	Principles of Communication Engineering		Anokh Singh	S.Chand& Co., New Delh
Reference books:				
1	Principles of Communication Engineering		Roody , Coolin	
2	Principles of Communication Engineering		Manoj Kumar	SatyaPrakashan, New Delhi

5th Semester

ET1335	OE I : Fundamentals of Image Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective
Students should be able to
1. Learn the fundamentals of digital image processing algorithms.
2. Learn the algorithms of spatial and frequency domain filtering.
3. Study the performance of digital images in frequency domain.
4. Learn segmentation and compression of digital images through various algorithms

Course outcomes
Students will be able to
1. Apply basic image processing algorithms for image enhancement.
2. Apply filtering techniques in spatial and frequency domain.
3. Describe and analyze various image transform techniques.
4. Apply segmentation and compression algorithms on images

UNIT-1: Introduction
Origin of Digital Image processing, Fundamental Steps in image processing, Component of Image processing system, elements of visual perception, Sampling and quantization, Concept of gray levels, Relationship between pixels
06Hrs

UNIT-2: Intensity Transformation
Background, Basic intensity transformation techniques: Image negative, log transformation, power law transformation, piecewise linear transformation, Histogram processing: Histogram Equalization, Histogram Matching, Local histogram processing
06Hrs

UNIT-3 : Image Filtering
Mechanics of Spatial filtering, Smoothing spatial filters: Linear and Order statistic filters, Sharpening filters: Foundation, Laplacian and Gradient, Filtering in frequency in frequency domain
06Hrs

UNIT-4 : Image Transforms
2-D FFT, Properties. Discrete cosine Transform, Discrete sine transform, Haar transform, Hadamard Transform, Slant transform
06Hrs

UNIT-5: **Image segmentation**
Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation
06Hrs

UNIT-6:Image compression
Redundancies and their removal methods, Measuring information, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression
06Hrs

Text books:

1	Digital Image Processing	2nd edition	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication 2002.
2	Digital Image Processing		S. Jayaraman, S. Esakkirajan, T Veerakumar	McGraw-Hill

6th Semester

GE1311	Fundamentals of Management	L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Learning Objective Students Should be able to	Course Outcomes Students will be able to
1. To introduce the fundamentals and legal provision of Management	1. Explain the Legal provision and Functions of Management.
2. To introduce the Human Resource and Financial practice of organization	2. Analyze the role of Human Resource and Financial Management in the organization.
3. To Introduce the Project Management	3. Analyze the project life cycles.
4. To provide knowledge of Marketing Activities of Management	4. Identify tools and techniques for the marketing of goods and services.

UNIT-1: Principles of Management
Evolution of Management Thought : Scientific, Classical, Neo Classical and Modern Theory of Management, Defintion Meaning and Concept of Management, Functions of Managment : Planning, Organizing, Directing Coordinating and Controlling. Motivation Theory, Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, Types of Partners, Right and Duties of Partners, Registration and Dissolution of firm, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Directors : Powers and duties, Winding up of the Company

UNIT-3: Human Resource Management
Human Resource Management-Meaning, Nature and Scope, Principles of HRD, Human Resource Planning, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Discipline and Grievance Procedure.

UNIT-4 Project management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Project Management, Tools and Techniques of Project Management, SWOT Analysis, Project Risk Analysis, Project cost, Project Planning, Project Control, Network techniques - Introduction and Use of CPM &PERT for planning.

UNIT-5 Marketing Management:-
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Rural Marketing, Marketing Environment, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

UNIT-6 Financial Management:-
Definition & Functions of Finance department, Sources of finance , Financing organizations, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

6th Semester

GE1311	Fundamentals of Management		L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSEs	TA	ESE		Total	ESE Duration
	30	10	60		100	3 Hrs
* MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment						

TEXT BOOKS:

1. S.C.Saxena, Business Management and Administration, SahityaBhawan Publication
2. P. SubbaRao, Management -- Theory and Practice (Text and Cases) (Himalaya Publication)
3. Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
4. P.S Rao , Essentials of Human Resource Managemen& IR, Himalaya , Mumbai
5. AvrahamShtub and Jonathan F. Bard, Project Management: Processes, Methodologies, and Economics (2nd Edition)
6. Kotler, Keller, Koshy&Jha, Marketing Management, Pearson, New Delhi
7. R.K. Sharma, Shashi K Gupta, Management Accounting,.Kalyani Publishers.

6th Semester

ET1314	Digital Communication	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand various source coding techniques. 2. Understand signal space concepts. 3. Understand the key modules of digital communication systems with emphasis on digital modulation techniques. 4. Learn different channel coding techniques 5. Understand the concept of spread spectrum modulation, its types and applications.	Students will be able to 1. Compare different source coding techniques. 2. Describe and analyze signal space concepts. 3. Distinguish various digital modulation techniques. 4. Describe & compare different channel coding techniques 5. Apply spread spectrum modulation for various applications of communication systems.

UNIT-1Analog Source Coding:-
Sampling theorem, PCM, DM, ADM, ADPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding. Introduction to Image compression, Review of techniques used in JPEG and MPEG standards.
08Hrs

UNIT-2Digital Source coding:
Introduction to information theory, channel capacity,Huffman, Prefix code, and L-Z encoding algorithm. Rate distortion theory for optimum quantization, scalar and vector quantization.
08 Hrs

UNIT-3Signal Space Concepts:-
Gram-Schmitt procedure, Signal space representation of modulated signals, nonlinear modulation methods with memory, Error probability and optimum receivers for AWGN channels, Matched filters.
08Hrs

UNIT-4 Digital Modulation methods:-
PSK, FSK, QPSK, MSK, DPSK, GMSK,MPSK, MFSK, OFDM,TDM
08 Hrs

UNIT-5 Channel Coding:-
Review of channel coding, Linear block codes, cyclic codes convolution, encoding and decoding, distance properties, Viterbi algorithm and Fano algorithm. Trellis coded modulation methods. Golay code, Turbo code.
08Hrs

UNIT-6 Spread - Spectrum methods:-
Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, performance analysis, synchronization methods for spread spectrum. Application of spread spectrum, CDMA.
08 Hrs

Text books:				
1	Digital communication	4theditionDate:2005	John G Prokis	TMG
2	Digital communication	3rdeditionAugust 2007	Simon Haykin	WEP
Reference books:				
1	Modern Communication systems (Principles and application)	1st edition...Publication: 1994	Leon W. Couch II	PHI
2	Digital Communication	1st edition.	Shanmugham	CBS Publisher
3	Modern Digital & Analog Communication Systems	4th editionDate: 2009	B.P.Lathi	Oxford UnivPrPublication
4	Principles of Communication Systems	2nd edition Pub Date: SEP-07	Taub Schilling	Publisher: Prentice Hall

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

6th Semester

ET1315	Lab. : Digital Communication	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to

1. Understand various source coding techniques.
2. Understand signal space concepts.
3. Understand the key modules of digital communication systems with emphasis on digital modulation techniques.
4. Learn different channel coding techniques
5. Understand the concept of spread spectrum modulation, its types and applications.

Course Outcome

Students will be able to

1. Compare different source coding techniques.
2. Describe and analyze signal space concepts.
3. Distinguish various digital modulation techniques.
4. Describe & compare different channel coding techniques
5. Apply spread spectrum modulation for various applications of communication systems.

Expt. No.	Experiments based on
01	Sampling & reconstruction
02	Linear PCM system
03	Differential PCM system
04	Delta Modulation system
05	Adaptive Delta Modulation system
06	Companded PCM (A law &μ law)
07	Data formatting
08	Shift Keying Techniques- ASK & FSK
09	QPSK & BPSK

6th Semester

ET1316	Transmission Lines and Waveguides	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective
Students should be able to
1. Understand the concept of transmission lines and its parametric analysis.
2. Learn the concept of uniform plane wave.
3. Study the characteristics of guided wave propagation in parallel plane waveguide.
4. Understand the properties of rectangular and Circular waveguide.

Course Outcome
Students will be able to
1. Describe and analyze Transmission line parameters.
2. Explain and analyze the propagation of electromagnetic waves.
3. Describe and analyze the properties of TE, TM, TEM waves in parallel plane waveguide.
4. Describe and analyze the properties of TE, TM, waves in rectangular and circular waveguide.

UNIT-1: TRANSMISSION LINE THEORY & PARAMETERS:
Introduction to different types of transmission lines, Definition of line parameters, the transmission line, - General Solution, Physical Significance of the equations, the infinite line, input impedance, loading of transmission line, waveform distortion, Distortion less transmission line, input and transfer impedance, Reflection phenomena, Line losses, Return loss, reflection loss, insertion loss.

08 Hrs

UNIT-2:THE LINE AT RADIO AND POWER FREQUENCIES:
Parameters of open wire line and Coaxial line at high frequencies; Line constants for dissipation less line - voltages and currents on dissipation less line - standing waves and standing wave ratio - input impedance of open and short circuited lines –impedance matching - Introduction to Smith Chart, power and impedance measurement on lines – real and reactive power, impedance matching

08 Hrs

UNIT-3:ELECTROMAGENTIC WAVES:
Solution for Free-Space conditions, Uniform plane wave Propagation, The Wave Solutions for a conducting medium – Conductors and dielectrics – Polarization – Reflection by a perfect conductor for Normal incidence and Oblique incidence – Reflection by a perfect dielectric and insulator for Normal incidence and Oblique incidence – Reflection at the surface of a conductive medium – Surface impedance, Numerical Problems.

09Hrs

UNIT-4: GUIDED WAVES IN TWO CONDUCTOR LINES
Waves between parallel planes, Transverse electric and Transverse magnetic waves, Characteristics of TE and TM waves, Transverse electromagnetic waves, Velocities of propagation, Attenuation in parallel plane guides, wave impedance,Electric field and current flow within the conductor, Waves in Coaxial lines & modes.

08Hrs

UNIT-5: RECTANGULAR WAVE GUIDE:
Solution of the field equations: Rectangular Co-Ordinates, Transverse Magnetic and Transverse Electric waves in rectangular guides, Impossibility of TEM wave in wave guides Wave impedances and characteristic impedances, Dominant mode current distribution on walls, Power transmission and Attenuation Constant, Excitation of modes, Applications

08Hrs

6th Semester

ET1316	Transmission Lines and Waveguides	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT-6: CIRCULAR WAVE GUIDE:
Solution of wave equation in circular guides, TE and TM wave in circular guides, Wave impedance, Power transmission and attenuation constant, Excitation of modes, Applications.

07 Hrs

Text books:				
1	Electromagnetic waves and Radiation System	III Edition 2000	Edward. C.Jordan	-Prantice Hall of India Pvt.Ltd. New Delhi
2	Field and Wave Electromagnetics	Third Edition(1989	David K.Cheng	Addison – Wesly, Pub, Co
Reference books:				
1	Fields and Waves in Communication electronics	2 nd Edition 1965	Simon, Ramo, J.R. WinneryndT.V .Duzer	John Willey and Sons
2	Microwave Engineering	1st Edition 1999, Reprint 2001	Annapurna Das, Sisir.K.Das	Tata McGraw-Hill Co., Ltd

6th Semester

ET1317	Digital Signal Processing	L= 3	T = 1	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Learn discrete time system, discrete Fourier Transform and Computation of DFT. 2. Understand realization of digital filters in a variety of structures. 3. Understand the Architectures of programmable DSP processors. 4. Study the design of IIR and FIR digital filters	Students will be able to 1. Analyze discrete time signals and system 2. Apply and verify the properties of Discrete Fourier transform. 3. Implement digital filters in a variety of structures. 4. Describe the architectural features of programmable DSP. 5. Design and analyze digital IIR and FIR filter

UNIT-1:
Signals and System, Concept of Frequency in Continuous time and Discrete time signals, sampling Theorem, Discrete time Signal and Systems, The analysis of discrete-time systems.

08Hrs

UNIT-2:
Discrete Fourier transform:
Frequency domain sampling: DFT, Computation of DFT, Properties of DFT, Circular convolution, Use of DFT in Linear Filtering, FFT algorithms: Decimation in time, Decimation in Frequency.

08 Hrs

UNIT-3:
Digital filter structures:
Block diagram representation, equivalent structures, Basic FIR structures, Basic IIR structures, IIR tapped cascaded lattice structures, FIR cascaded lattice structures.

08 Hrs

UNIT-4:.
Introduction to Programmable DSP's, Architecture of TMS320C6X:Feature, CPU, General Purpose Register File**,** Functional Unit and Operation, and Data Paths, Control Register File.

08 Hrs

UNIT-5:IIR filter design –
Bilinear transformation, Impulse invariant transformation, Lowpass IIR digital filters, Butterworth and Chebyshev filter, Spectral transformations.

08Hrs

UNIT-6: FIR filter design using windowing techniques (Rectangular, Hann, Hamm, Blackmann, Bartlett and Kaiser), Frequency sampling technique.

08Hrs

Text books:				
1	Digital signal processing- A computer based approach,	2nd Edition2004	S. K. Mitra	Tata McGraw Hill, 2002
2	Discrete time signal processing	2nd Edition 2008	V. Oppenheim, R, W, Schafer	PHI
Reference books:				
1	Digital signal processing –Principles, algorithms and applications	2ndEdition 1995	J. G. Proakis, D. G. Manolakis	PHI
2	Digital signal processing- A practical approach	Second Edition, 2002.	E. C. Ifeachar, B. W. Jarvis	Pearson Education
3	Digital Signal Processors, Architecture, Programming and Applications	2 ndEdition 2002 ...	Venkataramani, Bhaskar	1. Tata McGraw Hill.
4	'Introduction to DSP'	2nd edition 2003	Johny R Johnson	PHI

6th Semester

ET1318	Lab. : Digital Signal Processing	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to

1. Learn discrete time system, discrete Fourier Transform and Computation of DFT.
2. Understand realization of digital filters in a variety of structures.
3. Understand the Architectures of programmable DSP processors.
4. Study the design of IIR and FIR digital filters

Course Outcome

Students will be able to

1. Analyze discrete time signals and system
2. Apply and verify the properties of Discrete Fourier transform.
3. Implement digital filters in a variety of structures.
4. Describe the architectural features of programmable DSP.
5. Design and analyze digital IIR and FIR filter

Expt. No.	Experiments based on
01	Sampling of Continuous time Signal
02	Reconstruction of Discrete time Signal and Illustration of Aliasing
03	Generation of Discrete Time Signal
04	Operations on Discrete Time Signals
05	Convolution of two Discrete Time Signals
06	Discrete Fourier transforms and Inverse Discrete Fourier transform of Discrete Time Signals.
07	Circular Convolution of a discrete time signal.
08	Design FIR and IIR filter
09	Filter Design and Analysis Tool
10	To design and implement Audio Reverberation model in DSP processor TMS320C6711.

6th Semester

ET1319	PE II : Embedded System	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Study & understand the difference between microprocessor & microcontroller, CISC & RISC controllers also, to learn the detailed architectural features of ARM processor.
2. Study instruction set of ARM processor.
3. Explore the details about ARM9TDMI, ARM coprocessors & memory buses
4. Understand interfacing of various peripherals with ARM controller.
5. Understand the details about memory management in ARM and obtain a broad understanding about real time systems

Course Outcome

Students will be able to

1. Describe architectural features of ARM processors.
2. Apply ARM instruction set in developing assembly language programs.
3. Describe ARM processors and memory buses.
4. Interface different peripherals with ARM processors.
5. Explain memory management in ARM and concept of real time systems.

UNIT-1: Introduction to embedded system and ARM Processor, Difference between RISC & CISC, advantages of architectural features of ARM Processor, Processor modes, Register organization, Exceptions and its handling. 3/5-stage pipeline ARM organization.
LPC2148 ARM 7 microcontroller, Features of LPC2148, Block diagram of LPC2148, Pin diagram of LPC2148, Architectural overview, On-chip flash program memory, On-chip static RAM.

06 Hrs

UNIT-2
Memory and memory-mapped I/Os, ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs.

06Hrs

UNIT-3ARM floating point architecture and DSP extensions, ARM co-processors. ARM 9 TDMI ARCHITECTURAL STUDY: - H/W architecture, Timing diagrams for various accesses, Memory buses: AMBA, ASB, & APB. Architectural support for system development

06 Hrs

UNIT-4: Interfacing and Programming: Basic embedded C programs for GPIO and interfacing of different devices like switches, matrix keypad, LED, LCD, Stepper Motor, Study and programming of on-chip peripherals like timers, counters, on-chip ADC, DAC, RTC modules, UART, PWM, etc.

06Hrs

UNIT-5 : Memory Hierarchy, memory size and speed, on-chip memory, caches, cache design, memory management.

06 Hrs

UNIT-6: Architectural support for operating system. RTOS issues, uCOS-II and embedded Linux features. The shared Data Problem, Software Architectures (Round Robin, Round Robin with Interrupts, Function Queue Scheduling,) Selecting a software Architecture, Case for Real Time Operating System, Introduction to RTOS :tasks and task states, tasks and data, semaphores and shared data, message queues, mailboxes and pipes, events, RT Linux.

06 Hrs

Text books:				
1	ARM System–on-chip Architecture	2nd edition August 25, 2000	by Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2nd Edition2002	By Craig Hallabaugh	Pearson Education Asia
Reference books:				
1	System Developer's Guide: Designing and Optimizing	Publish Date: 2004	Sloss Andrew N, Symes Dominic, Wright Chris	Morgan Kaufman Publication

Chairperson		Version	1.01	Applicable for
Dean (Acad. Matters)		Date of Release	May 2017	AY 2017-18 Onwards

6th Semester

ET1320	Lab. : PE II : Embedded System	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to

1. Study & understand the difference between microprocessor & microcontroller, CISC & RISC controllers also, to learn the detailed architectural features of ARM processor.
2. Study instruction set of ARM processor.
3. Explore the details about ARM9TDMI, ARM coprocessors & memory buses
4. Understand interfacing of various peripherals with ARM controller.
5. Understand the details about memory management in ARM and obtain a broad understanding about real time systems

Course Outcome

Students will be able to

1. Describe architectural features of ARM processors.
2. Apply ARM instruction set in developing assembly language programs.
3. Describe ARM processors and memory buses.
4. Interface different peripherals with ARM processors.
5. Explain memory management in ARM and concept of real time systems.

Expt. No.	Experiments based on
01	swap contents of two memory locations.
02	add 16 bit and 32 bit numbers in memory locations.
03	find factorial of number.
04	copy string from one memory location to another.
05	find greatest and smallest number from given memory block.
06	solve given mathematical equation.
07	Toggle LED connected to port pin of ARM micro-controller
08	display message on LCD using ARM microcontroller.
09	serial communication using UART of ARM microcontroller.
10	generate square wave using DAC of ARM microcontroller.
11	toggle LED connected to port of ARM microcontroller.Genrate time delay using timer.
12	Interfacing ADC with ARM microcontroller

6th Semester

ET1321	PE II : Digital System Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Understand programmable devices and discuss the architecture of CPLD and FPGA.
2. Learn basics of Hardware description Language, design flow and design Methodology.
3. Understand the concept of modeling digital systems.
4. Understand the concept of generic, generate and attributes.
5. Comprehend combinational and sequential circuit design approaches

Course Outcome

Students will be able to

1. Describe and compare different FPGA and CPLD architectures.
2. Describe HDL design flow.
3. Design, develop and analyze combinational circuits.
4. Design, develop and analyze sequential circuits.

UNIT-1 Programmable Devices:
XILINX, ALTERA logic families-architecture, logic module, switching technology, I/O cells, Programmable interconnect. Design flow for different design styles.

06Hrs

UNIT-2Hardware Descriptive Language:
Introduction to HDL, Design Flow, Design Methodologies, HDL History, Capabilities, Hardware Abstraction, Basic Terminology, Model Analysis, Comparison between VHDL and Verilog, Basic VHDL Elements; Identifiers, Data Objects, Data Types, Operators.

06 Hrs

UNIT-3Dataflow Modeling:
Concurrent Signal Assignment Statements, delta delay model, multiple drivers, block statement, concurrent assertion statement. Structural Modeling: Component Declaration, component Instantiation, resolving signal values.

06Hrs

UNIT-4: Sequential Logic Design
Synchronous Sequential Circuits, Asynchronous Sequential Circuits. Finite State Machines: Modeling and Simulation of Moore and Mealy FSMs.Generate statements, Model Simulation: Writing a Test Bench.

06 Hrs

UNIT-5: Combinational Logic Design
Adders/Subtractions, ALU, Multipliers, Hardware Modeling Examples, use of text file for input and output,

06Hrs

UNIT-6:
Advanced feature:
Qualified type conversion, guarded signals, attributes, aggregate target, Hardware modeling examples..

06 Hrs

6th Semester

ET1321	PE II : Digital System Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text books:				
1	A VHDL Primmer	Second Edition 1995	Bhasker	Prentice Hall
2	Digital System Design using VHDL	Second Edition1998	Charles. H.Roth	PWS
Reference books:				
1	Applications Specific Integrated Circuits	1997	Michael John &	Wiley
2	VHDL-Analysis & Modelling of Digital Systems	Second Edition1998.	Navabi Z	McGraw Hill
3	VHDL-IV	Edition: Perry 2002		TMH
4	Fundamentals of Digital Logic with VHDL Design	1st Edition edition 2000	Brown and Vranesic	TMH

6th Semester

ET1322	Lab. : PE II: Digital System Design	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to

1. Understand programmable devices and discuss the architecture of CPLD and FPGA.
2. Learn basics of Hardware description Language, design flow and design Methodology.
3. Understand the concept of modeling digital systems.
4. Understand the concept of generic, generate and attributes.
5. Comprehend combinational and sequential circuit design approaches

Course Outcome

Students will be able to

1. Describe and compare different FPGA and CPLD architectures.
2. Describe HDL design flow.
3. Design, develop and analyze combinational circuits.
4. Design, develop and analyze sequential circuits.

Expt. No.	Experiments based on
01	Write a VHDL code for Basic gates.
02	Write a VHDL Dataflow code for Half Adder, Half Subtractor.
03	Write a VHDL Dataflow code for 4:1 MUX, 2:4 Decoder, 1:4 DEMUX.
04	Write a VHDL Dataflow code for 1-bit, 2-bit Comparator.
05	Using Selected Signal Assignment, write VHDL code for 4:1 MUX, 2:4 Decoder, Full Adder.
06	Using Conditional Signal Assignment, write VHDL code for 4:1 MUX, 2:4 Decoder, Full Adder.
07	Write Behavioral VHDL code for sr latch.
08	Write Behavioral VHDL code for d latch.
09	Write Behavioral VHDL code for 4-bit Shift register, 4-bit counter.
10	Write Structural VHDL code for FA using HA, 16:1 MUX using 4:1 MUX.
11	Using Generate Statement Write VHDL code for 8 Bit Carry Look Ahead Adder using FA.
12	Write VHDL Code for 4 bit Sequence Detector MOORE M/C, Overlapping allowed
13	Write VHDL Code for 4 bit Sequence Detector MEALY M/C, Overlapping allowed

6th Semester

ET1338	PE II: Data Compression and Encryption	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Understand the basic concept of Cryptography and Network Security, their mathematical models.
2. Various types ciphers, DES, AES, message Authenication, digital Signature.
3. Acquire knowledge in security issues, services, goals and mechanism.
4. Understand the concept of Network security, virous, worms and firewall.
5. Understand mathematical foundation required for various cryptographic Algorithms.
6. Identify and classify computer and security threats and develop a security model to prevent, detect and recover from attacks

Course Outcome

Students will be able to

1. Describe communication protocols and layered network architectures
2. Explain conventional computer system interfacing standards and peer to peer data link communication protocols.
3. Design basic network systems using routing methods and analyse data communication technology.
4. Describe the operation of a packet based sliding window protocol, Encryption and Decryption methods.
5. Describe the operation of application layer using SMTP, TELNET, DNS, FTP etc.
6. Apply the concept of virous, worms and firewall in Network security

Unit -1Text Compression

Shannon Fano Coding, Huffmann coding, Arithmetic coding and dictionary techniques-LZW, family algorithms. Entropy measures of performance and Quality measures.

06hrs

Unit- 2Audio Compression

Digital Audio, Lossy sound compression, M-law and A-law companding, DPCM and ADPCMaudio compression, MPEG audio standard, frequency domain coding, format of compressed data.

06hrs

Unit-3Image And Video Compression

Loss less techniques of image compression, gray codes, Two dimensional image transforms, JPEG, JPEG 2000, Predictive Techniques PCM and DPCM. Video compression and MPEG industry standard.

06hrs

Unit-4Conventional Encryption

Introduction, Types of attacks, Steganography, Data Encryption Standard, Block Cipher Principle, S-box design, triple DES with two three keys, introduction to international data encryption algorithm and key distribution.

06hrs

Unit-5 Public Key Encryption And Number theory

Euler.s theorems, Chinese remainder theorem, Principles of public key cryptography, RSA algorithm, Diffie-Hellman Key Exchange. Elliptic curve cryptology, message authentification and Hash functions, Hash and Mac algorithms, Digital signatures.

06hrs

Unit-6System Security & Case Studies

Intruders, Viruses, Worms, firewall design, antivirus techniques, digital Immune systems, Certificate based & Biometric authentication, Secure Electronic Payment System.

06hrs

Text books:				
1	Data Compression	4th Edition.	David Salomon	Springer Publication
2	Introduction to Data Compression	3rd Edition	Khalid Sayood	Morgan Kaufmann Series
3	Cryptography and Network Security	5th Edition	William Stallings	Pearson EducationAsia Publication
4	Cryptography and Network Security	1st Edition	BehrouzForouzan	McGraw-Hill
Reference books:				
1	The Data Compression Book	2nd Edition	Mark Nelson	BPB publication
2	Applied Cryptography	2nd Edition	Bruce Schnerer	John Willey & Sons Inc. Publication
3	Cryptography & Network Security	2nd Edition	AtulKahate	Tata McGraw Hill

6th Semester

ET1339	Lab. : PE II: Data Compression and Encryption	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to

1. Understand the basic concept of Cryptography and Network Security, their mathematical models.
2. Various types ciphers, DES, AES, message Authenication, digital Signature.
3. Acquire knowledge in security issues, services, goals and mechanism.
4. Understand the concept of Network security, virous, worms and firewall.
5. Understand mathematical foundation required for various cryptographic Algorithms.
6. Identify and classify computer and security threats and develop a security model to prevent, detect and recover from attacks

Course Outcome

Students will be able to

1.Describe and compare different communication protocols and layered network architectures

2. Apply the concepts of routing methods to design network systems.

3. Apply the concept of various worms and firewall for network security system.

Expt. No.	Experiments based on
01	Implement Huffman data compression algorithm to generate Prefix codes and encoded text.
02	Implement the concept of block cipher
03	Implement RSA algorithm
04	Study of Cryptographic hash function and application
05	Study of Diffie-Hellman Key Establishment
06	Study of Digital Signatures
07	Study of Message Authentication Codes

6th Semester

ET1323	PE II : TV &Video Engineering	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to
1. Introduce the basic principles of T.V.
2. Study different television systems and standards
3. Learn to elaborate video amplifiers and luminance channel.
4. Explore different types of color T. V. receivers.
5. Describe cable television and video disc-recording and playback.
6. Study digital television-transmission and reception.

Course Outcome

Students will be able to
1. Describe basic concept of monochrome and color TV.
2. Describe and troubleshoot Video Amplifier & luminance circuits.
3. Explain and compare PAL, NTSC and SECAM systems.
4. Explain and compare analog and digital television-transmission and reception.

UNIT-1: COLOUR SIGNAL GENERATION AND ENCODING:

Introduction monochrom T V system ,Colour TV camera , Desired Composition of Video Signal, Freq. interleaving, PAL colour TV standards ,Luminance Signal (Y),,Colour Difference Signals, Encoding of Colour Difference Signals, generation of U and V signals, PAL Encoder, Chrominance Signal for Colour Bar Pattern, colour TV Transmitter Block diagram,

06 Hrs

UNIT-2:TELEVISION SYSTEMS AND STANDARS:

NTSC Colour T V standards, generation of I and Q signals, NTSC encoder, NTSC colour T V system ,SECAM colour TV standards, ,Transmission of colour difference signal in SECAM system, SECAM encoder SECAM colour TV system .

06Hrs

UNIT-3VIDEO AMPLIFIERS AND LUMINANCE CHANNEL

Desired Composition of colour Video Signal, Video Amplifier, Problems of DC Coupling, Consequences of AC Coupling, DC Reinsertion, Contrast and Brightness Control Methods, Video Amplifier Circuits Luminance or Y Channel, Trouble shooting Video Amplifier circuits

06Hrs

UNIT-4: COLOUR TELEVISION RECEIVERS

PAL-D Decoder, Separation of U and V Signals, U and V demodulators Colour Burst Separation, Colour Killer Circuits, Colour Signal Matrixing, PAL Colour RGB Drive Amplifiers, Sync Separation, Noise in Sync Pulses, Separation of Frame (Vertical) and Line (Horizontal) Sync Pulses, NTSC decoder, SECAM decoder.

06Hrs

UNIT-5:CABLE TELEVISION, VIDEO DISC-RECORDING

Cable Signal Sources, Cable Signal Processing, Cable Signal Distribution, Bi -Directional Networks, Scrambling of TV Signals, Cable Signal Converters, Disc Recording and Playback Technology, Single layer and multilayer Discs, DVD Player.

06Hrs

UNIT-6:DIGITAL TELEVISION-TRANSMISSION AND RECEPTION

Digital System Hardware, Signal Quantization and Encoding, Digital Satellite Television, Direct-to-Home Satellite Television, Digital TV Receiver, Merits of Digital TV Receivers, Extended Definition Television (EDTV),High Definition Television (HDTV), LCD Technology, LCD Matrix Types and Operation,

06 Hrs

Text books:				
1	Modern Television Practice, Principles and Servicing	3rd edition Publishing Date : 2010	by R.R. Gulati	New Age International Publishers, Delhi.
2	Television and Video Engineering	2nd Edition MAY-2001	Dhake.A.M	Tata McGraw-Hill
Reference books:				
1	Basic television and video systems	2nd Edition PublishingDate :1999	Grob. B, Herndon. C.E	McGraw-Hill,

Chairperson		Version	1.01	Applicable for
Dean (Acad. Matters)		Date of Release	May 2017	AY 2017-18 Onwards

6th Semester

ET1324	Lab. : PE II: TV& Video Engineering	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective

Students should be able to
1. Introduce the basic principles of T.V.
2. Study different television systems and standards
3. Learn to elaborate video amplifiers and luminance channel.
4. Explore different types of color T. V. receivers.
5. Describe cable television and video disc-recording and playback.
6. Study digital television-transmission and reception.

Course Outcome

Students will be able to
1. Describe basic concept of monochrome and color TV.
2. Describe and troubleshoot Video Amplifier & luminance circuits.
3. Explain and compare PAL, NTSC and SECAM systems.
4. Explain and compare analog and digital television-transmission and reception.

Expt. No.	Experiments based on
1	To study block diagram of CTV Receiver.
2	To study in detail, circuit of RF tuner section through various test points and step-by-step fault finding.
3	To observe the composite video signal at the output of VIF section
4	To study in detail, circuit of SIF and VIF section through various test points, and step-by-step fault Finding.
5	To study the Horizontal oscillator section through various test points and step-by-step fault finding.
6	To study the Vertical oscillator section through various test points and step-by-step fault finding.
7	To study the detail circuit of video and chroma section through various test points and step-by-step Fault finding.
8	To study in details, of audio section through various test points
9	To study power supply section through various test points.
10	To study CCVS signal for color bar pattern using pattern generator.
11	To study the chrominance signal, which represents colour saturation and Hue of a scene or picture.

6th Semester

ET1344	PE II: Fundamentals of Computing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand the use of Python as a scripting language for programmers. 2. Learn Python programming and to design applications	Students will be able to 1. Describe and develop Python programming using data types, operators and control structures 2. Develop python programs using loops and decision statements. 3. Describe and apply strings, lists, tuples, Numpy and dictionaries in Python programs. 4. Develop python programs using functions and recursions.

Unit -1
Introduction to Python ,Python syntax ,comments variables, basic programming
06hrs

Unit- 2
Data types, numbers, Casting strings Booleans, python operators: basic, membership and bitwise.
06hrs

Unit-3
Conditions, Control statements: if-else, loops, Use of while loops in python Loop manipulation using pass, continue, break and else
06hrs

Unit-4
Python String Defining list and list slicing, Use of Tuple data Types
06hrs

Unit-5Public Key Encryption And Numbertheory
List and Dictionary Manipulations Building blocks of python programs
06hrs

Unit-6System Security & Case Studies
Numpy, Functions, recursion and advanced programming
06hrs

Text books:				
1	NPTEL material		Swayam.gov.in	NPTEL material
2	Online resources			Online resources
3	Complete Reference		Martin C Brown	TATA McGraw Hill
Reference books:				
1	Core Python Programing		Wesley Chun,	Prentice Hall publications

6th Semester

ET1345	Lab. : PE II: Fundamentals of Computing	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to

1. Understand the use of Python as a scripting language for programmers.
2. Learn Python programming and to design applications

Course Outcome
Students will be able to

1. Describe and develop Python programming using data types, operators and control structures
2. Develop python programs using loops and decision statements.
3. Describe and apply strings, lists, tuples, Numpy and dictionaries in Python programs.
4. Develop python programs using functions and recursions.

Expt. No.	Experiments based on
01	Write, test, and debug simple Python Programs
02	Develop Python programs using different data types and understand their use
03	Implement Python programs with conditionals and loops
04	Implement Python programs with strings
05	Develop Python programs for Python lists and understand their use
06	Develop Python programs for Python tuples and understand their use
07	Develop Python programs step-wise by Python dictionaries for representing compound data.
08	Develop Python programs step-wise by defining functions and calling them
09	Read and write data from/to files in Python.
10	Mini Project

6th Semester

ET1340	OE II : Soft Computing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Familiarize with soft computing concepts. 2. Learn the concepts of Genetic algorithm 3. Learn the concepts of Fuzzy Logic and Neural networks	Students will be able to 1. Describe and apply genetic operators and genetic algorithms for problem solving 2. Apply Neural Network algorithms in pattern classification 3. Apply fuzzy logic and arithmetic to handle uncertainty and solve engineering problems 4. Describe and analyze fuzzy implications and fuzzy controller

UNIT-1
Introduction of Soft Computing Methods, Fundamentals of Genetic Algorithms, Encoding, Fitness function, Genetic modeling, Applications of GA

06Hrs

UNIT-2
Introduction of neural networks, learning methods, perceptrons, perceptron training algorithm, single layer perceptron, multiplayer perceptron, neural network architectures, ADALINE, MADALINE

06Hrs

UNIT-3
Back propagation algorithm, RBF networks, ART Networks, self-organizing feature maps, Applications of ANN

06 Hrs

UNIT-4
Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conforms

06Hrs

UNIT-5
Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, fuzzy equations, fuzzy relations, binary fuzzy relations, fuzzy equivalence,

06Hrs

UNIT-6
Fuzzy controllers, Defuzzification Methods , Fuzzy Inference Techniques, Applications of fuzzy logic

06 Hrs

Text books:				
1	Fuzzy sets and Fuzzy logic	1995	by George Klir, Bo Yuan	PHI
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, VijayalaxmiPai	PHI
3	Elements of Artificial Neural Network	1997	K. Mehrotra	MIT Cognet

Reference books:				
1	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3	Fuzzy Logic & Applications	2003	J. Ross, TMH/Mc	McGraw Hill

6th Semester

ET1341	OE II : Industrial Instrumentation	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective
Students should be able to
1. Study the characteristics of Instruments.
2. Understand the Concepts of Pressure measurements and its calibration process
3. Understand the working principle of various active &passive temperature transducers.
4. Learn the working principle of various flow transducers.
5. Learn the working principle of various transducers like level, thickness speed, ph value etc.
6. Study PLC, SCADA.

Course Outcome
Students will be able to
1. Describe instrumentation system using various transducers.
2. Measure and analyze various parameters using transducers.
3. Explain and develop PLC & SCADA programming.

UNIT I : INTRODUCTION
Block diagram of instrumentation system, static and dynamic characteristics of instruments, functions of instruments, Definition of Transducers- Role of transducers in instrumentation- Advantages of electrical transducers - Classification of transducers- Analog and Digital, Active and passive, Primary and Secondary transducers- Inverse transducer- Sensitivity and specification for transducers - Characteristics and Choice of transducer-Factors influencing choice of transducer. Need of transducers, Classification, selection criteria,

06Hrs

UNIT II : PRESSURE MEASUREMENT
Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.

06Hrs

UNIT III : TEMPARATURE MEASUREMENT 1
Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.

06Hrs

UNIT IV : TEMPARATURE MEASUREMENT 2: THERMOCOUPLES AND PYROMETERS
Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation – Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.

06Hrs

UNIT V: FLOWMETERS
Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube.
Area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flow meters flow measurements for gases

06Hrs

UNIT VI : MISCELLANEOUS MEASUREMENT
Electrical level gauge: – Resistive - capacitive – Nuclear radiation - Ultrasonic type, Radar type ,Speed measurement D.C and A.C tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, soil & water pH Measurement

06 Hrs

Text books:				
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi
Reference books:				
1	Principles of Industrial Instrumentation		D. Patranabis	Tata McGraw Hill Publishing Company Ltd, 1996.
2	Instrumentation Measurement & Analysis	2004.	B.C. Nakra&K.K.Chau	Tata McGraw Hill Publishing Ltd

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Dean (Acad. Matters)		Date of Release	May 2017	AY 2017-18 Onwards

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3	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
4	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

6th Semester

ET1342	OE II : Medical Electronics	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Know the physiology of heart , brain and skin, Understand the basic principles of physical parameters
2. Comprehend the working principle of recording instruments flow, Pulse oximeters, Heart rate
3. Know the physical concepts of radiography related to X rays
4. Learn working principles of advanced medical imaging system

Course Outcome

Students will be able to

1. Describe various parameters of human anatomy and physiology.
2. Explain the functioning of different measuring and recording instruments
3. Describe radiography equipments
4. Explain Biomedical computer application

Unit 1 : Cell as bio electric generator:
Heart and Circulatory system, ECG, Brain and nervous system, EEG, Skeletal , Muscle and Skin Systems, EMG
06Hrs

Unit 2 : Physical Measurement
Blood pressure and Flow, Heart rate and Heart sounds, Respiration and temperature
06Hrs

Unit 3 : Recording Instrumentation
Electrodes, Basic Instrumentation,ElectrocardiographElectroencephalographElectromyograph Phonocardiograph
06Hrs

Unit 4 : Measuring Instrumentation
Transducers, Blood Pressure, Blood flow and Pulse oximeters, Heart rate , respiration rate and temperature meters, Audiometer and hearing Aid
06Hrs

Unit 5 : X-rays
X-ray Physics, Fluoroscopy and radiography, X-ray tubes and X-ray Equipments
06Hrs

Unit 6 : Advanced Imaging Systems
Ultrasonic scanner, CT scan, MRI, Endoscope and Electron microscope
06Hrs

Text books:				
1	Medical Electronics	2003	ISTE Excel book	Patil A. G.
2	Biomedical Instrumentation and Measurements	2004	PHI, second edition	Leslie Cromweel , Fred J. Weibell, Erich A. Pfeiffer
Reference books:				
1	Handbook of Biomedical Instrumentation	NewDelhi, 2003.	TATA McGraw-Hill	Khandpur, R.S.
2	Introduction to Biomedical equipment Technology	New York, 2004	John Wiley and Sons	Joseph J.Carr and John M.Brown

6th Semester

ET1343	OE II : Display Technology and Applications	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. To learn fundamental concepts of different display technologies related to manufacturing techniques and materials used for FPD selection. 2. To explore electrical, optical and physical specifications required for display technologies 3. To understand different displays and addressing of displays 4. To learn backplane technology and driver integration 5. To identify and comprehend materials and applications of display	Students will be able to 1. Identify and describe different display technologies, their working, Luminescence materials and manufacturing processes. 2. Characterize and analyze specifications of display technology, light emission process and analyze matrix addressing. 3. Explain the fundamentals of backplane and backlight unit technologies. 4. Elaborate materials and applications of displays.

UNIT I :
Overview of display technologies, information capacity of displays, introduction to different flat panel display technologies. Fundamentals of Photometry, Colorimetry, CIE colorimetry

06Hrs

UNIT II :
Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, driving power, efficiency, speed, memory and storage, degradation, resolution, addressability, physiological factors, and measurement instrumentation; Color filter manufacturing process.

06Hrs

UNIT III :
Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, Basics of matrix addressing of displays: active and passive matrix.

06Hrs

UNIT IV :
Technical discussion of display technologies: LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.

06Hrs

UNIT V:
Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration.
Back Light Unit Technologies (CCFL, LED, QD, etc.)

06Hrs

UNIT VI:
Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes

06Hrs

Text books:

1	Liquid crystal flat panel displays: manufacturing science & technology.	W. Mara	2012	Springer, Science & Business Media,

Reference books:

1	Liquid crystal displays: fundamental physics and technology.	R. H. Chen	2011	John Wiley and Sons

6th Semester

ET1327	**Seminar**	L= 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	100	-		100	2 Hrs

Course Objective	**Course Outcome**
Students should be able to 1. Get an exposure to the latest trends in the field of Electronics & Telecommunication. 2. Improve the communication skills and Stage daring. 3. Write effective reports and design documentation. 4. Make effective presentation.	Students will be able to 1. Function effectively as an individual. 2. Communicate effectively. 3. Demonstrate the knowledge of current trends in the field of Electronics & Telecommunication. 4. Demonstrate the understanding of Professional and ethical responsibilities.

7th Semester

ET1401	RF and Microwave	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Know various resonant and non resonant microwave power generators. 2. Study the concept of scattering matrix. 3. Understand working of various microwave passive devices. 4. Know the various microwave measurement techniques. 5. Learn the working principle of microwave solid state devices.	Students will be able to 1. Describe and analyze the behavior of linear beam and cross field tubes. 2. Apply s-parameters to model and analyze output response of microwave transmission lines. 3. Analyze behavior of passive components using s-matrix. 4. Measure performance parameters of microwave devices. 5. Explain and characterize microwave solid state devices.

UNIT I : KLYSTRONS

High frequency limitations of conventional microwave devices,Two cavity Klystron Amplifier – Mechanism and mode of Operation, Power output and Efficiency, Applegate diagram, applications, Reflex Klystron Oscillator – Mechanism and mode of Operation Power output, efficiency, Electronic Admittance.

09Hrs

UNIT II : MAGNETRONS

Helix, TWT, BWO Slow Wave Structures

Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Power output and Efficiency, Cylindrical magnetron, parallel plate magnetron, Types of strapping, Tuning of magnetron. Applications, Numerical Problems.

08 Hrs

UNIT III : MICROWAVE NETWORK ANALYSIS

Introduction, Symmetrical Z and Y matrices for reciprocal network, Scattering matrix representation of multi port networks, comparison between [S], [Z] and [Y] matrices. Inter relationship between impedance matrix, admittance matrix and Scattering matrix, properties of scattering matrix. Scattering matrix of transmission lines, ABCD parameters with S parameters, Numerical Problems .

08Hrs

UNIT IV : MICROWAVE PASSIVE DEVICES (RECIPROCAL AND NON RECIPROCAL):

Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, , Directional couplers, Wave guide Corners, Bends and Twists ,Attenuators, Isolators, Gyrators, Circulators, Phase shifter, Scattering matrix derivation for all components.

09Hrs

UNIT V: MICROWAVE MEASUREMENT:

Introduction, Tunable detector, Slotted line Carriage, VSWR meter, Power measurements sensor, Bolo meter sensor, power sensor, Low and High power measurement, Insertion loss and Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement. Frequency measurement, Measurement of cavity Q, Dielectric measurement, Microwave filters-design methods : Image parameter method, Insertion loss method.

07Hrs

UNIT VI: MICROWAVE SOLID STATE DEVICES AND CIRCUITS:

Microwave diodes – Gunn diode – Mode of operation, Crystal diode, PIN diode –, IMPATT diodes, Application as Oscillator and Amplifiers, Varactor diode, parametric amplifier, Microwave transistors, MASER, Strip lines- Micro Strip lines, Parallel Strip lines.

07Hrs

7th Semester

ET1401	RF and Microwave	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text books:				
1	Microwave device and circuits	Third Edition	Samuel Y.Lio	Pearson Education
2	Foundations of microwave engineering	Second Edition 1992	R.E. Collins	Tata Mc-Graw Hill
3	Microwave engineering	Second Edition 1992	R Chatterjee.	
4	Microwave Engineering	Third Ed. 2007	David Pozar	Wiley Ind. Pub.
Reference books:				
1	Microwave communication	1989	Hund	
2	Microwave theory and measurement		G. Lance	
3	Microwave Engineering	2nd Edition Reprint 2001	Annapurna Das, Sisir. K.Das	Tata McGraw-Hill Co., Ltd.
4	Microwave	1978	Reich J.H.et al	East West Press,

7th Semester

ET1402	Lab. : RF & Microwave	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective	Course Outcome
Students should be able to 1. Know various resonant and non resonant microwave power generators. 2. Study the concept of scattering matrix. 3. Understand working of various microwave passive devices. 4. Know the various microwave measurement techniques. 5. Learn the working principle of microwave solid state devices.	Students will be able to 1. Describe and analyze the behavior of linear beam and cross field tubes. 2. Apply s-parameters to model and analyze output response of microwave transmission lines. 3. Analyze behavior of passive components using s-matrix. 4. Measure performance parameters of microwave devices. 5. Explain and characterize microwave solid state devices.

Sr. No.	Experiments based on
1	Active RF Devices
2	Passive RF Devices
3	Microwave Measurement
4	MIC Components

7th Semester

ET1403	Principles of Image Processing	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Learn the fundamentals of digital image processing algorithms. 2. Learn the algorithms of spatial and frequency domain filtering. 3. Learn segmentation, restoration and compression of digital images through various algorithms 4. Study the performance of digital images in frequency domain	Students will be able to 1. Apply basic image processing algorithms for image enhancement. 2. Apply filtering techniques in spatial and frequency domain. Explain noise models and apply degradation process for image restoration 3. Implement the algorithms for image segmentation and compression 4. Describe various image transform techniques

UNIT-1:

Digital Image fundamental

Fundamental steps and components of an image processing system, elements of visual perception, Image formation and acquisition, Image sampling and quantization, some basic relationship between the pixels, mathematical tools used in digital image processing.

Intensity Transformation

Background, Some basic intensity transformation technique, Histogram Processing

08Hrs

UNIT-2:

Filtering in spatial and frequency domain

Spatial Filtering: Fundamentals,Smoothing linear filters, order statistics(nonlinear) filter.

Sharpening Filtering: Foundation, Laplacian, Unsharp masking, High boost filtering and Gradient.

Filtering in Frequency Domain:

Introduction to Fourier transform and frequency domain, Smoothing frequency domain filters, sharpening frequency domain filters, properties of Fourier transform, homomorphic filtering.

08Hrs

UNIT-3

Image Restoration

Image degradation/restoration process, noise model, restoration in presence of noise, periodic noise reduction, linear, position invariant degradation, estimating degradation function, Inverse filtering, Wiener filtering, constrained least squares filtering, geometric mean filter.

08Hrs

UNIT-4:

Image Segmentation

Fundamentals, Detection of discontinuities, Edge linking and boundary detection, Thresholding: Foundation, basic global thresholding, optimal global thresholding, multiple thresholds, variable thresholding, multivariablethresholding. Region based segmentation: Formulation, region growing, split and merge

08Hrs

UNIT-5

Image Transforms

2-D FFT, Properties, Discrete cosine Transform , Discrete sine transform, Hadamard Transform,, Haar transform, Slant transform, Hoteling transform

08Hrs

UNIT-6:

Image compression, Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.

08Hrs

7th Semester

ET1403	Principles of Image Processing	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text books:				
1	Digital Image processing	2nd Education, 2002.	R. C. Gonzalez & R. E. Woods	Addison Wesley/ Pearson education
2	Fundamentals of Digital Image processing	1989	A. K. Jain	PHI

Reference books:				
1	Digital Image processing using MAT LAB	Edition, PEA, 2004	Rafael C. Gonzalez, Richard E Woods and Steven L	Pearson
2	Digital Image Processing	3rd Edition, 2004	William K. Pratt, John Wiley	
4	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

7th Semester

ET1404	Lab. : Principles of Image Processing	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Learn the fundamentals of digital image processing algorithms.
2. Learn the algorithms of spatial and frequency domain filtering.
3. Learn segmentation, restoration and compression of digital images through various algorithms
4. Study the performance of digital images in frequency domain

Course Outcome
Students will be able to
1. Apply basic image processing algorithms for image enhancement.
2. Apply filtering techniques in spatial and frequency domain. Explain noise models and apply degradation process for image restoration
3. Implement the algorithms for image segmentation and compression
4. Describe various image transform techniques

Sr. No.	Experiments based on
1	Statistical properties of image and displaying histogram and profile
2	Histogram modification.
3	Image smoothing operations.
4	Edge detection.
5	Segmentation using threshold.
6	Region based segmentation.
7	Image transforms.

7th Semester

ET1405	PE III: Optical Communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Learn the principles of optical communication system with losses. 2. Understand Transceiver systems in optical communication. 3. Learn concept of active and passive devices with coding techniques 4. Understand measurements methods in optical communication	Students will be able to 1. Design and analyze an Optical Communication Systems with different types of losses. 2. Describe types of sources and receivers in fiber optics. 3. Explain splicing, connectors, couplers, and coding techniques. 4. Describe loss measurement methods in fiber optics

UNIT I : INTRODUCTION TO OPTICAL FIBERS

Evolution of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi modefibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure. Electromagnetic wave equation in step index and graded index fibers Modes and Power flow in fibers

06Hrs

UNIT II : SIGNAL DEGRADATION IN OPTICAL FIBERS

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides – Information Capacity determination – Group Delay – Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers – Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers – Mode Coupling – Design Optimization of SM fibers – RI profile and cut-off wavelength

06Hrs

UNIT III : FIBER OPTICAL SOURCES

Direct and indirect Band gap materials – LED structures – Light source materials – Quantum efficiency and LED power, Modulation of a LED, Laser Diodes – Modes and Threshold condition – Rate equations – External Quantum efficiency – Resonant frequencies – Laser Diodes structures and radiation patterns – Single Mode lasers – Modulation of Laser Diodes, Temperature effects, Source launching and coupling. Fabry Perot cavity Quantum laser

06Hrs

UNIT IV : FIBER OPTICAL RECEIVERS

PIN and APD diodes – Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise – Comparison of Photo detectors – Fundamental Receiver Operation – pre-amplifiers - Error Sources – Receiver Configuration – Probability of Error – The Quantum Limit

06Hrs

UNIT V : POWER LAUNCHING AND COUPLING IN DIGITAL TRANMISSION SYSTEM

Source to fiber power launching – Fiber to Fiber Joints – Fiber Splicing and connectors Line Coding - Error correction– Noise Effects on System Performance

06 Hrs

UNIT VI : MEASUREMENT IN OPTICAL FIBERS

Attenuation, Time domain dispersion and Frequency domain dispersion, NA measurement Refractive index profile and optical source characteristic measurements, OTDR, eye pattern

06 Hrs

Text books:				
1	Optical Fiber Communication	2008	Gerd Keiser	McGraw-Hill International, Singapore
2	Optical Communication, Principles and Practice.	1992	J.Senior	
Reference books:				
1	Optical Communication System		J. Gower	Prentice Hall of India
2	Fiber-Optic Communication System	3rdEdition	GovindAgrawal	John Willy & Sons

7th Semester

ET1406	Lab. : PE III: Optical Communication	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Learn the principles of optical communication system with losses.
2. Understand Transceiver systems in optical communication.
3. Learn concept of active and passive devices with coding techniques
4. Understand measurements methods in optical communication

Course Outcome
Students will be able to
1. Design and analyze an Optical Communication Systems with different types of losses.
2. Describe types of sources and receivers in fiber optics.
3. Explain splicing, connectors, couplers, and coding techniques.
4. Describe loss measurement methods in fiber optics

Sr. No.	Experiments based on
1	Digital and analog link using optical fiber
2	Fiber Attenuation
3	Optical Sources Characteristics
4	Fiber Bandwidth/ Data Rate
5	Digital transmission in optical communication
6	Measurement in optical fiber

7th Semester

ET1407	PE III: Microwave Integrated Circuits	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. To understand the various microwave Integrated circuits components 2. Develop the hands-on Trainer Kits of MIC. 3. To Learn the design of microstrips circuits in low and High Power circuits 4. To understand Hybrid MIC's & Monolithic MIC s fabrication techniques.	Students will be able to 1. Identify and describe the different MIC components. 2. Design and analyze Microwave Integrated circuit and various Microstrip antennas 3. Analyze the design of microstrips circuits in low and High Power circuits. 4. Analyze Hybrid MIC's & Monolithic MICs fabrication techniques.

UNIT-1:
Micro strip line:
Analysis using conformal transformation and Hybrid mode method. Characteristic impedance, Guide wavelength and loss, Slot line – Wave-guide analysis, coupling coaxial and micro strip lines Coplanar line: analysis using conformal transformation and Hybrid mode method

06 Hrs

UNIT-2:
Micro strip line devices:
Directional couplers, Micro strip coupler and branch-line couplers, even and odd mode analysis, coupling coefficient and bandwidth. Impedance transformers and filters, Lumped elements for MIC design and fabrication of inductors, resistors and capacitors, Non-reciprocal components, micro strip circulators, isolators, phase shifters

06 Hrs

UNIT-3:
Micro strip Antennas:
Radiation mechanism, radiation fields, patch antennas, traveling wave antennas, slot antennas, excitation techniques, surface waves

06 Hrs

UNIT-4:
Design of micro strip circuits:
High power circuits – Transistor Oscillator, step recovery diode frequency multiplier, avalanche diode oscillator, PIN diode switch, low power circuits Schottky diode, Balanced mixer, parametric amplifier, PIN diode limiter, Diode phase shifter

06 Hrs

UNIT-5:
Hybrid MICs:
Dielectric Substrates, thick film technology, thin film technology, methods of testing, encapsulation of devices, mounting

06 Hrs

UNIT-6:
Monolithic MICs fabrication:
Epitaxial growth, Diffusion, Ion implantation, Electron Beam technology for pattern delineation

06 Hrs

7th Semester

ET1407	PE III: Microwave Integrated Circuits	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text books:				
1.	Antennas and Radio Wave Propagation	1985	R.E.Collin	McGraw Hill Publishers
2.	Microwave Devices and Circuits	Third Edition	Samuel Liao	Prentice-Hall of India Ltd
3.	**Radio Frequency and Microwave Electronics**		**M.M. Radmanesh**	**2001, Pearson Education Asia,**
4.	Microwave Engineering	Third Edition	David Pozar	Wiley Ind. Pub.
5.	Strip line Transmission Line for MIC		BhartiBhat, S. K. Koul	New Age International

Reference books:				
1	Microwave Integrated Circuits	1974	K. C. Gupta and Amarjit Singh	Wiley East. Ltd
2	Micro strip Antennas	1980	I.J. Bahl and P. Bhartia	Artech House
3	Strip line Transmission Line for MIC		BhartiBhat, S. K. Koul	New Age International

7th Semester

ET1408	Lab. : PEIII: Microwave Integrated Circuits	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. To understand the various microwave Integrated circuits components
2. Develop the hands-on Trainer Kits of MIC.
3. To Learn the design of microstrips circuits in low and High Power circuits
4. To understand Hybrid MIC's & Monolithic MIC s fabrication techniques.

Course Outcome
Students will be able to
1. Identify and describe the different MIC components.
2. Design and analyze Microwave Integrated circuit and various Microstrip antennas
3. Analyze the design of microstrips circuits in low and High Power circuits.
4. Analyze Hybrid MIC's & Monolithic MICs fabrication techniques.

Sr. No.	Experiments based on
1	Directional coupler
2	Power Divider
3	Measurement of antenna pattern : parabolic antenna, slot antenna, Horn antenna
4	A micro strip antenna
5	Ferrite Devices / Components
6	Micro strip Filters.

7th Semester

ET1409	PE III: Communication Networks	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand Networks, Network topologies and service primitives. 2. Learn basics of LAN, MAN, WAN. 3. Learn the structure and applications of connecting devices. 4. Understand OSI and TCP/IP architecture. 5. Comprehend Network applications and Network Securities.	Students will be able to 1. Apply LAN structure to design data communication system. 2. Detect Data transmission errors in communication networks. 3. Describe and compare data transmission protocols. 4. Describe and compare data and network security protocols.

UNIT I :
Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model,

05 Hrs

UNIT II :
LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN

06 Hrs

UNIT III :
Physical layer and data link layer: transmission media, PSTN.
Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.

06 Hrs

UNIT IV :
Network layer and transport layer: network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways

06 Hrs

UNIT V: Network Applications
Application layer: domain name system, electronic mail system, multimedia, real time transport protocol, electronic mail, world wide web.

06Hrs

UNIT VI: Network Security:
Network security cryptography, secrete key, public key, digital signature, e-mail security, web security, communication security.

06Hrs

Text books:				
1	Computer networks	3rd Edition	Tanenbaum	*Amazon*
2	Computer communication	2003	by W. Stanlling	Prentice Hall
3	Data Communication and Networking	4th Edition	Forouzan	McGrawHill
Reference books:				
1	Telecommunication switching systems and networks	Paperback	by vishwanathan	PHI
2	Computer Networks	Third Edition 2003	Larry Peterson, Bruce Davie	MKP

7th Semester

ET1410	Lab. : PE III: Communication Networks	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Understand Networks, Network topologies and service primitives.
2. Learn basics of LAN, MAN, WAN.
3. Learn the structure and applications of connecting devices.
4. Understand OSI and TCP/IP architecture.
5. Comprehend Network applications and Network Securities.

Course Outcome
Students will be able to
1. Apply LAN structure to design data communication system.
2. Detect Data transmission errors in communication networks.
3. Describe and compare data transmission protocols.
4. Describe and compare data and network security protocols.

Sr. No.	Experiments based on
1	Network design LAN, MAN ,WAN
2	PC to PC communication using RS-232 port
3	Sliding window protocol
4	Wireless TCP and UDP protocols
5	Bluetooth
6	Network security cryptography
7	Communication networks like Wi-Fi, Wimax
8	Routing protocols

7th Semester

ET1431	PE III: Analog VLSI Circuits	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand the current trends in Analog VLSI technologies and study the various design methods of MOS amplifier. 2. Study the single stage amplifier with various loads. 3. Understand the basic concept of Differential amplifier and operational amplifier design. 4. Study the basics of switch capacitor and analog layout design	Students will be able to 1. Apply mathematical methods to analyze Analog VLSI circuits and design MOS amplifier to improve the gain and operating frequency range. 2. Design single stage amplifier with various loads and analyze the various characteristic. 3. Design and analyze the differential amplifier and Op-AMP with two stage & Cascade stage technique. 4. Explain basics of switch capacitor and design layout of analog circuits.

UNIT-1: MOS Device Physics
General Consideration: MOSFET as a switch, MOSFET structure, MOS symbols; MOS Operation and I/V Characteristics: Threshold voltage, Derivation of I/V characteristics; Second order effects; MOS capacitances; MOS Small-Signal Model

06Hrs

UNIT-2: Analog CMOS Subcircuits
MOS Diode/Active Resistor; Current Sinks and Sources: Simple MOS, Cascade MOS, Bootstrapped MOS, Regulated Cascoded; Current Mirrors: Simple, Cascode, Wilson, Wilder; Voltage and current references; Supply and Temperature independent biasing techniques.

06 Hrs

UNIT-3: Single-Stage Amplifiers
Basic Concepts; Common-Source Stage: Common-Source Stage with Resistive Load, CS Stage with Diode-Connected Load ,CS Stage with current source load, CS Stage with Triode Load , CS Stage with Source Degeneration; Source Follower, Common-Gate Stage; Cascade Stage: Folded Cascade

06 Hrs

UNIT-4: Differential Amplifiers
Single-ended and Differential Operation; Basic Differential Pair: Qualitative and Quantitative Analysis; Common mode response; Differential pair with MOS loads; Gilbert cell.

06Hrs

UNIT-5 : CMOS Operational Amplifiers
Design of CMOS Op-Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Cascade Op Amps, Micropower Op Amps.

06Hrs

UNIT-6:
Special Topics in Analog VLSI
Bandgap References, Switch-Capacitor Circuits and Switch Capacitor Filter, Comparators
Layout And Packaging
General layout Consideration: Design rules, Antenna effect; Analog Layout Techniques; Packaging.

06 Hrs

7th Semester

ET1431	PE III: Analog VLSI Circuits	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text books:				
1	Design of Analog CMOS Integrated Circuits	First Edition	BehzadRazavi	TATA McGRAW HILL
2	CMOS Analog Circuit Design	2nd Edition	Philip Allen and Douglas Holberg	Oxford University Press
Reference books:				
1	CMOS Circuit Design, Layout, and Simulation,	3rd Edition 2010	R. Jacob Baker	JonhWiely publication
2	VLSI Design Techniques for Analog and Digital Circuits	Third edition, 2008	Randall Geiger, Phillip Allen, Noel Strader	Tata McGraw Hill

7th Semester

ET1432	Lab. : PE III: Analog VLSI Circuits	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Understand the current trends in Analog VLSI technologies and study the various design methods of MOS amplifier.
2. Study the single stage amplifier with various loads.
3. Understand the basic concept of Differential amplifier and operational amplifier design.
4. Study the basics of switch capacitor and analog layout design

Course Outcome
Students will be able to
1. Apply mathematical methods to analyze Analog VLSI circuits and design MOS amplifier to improve the gain and operating frequency range.
2. Design single stage amplifier with various loads and analyze the various characteristic.
3. Design and analyze the differential amplifier and Op-AMP with two stage & Cascade stage technique.
4. Explain basics of switch capacitor and design layout

Sr. No.	Experiments based on
1	MOS I/V characteristics
2	Design MOS amplifier and consider various second order effects.
3	Single Stage Common Source Amplifier
4	Cascode Amplifier
5	Current Source and Sink
6	Design Current Mirrors
7	Design Differential Amplifier
8	Design two stage Op Amp
9	Design Comparators
10	Layout of Single Stage amplifier

7th Semester

ET1413	**Industrial Training/CRT**	**L = 0**	**T = 0**	**P = 0**	**Credits = 2**

Evaluation Scheme	**Continuous Evaluation**	**TA**	**Total**	**ESE Duration**
		100	**100**	

*** Evaluation Based on Seminar / Report.**

Course Learning Objective Students should be able to	**Course Outcomes** Students will be able to
1. Gain profound knowledge about English language. . 2. Learn logical and critical reasoning skills 3. Know mathematical formulae for quantitative reasoning 4. Acquire sound technical knowledge	1. Write effectively in English. 2. Analyze logically and critically on different issues. 3. Solve quantitative problems effectively. 4. Apply fundamentals of Electronics and Telecommunication for practical applications.

7th Semester

ET1414	Project Phase –I	L = 0	T = 0	P = 4	Credits = 4

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	2 Hrs

Course Objective
Students should be able to
1. Understand the project problem statement by doing the literature survey.
2. Define and prepare road map to get a desired output.
3. Gain knowledge about the project.
4. Improve the communication skills and stage daring through effective presentation.
5. Write effective reports and design documentation.

Course Outcome
Students will be able to
1. Identify, formulate and analyze complex engineering problems through literature survey.
2. Apply knowledge to assess health, social, safety and environmental issues.
3. Implement core /multidisciplinary/ industry based electronics projects in cost effective manner.
4. Communicate technical details effectively

8th Semester

ET1415	Antenna Theory and Design	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Learn the basic principles and of antenna parameters.
2. Design and analyze dipole antennas.
3. Design and analyze loop antennas & Arrays.
4. Design and Analyze Travelling wave & Broadband Antennas.
5. Design & Analyze aperture, Reflector and Patch Antennas.
6. Study different antenna measurements

Course Outcome

Students will be able to

1. Evaluate various parameters of antennas.
2. Design and Analyze performance parameters of various antennas.
3. Analyze various antenna measurements techniques.
4. Design and analyze various antenna Arrays.

UNIT I : BASIC ANTENNA CONCEPTS:

Types of antennas, Radiation mechanism, Beam solid angle, radiation intensity, Directivity, effective aperture, beam efficiency, Antenna field zones, Polarization, impedance, bandwidth, impedance, effective length, antenna temperature

08Hrs

UNIT II : DIPOLE ANTENNA RADIATION:

Scalar and vector potentials, retarded potentials, field due to a current elements, power radiated and radiation resistance for field due to a dipole, power radiated and radiation resistance, Earth curvature, Half wave dipole antenna radiated fields of short dipole, small loop and helical Antenna, Radiation resistance, Directivity and Design Feature. Half wave dipole: radiated fields and other feature

08Hrs

UNIT III : LOOP ANTENNAS AND ARRAYS:

circular loop ,polygonal loop and ferrite loop antenna**,** circular loop antenna with constant current, Two element array, linear array, N- element array ,uniform ,broad side, end fire ,Non uniform Amplitude antenna array**,** planar and circular array

08Hrs

UNIT IV :

TRAVELING WAVE AND BROAD BAND DIPOLE

Introduction, traveling wave antenna, long wire, V antenna, rhombic antenna, Broadband antennas, Helical antenna, Electric-Magnetic Dipole, Yagi-Uda array of linear Elements, Yagi array of loops.

08Hrs

UNIT V: SPECIAL ANTENNAS:

Aperture Antennas: Rectangular aperture, Circular aperture, Babinet's principle, Horn antenna: conical horn, corrugated Horn, Multimode horn reflector antenna: plane reflector, corner reflector, corner, parabolic, spherical, Patch Antenna

08Hrs

UNIT VI: ANTENNA MEASUREMENTS:

Antenna Range, Radiation Pattern, Gain Measurement, Directivity Measurement, Radiation Efficiency, Impedance Measurement, Current Measurement, Polarization Measurement

08Hrs

Text books:				
1	Antenna Theory Analysis and Design Technology	1982 Third edition	Balanis E.S.	Wiley India
2	Antennas	II edition 1988	John D.Krauss	McGraw-Hill International edition
Reference books:				
1	Electromagnetic waves and Radiating systems	1993	Edward C.Jordan, Keith G.Balmain	Prentice Hall of India 1Td
2	Antennas and Radio Propagation	1985	R.E. Collins	McGraw-Hill

Chairperson		Version	1.01	Applicable for
Dean (Acad. Matters)		Date of Release	May 2017	AY 2017-18 Onwards

8th Semester

ET1416	Lab. : Antenna Theory and Design	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Learn the basic principles and of antenna parameters.
2. Design and analyze dipole antennas.
3. Design and analyze loop antennas & Arrays.
4. Design and Analyze Travelling wave & Broadband Antennas.
5. Design & Analyze aperture, Reflector and Patch Antennas.
6. Study different antenna measurements

Course Outcome
Students will be able to
1. Evaluate various parameters of antennas.
2. Design and Analyze performance parameters of various antennas.
3. Analyze various antenna measurements techniques.
4. Design and analyze various antenna Arrays.

Sr. No.	Experiments based on
1	Dipole
2	Half Wave Dipole
3	Monopole
4	Yagi Antenna
5	Boardside array
6	Endfire array
7	Loop Antenna
8	Crossed Dipole
9	Lock Periodic Antenna
10	Slot Antenna
11	Helix Antenna
12	Microstrip Antenna

8th Semester

ET 1417	CMOS VLSI Design	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand and study analysis of the MOS transistor with first order and second order effects. 2. Study the static and dynamic operating principles of inverter circuit. 3. Understand the different CMOS implementation process. 4. Learn switching characteristics and interconnection effects of MOS device. 5. Study advanced techniques in CMOS logic	Students will be able to 1. Analyze the characteristics of MOSFET 2. Analyze the voltage transfer characteristics of MOS inverters. 3. Apply the LAMBDA design rules for design of optimized CMOS circuits and describe the process of fabrication for CMOS circuits 4. Analyze switching characteristics and interconnection effects of MOS device 5. Design and analyze CMOS logic circuits.

UNIT-1: Basic MOS Device Physics
General Consideration: MOS as a switch, MOS Structure & Symbols, MOS I/V Characteristics, MOS Enhancement Transistor, Second order effect of MOS: Body Effect, Junction Effect, Gate Leakage Effect, Channel Length Effect, Tunneling Effect, Velocity Modulation, Mobility Variation, Small Signal Modeling of MOSFETs.

08 Hrs

UNIT-2: MOSFET Inverter Characteristics
Resistive Load Inverter, Inverter with n type MOSFET load, Inverter with Active Load, CMOS Inverter, Principle of operation & DC Characteristics, Tri-stated Inverter, Noise Margin Calculation, Logic Design with MOSFETs. Compound Gates in CMOS.

08 Hrs

UNIT-3: Fabrication & Layout of CMOS IC
Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process. CMOS Technology: N-well, P-well, Twin Tub Process, Silicon on Insulator (SOI) Process, Layout Design Rules, Physical Design of Logic Gates, Euler's Path, Stick Diagram, Layout, Latch-up Effect.

08Hrs

UNIT-4: Switching Characteristics & Interconnection Effect
MOS Device Capacitance Estimation, Switching Characteristics: Rise Time, Fall Time, Propagation Delay, Delay Estimation: Propagation Delay, Contamination Delay, Power Dissipation in CMOS: Static & Dynamic Power Calculation, Charge Sharing, Fan-in, Fan-out.

08 Hrs

UNIT-5 : Combinational & Sequential MOS Logic Circuits
Combinational circuit design, static CMOS, Transmission Gate Circuits(TG),Pass Transistor, Multiplexers, Logic Design Using Pass Transistor and TG. Ratio-ed Logic circuits, sequential circuit, Latches and Flip Flops,, Clock Flip- Flop.

08Hrs

UNIT-6: Advanced Techniques in CMOS Logic Circuits
Complementary Static CMOS, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, Zipper Logic, Clocked CMOS Logic, CVSL, Bi-CMOS Logic Family.

08Hrs

8th Semester

ET 1417	CMOS VLSI Design	L= 4	T = 0	P = 0	Credits = 4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text books:				
1	Introduction to VLSI Circuits and Systems	First Edition	John P. Uyemura	Wiley Publication
2	Principle of CMOS VLSI Design	2nd Edition, 1994	Neil H. E. Weste, K. Eshraghian	Addison Wesley VLSI Series
Reference books:				
1	CMOS VLSI Design	3rd Edition, 2005	Pucknell , K. Eshraghian	Prentice Hall
2	CMOS Digital Integrated circuits Analysis and Design	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici	TataMcGraw Hill
3	Design of Analog CMOS Integrated Circuits	2001	Razavi, Behzod	McGraw Hill

8th Semester

ET1418	Lab. : CMOS VLSI	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Understand and study analysis of the MOS transistor with first order and second order effects.
2. Study the static and dynamic operating principles of inverter circuit.
3. Understand the different CMOS implementation process.
4. Learn switching characteristics and interconnection effects of MOS device.
5. Study advanced techniques in CMOS logic

Course Outcome
Students will be able to
1. Analyze the characteristics of MOSFET
2. Analyze the voltage transfer characteristics of MOS inverters.
3. Apply the LAMBDA design rules for design of optimized CMOS circuits and describe the process of fabrication for CMOS circuits
4. Analyze switching characteristics and interconnection effects of MOS device
5. Design and analyze CMOS logic circuits.

Sr. No.	Experiments based on
1.	Introduction to EDA Tool.
2.	To study and Plot the transfer characteristics of NMOS and PMOS using EDA Tools
3.	To study and Plot the transfer characteristics of CMOS Inverter using EDA Tools.
4.	To perform the analysis of Basic logic Gates like NAND, NOR, AND, OR using gate level design.
5.	To perform the Gate Level Analysis of Pass Transistor and Transmission Gate.
6.	To study the Gate Level Analysis of Half Adder and Half Subtractor.
7.	To study the Gate Level Analysis of Full Adder and Full Subtractor.
8.	To study the Gate Level Analysis of 4:1 Multiplexer using CMOS and Transmission Gate.
9.	To perform the analysis of Resistive Load Inverter and Pseudo NMOS Inverter.
10.	To study and Design a D Flip-flop.
11.	Mini-project. (For Example: Look Ahead Carry Adder, 4 Bit Parallel Adder)

8th Semester

ET1419	PE IV: Power Electronics	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand the characteristics of different power electronics switches and selection of components for different applications. 2. Learn different types of power devices 3. Understand the switching behavior of power electronics circuits such as DC/DC converters. 4. Learn the role of different type of inverters	Students will be able to 1. Describe and characterize power electronics devices 2. Describe and Analyze 3 Phase rectifier circuit. 3. Describe and Analyze converters, cyclo converters and inverters. 4. Explain protection circuits.

UNIT I :
Power Semiconductor Diodes and Circuits, control Characteristics of power devices, power modules, power diodes, reverse recovery, series, shunt connected diodes, Diode Rectifiers—single phase, three phase rectifiers, bride rectifiers, design of rectifiers

06Hrs

UNIT II :
Power Transistors, Switching characteristics of BJT, Power MOSFETs, IGBTs, limitations, Power Thyristors

06Hrs

UNIT III:
Controlled Rectifiers: phase control converter, single phase, three phase converters, AC Voltage Controllers. Principle of ON-OFF control, Phase control, Single phase controllers, three phase controllers, cyclo-converters

06Hrs

UNIT IV :
Turn on Turn off mechanism SCR, Commutation methods of SCR. DC-DC Converters, Step up, stepdown, thyrister Choppers, design of choppers

0**6Hrs**

UNIT V :
Resonant Pulse Inverters—Series, parallel, resonant inverters, Class E resonant inverter, Pulse width Modulated Inverters: Principle, single phase, Multiple phase, PWM Forced commuted inverters, current source inverters, design of inverter.

06Hrs

UNIT VI:
Power Supplies, SMPS, SM ac power supplies, Gate Drive Circuits- Protection of Devices and Circuits Snubber, reverse recovery transients, Introduction to AC and DC drives.

06Hrs

Text books:				
1	Power Electronics:Circuits,Devices and Applications	Second Edition 1993	M. Rashid	PHI
Reference books:				
1	Power Electronics and its application	Second Edition, 2004	Alok Jain	Penram International Publishing Pvt Ltd

8th Semester

ET1420	PE IV : Wireless Mobile Communication Systems	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to
1. Study cellular concepts and techniques to improve capacity in cellular system.
2. Understand mobile radio environment and its different parameters.
3. Study fundamentals of equalization, diversity & its techniques.
4. Understand the operating principles of various wireless systems & standards.
5. Learn the fundamentals of wireless networking.

Course Outcome

Students will be able to
1. Describe the evolution of wireless systems & cellular standards.
2. Apply the concepts of frequency reuse for design of cellular systems and capacity improvement in cellular systems.
3. Quantify causes and effects of path loss and signal fading on received signal characteristics and use various techniques to improve signal quality and link performance.
4. Analyze GSM & CDMA systems & understand the fundamentals of wireless networking.

UNIT I : Introduction to Wireless Communication Systems:

Evolution of Mobile Radio Communications, Mobile Radio Systems around the world. Examples of Wireless Communication Systems, Comparison of common wireless communication systems, trends of cellular radio and personal communications, Second generation (2G) cellular Networks, Third generation (3G) cellular Networks, wireless local loops and LMDS

06Hrs

UNIT II : The Cellular Concept :

Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system

06Hrs

UNIT III : Mobile Radio Propagation- Large & Small Scale Path Loss & Fading:

Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling. Small Scale Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types Of Small Scale Fading, Rayleigh &Rician Distribution

06Hrs

UNIT IV : Equalization & Diversity:

Fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver

06Hrs

UNIT V: Wireless Systems and Standards:

GSM- global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard (IS-95)

06Hrs

UNIT VI: Wireless Networking:

Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signaling, Signaling System No 7.An Example of SS7, SIP -Global Cellular Network Interoperability

06Hrs

Text books:

1	Wireless Communication – Principles and practice	Second edition	by T S. Rappaport	(Prentice Hall PTR, upper saddle river, New Jersey.)

Reference books:

1	Wireless digital communication	1995	by KamiloFeher	PHI
2	Mobile Communications Design fundamentals	1993	by William C. Y. Lee	John Willey
3	Mobile Cellular Communication	2005	by W .C .Y. Lee	McGraw Hill

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

4	The Mobile Radio Propagation channel	1996	by J.D. Parson	John Willey

8th Semester

ET1433	PE IV : Satellite Communication & Radar Engineering	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective	Course Outcome
Students should be able to 1. Understand propagation of satellite with satellite services. 2. Understand the concept of Earth Station Technology. 3. Understand the principles of Radar and effect of weather conditions on Radar. 4. Learn the concept of Radar antennas, and Radar Receivers.	Students will be able to 1. Explain satellite System and Services in propagation of satellite. 2. Describe various systems in Earth Station. 3. Analyze the effect of weather conditions on Radar Systems. 4. Describe and apply the Radar range equation and Doppler principle to detect moving targets and cluster.

UNIT I : Introduction: Origin of Satellite communication, Current state of satellite communication. Orbital aspect of satellite communication: Orbital mechanism, equation of orbit, locating satellite in orbit, orbital elements, and orbital perturbation. Space craft subsystem: Attitude and orbit control system, Telemetry tracking and command power system, and communication subsystem. Satellite link design: System noise temperature and T / T ratio, down link design, domestic satellite system, uplink design, design of satellite link for specified (C / N).

06Hrs

UNIT II : Propagation on satellite: Earth's path – propagation effects, atmospheric absorption, Scintillation effects, Land and Sea multipath, Rain and ice effects, Rain drop distribution, calculation of attenuation. Rain effects on Antenna noise temperature

06Hrs

UNIT III :Earth Station technology: Earth Station design; antennas tracking, LNA, HPA, RF multiplexing, factors affecting orbit utilization, tracking, equipment for earth station.

06Hrs

UNIT IV :
RADAR Range Equation, CW and FM modulated RADAR, MTI and Pulse Doppler RADAR, Tracking RADAR

06Hrs

UNIT V:
RADAR antennas, parabolic reflector, Scanning field reflector, Lens **antennas**.
RADAR Receivers, Displays and Duplexer, Detection of RADAR; signals in noise

06Hrs

UNIT VI:
RADAR clutter, Effects of weather on RADAR, Detection of targets in Precipitation, Synthetic Aperture RADAR, HF over the Horizon RADAR.

06Hrs

Text books:				
1	Introduction of RADAR system		Skolnik	McGraw Hill
2	Satellite Communication		Dennis Roddy	
Reference books:				
1	Satellite Communications		VarshaAgrawal Anil	Wiley India Pvt Ltd
2	Satellite Communication Systems		M. Richharia	Mcgraw Hill Telecommunications
3	Radar Systems Principle		Harold R.Raemer	

8th Semester

ET1434	PE IV: Bio-medical Instrumentation	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective
Students should be able to
1. Know the physiology of heart , brain and skin.
2. Understand the basic principles of physical parameters such as blood pressure, heart rate and body temperature.
3. Comprehend the working principle of recording instruments such as ECG,EEG EMG and phonocardiograph.
4. Comprehend the working principle of instrumentation for Blood Pressure, Blood flow , Pulse oximeters, Heart rate , respiration rate ,temperature and hearing Aid.
5. Know the physical concepts of radiography related to X rays.
6. Learn working principles of advanced medical imaging system

Course Outcome
Students will be able to
1. Describe and analyze various parameters using ECG, EEG EMG and phonocardiograph.
2. Describe and analyze various parameters such as -Blood Pressure, Blood flow rate, Pulse rate, Heart rate, respiration rate and temperature and hearing ability.
3. Explain the working principle of radiology equipments
4. Describe working principles of advanced medical imaging systems.

Unit 1 : Cell as bio electric generator:
Heart and Circulatory system, ECG, Brain and nervous system, EEG, Skeletal , Muscle and Skin Systems, EMG
06Hrs

Unit 2 : Physical Measurement
Blood pressure and Flow, Heart rate and Heart sounds, Respiration and temperature
06Hrs

Unit 3 : Recording Instrumentation
Electrodes, Basic Instrumentation, Electrocardiograph, Electroencephalograph Electromyography and Phonocardiograph.
06Hrs

Unit 4 : Measuring Instrumentation
Transducers, Blood Pressure, Blood flow and Pulse oximeters, Heart rate , respiration rate and temperature meters, Audiometer and hearing Aid
06Hrs

Unit 5 : X-rays
X-ray Physics, Fluoroscopy and radiography, X-ray tubes and X-ray Equipments
06Hrs

Unit 6 : Advanced Imaging Systems
Ultrasonic scanner, CT scan, MRI, Endoscope and Electron microscope
06Hrs

Text books:				
1	Biomedical Instrumentation and Measurements	2007	Prentice Hall of India, New Delhi	Cromwell
2	Biomedical Instrumentation	2006	Anuradha Agencies Publishers, Kumbakonam	Arumugam.M.
3	Handbook of Biomedical Instrumentation	2003	Prentice Hall of India, New Delhi	R.B.Khandpur
Reference books:				
1	Introduction to Biomedical Equipment Technology	2004	Pearson Education India, Delhi	Joseph J. Carr and John M. Brown
2	Standard Handbook of Biomedical Engineering & Design	2003	McGraw-Hill Publisher, New York	Myer Kutz
3	Medical Instrumentation – Application & Design	2009	John Wiley and sons Inc, Netherlands	Webster
4	Medical Electronics	2003	ISTE Excel book	Patil A. G.

8th Semester

ET1437	PE IV : Display Technology	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able

1. To provide the fundamental knowledge and explore specifications for understanding concepts of different display technologies related to manufacturing techniques and materials selection
2. To understand properties of materials modes and Luminescence materials
3. To understand different displays and addressing of displays
4. To learn backplane technology and driver integration.

Course Outcome

Students will be able to

1. Identify and describe different display technologies, manufacturing process and specifications of display technology.
2. Explain and analyze properties of Luminescence materials
3. Explain design parameters for displays and analyze matrix addressing.
4. Explain backlight unit technologies and elaborate applications of displays

UNIT I : Overview of display technologies, information capacity of displays, introduction to different flat panel display technologies. Fundamentals of Photometry, Colorimetry, CIE colorimetry

06Hrs

UNIT II : Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, driving power, efficiency, speed, memory and storage, degradation, resolution, addressability, physiological factors, and measurement instrumentation;

06Hrs

UNIT III : Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, processes responsible for the transfer of energy in luminescent materials, chemistry and preparation of luminescent materials, and emission properties of the prepared materials;

06Hrs

UNIT IV : Basics of matrix addressing of displays: active and passive matrix.
Technical discussion of display technologies: LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.

06Hrs

UNIT V: Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration.
Back Light Unit Technologies (CCFL, LED, QD, etc.)

06Hrs

UNIT VI: Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes

06Hrs

Text books:				
1	Liquid crystal flat panel displays: manufacturing science & technology.	W. Mara	2012	Springer, Science & Business Media,
2	Introduction to Flat Panel Displays	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu		Wiley publications
Reference books:				
1	Liquid crystal displays: fundamental physics and technology.	R. H. Chen	2011	John Wiley and Sons
2	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	Vinod Kumar Khanna		CRC press

8th Semester

ET1422	PE V: Fuzzy Logic & Neural Network	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective
Students should be able to
1. Learn computing algorithms in Neural network and FLNN
2. Understand supervised and unsupervised algorithms in neural networks.
3. Understand operation of basic elements in fuzzy logic, fuzzy reasoning, operations and relations.
4. Learn design parameters for fuzzy logic controller and development of algorithms to solve real life applications

Course Outcome
Students will be able to
1. Analyze computing algorithms in Fuzzy logic and neural network.
2. Describe neural network architecture and apply supervised/unsupervised algorithms for pattern recognition/classification problems.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4. Prove and Apply fuzzy arithmetic operations and relations for problem solving.
5. Apply Fuzzy implications and Design Fuzzy logic controller for solving real life problems

UNIT I : Introduction of neural networks, NN Architecture Neural learning and laws, Applications of ANN Evaluation of network,
Supervised Learning : Single layer network : MP neuron, Perceptron, Perceptron training algorithm, LMS algorithm , ADALINE

06Hrs

UNIT II : Supervised Learning :
Multiplayer network: Multilevel Discrimination, Backpropogation Algorithm, Setting the parameter values, Accelerating the learning Process, MADALINE, Recurrent Network, RBF networks

06Hrs

UNIT III : Unsupervised Learning :
Winner Take Network, ART Networks, self-organizing feature maps, Associate Models

06Hrs

UNIT IV :
Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conforms

06Hrs

UNIT V:
Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations, fuzzy relations, projections and cylendric extensions, binary fuzzy relations, fuzzy equivalence, compatibility and ordering relations, fuzzy morphism

06Hrs

UNIT VI:
Fuzzy controllers, Defuzzification Methods , Fuzzy Inference Techniques, applications of fuzzy logic in pattern recognition and image processing

06Hrs

Text books:				
1	Fuzzy sets and Fuzzy logic	1995	by George Klir, Bo Yuan	PHI
2	Elements of Artificial Neural Network	1997	K. Mehrotra	MIT Cognet
Reference books:				
1	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3	Fuzzy Logic & Applications	2003	J. Ross, TMH/Mc	McGraw Hill
4	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, VijayalaxmiPai	PHI Timothy Ross

8th Semester

ET1423	Lab. : PE V: Fuzzy Logic & Neural Network	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Learn computing algorithms in Neural network and FLNN
2. Understand supervised and unsupervised algorithms in neural networks.
3. Understand operation of basic elements in fuzzy logic, fuzzy reasoning, operations and relations.
4. Learn design parameters for fuzzy logic controller and development of algorithms to solve real life applications

Course Outcome
Students will be able to
1. Analyze computing algorithms in Fuzzy logic and neural network.
2. Describe neural network architecture and apply supervised/unsupervised algorithms for pattern recognition/classification problems.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4. Prove and Apply fuzzy arithmetic operations and relations for problem solving.
5. Apply Fuzzy implications and Design Fuzzy logic controller for solving real life problems

Sr. No.	Experiments based on
1.	Learning Rules and Activation functions in NN
2.	MP Neuron, Hebb Neuron
3.	Perceptron/ LMS/Adaline
4.	Backpropogation Algorithm
5.	Unsupervised Learning:
6.	Fuzzy sets and representation of fuzzy sets
7.	Fuzzy numbers
8.	Arithmetic operation on fuzzy sets
9.	Fuzzy Relations
10.	Fuzzy Controller
11.	Application Development using NN and Fuzzy Logic

8th Semester

ET1424	PEV : R.F. Circuit Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Learn fundamentals of RF circuits and understand the use of HF component in design the RF circuit.
2. Study the bandwidth estimation techniques.
3. Learn the design of high frequency amplifier and the concept of CMOS technology in RF circuits.
4. Study the PLL, phase detector principle at high frequency

Course Outcome

Students will be able to

1. Apply the fundamentals of RF to design and analyze the RLC circuits at high frequency
2. Design and analyze different bandwidth estimation techniques.
3. Apply the knowledge of CMOS technology for design of supply independent bias circuit.
4. Design and analyze the parameters of HF power amplifier circuits
5. Describe and analyze Phase detectors

UNIT I :

Introduction, History of wireless Communication, Noncellular wireless Applications, Shannon , Modulations, Propagation, Parallel RLC Tank Circuit, Series RLC Circuit , RLC Network as Impedance Transformer ,Skin Effect, Resistor, Capactor, Inductor, Transformer

06Hrs

UNIT II :

MOSFET Physics, MOS Device Physics in Short Channel Regime , Other Effects, Link Between Lumped and Distributed Regime ,Driving Point impedance at iterated structures , Transmission line , Behavior of finite length Transmission line, Artificial lines

06Hrs

UNIT III :

Review of Smith Chart and S- Parameter, Bandwidth Estimation Techniques , Rise time , Delay , Open Circuit Time Constant , Short Circuit Time constant

06Hrs

UNIT IV :

Introduction to High Frequency Amplifier Design, Zeros as Bandwidth Enhancer , The shunt series Amplifier, Tuned Amplifiers, Neutralization and Unilateralization Cascaded Amplifiers, AM-PM Conversion

06Hrs

UNIT V:

Introduction to Voltage references and Biasing, Review of Diode Behavior, Diodes and Bipolar transistors in CMOS Technology Supply independent bias circuits, Band gap Voltage References, Amplifier linearity, Noise and Noise Figure analysis, Introduction to Mixers

06Hrs

UNIT VI:

Introduction to RF Power Amplifiers, Classification of Power Amplifiers, Modulation of Power Amplifiers, Introduction to Phase lock loops , Linear zed PLL Model, Phase Detector, Sequential Phase Detector, Loop Filters and Charge Pumps

06Hrs

Text books:				
1	The Design of CMOS Radio-Frequency Integrated Circuits	Second Edition	by Thomas H. Lee	The Design of CMOS Radio-Frequency Integrated Circuits
2	RF Circuit Design Theory and Applications		R. Ludwig & P. Bretchko	RF Circuit Design Theory and Applications
Reference books:				
1	Analysis and Design of Analog Integrated Circuits		By Paul R. Gray	Razavi

Chairperson		Version	1.01	Applicable for
Dean (Acad. Matters)		Date of Release	MAY. 2017	AY 2017-18 Onwards

8th Semester

ET1425	Lab. : PE V: R.F. Circuit Design	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Learn fundamentals of RF circuits and understand the use of HF component in design the RF circuit.
2. Study the bandwidth estimation techniques.
3. Learn the design of high frequency amplifier and the concept of CMOS technology in RF circuits.
4. Study the PLL, phase detector principle at high frequency

Course Outcome
Students will be able to
1. Apply the fundamentals of RF to design and analyze the RLC circuits at high frequency
2. Design and analyze different bandwidth estimation techniques.
3. Apply the knowledge of CMOS technology for design of supply independent bias circuit.
4. Design and analyze the parameters of HF power amplifier circuits
5. Describe and analyze Phase detectors

Sr. No.	Experiments based on
1	Importing the data files
2	Series RLC circuit
3	Parallel RLC circuit
4	High frequency amplifier design
5	High frequency filters design
6	RF Tuned Amplifier
7	RF Oscillator
8	RF Crystal Oscillator
9	IF Amplifier
10	RF Mixer

8th Semester

ET1426	PE V : Multimedia Communications	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Learn the basics of image data types, file formats and color models used for image and video
2. Understand various Fundamental concepts in video and digital audio
3. Get acquainted with various algorithms used for multimedia data compression
4. Learn basic concepts of multimedia communication networks.
5. Understand basic concepts of Content Based Retrieval in Digital Library

Course Outcome

Students will be able to

1. Describe and compare different color models and file formats used for video and audio.
2. Analyze and compare digital/ analog video signal and quantization techniques for digital audio signals.
3. Apply different compression scheme used for image and video
4. Describe and compare various multimedia networks communication protocols.
5. Explain content based image retrieval techniques

UNIT I :

Fundamental concepts in Text and Image: Multimedia and hypermedia, world wide web,overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video

06Hrs

UNIT II :

Fundamental concepts in video and digital audio: Types of video signals, analog video,digital video, digitization of sound, MIDI, quantization and transmission of audio

06Hrs

UNIT III :

Multimedia data compression: Lossless compression algorithm: DCT, Wavelet- Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT), Basic Audio Compression Techniques

06Hrs

UNIT IV :

Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, MPEG2, MPEG4

06Hrs

UNIT V:

Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications : Quality of Multimedia Data Transmission, Multimedia over IP, RTCP,RTP,SIPTransport of MPEG-4, Media-on Demand(MOD)

06Hrs

UNIT VI:

Content-Based Retrieval in Digital Libraries C-BIRD— A Case Study ,C-BIRD GUI Color Histogram Color Density Color Layout Texture Layout Search by Illumination Invariance Search by Object Model

06Hrs

Text books:

1	Fundamentals of Multimedia	2004	Ze-Nian Li , Mark S Drew	PHI/Pearson Education
2	Multimedia Applications	2004	Steinmetz, Nahrst	Springer

Reference books:

1	Multimedia Communications: Applications, Networks, Protocols and Standards	2001	Fred Halsall	Addison-Wesley

8th Semester

ET1427	Lab. : PE V: Multimedia Communications	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Learn the basics of image data types, file formats and color models used for image and video
2. Understand various Fundamental concepts in video and digital audio
3. Get acquainted with various algorithms used for multimedia data compression
4. Learn basic concepts of multimedia communication networks.
5. Understand basic concepts of Content Based Retrieval in Digital Library

Course Outcome
Students will be able to
1. Describe and compare different color models and file formats used for video and audio.
2. Analyze and compare digital/ analog video signal and quantization techniques for digital audio signals.
3. Apply different compression scheme used for image and video
4. Describe and compare various multimedia networks communication protocols.
5. Explain content based image retrieval techniques

Sr. No.	Experiments based on
1.	Convert given image from one color model to another using inbuilt MATLAB functions and conversion formulae
2.	Write MATLAB program to implement delta modulation and ADPCM
3.	Write MATLAB program to implement DCT image compression scheme and find Root Mean Square Error for different quantization level.
4.	Write MATLAB program to convert given image to its dithered version using 2X2 dithered matrix.
5.	Write MATLAB program to implement EZW encoder on given 4X4 matrix of Wavelet coefficient.
6.	Write MATLAB program to decode output of EZW encoder and generate the matrix of Wavelet coefficient.
7.	Write MATLAB program to implement SPIHT encoder on given 4X4 matrix of Wavelet coefficient.
8.	Write MATLAB program to decode output of SPIHT encoder and generate the matrix of wavelet coefficient.
9.	Write MATLAB program to play video file and display any two frames from video.
10.	Write MATLAB program to obtain motion vector using Sequential Search Method.

8th Semester

ET1435	PE V : Advances in Communication	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Objective

Students should be able to

1. Understand the fundamental principles of advanced communication system.
2. Introduce fundamentals functions of a telecom switching and digital subscriber access.
3. Learn ISDN protocol & architecture.
4. Understand the working principles of digital telephony.
5. Understand the broadband communication.
6. Understand Basic Probability & Random variables.

Course Outcome

Students will be able to

1. Apply the knowledge of switching technologies for digital telephony
2. Describe digital subscriber & wireless local loop.
3. Apply the concept of random variables to characterize the signal behavior in communication.
4. Apply the concept of density function to analyze the performance of communication system.

UNIT-1:

Telephony Background

An overview of telephone networks, transmission system, switching system, Signaling, echo cancellation, working principles of telephone, DC (pulse) and DTMF (tone) signaling Traffic analysis Traffic characterization, loss systems, network blocking probabilities, delay systems

06 Hrs

UNIT-2:

Digital switching and networks

Space division switching, time division switching, time space time (TST) switch, space time space (STS) switch, comparison of TST and STS switches, network synchronization, control and management, timing, timing inaccuracies, network synchronization, network control, Network management

06 Hrs

UNIT-3:

ISDN protocol & SONET

Integrated service digital network (ISDN) ISDN overview, ISDN interfaces and functions, user network interface, ISDN protocol architecture, ISDN physical layer: basic user -network interface, primary rate user- network interface, U interface. SONET/SDH: SONET Multiplexing Overview, SONET Frame Formats, SONET Operations

06 Hrs

UNIT-4:

Broadband Communication

ISDN data link layer: LPAD protocol, terminal adaptation, bearer channel data link control, ISDN network layer: basic call control, control of supplementary services,Broadband ISDN (B - ISDN)-Architecture , Protocols Digital subscriber loop (DSL)-ADSL, HDSL, VDSL, Fiber in loop, wireless local loop (WLL)

06 Hrs

UNIT-5:

Basic Probability & Random variables

Introduction, definitions of probability, axioms of probability, Conditional probability, Total probability and Bayes' theorem.

Random variables: Definition, cumulative distribution function (CDF), continuous, discrete and mixed random variables, probability density function (pdf), probability mass function(PMF),properties of distribution functions, Specific random variables: Gaussian, Exponential, Rayleigh, Uniform, Binomial and Poisson distributions

06 Hrs

UNIT-6:

Random processes

Definition, Statistics of stochastic processes, mean, autocorrelation and autocovariance, independent process, Stationary and ergodic processes: strict-sense stationary, wide-sense stationary random processes, transmission of random process through a linear filter - relationship between input and output processes, power spectral density (PSD) - definition and properties, cross spectral densities, Gaussian random process – properties.

06 Hrs

8th Semester

ET1435	**PE V : Advances in Communication**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text books:				
6.	Digital Telephony		JOHN BELLAMY	Wiley Series
7.	Probability, Random Variables and Stochastic Processes		Papoulis, S. U. Pillai,	Tata McGraw Hill
Reference books:				
1	Telecommunication Switching and Networks		ThiagrajanViswanathan	PHI Publication
2	ISDN and Broadband ISDN with Frame Relay and ATM	4th Edition	William Stalling	Pearson education Asia publication
3	Probability and Random Process for Electrical Engineers		A L Garcia	1. Pearson Education

8th Semester

ET1436	Lab. : PE V: Advances in Communication	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective
Students should be able to
1. Understand the fundamental principles of advanced communication system.
2. Introduce fundamentals functions of a telecom switching and digital subscriber access.
3. Learn ISDN protocol & architecture.
4. Understand the working principles of digital telephony.
5. Understand the broadband communication.
6. Understand Basic Probability & Random variables.

Course Outcome
Students will be able to
1. Apply the knowledge of switching technologies for digital telephony
2. Describe digital subscriber & wireless local loop.
3. Apply the concept of random variables to characterize the signal behavior in communication.
4. Apply the concept of density function to analyze the performance of communication system.

Sr. No.	Experiments based on
1.	Study of DTMF signaling
2.	Study of ISDN protocol
3.	Study of Digital subscriber loop
4.	Study of wireless local loop (WLL).
5.	Study of cumulative distribution function (CDF)
6.	Study of probability density function (pdf)
7.	Study of Binomial and Poisson distributions
8.	Study of power spectral density in AWGN channel
9.	Study of Gaussian random communication system'

8th Semester

ET1428	Project Phase-II	L = 0	T = 0	P = 8	Credits = 8
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Course objective Students should be able	Course Outcomes Students will be able to
1. Work on the defined problem. 2. Define and prepare road map to get a desired output. 3. Gain knowledge about the project. 4. Improve the communication skills and stage daring through effective presentation. 5. Write effective reports and design documentation.	1. Design and analyze application based electronic systems. 2. Implement core / multidisciplinary / industry based electronics projects in cost effective manner. 3. Communicate technical details effectively

8th Semester

ET1429	Comprehensive Viva-Voce	L = 0	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	--	100	100	3 Hrs

Course objective Students should be able	Course Outcomes Students will be able to
To prepare the students for various competitive exams and personal interviews	The students will be able to demonstrate their technical knowledge which they have learnt throughout the program.

8th Semester

ET1430	Extra/Co-Curricular Activities		L = 0	T = 0	P = 0	Credits = 2
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
--	--	--	100	--	100	

Course Objectives Students should be able	**Course Outcomes** Students will be able to
To develop the students personality to face the challenges in life.	The students will be able to demonstrate their involvement and achievement in Extra/Co curricular Activities which they have exhibited throughout the program.

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2014

3 to 8 Semester

Computer Technology

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Computer Technology

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE-I	MSE-II	TA	ESE	
THIRD SEMESTER												
1	GE1201	Engineering Mathematics - III	3	1	0	4	4	15	15	10	60	3
2	CT1221	Object Oriented Programming	4	0	0	4	4	15	15	10	60	3
3	CT1222	**Lab:** Object Oriented Programming	0	0	2	2	1			40	60	
4	CT1203	Data Structure	4	0	0	4	4	15	15	10	60	3
5	CT1204	**Lab:** Data Structure	0	0	2	2	1			40	60	
6	EE1217	Logic Design & Microprocessor	3	1	0	4	4	15	15	10	60	3
7	EE1218	**Lab:** Logic Design & Microprocessor	0	0	2	2	1			40	60	
8	CT1210	**Lab:** Web Technology	0	0	2	2	1			40	60	
Total			14	2	8	24	20					
FOURTH SEMESTER												
1	GE1206	Discrete Mathematics & Graph	3	1	0	4	4	15	15	10	60	3
2	CT1205	Programming Language Concepts & Constructs	3	1	0	4	4	15	15	10	60	3
3	CT1206	**Lab:** Programming Language Concepts & Constructs	0	0	2	2	1			40	60	
4	CT1207	Computer Architecture & Organization	4	0	0	4	4	15	15	10	60	3
5	CT1223	Advanced Data Structures	4	0	0	4	4	15	15	10	60	3
6	CT1224	**Lab:** Advanced Data Structures	0	0	2	2	1			40	60	
7	CT1208	System Programming	4	0	0	4	4	15	15	10	60	3
8	CT1209	**Lab:** System Programming	0	0	2	2	1			40	60	
Total			18	2	6	26	23					

Aravind		1.00	May 2015	Applicable for AY 2015-16 Onwards
Chairperson	**Dean (Acad. Matters)**	**Version**	**Date of Release**	

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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Computer Technology

S. N.	Sub Code	Subject	Contact Hours				CR	% Weightage				ESE Duration
			L	T	P	Total		MSE I	MSE II	TA	ESE	
FIFTH SEMESTER												
1	GE1312	Fundamental of Economics	3	0	0	3	3	15	15	10	60	3
2	CT1301	Theoretical Foundation of Computer Science	3	1	0	4	4	15	15	10	60	3
3	CT1302	Operating Systems	4	0	0	4	4	15	15	10	60	3
4	CT1303	**Lab. :** Operating Systems	0	0	2	2	1			40	60	
5	CT1316	Database Management Systems	4	0	0	4	4	15	15	10	60	3
6	CT1317	**Lab. :** Database Management Systems	0	0	2	2	1			40	60	
7	CT1340	Computer Networks	4	0	0	4	4	15	15	10	60	3
8	CT1341	**Lab. :** Computer Networks	0	0	2	2	1			40	60	
9	**Open Elective-I**		3	0	0	3	3	15	15	10	60	3
	CT1342	OE I: Introduction to DBMS										
	CT1343	OE I: Operating System Concepts										
	CT1344	OE I: Essentials of IT										
10	CT1328	Seminar I	0	0	2	2	1			100		
Total			21	1	8	30	26					
SIXTH SEMESTER												
1	GE1311	Fundamental of Management	3	0	0	3	3	15	15	10	60	3
2	CT1314	Design & Analysis of Algorithm	3	1	0	4	4	15	15	10	60	3
3	CT1318	Language Processors	3	1	0	4	4	15	15	10	60	3
4	CT1319	**Lab.** :Language Processors	0	0	2	2	1			40	60	
5	CT1345	Software Engineering	4	0	0	4	4	15	15	10	60	3
6	CT1346	**Lab. :** Software Engineering	0	0	2	2	1			40	60	
7	**Professional Elective I**		4	0	0	4	4	15	15	10	60	3
	CT1320	PE I: Computer Graphics										
	CT1322	PE I: Realtime Systems										
	CT1347	PE I: Mobile Operating System										
	CT1349	PE I: Business Intelligence and its Applications										
	CT1353	PE I: : Introduction to Geographical Information System										
	CT1355	PE1 : Privacy and Security in Online Social Networks										
8	**Lab. : Professional Elective I**		0	0	2	2	1			40	60	
	CT1321	**Lab. :PE I:** Computer Graphics										
	CT1323	**Lab. :PE I:** Realtime Sysmes										
	CT1348	**Lab. :PE I:** Mobile Operating System										
	CT1350	**Lab. :PE I:** Business Intelligence and its Applications										
	CT1354	**Lab. :PE I:** : Introduction to Geographical Information System										
	CT1356	**Lab. :PE1 :** Privacy and Security in Online Social Networks										
9	**Open Elective II**		3	0	0	3	3	15	15	10	60	3
	CT1351	OE II: Multimedia and Animation										
	CT1352	OE II: Current Trends and Technologies										
10	CT1329	Software Lab (Mini Project)	0	0	2	2	1			100		
Total			20	2	8	30	26					

Chairperson		**Version**	**1.02**	**Applicable for AY 2017-18 Onwards**
Dean (Acad. Matters)		**Date of Release**	**Nov. 2017**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.E. SCHEME OF EXAMINATION 2014

Computer Technology

S. N.	Sub Code	Subject	Contact Hours				CR	% Weightage				ESE Duration
			L	T	P	Total		MSE I	MSE II	TA	ESE	
SEVENTH SEMESTER												
1	CT1415	Network Security	4	0	0	4	4	15	15	10	60	3
2	CT1451	Artificial Intelligence	4	0	0	4	4	15	15	10	60	3
3	CT1452	**Lab.** Artificial Intelligence	0	0	2	2	1			40	60	
4	**Professional Elective II**		4	0	0	4	4	15	15	10	60	3
	CT1405	PE II: Embedded Systems										
	CT1406	PE II: Neural Network & Fuzzy Logic										
	CT1407	PE II: Ad-hoc Wireless Network										
	CT1453	PE II: Probabilistic Statistical Data Analysis										
5	**Professional Elective III**		4	0	0	4	4	15	15	10	60	3
	CT1408	PE III: Cloud Computing										
	CT1409	PE III: Operations Research										
	CT1437	PE III: Parallel Computing										
	CT1454	PE III:: Machine Learning Techniques										
6	CT1413	Industrial Training/ CRT	0	0	0	0	2			100		
7	CT1414	Project Phase I	0	0	4	4	4			40	60	
Total			16	0	6	22	23					
EIGHTH SEMESTER												
1	GE1408	Cyber Laws	4	0	0	4	4	15	15	10	60	3
2	CT1450	Object Oriented Modeling	3	1	0	4	4	15	15	10	60	3
3	**Professional Elective IV**		4	0	0	4	4	15	15	10	60	3
	CT1418	PE IV: Digital Image Processing										
	CT1420	PE IV: Pattern Recognition										
	CT1441	PE IV: Mobile Communication										
	CT1455	PE IV: Cyber Forensics										
4	**Lab. Professional Elective IV**		0	0	2	2	1			40	60	
	CT1419	**Lab.: PE IV:** Digital Image Processing										
	CT1421	**Lab.: PE IV:** Pattern Recognition										
	CT1442	**Lab.: PE IV:** Mobile Communication										
	CT1456	**Lab.: PE IV:** Cyber Forensics										
5	**Professional Elective V**		4	0	0	4	4	15	15	10	60	3
	CT1432	PE V: Software Project Management										
	CT1443	PE V: Internet of Things										
	CT1445	PE V: Numerical Computing										
6	**Lab.: Professional Elective V**		0	0	2	2	1			40	60	
	CT1433	**Lab. : PE V:** Software Project Management										
	CT1444	**Lab. : PE V:** Internet of Things										
	CT1446	**Lab. : PE V:** Numerical Computing										
7	CT1425	Comprehensive Viva	0	0	0	0	3				100	
8	CT1426	Project Phase -II	0	0	8	8	8			40	60	
9	CT1427	Extra/Co-curricular / Competitive Examination	0	0	0	0	2			100		
Total			15	1	12	28	31					

Chairperson		**Version**	**1.01**	**Applicable for AY 2017-18 Onwards**
Dean (Acad. Matters)		**Date of Release**	**May 2017**	

3 Semester

GE1201	Engineering Mathematics-III			L= 3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Objective	Outcome
The aim of this paper is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	• With the completion of this syllabus students will be familiar with Laplace ,Z-transform and their methods of solutions and partial differential equation with simple applications and essential concepts of optimization techniques and use these mathematical techniques in variety of technical, business, industry optimization problems.

UNIT-1: : Finite Differences (a,e) [8 hrs]

Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform (a,e) [7 hrs]

Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform (a,e) [8 hrs]

Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 : Matrices (a,e) [9 hrs]

Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigen vectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation (a,e,h) [8 hrs]

Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.

Partial Differential Equations – PDE of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

UNIT-6 : Fourier Transform (a,h) [6 hrs]

Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.

Text books:

1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference books:

1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill.
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan

		1.00	May 2015	Applicable for AY 2015-16 Onwards
Chairperson	Dean (Acad. Matters)	Version	Date of Release	

3 Semester

CT1221	Object Oriented Programming				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3 Hrs		

Objectives	Outcomes
Understand principles of object- oriented programming- class, objects, and features Comprehend the features of OOP: abstraction, encapsulation, information hiding, use of reusable components, Comprehend and analyze problems and programming issues- dynamic memory management, indirect object references, and recursion, Understand file handling and streams, object oriented development, software lifecycle, requirements, design, notation and tools	Students should be able to write efficient programs using different object oriented programming language concepts
Mapped Program Outcomes: a, b, c, d, e, i, k, l, m	

UNIT 1: **[07 Hrs]**
Introduction to object oriented programming paradigm, procedure oriented programming Vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class.

UNIT II: **[08 Hrs]**
Functions in OOP, function overloading, friendly functions, Passing & returning Objects, pointers to members, constructors and destructors, copy constructor, operator overloading.

UNIT III: **[08 Hrs]**
Inheritance, types of inheritance, interface, virtual base classes, abstract classes, virtual function, late binding

UNIT IV: **[08 Hrs]**
Streams, stream classes, file handling, command line arguments, class templates, function templates

UNIT V: **[07 Hrs]**
Basics of exception handling, exception handling mechanism, introduction to the standard template library.

UNIT VI: **[07 Hrs]**
Object Oriented System Development, procedure oriented paradigms, procedure oriented development tools, object oriented paradigm, object oriented notations and graphs, steps in object oriented analysis, steps in object oriented design, prototyping paradigm.

Text Books:
1. "Object Oriented Programming with C++", E. Balagurusamy, TMH Publication
2. "Thinking in Java", Bruce Eckel, 4th edition, Prentice Hall
3. "Java: how to program", H. M. Deitel, P. J. Deitel, 5th edition, Prentice Hall

Reference books:

1. "Object oriented programming in C++", Robert Lafore, Galgotia Publication
2." Mastering C++", Ravishanker, Venugopal, TMH Publication

3I Semester

CT1222	Object Oriented Programming Laboratory	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
Read and modify substantial well-written C++ programs, to create classes and small programs in C++ that are correct, robust reused and modified by others, to make use of various object-oriented features, including inheritance, multiple inheritance and genericity, to enhance the above qualities.	Students should be able to write efficient programs using different object oriented programming language concepts and enhance the qualities of OOP.
Mapped Program Outcomes: a, b, c, d, e, i, k, l, m	

LIST OF EXPERIMENTS

1. Implement the concept of Class and its data members and member functions.
2. Implement the Class with arrays of Objects.
3. Implement the concept of function overloading.
4. Implement the concept of passing object as a function argument.
5. Implement the concept of friend function.
6. Implement the concept of constructor and its type.
7. Implement the concept of dynamic constructor.
8. Implement the concept of object pointers.
9. Implement the concept of unary operator overloading.
10. Implement the concept of binary operator overloading.
11. Implement the concept of single inheritance.
12. Implement the concept of multilevel Inheritance.
13. Implement the concept of each access specifiers (Private, Public and Protected) .
14. Implement the concept of run time polymorphism.
15. Implement the concept of Files.
16. Implement the concept of command line arguments.
17. Implement the concept of function templates.
18. Implement the concept of Class templates.
19. Implement the concept of exception.
20. Implement the concept of multiple catch statement.

3 Semester

CT1203	Data Structure				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration Scheme		
	15	15	10	60	100	3 Hrs		

Objectives	Outcomes
To provide the student with an advanced treatment of computer programming, to give emphasis on design & implementation of abstract data structures. Compare the efficiency of various sorting algorithms in terms of both time and space, Implement the user defined data structures in a high level language (C / C++).	Students should be able to write efficient programs using different data structures.
Mapped Program Outcomes: a, b, c, e, i, k, l	

UNIT I: **[3 Hrs]**
Introduction to Data Structures, abstract data types, Analysis of algorithms, creation and manipulation of DS: Array

UNIT II: **[7 Hrs]**
Searching Techniques: Linear, Binary and Hashing and Collision handling
Sorting: Quick Merge, Heap, External sorting.

UNIT III: **[6 Hrs]**
Stacks: Fundamentals, Operations: Push, Pop, Applications of Stacks: Evaluation of expressions, Recursion, Stack Machines, and Multiple Stacks.
Queues: Fundamentals, Operations: Add, Delete, Types of Queues: Priority Queues, Circular Queue, Dqueue.

UNIT IV: **[10 Hrs]**
Linked list: Fundamentals, Types: Singly, Doubly, Circular, Linked Stacks and Queues, Examples on linked list, Circular linked list, doubly linked list and Applications of Linked List: Operations on Polynomials.

UNIT V: **[10 Hrs]**
Trees: Basic terminology, Binary Tree Traversals, threaded storage representation, binary search tree, applications of tree, preliminary treatment of AVL Trees, B-Trees, B+ Trees,

UNIT VI: **[9 Hrs]**
Graphs: Basic terminology, Graph representation: Matrix, list, Multilist, Graph Traversals: Breadth first search, Depth first search, Minimum Cost Spanning trees, shortest path algorithm, Topological Sort

Text Books:

1. "An Introduction to data Structures with applications", Trembley and Sonernson 2nd edition, TMH publication
2. "Fundamentals of data structure", Horowitz and Sahani 2nd edition, Galotia Publication
3. "Data structure a Pseudocode approach with C", Gilberg Forouzan 2nd edition, Course Technology Publisher.

Reference Books:

1. "Data Structure and Program Design in C", Kruse, Leung and Tondo, 2nd edition PHI
2. "Data structure and Algorithm in Java", Lafore 2nd edition, SAMS publication.
3. "Data structure Using C", Reema Thareja, Oxford Higher Education
4. "Data structure Through : A Practical Approach", G.S. Baluja, Dhanpat Rai & Co

3 Semester

CT1204	Lab. : Data Structure	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
To understand selection of suitable data structure for implementation of given problem, Comparison between different data structures, understand and compare different sorting/ searching techniques, Understand need of dynamic memory allocation, real time applications of stacks, queues, trees and graphs	Students should be able to compare efficiency of programs using different data structures. Analyze real time applications of stacks, queues, trees and graphs
Mapped Program Outcomes: a, b, c, e, i, k, l	

LIST OF EXPERIMENTS

1. Creating Employee database, Displaying database and Searching database

2. a. Program for **Quick Sort**
   b. Program for **Heap Sort**
   c. Program for **Merge Sort** using arrays
   d. Program for Binary Search

3. a. Program for performing following operations on **Stack Using Array**: Push, Pop and Display
   b. Program for Conversion of **Infix to Postfix** using stack.

4. a. Menu Driven program for performing following operations on **Queue using Array**:-Insertion, Deletion, Traverse
   b. Menu Driven program for performing following operations on **Circular Queue using Array** :- Insertion, Deletion, Traverse

5. a. Menu driven program for performing following operations on **Singly Link List**
   i) Insertion of a node at all positions.
   ii) Display of link list
   iii) Deletion of any node

   b. iv) Display of link list
   v) Reversing of singly link list

   c. vi) Display of Link list

6. a. Menu driven program for performing following operations on **Doubly Link List**
   i) Insertion of a node at specified position.
   ii) Display of link list
   iii) Deletion of any node.

7. a. Program for addition of two **Polynomials Using Link List**.

8. a. Write a program to perform following operations on **Binary Tree.**
   i) Creation
   ii) Display using Breadth First Search
   iii) Counting no. of nodes
   iv) No. of leaf nodes and
   b. v) Finding height of Binary Tree.
   vi) Finding Mirror of a Binary Tree

3 Semester

CT1204	Lab. : Data Structure	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

9. a. Program for finding following traversals of **Binary Search Tree** using recursion
   i) In-order
   ii) Pre-order
   iii) Post-order

10. a. Program for Implementation of Depth First Search on Graphs.

11. a. Program for finding minimum spanning tree using Kruskals algorithm
    b. Program for finding minimum spanning tree using Prims algorithm

Beyond Syllabus:
12. Implementation of 8 Queen's problem.
13. Implementation of Travelling Salesman Problem.

3 Semester

EE1217	Logic Design & Microprocessor				L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3 Hrs		

Objectives	Outcomes
To study basic logic gate, to understand Boolean algebra, to design simple combinational logics-maps, sequential logic circuits, to designs, Adders, Shifters, Comparators; Counters, Multiplier, To study the architecture of 16 bit processors and its assembly language programming, to interface various peripheral devices with 16-bit processor 8086	Students should be able to design logic circuits using appropriate components , able to optimize simple logic using Karnaugh maps, to understand architecture of 8086 and do assembly language programming.
Mapped Program Outcomes: a , b , c , d , e , h , i	

UNIT I: **[07 Hrs]**
Boolean Algebra and Logic Gates: Logic Operations, Boolean functions. Boolean Theorems, AND and OR gates, Canonical Logic Forms, Logic NAND and NOR Sets, Gate-Level Minimization: Algebraic Reduction, Karnaugh Maps, NAND and NOR Implementation ,Digital Hardware Considerations, Exclusive-

OR

UNIT II : **[08 Hrs]**
Combinational Logic : Equality and BCD Detectors, Line Decoders, Multiplexers and Demultiplexers, Binary Adders, Subtraction and Multiplication

UNIT III : **[07 Hrs]**
Sequential Logic: Sequential Network Concepts, Latches, Clocks and Synchronization, Flip-Flops, Sequential Network Design, Registers, Counters

UNIT IV: **[06 Hrs]**
Introduction to 16 bit microprocessor family, architecture of 8086, memory organization, pipelining, fetch read & write cycle, minimum mode system, Addressing modes of instruction, assembler directives, instruction set of 8086/8088, assembly language programming of 8086/8088

UNIT V: **[08 Hrs]**
Maximum mode of 8086, read and write machine cycle, 8288 bus controller, 8284 clock generator, coprocessor 8087 , interfacing 8087 with 8086 instruction set &programming of 8087

UNIT VI: **[09 Hrs]**
Interfacing memory with 8086, interfacing buffers & latches, 8255 keys, LEDs/7-segment, display, ADC, DAC , stepper motor, Interrupt structure of 8086, interfacing 8259, interfacing 8253/8254, interfacing 8251, interfacing 8279

Text Books :
1. Digital Design, Fifth Edition, by M. Morris Mano and Michael D. Ciletti, Prentice Hall
2. Digital Circuits & Microprocessors, Hebert Taub, Mc Graw Hill
3. Switching Theory & Finite Automata, Zvi Kohavi, Mc Graw Hill, 2nd edition,
4. 8086/88 Family Architecture, Interfacing & Programming by D.V. Hall. TMH.
5. Advanced Microprocessor & Peripherals by Ray, Bhurchandi. McGraw Hill.
6. 16 bit Microprocessors by Triebel & A. Singh
Reference Books:
1. Fundamentals of Logic Design, C.H.Roth ,Public Work & Services,3rd edition 2007
2. Engg Approach to Digital Design, Fletcher, Prentice Hall
3. Digital Design, M. Morris Mano, Third Edition, Prentice Hall of India,4th edition

3 Semester

EE1218	Lab. : Logic Design & Microprocessor	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
To learn the basic methods for the design of digital circuits, To know architecture of 8086 microprocessor, to provide programming skills, to interface with different peripherals	Students should be able to perform various operations on logic circuits, to write assembly language programs using different addressing modes and interface various peripheral devices to 8086.
Mapped Program Outcomes: a , b , c , d , e , h . i , k	

LIST OF EXPERIMENTS:

1. To verify truth table of logic gates
2. Verification of Boolean expression using De'Morgans Theorem
3. Verification of truth table for MUX / DeMUX
4. Design& Verification of Half & Full Adder/Subractor Circuit
5. To Implement RS Flip-Flop & Clocked D Flip-Flop using NAND Gate
6. To Implement JK Flip-Flop & T Flip-Flop & Verify its truth table
7. To Design Two bit Binary Counter & verify its truth table
8. To Design Asynchronous counter using Flip-Flop
9. To Design Left & Right Shift 3-bit register
10. To write an assembly language program to compare to arrays of 10 bytes by using string instruction.
11. Write a program to solve automatic equation using Shift and Add method.
12. To write an assembly language program to add 10 BCD numbers.
13. To write an assembly language program to find a data byte in a string .
14. To interface IC 8253 with 8086 at an address 5000H. Write a program to generate a square wave of 50ms. ON time.
15. To interface DAC 0808 with 8086 at an address 4000H and write a program to generate a sawtooth wave of amp.5V at the output.
16. To interface 8279 with 8086 at an address 4444H and interface keyboard and displays with 8086.

3 Semester

CT1210	Lab. : Web Technology	L=0	T=0	P=2	Credits=2
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
The course delivers an overview for developing Web-based applications. This course focuses on techniques for building server-side programs for dynamically generated Web sites, Web-enabled enterprise computing, and other applications that require WWW access to server-based resources.	Student should be able to design interactive web sites as per the requirements of applications.
Mapped Program Outcomes: a, b, c, d, e, f, g, h, i, j, k, l, m	

INTRODUCTION: Basic tools of internet access, email, ftp, news, www, introduction to internet programming, Electronic Mail, File Transfer protocol, domain Name, client server application

WEB PAGE DESIGNING: Standard use for www documents on internet, HTTP, MIME, SGML, DTD, MTNL, URL, URL, Static and Dynamic Web sites ,Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames , style sheets

SCRIPTING: JAVA SCRIPT: Introduction to Javascript, Basic Syntax, Control Structures, Writing Functions, The Document Object Model, Events Handling.

XML: XML basics, understanding markup languages, structures and syntax, valid vs. well formed XML, DTD (document type Definitions) classes. Scripting XML, XML processor, parent child relationship, XML as a data, data type in XML, XML namespaces,

ASP.NET Fundamentals: HTTP and HTML, ASP.NET Controls, Data Validation Controls, Working with Images, CSS.
WEBSITE DESIGN USING ASP.NET: Designing sample application in ASP.net, GET & POST Requests in forms

LIST OF PRACTICAL

1. Introduction to Internet (overview of Internet, email, www, broad band, FTP)
2. File transfer using FTP using open source tool - Filezilla
3. Study and implement basic html tags.
4. Create an HTML page to display basic information about all the institutions under MGI in tabular format. Each institution name should be a hyperlink to home page of the individual institution.
5. Create an College Admission Form by using FORMS in HTML.
6. Create a sample page displaying use of frames.
7. Study JavaScript, basic syntax, Document Object Model.
8. Program to demonstrate the use of conditional statements.
9. Program to demonstrate the use of while and for loops.
10. Program to demonstrate use of functions.
11. Demonstrate validation of form controls using simple functions written in JavaScript.
12. Program to demonstrate use of External and Internal DTD.
13. To create a web form to demonstrate use of ASP.net web controls – Textbox Control, Hyper Link Control and Check Box Control.
14. To create a web form to demonstrate use of ASP.net web controls – Radio Button Control, Image Control and Link Button Control.
15. Create a web form which will accept two numbers as input and perform an operation depending on value selected from dropdown list control.
16. To demonstrate use of validation controls including required field validator, range validator, compare validator, regular expression validator and summary validator.

3 Semester

CT208	Web Technology Laboratory	L=0	T=0	P=2	Credits=2
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

17. Create a web application which allows users to enter First name, Middle name and Last name. Display First name, middle name and last name as well as full name into another page. Retrieve the value from previous page using POST method only.
18. Create a web application which allows users to enter First name, Middle name and Last name. Display First name, middle name and last name as well as full name into another page. Pass the value across the web page using Query string only.

Reference books

1. "Web Technologies", Achyut S. Godbole & Atul Kahate, 2nd edition, Tata McGraw Hill
2. "Internet and World Wide Web – How to program", Dietel and Nieto, PHI/Pearson
3. "ASP.NET 3.5 Unleashed", Stephan Walther
4. "Sams Teach Yourself JavaScript in 24 Hours", Michael Moncur

4 Semester

GE1206	DISCRETE MATHEMATICS AND GRAPH THEORY		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Objective	Outcome
The objective of this paper is to study mathematical , logic and set theory and their methods of solution and graph theory, group theory with simple applications and to introduce the essential concepts of probability and statistics.	• With the completion of this syllabus students will be familiar with mathematical, logic and set theory and their methods of solutions and graph theory, group theory with simple applications and essential concepts of probability and statistics and use these mathematical techniques in variety of technical, business, industry optimization problems.

UNIT I: (08 Hrs) (a,e)
Mathematical, Logic & Set Theory: Statement & Notation, Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, The Power Set, Ordered Pairs & n-tuples, Operations on Sets , , Partial order, Equivalence relations, mathematical induction. Propositions, Predicate logic, formal mathematical systems,

UNIT II: (07 Hrs) (a,e)
Relations & Functions: Relation & Ordering, Properties of Binary in a set Relation Matrix & Graphs - a relation, Partition & Covering of a set, Equivalence relation, Partial ordering, Partially Ordered sets, Function (Definition & Introduction), Composition of functions, Inverse Functions, Characteristics function of a set.

UNIT III: [07 Hrs] (a,e)
Group Theory: Groups (Definitions & Examples) Subgroups & Homomorphism, Cosets & Lagranges theorem, Normal subgroups, Codes & Group Codes. Semi groups & Monoids (definitions & examples). Homomorphism of semigropups & monoids, SubSemi groups & monoids.

UNIT IV: [07 Hrs] (a,e)
Rings (Definitions & Examples): Integral domains ring homomorphisms, ideas of ring polynomial,Fields, Lattice.
Fuzzy Sets and Fuzzy Logic :Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

UNIT V : [08 Hrs] (a,e)
Graph Theory: Basic concepts of graph theory, Basic definitions, Paths & circuits Reach ability & connectedness, Matrix Representation of graphs, Tree & their representation & operations, Rooted trees, Path lengths in rooted trees, Multi graphs & weighted graphs, and graph isomorphism shortest paths in weighted graphs, Hypergraphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm

UNIT VI: Random variable and probability distribution [07 Hrs] (a,e)
Joint probability density function and marginal probability density function, joint distribution functions and marginal distribution functions .
Mathematical Expectation , Co-variance and correlation and its applications**.**

Text Books:

1. Discrete Mathematics Structure with application to Computer Science by J. P. Tremblay & R. Manohar ,23rd re-print,2005,Tata McGraw-Hills Publication Company Limited, New Delhi.
2. Probability and Statistics – M R Spiegel, John Schiller, R. Alu Shrinivasan, 2nd edition, Tata McGraw-Hills Publication Company Limited, New Delhi.
3. Advanced Engineering Mathematics - by H.K. Dass, 8th revised edition, 2007.S.Chand and Company Limited ,Delhi.

Reference Books:

1. Discrete Mathematics by Lipschutz Schaums's Outline series,2nd edition,Tata McGraw-Hills Publication Company Limited, New Delhi.
2. Discrete Mathematical structures :-By Bernard Kolman ,Robert C.Busby,Sharon
3. Ross,3rd edition,2001,Prentice Hall of India, New Delhi.

4 Semester

CT1205	Programming Languages Concepts and Constructs				L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3 Hrs		

Objectives	Outcomes
To study different programming language constructs, to make comparative study of various languages, to study implementation of various language constructs.	Students should be able to select appropriate language and construct to solve the programming problems.
Mapped Program Outcomes: b, c, d, e, i, k, l, m	

UNIT I **[08 Hrs]**
Basic elements of program namely: data, operations and sequence. Definition of Programming language. Implementation of high-level languages: Compilers and Software Interpreters. Why to study different programming languages. Attributes of a good programming language. Language evaluation criteria namely: readability, writability, reliability and cost. Operating and programming environments, their influence on language. Language paradigms.

UNIT II **[07 Hrs]**
Concept of binding, identifiers binding, binding time, binding identifiers to names, binding of attributes, importance of binding time. Concept of r-value and l-value . Static and dynamic allocation, stack based allocation, heap based allocation concept of garbage and dangling reference.

UNIT III **[08 Hrs]**
Concept of Data type, elementary data type, structured data type, specification and implementation of data type. Type checking, type conversion. Implementation of elementary data types: integer, real, character, Boolean and pointer. Implementation of structured data types: Vectors & arrays, records and files.

UNIT IV **[07 Hrs]**
Concept of abstract data type, encapsulation. Mechanisms to create new abstract data types, type definition, type equivalence, type definitions with parameters.

UNIT V **[08 Hrs]** Sequence control structures used in expressions and their implementation. Sequence control structures used between statements or group of statements and their implementation. Subprograms: subprogram definition and activation, their implementation, recursive and non recursive subprogram calls, parameter passing, generic subprograms

UNIT VI **[07 Hrs]**
Data control, referring environment, dynamic and static scope, static chain implementation and display implementation.

Text Books
1. "Programming Languages Design and Implementation", T. W. Pratt, Marvin V. Zelkowitz, 4th edition, Prentice-Hall
2. "Concepts of Programming Languages", Robert W Sebesta. 6th Edition, Pearson Education.

Reference Books:
1. "Programming Languages Concepts and Constructs", Ravi Sethi, 2nd Edition, Addison-Wesley
2. "Programming Languages Principles and Paradigms", Allen B. Tucker and Robert E. Noonan, 2nd Edition, Tata McGraw-Hill.
3. "Programming Languages Concepts", Ghezzi C, Milano P., Jazayeri M., 3rd Edition, John Wiley
4. "Programming Language Pragmatics", Michael L. Scott, ELSEVIER Publication
5. "Programming Languages Paradigms and Practices", Dories Appleby and Julius J. Vandekopple, 2nd Edition Tata McGraw-Hill.
6. "Foundations of Programming Languages", Sta S., Thomson Brookes/Cole
7. "Programming Languages", P. S. Groover, S. Chand Publication.

4 Semester

CT1206	Lab.: Programming Languages Concepts and Constructs	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
To understand the concepts of various programming language constructs, to write the program in different programming Languages, to develop program that is both correct and efficient in execution	Students should be able to write efficient programs using different programming languages
Mapped Program Outcomes: b, c, d, e, i, k, l	

LIST OF PRACTICAL

BASIC Language
1) To perform various Arithmetic operations .
2) To implement various control structures .
3) To implements the concept of functions.

PASCAL Language
4) To implement conditional control structures .
5) To implement the concept of loop control structures.
6) To implement concept of functions.

FORTRAN Language
7) To implement the various control structures.
8) To implement the concept of subprograms.
9) To implement parameter passing methods .

C Language
10) To implement the concept of various storage classes.
11) To implement the concept of unconditional and conditional transfer controls.
12) To implement the concept of Bitwise operator.
13) To implement the concept of File handling.

C++ Language
14) To implement the concept of inheritance
15) To implement the concept of polymorphism.
16) To implement the concept of templates.

4 Semester

CT1207	Computer Architecture & Organization				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration	
	15	15	10	60	100		3 Hrs	

Objectives	Outcomes
To understand evaluation of Von-Neumann architecture and various advance mechanism to computer design to improve performance and speed of computer	Students should be able to select Appropriate architecture and various mechanisms to improve performance
Mapped Program Outcomes: a, c, e, h, i, k	

Unit I: **[06 HRS]**
Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, Introduction to pipelining, Bus Structures, Software, addressing methods and machine program sequencing: Memory Locations, addressing and encoding of information, Main memory operation, Instructions and Instruction sequencing, addressing modes, Assembly language, Stacks, Subroutine.

UNIT II: **[06 HRS]**
Processing UNIT: Some fundamental concepts, Execution of a complete instruction, Instruction Sets: Instruction Format, limitations of Short word- length machines, High level language considerations, (Motorola 68000) processor Architecture. Single, two, three bus organization, Sequencing of control Signals.

UNIT III: **[07 HRS]**
Processor Design, hard wired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, perfecting microinstruction,

UNIT IV: **[10 HRS]**
Arithmetic: Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm, Integer Division, Floating point numbers and operations.

UNIT V: **[10 HRS]**
The main Memory: some basic concepts, Memory Hierarchy, semiconductor RAM memories, Memory system consideration, semiconductor ROM memories, **Speed Size and Cost**, Cache Memory, **Performance Considerations**, Mapping techniques, Virtual memories, memory management requirements**.**

UNIT VI: **[06 HRS]**
Computer Peripherals: I/O Devices, DMA, Interrupt handling, Online storage, File services, working of USB. **Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, influence on Instruction Sets, Data Path and Control Considerations, Super Scalar Operation, UltraSPARC 2 Example, Performance Consideration**
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Text Books:

1. "Computer Organization", V. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5th Edition- McGraw Hill Publication.

Reference Books:

1. "Computer Organization and Architecture", Willaiam Staliing 6th Edition, Pearson
2. "Computer Architecture & Organization", J.P. Hayes 3rd Edition, McGrawHill

4 Semester

CT1223	Advanced Data Structures			L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3 Hrs	

Objectives	Outcomes
The primary objective of this course is to provide the student with an advanced treatment of computer programming with an emphasis on design and implementation of advanced data structures. Compare the efficiency of various data structures in terms of both time and space. Implement the user defined data structures in a high level language (C / C++).	
Mapped Program Outcomes:	

Unit I **(7 Hrs)**
Binary Search Trees, AVL trees, Red Black Trees, Heaps and Heapsort

Unit II **(7 Hrs)**
Splay trees,Tries, Multidimensional search trees, Tries, Skip Lists

Unit III **(8 Hrs)**
Multiway trees, External Sorting, B, B+ trees operations and applications,

Unit IV **(7 Hrs)**
Graphs- directed, undirected graphs,Graph Algorithms connectivity, biconnectivity, topological sort, Applications of BFS and DFS

Unit V **(8 Hrs)**
Topological Sort, Minimum Spanning trees, Shortestpath algorithms and applications, All Pairs Shortest Paths, Introduction to Network Flow Problems

Unit VI **(5 Hrs)**
Disjoint set, Fibonacci Heap, Memory allocation, Garbage collection

Text Books:
1. Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
2. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassiaand .Mount, Wiley student edition, John Wiley and Sons.

Reference Books:
1. Data Structure and Program Design in C by Kruse, Leung and Tondo 2nd edition PHI publication.
2. Data Structure a Pseudocode approach with C by Richard Gilberg, B. Forouzan 2nd edition.Thompsons Course Technology

4 Semester

CT1224	Lab. : Advanced Data Structures	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
To understand working of advanced data structures and their use for complicated problems of different domains like language processing, networking, mining etc.	Student will be able to select appropriate data structure suitable to specific problem and analyze their operations with respect to time and space complexity

1. WAP for creation of Binary Search Tree and perform insertion and deletion of node in it.
2. WAP for creation of AVL tree and display it level wise along with balance factor of each node.
3. WAP for creation of 3-way B tree.
4. WAP for creation of Multidimensional search tree with exact match for employee record.
5. WAP for implementation of trie.
6. WAP for displaying of Minimum Spanning tree of given directed graph.
7. WAP for BFS and DFS on graph.
8. WAP for implementation of all pair shortest path algorithm.
9. WAP for printing topological sequences of given graph.
10. WAP for creation of Fibonacci Heap.

4 Semester

CT1208	System Programming			L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3 Hrs	

Objectives	Outcomes
To understand the procedures for the design of software system, to compare different processor architectures, to understand the concept of device driver	Students should be able to design some basic system software's, compare various processor architectures.
Mapped Program Outcomes: b, c, d, e, ,i ,j, k, l, m	

UNIT I: **[08 Hrs]**
Basic architecture, memory organization. Need of relocation, relocation through registers, various Addressing Modes.

UNIT II: **[08 Hrs]**
Data Types, Instruction set summary

UNIT III: **[07 Hrs]**
Assembler: Machine language and assembly language, Assemblers general Design Procedure, Design of Assembler.

UNIT IV: **[08 Hrs]**
Macro Processor: Macro language and the macro processor, Macro instructions, features of macro facility, Implementation of macro.

UNIT V: **[07 Hrs]**
Loader: Basic loader functions, Machine independent loader features, Loader design options, Implementation. Various Object file format.

UNIT VI: **[07 Hrs]**
Device Driver: Introduction to device Drivers : Basic device driver operation, Accessing drivers, interface with kernel, Study of mouse drivers

Text Books:
1. "System Programming", Leland Beck, Pearson Ed.
2. "System Programming", John Donovan, MacGrawhill

Reference Books:
1. "The 68000 Microprocessor: Hardware and Software Principles and Applications", James Antonakos, 5th Edition, Prentice Hall
2. "M68000 Family Programmers Reference Manual (Include CPU32 Instructions) M68000PM/AD Rev1.
3. "The Intel Microprocessors", Barry Brey, 8th Edition, Prentice Hall
4. "Unix device drives", George Pajani, Pearson Education.
5. " Device Drives for Windows", Norton, Add Wesley.
6. " Assembly & Assemblers", Gorshine, Prentice Hall.

4 SEMESTER

CT1209	Lab.: System Programming	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
To learn how to design symbol table, Literal table, design Machine-Op table, Pseudo-Op table, to learn how to Implement pass I, pass II of assembler, to learn how to Implement the routine for error reporting, how to design Macro Name Table and Macro Definition Table.	Students should be able to design symbol table, literal table, Implement pass I,II assemblers, Macro name and definition table.
Mapped Program Outcomes: b, c, d, e, ,i, j, k, l, m	

LIST OF PRACTICALS

1. Implementation of Symbol Table(ST) for pass I of assembler.
2. Implementation of Literal Table(LT) for pass I of assembler.
3. To Design the Machine-Op Table(MOT) for assembler processing.
4. To Design the Pseudo-Op Table(POT) for assembler processing.
5. Implementation of pass I of assembler.
6. Implementation of pass II of assembler.
7. To Implement the routine for error reporting.
8. Implementation of Macro Name Table(MNT) for macro processing.
9. Implementation of Macro Definition Table(MDT) for macro processing

5th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Sr. No.	Course Objectives	Course outcomes	Mapped Program Outcomes
1	It introduced the concept of economics and provides knowledge about consumer's rational behaviour.	It will helps for rational selection of goods and services.	12
2	This introduced various factors of production and its role in production process, gives idea about short run and long run production constraint, types of cost and depreciation.	It helps to prepare students being a businessman how to deal with various production constrain.	12
3	It provide knowledge to the students about various market structure, demand and revenue curves in it, How price and output determine in various forms of market and how price discriminate for consumer to consumer.	To make use of these concepts while performing the entrepreneurial operations.	12
4	It gives knowledge about various national products, its counting with respect to various factors and factors causes to economic growth and development.	Provide idea about national income accounting.	12,7
5	Provide knowledge of functioning of money, financial institution and various sources of public finance/revenue and its types.	Helps to create awareness about functioning of financial institutions and taxation system.	12,7
6	To provide knowledge about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institution.	It provides knowledge about international economics.	12

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

5th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

Text Books:
1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:
1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

5th Semester

CT1301	Theoretical Foundation of Computer Science	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To study theoretical foundations and find their applications in the area of compiler construction, complexity analysis, verifying the correctness of circuits, and protocols.	Students should be able to apply theoretical foundations in various applications for verifications and analysis.
Mapped Program Outcomes: a,c,d,e,i,	

UNIT I: **[8 hrs]**
Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.

UNIT II: **[7 hrs]**
Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets (Proofs not required), Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.

UNIT III: **[6 hrs]**
Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form, CYK algorithm.

UNIT IV: **[6hrs]**
Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.

UNIT V: **[8hrs]**
Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church"s hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machine

UNIT VI: **[5 hrs]**
Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function unbounded minimization and recursive function.

TEXT BOOKS:
1. "Introduction to Automata Theory, Languages, and computation ", Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman, 3rd Edition, Pearson Education.
2. "Introduction to languages and the Theory of Computation ", John C.Martin, 3rd Edition, Mc Graw Hill

REFERENCE BOOK:
1. "Introduction to the Theory of Computation" , Michael Sipser, 2nd Edition, Kindle edition, GALE CENGAGE Learning
2. "Theory of Computation", Dr. O.G. Kakde, Laxmi Publication.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

5th Semester

CT1302	Operating Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To understand OS Concepts with emphasis on foundations & design principles, Batch processing, Multiprogramming & Timesharing, to understand structures & functions of operating systems, to learn different components of OS like Process Management, Concurrency mechanisms, Memory Management, Virtual Memory, File System and Secondary Storage Management, Deadlock handling, Security & protection.	Students should be able to solve process management, deadlock, concurrency, resource problems by applying appropriate mechanism.

Mapped Program Outcomes: a,b,c,e,k,l,m

UNIT I: **[7Hrs]**
Introduction, evolution of OS, concept of distributed OS, basic hardware support necessary for modern operating system, services provided by OS, system calls.

UNIT II: **[8Hrs]**
Process management-introduction, process control block, process states, process context switch, and threads: user level and kernel level, CPU scheduling, goals of scheduling, CPU Scheduling Algorithms: FCFS, SJF, SRTF, RR, Priority Based, Multilevel Queue scheduling, Multilevel Feedback Queue scheduling, algorithm evaluation, Introduction to Real Time CPU scheduling.

UNIT III: **[7Hrs]**
Inter-process communication: process cooperation and synchronization, race condition, critical section, mutual exclusion and implementation, semaphores, conditional critical regions and monitors, classical inter-process communication problems, message passing.

UNIT IV: **[8Hrs]**
Deadlocks: necessary conditions, deadlock avoidance, deadlock prevention, recovery from deadlock. Protection and security: Goal of protection, Mechanism and policies, Domain of protection, access list Capability list access matrix and its implementation, dynamic protection structures, revocation.

UNIT V: **[8Hrs]**
Memory management techniques-contiguous and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads, virtual memory and demand paging, page faults and instruction restart, problems of large address spaces, page replacement algorithms and working sets.

UNIT VI: **[7Hrs]**
File systems-introduction, disk space management and space allocation strategies, directory structures, disk caching, file system consistency and log structured file system, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, Selecting a disk scheduling algorithm, I/O management, File Organization: Sequential, Index, Index Sequential.

5th Semester

CT1302	Operating Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

TEXT BOOKS:

1. "Operating system concepts", A. Silberchatz and P.Galvin, 5th Edition, Addison Wesley Longman, Inc.
2. "Operating system Principles", A. Silberchatz and P.Galvin, 7th Edition, John Wiley & Sons Inc.

REFERENCE BOOKS:

1. "Modern operating systems", A.S. Tanenbaum, 2nd edition, Prentice Hall of India publication.
2. "Operating System", Crowley, 2nd Edition. Tata McGraw Hill publication.
3. "Operating System", William Stalling, 5th Edition, Pearson Education publication.
4. "Shell Programming", Rebecca Thomas , Prentice Hall,
5. "The UNIX operating system", Maurice Bach, 2nd Edition, Prentice Hall publication.
6. "Operating Systems", Achyut Godbole, 3rd Edition, McGraw Hill Education

5th Semester

CT1303	Lab. : Operating Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
To understand the concepts of operating system, Compare different CPU Scheduling algorithm, Distinguish between different page replacement algorithm, Choose safe state to avoid deadlock	Students should be able to solve CPU scheduling, Page replacement and deadlock related problems by writing programs.

Mapped Program Outcomes: a,b,c,e,k,l,m

LIST OF PRACTICAL

1. Study of operating system
2. To implement FCFS CPU scheduling algorithm
3. To implement Round Robin CPU Scheduling Algorithm
4. To implement SJF CPU Scheduling Algorithm
5. To implement Priority based CPU Scheduling Algorithm
6. To implement non -preemptive priority based CPU Scheduling Algorithm
7. To implement Deadlock Avoidance using Bankers algorithm
8. To implement page replacement algorithm using FIFO
9. To implement page replacement algorithm using LRU(Least Recently Used)
10. To implement Optimal Page Replacement algorithm

5th Semester

CT1316	Data Base Management System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To understand fundamental database concepts and the different database systems, methodologies to conceptualize systems, advanced database concepts, Identify the key issues in developing database systems and applications, develop applications involving advanced database systems using commercial RDBMS such as Oracle.	Students should be able to design relational database for given situation, write appropriate queries for accessing database.

Mapped Program Outcomes: a,b,c,e,k,l,m

UNIT I: **[7 Hrs]**

Introduction to Database Management System: General File System and Database system Concepts and Architecture, Relational Model, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence.

Entity-Relationship Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Reducing E-R Diagrams to Tables, Generalization, Aggregation, Design of an E-R Database Scheme.

UNIT II: **[8 Hrs]**

Relational Data Model: Structure of Relational Databases, the Relational Algebra, SQL.

Relational Constraints: Domain Constraints, Referential Integrity, Assertions and Triggers, View, Programmatic ways for implementing constraints and triggers.

UNIT III: **[8 Hrs]**

Relational Database Design: Pitfalls in Relational Database Design, Functional Dependencies, Normalization using Functional Dependencies, Alternative Approaches to Database design.

Storage structures: cluster, index organized table, partitions, various table storage parameters and block storage parameters, concept of index, B-trees, hash index, function index, bitmap index.

UNIT IV: **[7 Hrs]**

Transaction Management: ACID Properties, Implementation of ACID Properties, Database processes to support ACID Properties, Schedules, and Testing of Serializability.

Concurrency Control: Lock-based Protocols, Timestamp Based Protocols, Validation Techniques, Multiple Granularity, Multi version Timestamp Protocol, Transaction isolation levels, Read consistency.

UNIT V: **[8 Hrs]**

Crash Recovery: Failure Classification, Log Based Recovery, Buffer Management, Checkpoints, Shadow Paging, and Failure with Loss of non-volatile Storage, Stable Storage Implementation.

Query optimization: Query optimization and performance tuning – Various techniques for query optimization, strong and weak equivalence, cost based optimization.

UNIT VI: **[7 Hrs]**

Introduction to Object oriented database: The evolution of object oriented concepts. Object-oriented concepts, characteristics of an object-oriented data model, object schemas, Advantages and disadvantages, Applications.

5th Semester

CT1316	Data Base Management System	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

TEXT BOOKS:

1. "Fundamentals of Database Systems ", Elmasri, Navathe & Gupta, Pearson Education.
2. "Database System Concepts" Korth, Silberschatz: McGraw-Hill publication.

REFERENCE BOOKS

1. Database System Concepts by Henry Korth and Others
2. Database Systems by Connolly, 3rd edition, Pearson Education.
3. Database Systems by S. K. Singh, Pearson Education.
4. Principles of Database Systems – Ullman, Golgotia Publications 1998.

5th Semester

CT1317	Lab. : Data Base Management System	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
To understand and implement the fundamental Database concepts, methodologies and conceptualize and design database system.	Students should be able to implement database concepts. Methodologies and design database system.

Mapped Program Outcomes: b,c,d,e,h,j,k,l,m

PRACTICAL LIST:

1. To perform and analyze DDL and DML commands.
2. To implement constraints on data base tables in Oracle.
3. To execute queries based on Group By, Having, Order By clause.
4. To execute queries using Aggregate functions and Built in functions.
5. To implement various joins in Oracle.
6. To write and execute the Sub queries.
7. To study and create Views.
8. To create and implement Triggers.
9. To create basic programs in PL/SQL.
10. To create and modify Users and Privileges/ To execute TCL commands.

5th Semester

CT1340	Computer Networks				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. Understand the importance of layering architecture and classify different types of networks. 2. Study guided and unguided media and understand the importance of telephone system in computer communication. 3. Study various error control, flow control and access control protocols of data link layer 4. Study various access control protocols and understand different computer networking standards. 5. Understand role of network layer and its associated protocols. 6. Study design issues related to transport layer, QoS provisioning. Understand the need of security provisioning and various application layers protocols.	1. Identify appropriate design issues, apply appropriate solution as per the reference model. 2. Select appropriate transmission media and switching mechanism for a given task. 3. Solve problems in the domain such as hamming code, CRC, framing etc. Also select proper error control and flow control algorithm depending upon requirement. 4. Select proper access control algorithm depending upon requirement. And recognize the role of standards in computer network and apply knowledge of standards with real world applications 5. Select appropriate routing algorithm to send data from source to destination. 6. Know the importance of QoS provisioning to achieve end to end communication. Identify the protocols needed for specific application.
PO MAPPING :- PO1, PO2,PO6 PO8, PO12	

Unit I
Introduction: The uses of computer networks, LAN's, MAN's, WAN's. wireless networks, protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference models, Critique of OSI model & protocols, critique of TCP/IP reference model.

Unit II
Transmission Impairments, Data Rate Limits, Transmission Media-Guided media: coaxial, twisted pair, optical fiber cable. Electromagnetic spectrum, unguided media: radio waves, microwaves, Infrared, Ultraviolet, Bluetooth. Telephone System, Switching: circuit, packet and message switching, Modems, RS-232C & RS-449.

Unit III
The Data Link Layer: Data link layer design issues- Framing, Error Control, Flow Control, , Error detection and Correction-Error-Correcting Codes, error-detecting codes, Elementary data link protocols-An Unrestricted simplex Protocol, A simplex stop and wait protocol, A simplex protocol for a noisy channel, Sliding window protocols- A one bit sliding window protocol, Go Back N protocol, Selective Repeat Protocol.

Unit IV
The Medium Access Sub layer: Static and Dynamic Channel allocation in LAN's and MAN's, Access Protocols-ALOHA, Persistent and Non Persistent CSMA, CSMA/CD, Collision free protocols, Binary countdown, Limited-connection protocol. The adaptive tree walk protocol. IEEE standard 802 for LAN's-IEEE standard 802.3 and Ethernet, IEEE standard 802.4, 802.5, comparison.

Unit V
The Network Layer: Network Layer design issues-services provided to the transport layer, Routing and Routing Algorithms-Flooding, Flow-Based, Distance Vector, Link State, Hierarchical. Congestion Control algorithms-Preallocation of buffers, Packet discarding, Choke packets, Load shedding, Jitter control. Leaky bucket algorithm, token bucket algorithm, Internetworking, IP header format.

5th Semester

CT1340	Computer Networks				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

Unit VI

The Transport Layer: Transport layer design issues-services provided to the session layer, Quality of service, transport service primitives, Elements of transport protocols-Addressing, Establishing and Releasing a connection, Flow control and Buffering, Multiplexing, Crash Recovery. Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). The Application Layer**:** Introduction to cryptography, MIME, SMTP, FTP, TFTP.

Text Books:

1. Computer Networks by A.S. Tanenbaum, Pearson Publication

Reference Books:

1. Data Communications and Networking by Behrouz Forouzan
2. Data and Computer Communication by William Stallings.

5th Semester

CT1341	Lab. : Computer Networks	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
To understand the concept of OSI Reference model, to understand the concept of routing, Error detection and error correction, to Learn the Network Security Concept and Implementation of Encryption and Decryption Cipher.	Students should be able to implement error correction/detection techniques, Encrypt and decrypt given plaintext into cipher texts using appropriate mechanisms.
Mapped Program Outcomes: b,c,d,e,f,h,i,,k,l,m	

LIST OF PRACTICAL

1. Study and Comparison of OSI and TCP/IP reference model.
2. To study 802.3 LAN standard and Campus wide networking of YCCE.
3. To perform Encryption and Decryption using Playfair Cipher or Hill Cipher.
4. To perform Encryption and Decryption using Columnar transposition Cipher.
5. To implement Hamming Code.
6. Program for the simulation of Stop and Wait Protocol.
7. To implement RSA algorithm.
8. To implement Dijkstra"s Routing algorithm.
9. Diagnosis of computer networks using FLUK.
   - Verification of duplicate IP address.
   - Verification of duplicate host names.
   - Percentage of Broadcast by every terminal.

5th Semester

CT1342	OE I: Introduction to DBMS				L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
To understand basic database concepts by students whose basic degree is not in Computer or IT.	Students should be able to design database for given situation, write appropriate queries for accessing database.

PO, PSO MAPPING:- b, c, e, k

Unit I
An Overview of the Database Management System
What is database?, Why database?, database system, database management system (DBMS), advantages of DBMS.

Unit II
An Architecture of the Database system
Three levels of architecture, mappings, role of database administrator(DBA), E-R model, three approaches of DBMS-relational, hierarchical and network.

Unit III
Relational Database Management System (RDBMS)
Introduction, RDBMS terminology, relational model, base tables, keys.

Unit IV
The SQL Language
Introduction, Characteristics of SQL, data definition commands

Unit V
Data manipulation commands

Unit VI
Introduction to XML

Books:
1. Silberschatz A, Korth H.F and Sudarshan S, "Data base System Concepts", Fifth Edition, Tata McGraw-Hill.
2. R. Elmasri, S. B Navathe, " Fundamentals of Database System", Pearson Education.

Reference Books:
1. Leon A and Leon M, "Fundamentals of DBMS", Vijay Nicole & Tata McGraw-Hill.
2. Gill P.S, "DBMS", I.K. International.
3. Singh S.K, "Database Systems: Concepts, Design & Applications", Pearson Education.
4. Leon A and Leon M, "Database Management Systems", Vikas Publishing House.

5th Semester

CT1343	OE I: Operating System Concepts				L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
To understand the concepts of Linux and its potential. The students will also get hand on experience of Linux after undergoing this course.	Students should be able to use LINUX environment to implement some concepts.

PO, PSO MAPPING:- b,c,e,,k,

UNIT I:
Introduction: History of Linux and Unix, Linux Overview, Linux releases, open linux

UNIT II:
Linux Commands and Filters : Mkdir, CD, rmdir, pwd, ls, who, whoami, cat, more, fail, head, concept of, mv, chmod, grep,wc, comm., split, sort, diff, kill, write, wall, merge, mail, news

UNIT III:
Shell: The command line special characters and file arguments, standard input/output and redirection, pipes, redirecting and piping with standard errors, shell scripts, jobs.

UNIT IV:
Linux file Structure: Linux files, file structure, listing displaying and printing files, managing directories, file and directory operations.

UNIT V:
Vi Editor: Vi editing commands advanced Vi editing commands, line editing commands, options in Vi.

UNIT VI:
System Administration: System management, managing users, installing and managing devices, floppy disk management, file system administration, backups.

Text Books
1. Linux – The Complete Reference by Richard Peterson, Tata McGraw Hill, New Delhi
2. Linux – Install and Configuration Black Book by Die Annleblanc and Issac Yates, IDG Books India Private Ltd., Delhi
3. Unleashed Linux by Tech Media Publishers.

5th Semester

CT1344	OE I: Essentials of IT				L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

OBJECTIVES	OUTCOMES
1. To understand the problem Solving using algorithms 2. To understand how to design and test simple programs to implement Object Oriented concepts using Java 3. To Understand how the database systems can be modeled 4. To understand the implementation of RDBMS concepts using SQL 5. To understand the method and components to design the static and dynamic web pages 6. To understand the basic concepts of software engineering	1. Able to do Problem Solving using algorithms 2. Able to Design and test simple programs to implement Object Oriented concepts using Java 3. Able Designing and modeling of simple databases 4. Able to implement simple data store using RDBMS concepts and SQL 5. Able to design the static and dynamic web pages 6. Able to use the software engineering concepts in development of small projects

PO, PSO MAPPING:-

Unit I:
Programming fundamentals of Java: problem solving skills, Algorithm – representation using pseudo code, algorithm properties. Programming in java- programming constructs in JAVA, control structures type casting, SDLC overview and need for Object oriented approach, object oriented concepts, introduction to UML.

Unit II:
OO fundamentals – Java Implementation: OO fundamentals, coding standards, reference variables and objects in memory, methods, 'this' reference.
Data structures: data structures, linear data structures, non- linear data structures.

Unit III:
Data base basics- data storage, need for DBMS, functions of DBMS, data perspectives in DBMS, types of data models, relational model and keys, Database Design – Database life cycle, Data requirements, logical design – ER modeling, converting ER model to relational schema, functional dependency, normalization.

Unit IV:
SQL – need for sql, types of sql statements, data types in SQL, SELECT statement with various operators, single row and multi row functions, group by and having clauses.

Unit V:
Introduction to web technologies:
Computer Networks, HTML tags and CSS, Implementation of Java Scripts, Operators and control structures, function and dialog boxes, DOM element.

Unit VI:
Software Engineering – Basics, SE models and approaches, Requirement developing activities, software design and construction, software testing, introduction to user experience, Project categories and project management phases, software quality.

Books:
1. Andrew S. Tanenbaum , : Structured Computer Organization , PHI, 4th edition, 1999
2. John L. Hennessy, David Goldberg, David A. Patterson, Computer Architecture : A Quantitative Approach, 2nd Edition Published by Morgan Kaufman Publishers, 1996
3. Silberschatz and Galvin, Operating System Concepts, John Wiley & Sons ,Sixth edition
4. Andrew Tanenbaum, Modern Operating Systems, Pearson Education

5th Semester

CT1328	Seminar I				L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	-	-	100	-	100		

6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
Principle of Management	To familiarize the students with the basic concepts and principles of management. The students should clearly understand the definitions of different areas of management. This course will facilitate students to understand and describe specific theories related to perception, motivation, leadership. This will help the students to demonstrate effective management skill by knowing the various functions of management like planning, organising, directing, coordinating and controlling.
Legal Aspects of Management	The present course aims at familiarizing the students with various legal aspects of business, contract, partnership and companies. It aims at providing a rich fund of contemporary knowledge, time tested principles, basic concepts, emerging ideas and practices in the field of law in a comprehensive way.
Human Resource Management	The objective of this course is to endow the student with a broad perspective on themes and issues of Human Resource Management, Human Resource Development, Training and Development activities, Job Analysis, Performance Appraisal, disciplinary and grievance procedure. It will help the students to build up and refine decision making skills so that they can help organizations effectively manage employee relations.
Project Management	The course is intended to develop the knowledge of the students in the management of projects, special emphasis will be provided on project formulation as also on various tools and techniques for project appraisal and control so that they are able to draft the project proposal in any area of management and evaluate the projects.
Marketing Management	This course intends to provide an experienced-based approach to marketing concept and its practical application. The course is designed to enable the students to learn the basic of marketing, customer behaviour, marketing research & sales promotion. Topics of the syllabus shall be addressed and discussed from an application oriented perspective
Financial Management	The present course aims at familiarizing the participants with the skills related to basic principles, tools and techniques of financial management. This will help the students to demonstrate their skill in understanding the budgets and budgetary control, balance sheet, and profit and loss statement.

Mapped Program Outcomes:

6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1: Principles of Management
Evolution of Management Thought : Scientific, Classical, Neo Classical and Modern Theory of Management, Defintion Meaning and Concept of Management, Functions of Managment : Planning, Organizing, Directing Coordinating and Controlling. Motivation Theory, Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, Types of Partners, Right and Duties of Partners, Registration and Dissolution of firm, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Directors : Powers and duties, Winding up of the Company

UNIT-3: Human Resource Management
Human Resource Management-Meaning, Nature and Scope, Principles of HRD, Human Resource Planning, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Discipline and Grievance Procedure.

UNIT-4 Project management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Project Management, Tools and Techniques of Project Management, SWOT Analysis, Project Risk Analysis, Project cost, Project Planning, Project Control, Network techniques - Introduction and Use of CPM &PERT for planning.

UNIT-5 Marketing Management:-
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Rural Marketing, Marketing Environment, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

UNIT-6 Financial Management:-
Definition & Functions of Finance department, Sources of finance , Financing organizations, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

TEXT BOOKS:

1. S.C.Saxena, Business Management and Administration, Sahitya Bhawan Publication
2. P. Subba Rao, Management -- Theory and Practice (Text and Cases) (Himalaya Publication)
3. Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
4. P.S Rao , Essentials of Human Resource Managemen & IR, Himalaya , Mumbai
5. Avraham Shtub and Jonathan F. Bard, Project Management: Processes, Methodologies, and Economics (2nd Edition)
6. Kotler, Keller, Koshy & Jha, Marketing Management, Pearson, New Delhi
7. R.K. Sharma, Shashi K Gupta, Management Accounting,. Kalyani Publishers.

6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

TEXT BOOKS FOR REFERENCE:

1) Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2) Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3) Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4) C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,

5) Lock, Gower - Project Management Handbook
6) Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7) Rajan Saxena: Marketing Management, Tata McGraw Hill.
8) Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9) Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10) Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11) Khan M Y - Financial Services (Tata Mc Graw Hill, 1998)

6th Semester

CT1314	Design & Analysis of Algorithms	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To introduce basic algorithmic techniques, time requirements of an algorithm and mathematical techniques used in analysis of algorithms, learn analysis of algorithms for a wide variety of foundational problems occurring in computer science applications with discussions on complexity and NP-completeness.	Students should be able to design some algorithms and analyze their performance with respect to selected evaluation parameters

Mapped Program Outcomes: b,c,d,e,i,k,l,m

UNIT I: **[7Hrs]**
Mathematical foundations, summation of arithmetic and geometric series, Σn, Σn^2, bound summations using integration, Analysis of algorithms, analyzing control structures, worst case and average case analysis, Asymptotic notations, Analysis of sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, external Sorting, lower bound proof.

UNIT II: **[8Hrs]**
Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.

UNIT III: **[8Hrs]**
Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.

UNIT IV: **[7Hrs]**
Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.

UNIT V: **[8Hrs]**
Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen"s problem, graph colouring, Hamiltonian cycles etc.

UNIT VI: **[7Hrs]**
NP-hard and NP-complete problems, basic concepts, non deterministic algorithms, NP-hard and NP- complete, Cook"s Theorem, decision and optimization problems, polynomial reduction.

TEXT BOOKS:
1. "Computer Algorithms", Horowitz, Sahani, Rajsekharan, Galgotia Publications Pvt. Ltd.
2. "Introduction to Algorithms", Thomas H. Cormen , 3nd Edition, Prentice Hall of India.
3. "Fundamentals of Algorithms", Brassard and Bratley, Prentice Hall.

6th Semester

CT1318	Language Processors	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
This course emphasizes on the implementation of a compiler through the development of its various phases such as the scanner, parser, and code generator. This course covers the various aspects of designing a language translator in depth.	Students should be able to design compiler and design language translator.
Mapped Program Outcomes: b,c,e,l,k,l,m	

UNIT I **[7Hrs]**
Introduction to Compilation Process, Compilers & Translators, Phase structure of Compiler, Design of Lexical Analysis.

UNIT II **[8Hrs]**
Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, Bottom Up Parsing, Predictive Parsers, Recursive Decent Parser.

UNIT III **[9Hrs]**
Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table.

UNIT IV **[9Hrs]** Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/ Flex, Yacc / Biason).

UNIT V **[5Hrs]**
Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase.

UNIT VI **[9Hrs]**
Introduction to Code Optimization, The principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.

TEXT BOOKS:
1. Compilers Principles, Techniques & Tools by Alfred V. Aho, Jeffrey D. Ullman & Ravi Sethi, 2nd Edition, Pearson Education
2. Principles of Compiler Design by Alfred V. Aho, Jeffrey D. Ullman, Addison Wesley Publication

REFERENCE BOOKS:
1. "Compiler Design", Dr. O.G. Kakde, Laxmi Publication.
2. "Introduction to Compiling Techniques: First Course Using ANSI C, Lex and Yacc",J.P. Bennett, McGraw-Hill Publication
3. "Building Your Own Compiler with C++", Jim Holmes, Prentice Hall

6th Semester

CT1319	Lab. : Language Processors	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
Implementation of following practical will lead student to understand compilation phases of compiler, element of each phase, compiler, Construct the language by using notation/rules, Know the practical implementation of tools like FLEX &YACC.	Students should be able to implement phases of compiler and use practical implementation tools.
Mapped Program Outcomes: b,c,e,i,k,l,m	

PRACTICAL LIST:

1. Study of FLEX.
2. Write a Flex program to recognize
   - Word
   - Digit
   - Identifier
   - Constant
3. Write a Flex program to check whether the entered sentence is simple sentence or a compound sentence.
4. Write a Flex program to count the number of
   a. characters, words , spaces and lines in a given input text file.
   b. Printf and scanf keywords present in a given input program fragment.
5. Write a Flex program to check whether the entered string of parenthisis is balanced or not in a given input text file.
6. Write a Fex program to recognize a valid arithmetic expression and to recognize the identifier and operators present and print them seperately.
7. Write a Fex program to Count the number of IF conditions in a program using the Lexical Analyzer.
8. Study of YACC and Write a YACC Program to disply message "Have a good Day".
9. Write a YACC Program to recognize strings "aaab", "abbb", "ab" and "a" using the grammar ($a^n b^n$, n>= 0).
10. Write a YACC program to recognize a valid arithmetic expression that uses operators +,-,*, /
11. Write a YACC program to evaluate an arithmetic expression involving operators + ,-,*,/.

6th Semester

CT1345	SOFTWARE ENGINEERING	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
1. To introduce basic software engineering methods/models/practices and their appropriate application. 2. To understand concepts, principles, and strategies applicable to the analysis of software requirements and design activity. 3. To understand various testing strategies and types of testing. 4. To understand configuration management, version control and change control process. 5. To understand project management, planning, scheduling, risk management, project and process metrics. 6. To get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re- engineering.	1. Choose appropriate Software Process Model for given Project depending on requirements and resources at hand. 2. Perform requirements analysis and create design for a given case study. 3. Choose appropriate testing strategy and apply testing principles for testing a given application. 4. To understand basics of software configuration management , version control and change control. 5. To calculate effort and cost estimate for given requirements and assess risks. 6. To perform basic operations on Sub-version.
Mapped Program Outcomes: a,b,c,d,e,f,g,h,I,j,k,l,m	

UNIT I
Introduction to Software Engineering, A Generic View of process, Process models: Water fall Mode l, RAD Model, Prototyping Model, Component Development Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation

UNIT II
Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.

UNIT III
Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White- Box Testing, Basis Path testing: Flow Graph Notation, Independent Program Paths, Control Structure Testing, Black Box Testing, Introduction to object oriented testing.

UNIT IV
Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards.

UNIT V
Project Management, Metrics for Process and Projects, Project Estimation, Risk Management: Reactive vs. Proactive, Risk Strategies, Software Risks, Risk Identification, Risk Projection.

UNIT VI
Advanced Topic sin Software Engineering: Reengineering Computer Aided software engineering, Open source SE tools introduction, Example-Subversion: Overview, Typical subversion usage and workflow.

TEXT BOOKS:
1. Software Engineering – A Practitioner's Approach (Sixth Edition) by Roger S. Pressman– Mc Graw Hill.
2. Object Oriented Software Engineering by Leth Bridge, Pearson Edu.

6th Semester

CT1346	Lab. : SOFTWARE ENGINEERING	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Practical List:

Sr.No.	Practical Name
1	Introduction to Software Engineering fundamentals.
2	Introduction to RATIONAL ROSE Interface.
3	Overview and Case study of UML.
4	To study and draw Use Case diagram for the given case study.
5	To create use case documents for the given case study.
6	To study and create Software Requirement Specification document.
7	To study and draw UML Class diagram.
8	To study and draw UML Activity diagram.
9	To create SRS for Mini Project including appropriate UML diagrams.
10	To study basic operations on a Subversion Repository under Windows.

6th Semester

CT1320	PE I : Computer Graphics	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To provide an introduction to the theory and practice of computer graphics, understanding 3D graphics, visual communication, and presentation, Interactive handling of Images and Text, Understand computer animation and design animation program.	Students should be able to use 3D graphics, should handle interactive images & text. Develop animated programs for various applications.
Mapped Program Outcomes: a,b,c,d,e,g,i,j,k,l,m	

UNIT 1: **[8Hrs]**
Introduction, Point Pixel Plotting. Line Generation Algorithms, polygon filling algorithms

UNIT 2: **[6Hrs]**
2D Transformations, Clipping, Window, View Port Mapping, Graphical User Interfaces and Interactive input methods, picture construction techniques

UNIT 3: **[7Hrs]**
3D Graphics 3D Transformation, 3D Viewing, Visible Surface Detection, Back Face Detection, Depth Buffer Method, Scan Line Method, Virtual Reality Environment

UNIT 4: **[8Hrs]** Visual Communication Creative Process, Digital Imaging Technology, Still Image, Digital Imaging, Using Images in Multimedia, Images on Web, Color Models.

UNIT 5: **[8Hrs]**
Interactive Illustrated 3D with Images and Text: Generating Illustrated Documents, Consistency of Rendered Images and their Textual Labels, Architecture, Zoom Techniques for Illustration Purpose, Interactive handling of Images and Text, Figure Captions for Anatomical Illustrations.

UNIT 6: **[8Hrs]**
Computer animation : Design of animation sequence, general computer animation functions raster animation, computer animation languages, key frame systems, motion specifications.

TEXT BOOKS:
1. Donald Hearn and M. Pauline Baker, "Computer Graphics in C Version", Second Edition, Pearson Education.

REFERENCES BOOKS:
1. "Multimedia: Computing, Communication and applications", Raf Steinmetz and Klara Nahrstedt, 2nd Edition, Pearson Education.
2. "Multimedia Graphics", John Villamil Casanova and Leony Fernandez-Elias, Prentice Hall India.
3. "Computer Visualization-Graphics Abstraction and Interactivity", Thomas Strothotte, Springer Verlag, Berlin

6th Semester

CT1321	Lab.: **PE I :** Computer Graphics	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
To design and implement low level object-oriented code to encapsulate event-driven graphical objects, to perform homogeneous transformations, Parameterize curves for controlling object trajectories and improving rendering, design new viewing models, Perform clipping of polygons, shading, Texture map and. Animate scenes with multiple interacting objects.	Students should be able to design and implement low level object oriented code design models, create animated scenes.

Mapped Program Outcomes: b,c,d,e,g,i,j,k,l,m

LIST OF PRACTICAL

1. Creation of polygon and filling it using any polygon filling algorithm.
2. Creation of two dimensional objects and applying simple transformations like Translation, Scaling, Rotation and applying Composite transformations.
3. Creation of simple three dimensional objects like cube, cone and cylinder and applying simple transformations like Translation, Scaling, Rotation and applying Composite transformations.
4. Finding out visible surfaces and removal of hidden surfaces in simple objects using object space.
5. Remove hidden surfaces in simple objects using image space algorithms.
6. Image enhancement, Image transformation from color to gray scale and vice versa
7. Image enhancement, Image transformation from gray scale to color.
8. Image manipulation and Image optimization for web - Usage of editing tools, layers, filters, special effects and color modes.
9. Creation of simple Gif animated images with textual illustrations.
10. Creation of moving ball or any object.

6th Semester

CT1322	**PE I :** Real Time Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To learn the concepts of Real Time Systems, to study the different design issues of Real Time Systems, to study the techniques for scheduling, resource access control and validation, to provide experience in the implementation of typical algorithms used in real time systems.	Students should be able to apply techniques for scheduling, implement algo. In real time environment.
Mapped Program Outcomes: d,c,d,e,k,l,m	

UNIT I **[6 Hrs.]**
Introduction to real time systems: Digital control, high-level controls, signals processing, real time applications. Hard and soft real time system : Jobs & processors, release times, deadlines, timing, constraint, Hard & Soft timing constraint, Hard real time systems , soft real time systems. Modeling of real time systems.

UNIT II **[10 Hrs.]**
Approach to real time scheduling : Clock-driven approach, weighted round-robin approach, priority-driven approach, dynamic versus static systems, effective release times and deadlines, optimality of EDF & LST algorithms, non optimality of the EDF & LST, challenges in validating timing constraints in priority-driven systems, off line versus on-line scheduling. Clock driven scheduling: notation & assumptions, static timer- driven scheduler, general structure of cyclic schedules, cyclic executives, improving the average response time of a periodic jobs, scheduling sporadic jobs, practical consideration and generalizations, algorithms for constructing static schedules, pros-cons of clock-driven scheduling.

UNIT III **[08 Hrs.]**
Priority-driven scheduling: Static assumptions, fixed-priority versus dynamics priority algorithms, maximum schedulable utilization, optimality of the RM & DM algorithms, a schedulability test for fixed priority tasks with short response times & with arbitrary response times, sufficient schedulability conditions for the RM & DM algorithms.

UNIT IV **[08 Hrs.]**
Scheduling aperiodic & sporadic jobs in priority-driven systems: assumptions & approaches, deferrable servers, sporadic servers, constant utilization, total bandwidth and weighted fair-queuing servers, slack stealing in dead-line driven systems, slack stealing in fixed-priority systems, scheduling of sporadic jobs.

UNIT V **[06 Hrs.]**
Resources and resource access control : assumption on resources and their usage, effects of resource contention & resource access control, non preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack-based priority ceiling protocol, use of priority-ceiling protocol in dynamic- priority systems, preemption-ceiling protocol, controlling accesses to multiple-UNIT resources, controlling concurrent accesses to data object.

UNIT VI **[06 Hrs.]**
Real-time Communication: model of real time communication, priority-based service discipline for switched networks, weighted round-robin service discipline, medium-access control protocols of broadcast network and resource reservation protocols, real-time protocol, and communication in multicomputer systems.

TEXT BOOKS:
1. "Real-Time Systems" Jane W. S. Liu, 2000, Pearson Education
2. "Real Time Systems", C.M.Krishna & Kang G. Shin, McGraw Hill Publication.
3. "Real-Time Systems: Theory and Practice", Rajib Mall, 2007, Pearson Education.
REFERENCE BOOK:
1. "Real-Time Computer Control An Introduction", Stuart Bennett, 2nd edition, Pearson Education
2. "Real time systems", Albert M.K.Cheng , J. Willey and sons, vol 8, Editors Dan Ionescu, Aurel Cornell, world scientific
3." Real time systems" , Kopetz,Hermann, 2nd edition.

6th Semester

CT1323	Lab. **PE I :** Real Time Systems Laboratory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
To learn the concepts of RTS, to study the different design issues of Real Time Systems, to study the techniques for scheduling, resource access control and validation, to implement typical algorithms used in real time systems.	Students should be able to implement typical algorithms used in real time systems.

Mapped Program Outcomes: d,c,d,e,k,l,m

LIST OF PRACTICAL

1. To study different types of Real Time Operating System
2. To study Commands of LINUX Operating System for real time application.
3. Write a program to create processes in LINUX environment.
4. Write a program to implement round robin scheduling in LINUX environment.
5. Write a program to implement Priority-driven scheduling.
6. Write a program to create massages Queue for Inter Process communication.
7. Write a program to implement multithreading in LINUX environment.
8. To Study basic priority-inheritance protocol, basic priority-ceiling protocol.
9. To Study System calls for process creation, suspension and Termination.
10. To study shared memory in Inter-process Communications.
11. Write a program to design a cube using open GL.
12. Write a program to design a sphere using open GL.

6th Semester

CT1347	**PE I :** MOBILE OPERATING SYSTEMS				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To understand basic concepts about Mobile Operating System. 2. To understand features and development framework of Android platform. 3. To get an overview of various Android development tools, debugging techniques and performance optimization considerations. 4. To understand Android application development lifecycle and building process. 5. To understand User Interface elements for Android application and create UI designs. 6. To understand data storage network connection and data parsing for Android applications.	1. To understand fundamentals of Mobile Operating System. 2. Create sample Android application and deploy on Android mobile. . Create Android Application using Android Application development tools, debug application and incorporate performance and memory optimization considerations. . To generate and study APK file content and manifest. 5. To design Android application User Interface, views, layouts and styles. . To create Android application with SQLite database connectivity and network connection.
PO, PSO MAPPING: a,b,c,d,e,f,i,j,k,l	

UNIT I **[2Hrs]**

Mobility Technology Trends, Mobile Ecosystem Overview, Mobile Devices Overview, Mobile Development, Methodology, Wireless Networks Overview, Proximity Technologies

UNIT II **[8Hrs]**

Introduction to Android: Android Overview, Introduction to activities/Fragments, Introduction to services, broadcast receivers and content providers, Android Application Structure, Source Files, Resources, Assets and Manifest. **IDE Usage:** Basic IDE Operation (Eclipse), Project Creation and Handling (App Creation through Wizard), Running App on AVD and Device, DDMS and Debugging. **User Interface Designing-1:** Layout Overview, Linear Layout, Relative Layout, Frame Layout, Widgets (UI Controls) Overview and Text View, Image View, Button

UNIT III **[8Hrs]**

User Interface Designing-2: Notification Bar, Toast and DSialog, Listview, and Adapter, View Reusability, Spinner and Comples View. **Broadcast Receivers:** Broadcast receivers overview, Manifest Registration vs Component Registration, Unregistration, SMS Event Receiver, Boot Event Receiver and NetworkEvent Receiver. **Service:** Service Overview, Service Lifecycle, Service Usage Applicability and Message Binder, **Action Bar and Context Menu.**

UNIT IV **[8Hrs]**

Data Management: Data Storage Overview, Persistent v/s Local, Shared Preferences, Internal Storage and SQLite Database, **Threads and Processes:** Thread, Process overview, Async Task, Loaders, Handlers, Intent: Intent, Intent Filters and Intent Resolution, **Component Activations:** Activity Stack, Launch Modes and Activity Flags

UNIT V **[8Hrs]**

Inter Application Communication: Inter app Communication requirement overview and Intents Based. **Communication with Native application:** Gallery, Camera, SMS App and Contacts, **Content Providers:** Content Provider Overview, Need and Usage, Content Provider Structure. **Network Communication:** Network Communication basics and Connecting to server/request creation, Response Formats XML/JSON and Rest/Web Services. URI Permissions, Views, Triggers.

UNIT VI **[6Hrs]**

User Interface Designing-3: Style and Themes, View and Layout animation **Application Configuration:** Localization, Orientation and Config Change Handling, Handling multiple resolution devices, Device and Tablet consideration, Support Library. Application **Publishing:** Application Signing, Application Distribution, Application Publishing, Google Play

TEXT BOOKS:

1. Professional Android Application Development by Reto Meier, Wiley Publishing Inc.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

6th Semester

CT1348	Lab. : PE I: Mobile Operating Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Sr.No.	Practical Name
1	Introduction to Android Basics
2	Create and application having login functionality.
3	Create and application using View and View Groups
4	Create and application Using Layouts
5	Create and application Using Adapter, Spinner, Toast and Notification
6	Create and application that provides the functionality of Calculator.
7	Create and application using Shared preferences.
8	Create and application using SQLite data storage.
9	Create and application using Launch Modes.
10	Create and application using Content Provider.
Beyond Syllabus Practical List:	
11	Create an application that reads contacts from the native address book and supports edit/add new contact information

6th Semester

CT1349	PE I : Business Intelligence and Its Applications				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1.The proposed elective course exposes students to Business Intelligence domain. The objectives of this course include introduction to BI terminologies and framework, basics of data integration (Extraction Transformation Loading), introduction to multi-dimensional data modeling, basics of enterprise reporting and application of the concepts using open source/Microsoft tools.	Extract and transform data from an operational database to a data warehouse. 1.Map operational data to a data warehouse. 2.Design multidimensional data models. 3.Design reports using various reporting tools and methods. 4.Use BI tools to identify trends. 5.Exploit business analytics and performance measurement tools. 6.Design a BI solution for a business problem.
PO, PSO MAPPING :- a,b,c,d,e,f,g,i,j,k,l,m	

UNIT I
Introduction to Business Intelligence: Introduction to digital data and its types – structured, semi-structured and unstructured, BI Definitions & Concepts, BI Framework, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.

Unit II
Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP) Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, **Data Warehousing concepts and its role in BI**

Unit III
Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data – types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle).

UNIT IV
Identifying Dimension tables and fact table, designing of dimension and fact tables" schema, design of snowflake schema, query redirection. Aggregations: Why aggregate? , designing Summary tables, which summaries to create.

UNIT V
Introduction to business metrics and KPIs, creating cubes using Microsoft Excel ,Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards.

UNIT VI
Case study: Overview and use of products from Pentaho and other open software. BI road Ahead: BI and mobility, BI and cloud computing, BI for ERP systems, Social CRM and BI.

6th Semester

CT1349	PE I : Business Intelligence and Its Applications				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

TEXT BOOKS:
1. Fundamentals of Business Analytics by R. N. Prasad, Seema Acharya Wiley India
2. Data Warehousing in the real world A practical guide for building Decision Support System by Sam Anahory, Dennis Murray, PEARSON

Reference Books:
1. Business Intelligence by David Loshin.
2. Business intelligence for the enterprise by Mike Biere.
3. Business intelligence roadmap by Larissa Terpeluk Moss, Shaku Atre.
4. An introduction to Building the Data Warehouse, IBM.
5. Business Intelligence For Dummies, Swain Scheps.
6. Successful Business Intelligence: Secrets to making Killer BI Applications by Cindi Howson Information dashboard design by Stephen Few

6th Semester

CT1350	Lab. : PE I: Business Intelligence and Its Applications	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Sr. No.	Practical Name
1	Design a conceptual multidimensional model for the given data.
2	Implement the algorithm to extract the data from various sources.
3	Implement the algorithm to clean the data according to business requirement.
4	Transform the data into final „ready to load" form.
5	Implement the algorithm to load the data in the multidimensional format.
6	Solve the given business queries from the multidimensional model (Phase I).
7	Solve the given business queries from the multidimensional model (Phase II).
8	Design the report for output of Phase I.
9	Design the report for output of Phase II.
Beyond Syllabus Practical List:	
1.	Download and install any one free open source tool for reporting
2.	Take the reports from the system for the given data.

6th Semester

CT1353	PE I : Introduction to Geographical Information System			L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3Hrs

OBJECTIVES	OUTCOMES
1. Get overview of GIS applications and study fundamental concepts of GIS. 2. Explore the Coordinate Systems and Map Projections. 3. Study the fundamentals of Spatial Data that include creation, organization and displaying special data. 4. Comprehend the Making Sharing Maps. 5. Study the Metadata. 6. Understand the fundamentals of Spatial Analysis	1. To know the various GIS applications used by industries and government organization and also understand fundamental concepts of GIS. 2. To understand Coordinate Systems and Map Projections 3. To understand Fundamentals of Spatial data. 4. To create Sharing Maps 5. To understand metadata and special data standards. 6. To do special analysis using tools and techniques

Unit I [7 hrs]
Introduction to GIS Applications currently used by Industry & Government and their common usages. Fundamental concepts of GIS: GIS terminologies, various components of GIS software and types of GIS applications. The GIS Software Market.

Unit II [7 hrs]
Fundamentals of Coordinate Systems and Map Projections: History of Coordinate Systems, Geographic Coordinate Systems, Map Projections and Geo referencing.

Unit III [7 hrs]
Fundamentals of Spatial Data: Introduction to Spatial Data Formats, Creation of Vector data, Organization of Spatial Data and Displaying Spatial Data.

Unit IV [7 hrs]
Making Sharing Maps: Map Creation and Design, Sharing Maps as Services, Sharing Spatial Data and using shared Spatial Data.

Unit V [7 hrs]
Metadata: Metadata and Spatial Data Standards.

Unit VI [7 hrs]
Fundamentals of Spatial Analysis: Spatial Analysis, analyzing Vector and Raster data, overview of analysis tools, analyzing Spatial Relationships and sharing Analysis Results

Text Books:
1. "An Introduction to Geographical Information Systems", D. Ian Heywood, Sarah Cornelius & Steve Carver, 3rd edition, Pearson Prentice Hall, 2006

Reference Books:
1. "An Introduction to Geographical Information Systems", Heywood/Raju, Heywood Ian, Pearson Education India, 2009
2. "Getting to Know ArcGIS", Michael Law & Amy Collins, fourth edition, Esri Press
3. "Mathematical Modeling in Geographical Information System global Positioning System and Digital Cartography", H. S. Shrama, D. R. Ram, Rama Prasad & P. R. Binda, 4th Edition, Concept Publishing Company, 2006.

6th Semester

CT1354	Lab : PE I : Introduction to Geographical Information System	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
1. Get overview of GIS applications and study fundamental concepts of GIS. 2. Explore the Coordinate Systems and Map Projections. 3. Study the fundamentals of Spatial Data that include creation, organization and displaying special data. 4. Comprehend the Making Sharing Maps. 5. Study the Metadata. 6. Understand the fundamentals of Spatial Analysis	1. To know the various GIS applications used by industries and government organization and also understand fundamental concepts of GIS. 2. To understand Coordinate Systems and Map Projections 3. To understand Fundamentals of Spatial data. 4. To create Sharing Maps 5. To understand metadata and special data standards. 6. To do special analysis using tools and techniques

List of Practical:

1. To explore applications mentioned in the lecture on your own, understand the needs they meet and problems they solve.
2. To study GIS applications of various types and explore GIS resources, and Installation of GIS Desktop Software.
3. To explore various components of the GIS Desktop Software and study the GIS resources.
4. To understand and analyze Coordinate Systems and Projections.
5. To explore data formats using GIS Desktop Software, Creating data from scratch, Importing and exporting GIS data.
6. To create Geo databases, data conversion, introduction to making maps using GIS Desktop Software.
7. To make maps using GIS Desktop Software.
8. To install GIS Server, creating web services out of GIS maps or data, Sharing maps, Using GIS web services.
9. To manage metadata of Vector and Raster datasets, using metadata.
10. To use basic GIS analysis tools, Applications of GIS analysis tools, GIS Models, Creating web services from Analysis tools

6th Semester

CT 1355	PE I : Privacy and Security in Online Social Networks				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3 Hrs		

Objectives	Outcomes
1. To learn how to use different API's and tools for collecting social networking data. 2. To understand privacy in social media. 3. To understand policies for online social media. 4. To understand eCrimes and Attacks in online social media. 5. To learn profile linking on online social media. 6. To introduce to latest research in field of Location and Privacy.	Student completing the course will be able to: 1. Collect social networking data using different tools and API's. 2. Review privacy in social media. 3. Review policies for online social media. 4. Categorize eCrimes and Attacks in OSM. 5. Link profiles on OSM. 6. Explore issues in Location and Privacy in online social networks.
Mapped Program Outcomes: a, b, f, h, k	

UNIT I: **[7 Hrs]**
Incidents, OSM APIs and tools for data collection, Trust and Credibility on OSM

UNIT II: **[7 Hrs]**
Misinformation on Social Media, Privacy and Social Media, Privacy and Pictures on Online Social Media

UNIT III: **[6 Hrs]**
Policing and Online Social Media

UNIT IV: **[8 Hrs]**
eCrime on Online Social Media, Link Farming in Online Social Media, Nudges, Semantic attacks: Spear phishing

UNIT V: **[7 Hrs]**
Profile Linking on Online Social Media, Anonymous Networks

UNIT VI: **[8 Hrs]**
Privacy in Location Based Social Networks, Beware of What You Share Inferring Home Location in Social Networks, On the dynamics of username change behavior on Twitter, Boston Marathon Analyzing Fake Content on Twitter

Text Books:

Reference Books:

1. Programming Collective Intelligence: Building Smart Web 2.0 Applications by Toby Segaran
2. Practical Web 2.0 Applications with PHP by Quentin Zervaas
3. Building Social Web Applications by Gavin Bell
4. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws by Dafydd Stuttard

6th Semester

CT 1356	Lab : PE I : Privacy and Security in Online Social Networks					L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSPA - I	MSPA - II	MSPA - III	MSPA - IV	ESE	Total	ESE Duration		
	10	10	10	10	60	100	-		

Practical List

1. Collect data from Facebook using the graph API in Unix environment.
2. Collect data using twitter API in Unix environment.
3. Store the data collected from various OSNs in MySQL database.
4. Store the data collected from various OSNs in MongoDB.
5. Represent social media data in a graph format consisting of nodes and edges
6. Analyzing textual data obtained from Facebook using Python NLTK.
7. Generate graphs and clusters of data of social networks like Facebook and Twitter using Gephi.

6th Semester

CT1351	OE II: Multimedia and Animation				L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To learn basics of multimedia, applications of multimedia, requirements to make good multimedia. 2. To study Multimedia hardware, Macintosh and windows production platforms, multimedia authoring tools. 3. Multimedia building blocks. 4. The basics of animation, techniques of animation. 5. Animation in Flash. 6. To study 3D Animation, Types of 3D Animation Applications & Software of 3D Animation.	1. To understand the Basics of multimedia. 2. To understand multimedia hardware and multimedia authoring tools. 3. To develop skills in design, illustration, image manipulation, graphic designing, video editing, visual effects and game designing. 4. To apply the fundamental broad-based skills in traditional Animation techniques and emphasize to apply in practice. 5. To develop the skills in Flash Animation and apply it on some script. 6. To develop the 3D Animation skills.
PO, PSO MAPPING:- a,b,c,d,e,g,h,i,j,k,l	

UNIT I
Multimedia definitions, CD-ROM and the multimedia highway. Applications of multimedia, introduction to making multimedia, the stages of project, requirements to make good multimedia, multimedia skills and training, the multimedia tech.

UNIT II
Multimedia hardware, Macintosh and windows production platforms, hardware peripherals, connections, memory and storage devices, input devices output hardware, communication devices, media software, basic tools, making instant multimedia authoring tools.

UNIT III
Multimedia building blocks – text- using text in multimedia, computers and text, font editing and design tools, Sound-the power of sound , multimedia system sound, Digital audio, preparing digital audio files, Audio file format, images- Making still Images, Color, Image file format, video- Broadcast video standard, Analog video, Digital video, optimizing video files for CDROM .

UNIT IV
What is meant by Animation, Why we need Animation, History of Animation, Uses of Animation.
Types of Animation, Principles of Animation, Some Techniques of Animation, and Animation on the WEB, Special Effects, and Creating Animation.

UNIT V
Creating Animation in Flash: Introduction to Flash Animation – Introduction to Flash – Working with the Timeline and Frame-based Animation - Working with the Timeline and Tween-based Animation – Understanding Layers – Action script.

UNIT VI
3D Animation & its Concepts, Types of 3D Animation, Skeleton & Kinetic, 3D Animation Texturing & Lighting of 3D Animation, 3D Camera Tracking, Applications & Software of 3D Animation.

TEXT BOOKS:

1. Multimedia Making Work by Tay Vaughan (TMH), 3rd Ed.
2. Principles of Multimedia by Ranjan Parekh, 2007, TMH.
3. Multimedia Technologies by Ashok Banerji, Ananda Mohan Ghosh, McGraw Hill Publication.

REFERENCE BOOKS:

1. Multimedia systems design by K. Andleigh, K. Thakkrar, Phi Pub.
2. Multimedia: Computing, Communications & Applications by Raif Stein Metz and Kiara Nahrstedt.
3. Advanced Multimedia Programming by Steve Rimmer, McGraw Hill Pub.

6th Semester

CT1352	OE II: Current Trends and Technologies				L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. The objective of this course is to make the students aware of the basic fundamentals of communication. 2. Growth of technologies in Internet, E- Technologies & E-Learning. 3. Students should know about the Green Computing and its implementation.	1.Using the Basics of Internet for deployment of various servers and recourses. 2.Designing and implementation of Etechnologies 3. Design E-Learning Resources. 4. Choose appropriate processors and Real Time System for Green Computing 5. Develop the Social Networking for next generation.
PO,PSO MAPPING :- a,b,c,d,e,f,g,h,i,j,k,l,m	

UNIT I

Fundamentals of Communications: Types of communication- Wired, wireless, mobile, Modes of transmission: Simplex, Half Duplex, Full Duplex, Multiplexing techniques, History and evolution of wireless and mobile systems, Transition and characteristics of 1G, 2G, 3G, 4G, Spectrum, regulations, and frequency allocation.

UNIT II

Fundamental of INTERNET: History, Internet working, Connections, Internet services, The World Wide Web, Tools for the WWW, Web servers, Web browsers, Web page makers and editors, Plug-ins and delivery vehicles.

UNIT III

E-Technologies: Electronic Commerce: Framework, Media Convergence of Applications, Consumer, Applications, Organization Applications, Electronic Payment Systems: Digital Token, Smart Cards, Credit Cards, Risks in Electronic, Payment System, Designing Electronic Payment Systems, Electronic Data Interchange (EDI): Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software, Implementation, EDI Envelope for Message Transport, Internet-Based EDI.

UNIT IV

E-Learning: Definition, Introduction, Types of e-Learning: Learner-led e-Learning, Facilitated e-Learning , Instructor-led e-Learning , Embedded e-Learning, Tele monitoring And e- Coaching E-Learning Models: WBT, CBT, LMS, LCMS , Virtual School Systems, E-Learning Tools And Technologies: e-mail, Online Discussion, Chat and Instant Messaging, Voting, Whiteboard, Application Sharing, Conferencing, Online Meeting Tools ,Case study.

UNIT V

Green Computing: Introduction, Why....Green Computing? Approaches to Green Computing- Virtualization, Power Management, Power supply, Storage, Video Card, Display, IT Equipment, Recycling, Remote Conferencing & Telecommuting Strategies, Product longevity, Resource allocation, Terminal servers, Operating system support, How to Implement? Industrial implementations of Green Computing- Blackle, Fit-PC, Zonbu computer, Sunray thin client.

UNIT VI

Social Networking: Definition, Overview of Social Networking Sites, Types of Social Networking Sites: General purpose, Niche. Advantages of Social Networking Sites, Drawbacks of Social Networking Sites, Features and Need of Social Networking, Security Issues with Social Networking Sites, Case Studies.

TEXT BOOKS:

1. Impact of E-Business Technologies on Public and Private Organizations by OzlemBak, Nola Stair.
2. Mobile Computing by Tomasz Imielinski , Henry F. Korth .
3. Broadband telecommunications technology by Byeong Gi Lee, Minho Kang, Jonghee Lee.

REFERENCE BOOKS:

1. Introduction to broadband communication systems by Cajetan M. Akujuobi, Matthew, N. O. Sadiku.
2. E-Learning Tools and Technologies William Hortan, Katherine Hortan,Wiley Pub
3. Internet (Use of Search Engines Google & Yahoo etc).

6th Semester

CT1329	Software Lab. (Mini Project				L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	-	-	100	-	100	-		

7th Semester

CT1415	Network Security				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

Objectives	Outcomes
1. Understanding of basic issues, concepts, principles and mechanisms in n/w security, mathematics of cryptography, determine appropniate mechanisms forprotecting networks.	1. To identify n/w security threats and determine efforts to counter them. 2. To apply basic Principles, Theorems, Algorithms to solve the problem. 3. To use different encryption Algorithms. 4. To apply approtunate function and protocols for massage authentication. 5. To design solution for securiedn/w application. 6. To analyze given system with respect to security.
PO, PSO MAPPING:- a,c,d,e,f,h,i,k,l,m	

UNIT I Introduction: Security goals, cryptographic attacks,Services and mechanism, techniques. Mathenatics of cryptography:Integer arithmetic, modular arithmetic, matrices,linear congruence. Mathematics of symmetric key cryptography: Algebraic structure, GF(2^n) Fields

UNIT II Traditional symmetric key ciphers: Introduction, substitution ciphers, Transposition ciphers, stream and block ciphers. Introduction to modern symmetric-key ciphers: Modern block ciphers, modern stream ciphers.

UNIT III DES, AES, Encipherment using modern symmetric key ciphers: Use of modern block ciphers, use of stream ciphers: RC4. Mathematics of asymmetric key cryptography: Primes, primality testing, factorization, Chinese remainder theorem, Quadratic congruence, Exponentiation and logarithms. Asymmetric key cryptography: RSA, ElGamal.

UNIT IV Message integrity and authentication: Message integrity, Random oracle model, message authentication. Cryptographic hash functions: Introduction, Description of MD hash family, Whirlpool, SHA-512. Digital signature: Comparison, process, services, attacks on digital signature, Digital signature schemes. Entity authentication: Introduction, passwords, Challenge-Response, Zero knowledge, Biometric. Key management: Symmetric key distribution, Kerberos, symmetric key agreement, Public key distribution.

UNIT V Security at application layer : E-mail, PGP, S/MIME. Security at transport layer: SSL architecture, four protocols, SSL message formats, Transport layer security. Security at network layer IPSec : Two modes, two security protocols, security association, security policy, Internet key exchange, ISAKMP

UNIT VI System security: Description of the system, Users, Trust and trusted systems, Buffer overflow and malicious software, malicious programs, worms, viruses, Intrusion detection systems, Firewalls: Definitions, construction and working principles

TEXT BOOKS:

1. Cryptography and Network Security, by Behrouz A. Forouzan, and Debdeep Mukhopadhyay, McGraw-Hill Publication.,2nd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security Principles and Practices , by William Stallings, Pearson Edu Asia
2. Networks Security Essentials, Applications and Standards, by William Stalling, Pearson Edu.

7th Semester

CT1451	Artificial Intelligence				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. The study of Artificial Intelligence course will equip the students with the sound understanding of AI concepts, perspectives to apply the AI themes to the challenging research are as related to AI. 2. To introduce the fundamental concepts in Artificial Intelligence, applications of AI, techniques in AI. 3. To concentrate on the basic algorithms for searching the goal, concepts of representation and control. 4. Provide the ability to assess the applicability, strengths, and weaknesses of the basic knowledge representation, various approaches. 5. To compare various Knowledge Representation methods and to understand Prolog fundamentals for Knowledge Representation. 6. To understand the reasoning process is carried out in Machines. 7. To understand how human thinking be emulated by a machine and Provide the ability to assess the applicability, strengths, and weaknesses of various learning methods.	1. Apply fundamentals of Artificial Intelligence for given problem statements. 2. Use basic algorithms for searching the goal, represent various knowledge structures in various applications of AI and related fields. 3. Assess the applicability, strengths , and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems. 4. Compare various knowledge representation approaches, solve problems based on knowledge representation methods. 5. Assess Monotonic and Non-monotonic reasoning methods. 6. Assess various learning methods, compare them.
PO, PSO MAPPING :- a,c,e,h,i,k,l	

UNIT I

Introduction to AI: Definition of AI, early work in AI, the importance of AI,AI and related fields, distributed AI, task domain of AI, Problems, problem spaces and searches: defining the problem on a state space search, Introduction to intelligent agents, generic architecture of intelligent agents.

UNIT II

Production systems and control strategies: depth first and breadth first search, back tracking, problem characteristics , issues in the design of search programs.
Heuristic search techniques: generate and test, hill climbing, best first search, problem reduction, constraint satisfaction, means-ends analysis.

UNIT III

Knowledge representation: issues, representation and mapping approaches, procedural Vsdeclarative knowledge, introduction to proposition logic, knowledge representation using predicate logic, unification and resolution algorithms.

UNIT IV

Representation of knowledge using rules, logic programming, forward backward reasoning, matching, control knowledge. Knowledge representation using semantics' nets, Prolog: Representation of Predicates, rules, and facts, recursion unification.

UNIT V

Introduction to non-monotonic reasoning, logics for non-montonic reasoning Statistical reasoning: probability and Bay's theorem, certainty factors and rule based system.

7th Semester

CT1451	Artificial Intelligence				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

UNIT VI

Learning: general learning model, overview of different forms of learning, learning decision trees, Artificial Neural Networks (Introduction).

Expert Systems: Design & Development of Expert System, knowledge based Systems, Rule Based Expert System, Expert System Shell, Application Areas of Expert System

TEXT BOOKS:

1. Artificial Intelligence by E. Richand K. Knight and Nair.

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence and Expert System by D. W. Patterson, PHI. Principles of Artificial Intelligence by N. J. Nilsson, Narosa.
2. Artificial Intelligence by George F. Lugar, 4 Edition , Pearson Education.
3. Expert Systems: Design and Development by John Durkin, Macmillan, USA.

7th Semester

CT1452	Lab. : Artificial Intelligence		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration		
	40	60	100			

7th Semester

CT1405	PE II : EMBEDDED SYSTEM				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To make the students aware of the Embedded Systems surrounding them. 2. Students should know about the types of processors & architectures used, design & co design concepts used in ES. 3. To learn the concept of Real Time Operating System, Mobile Operating System. The working of micro controller to be used in ES.	1. Using the Basics of ES, decide the components of a particular ES. 2. Design & implement the hardware & software and integrate them to develop the final device. 3. Choose appropriate processors and Real Time operating system for ES design. 4. Use assembly or high level languages for S/W development & decide which development & debugging tool will be suitable for ES development. 5. Choose proper microcontroller / microprocessor for a particular ES design. 6. Develop the program for core functionality & communication of ES with other devices.
PO, PSO MAPPING : - a,c,d,e,h,i,k,l,m	

UNIT I
Embedded Systems concepts and definition, Embedded System design: Requirement analysis, Hardware and Software Design, co-design, I/O interface co-design for distributed embedded system, Applications of Embedded system.

UNIT II
Embedded Computing platform Software Development tools and debugging technologies Host and Target machines, Cross Assemble &Cross Compiler, Linker/Loader for embedded software, study and use of simulator, EPROM emulator, In Circuit Emulator, concept of tool chain.

UNIT III
Concept of Real Time Operating System, Real Time IO, R/T Multitasking & multithreading processes, RTOS Task Scheduling models Inter-task Communication, memory management.

UNIT IV
Overview of Embedded Operating Systems, Real Time operating System, Handheld operating system, Some Representative Embedded Systems.

UNIT V
ARM Architecture Block Diagram, Pin Description Memory Organization, Register Description, I/O Ports, Interrupts.

UNIT VI
Thumb Instruction Set and Programming Timers, Serial communication, interfacing with analog and digital circuits.

TEXT BOOKS:

1. An Embedded software primer by David E. Simon, Pearson Edu. Asia.
2. Embedded System by Raj Kamal.
3. ARM System on Chip Architecture by Steve Furber, Pearson Edu. Asia.

REFERENCE BOOKS:

1. Real–time system: design principles for distributed embedded application by H. Kopetz .
2. Embedded system design by Krishna & Shinn.
3. Embedded Real -Time Systems: Concepts, Design & Programming by Dr. K. V. K. K. Prasad.

7th Semester

CT1406	PE II : Neural Networks & Fuzzy Logic				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. This course provides introduction various aspect so fneuralnet works, with emphasison element of design no ftrainable systems. The course introduces students to the fundamental theory, mathematics and modeling tools necessary to analyze and simulate natural and engineered systems.	1. Apply training and classification using the discrete perceptron and single layer continues perceptron networks for linearly separable classification. 2. Summarize Operations on fuzzy sets by solving the problem. 3. Compute fuzzy numbers. 4. Construct arithmetic operations on intervals and arithmetic operations on fuzzy numbers. 5. Apply lattice fuzzy numbers and Fuzzy equations to solve fuzzy controller problem.
PO, PSO MAPPING :- a,b,c,e,h,i,j,l	

UNIT I
Fundamentals concepts and model so fartificial neural systems: Biological neurons and their artificial models, models of artificial neural networks, learning and adaptation, neural network learning rules, overview of neural networks, Simple Programming exercise in "C".

UNIT II
Single-layer perceptron classifiers: Discriminant functions, linear machine and minimum distance classification, training and classification sing the discrete perceptron: algorithm and example, single layer continuous perceptron networks for linearly separable classification.

UNIT III
Multi layer feedback networks: linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors, Hopfield networks, Applications of Neural Networks.

UNIT IV
From classical (CRISP) sets to fuzzy sets: introduction crispsets: an overview, fuzzy sets: basic t ypes, fuzzy sets: basic concepts, characteristics and significant of the paradigms hift. Fuzzy set sversuscrisp sets, representation of fuzzy sets, alpha cuts cardinality, Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersection: t- norms, fuzzy unions: t-Conorms, Distinction between Probability, Fuzzy and Random System.

UNIT V
Linguistics variables, linguistic edges, Fuzzy relations, Binary Operation on a single set, projection and cylindrical extension, Extension principles for fuzzy sets, Fuzzy Arithmetic: fuzzy numbers, arithmetic operations on fuzzy numbers, Fuzzy Equations.

UNIT VI
Defuzzification methods, design fuzzy rule base, Fuzzy Inference Systems: Mamdani Vs Sugeno, Steps indesign of a fuzzy controller, applications of fuzzy logic, Use of MATLAB for Design and Arguments

TEXT BOOKS:
1. Introduction to Artificial Neural System by J. M. Zurada, Jaico Publishing House, India.
2. Fuzzy logic & Neural Network b y T. J. Ross, TMH.

7th Semester

CT1407	PE II : Ad-hoc Wireless Network				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. Understand the design issues and application areas of Ad hoc network. 2. Understand the design goals of MAC protocols, classification of MAC protocols. 3. Introduce design issues and various types of routing protocols. 4. Understand design issues, operation and classification of multicast routing protocol. 5. Understand issues and challenges in the design of transport protocol and security aspect of communication in ad hoc network. 6. Introduce Quality of Service and energy management techniques in Ad-hoc network.	1. Identify the need of Adhoc network compare infrastructure base and infrastructure less wireless network 2. Identify the design issues involved in the design of MAC protocol and classify the different MAC protocols. 3. Compare proactive and reactive routing protocols, Classify routing protocols. 4. Compare tree based and mesh based multicast routing protocols, identify advantage and drawback involved in each protocol. 5. Identify the various types of attack in ad hoc network and classify various types of transport layer protocol. 6. Classify QoS approaches and Identify the need of energy management in ad hoc network.
PO, PSO MAPPING :- a,c,d,f,h,k,l	

UNIT I
Adhoc Wireless Networks: Introduction, Issues in Ad hoc wireless Networks, Ad hoc Wireless Internet.

UNIT II
MAC Protocols for Ad hoc Wireless Networks: Introduction, issues in designing MAC protocol, Design goals of MAC protocols, classification, Contention based protocols: MACAW. Floor acquisition multiple access Protocols. Contention based protocols with reservation mechanism: Distributed Packet reservation multiple access protocol, Collision avoidance Time allocation protocol. Contention based MAC protocols with scheduling mechanism: Distributed priority scheduling and medium access in ad hoc networks.

UNIT III
Routing Protocols for Ad hoc Wireless Networks: Introduction, Issues in designing routing protocol, classification, table driven routing protocols: DSDV, cluster head gateway switch routing protocol. On demand routing protocols: DSR, AODV. Hybrid routing protocols: core extraction distributed routing protocol, Zone routing protocol. Routing protocols with efficient flooding mechanisms, hierarchical routing protocols, Power aware routing protocols.

UNIT IV
Multicast routing in adhoc wireless networks: Introduction, Issues in designing multicast routing protocol, operation of multicast routing protocols, An architecture reference model, classification, Tree based multicast routing protocol: Bandwidth efficient multicast routing protocol, Multicast routing protocol based on zone routing, Multicast core extraction distributed Ad hoc routing, MAODV. Mesh based multicast routing protocols: on demand multicast routing protocol, Dynamic core based multicast routing protocol. Energy efficient Multicasting: Energy efficient reliable broadcast and multicast protocols, A distributed power aware multicast routing protocol. Multicasting with Quality of Service guarantees, Application dependent multicast routing.

UNIT V
Transport layer and security protocols: Introduction, Issues in designing transport layer protocol, design goals of transport layer protocol, Classification of transport layer solutions, TCP over ad hoc wireless networks, Other transport layer protocols for ad hoc wireless network, security in ad hoc wireless network, network security requirements, Issues and challenges in security provisioning, Network security attacks, Key man agement, Secure routing in AD hoc Wireless networks: Requirements of secure routing protocol, security aware ad hoc routing protocol.

7th Semester

CT1407	PE II : Ad-hoc Wireless Network				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

UNIT VI

Quality of service and energy management in Ad hoc Wireless networks: Introduction, Issues and challenges in providing Quality of service, classification of Quality of service solutions. Introduction to energy management, Need for energy management, classification, Battery management schemes, transmission power management schemes, system power management schemes.

TEXT BOOKS:

1. Ad Hoc Wireless Networks Architecture and protocols by C. Siva Ram Murthy, B. S. Manoj. Pearson Publication.

REFERENCE BOOKS:

1. Ad hoc Networking by Charles E. Perkins Addison Wesley.
2. The hand book of ad hoc wireless networks by Mohammad Ilyas, CRC press.

7th Semester

CT1453	PE II : Probabilistic Statistical Data Analysis				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To introduce basic statistical formulae to find out the tendency of data 2. To introduce probability and probability distribution concepts 3. To introduce the concepts of sampling and estimation 4. To introduce hypothesis testing and various scenarios for testing hypothesis 5. To introduce the statistical method for comparing more than two proportions 6. To introduce the modeling technique, regression to perform the predictive analysis	1. Able to analyze the hidden meaning in the data using some basic formulae and able to implement it using 'R Statistics' 2. Able to find out the probability and probability distribution for the given samples 3. Able to analyze the data using sampling technique 4. Able to take the decisions by using hypothesis testing on samples 5. Able to compare the population proportions 6. Able to create the model for predictive analysis

UNIT I [7 Hrs]
Introduction: Grouping and displaying data to convey meaning: Raw data, arranging data, frequency distribution, Measures of central tendency and dispersion in frequency distribution: arithmetic mean, weighted mean, geometric mean, Median, mode, dispersion, ranges, Exploratory data analysis(EDA). Introduction to R Statistics

UNIT II [8 Hrs]
Probability and Probability distribution: Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence. Probability distribution: What is probability distribution, random variables, use of expected value in decision making, and various distributions.

UNIT III [7 Hrs]
Sampling and Sampling Distribution and Estimation: Introduction to sampling, random sampling, Introduction to sampling distribution. Estimation: Introduction, Point estimates, Interval estimates and confidence interval, interval estimates using t distribution, determining the sample size in estimations

UNIT IV [8 Hrs]
Testing Hypothesis: One sample test, Two sample tests: Introduction, testing hypothesis, hypothesis testing of means when the population standard deviation is known, measuring power of hypothesis, hypothesis testing of proportions, HT when standard deviation is not known, hypothesis testing for means and proportions, test for difference between means for various sample sizes.

UNIT V [7 Hrs]
Chi-square and analysis of Variance: Introduction, chi-square as a test of independence, chi-square as a test of goodness of fit: testing the appropriateness of a distribution, analysis of variance, inference about a population variance, Inference about two population variance

UNIT VI [8 Hrs]
Simple Regression and Correlation and Multiple Regression and Modeling: Estimation using regression line, correlation analysis, making inference about population parameters, multiple regression and correlation analysis, finding the multiple regression equation, making inference about population parameters, modeling techniques

Text Book:
1. "Statistics for Management", Richard I. Levin & David S. Rubin, 7th Edition, Pearson Education.

Reference Book:
1. "Practical Statistics for Data Scientists, 50 Essential Concepts", Peter Bruce & Andrew Bruce, O'Reilly Media
2. "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer Press

7th Semester

CT1408	PE III: CLOUD COMPUTING				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
Main objective is to create, promote and exploit an open-source Cloud API and platform targeted for designing and developing multi- Cloud-oriented applications.	1. Explain software and hardware support for enterprise and cloud computing. 2. Perform data modeling for enterprise and cloud knowledge bases. 3. Design enterprise and cloud software applications. 4. Implement and run distributed and cloud applications. 5. Ensure security and privacy in enterprise and cloud applications.
PO, PSO MAPPING :- a,b,c,d,e,f,g,h,i,k,l,m	

UNIT I
Introduction to Cloud Computing: Defining Cloud Computing; Cloud Types and different models-The NIST model, The Cloud Cube Model, Deployment models, Service models; Examining the Characteristics of Cloud Computing; Benefits of cloud computing; Disadvantages of cloud computing; Assessing the Role of Open Standards.

UNIT II
Cloud Architecture, Services and Applications: Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frame works, Software as a Service, Identity as a Service, Compliance as a Service .

UNIT III
Abstraction and Virtualization: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT IV
Exploring Cloud Infrastructures: Managing the Cloud Administrating the Clouds, Management responsibilities, Lifecycle management Cloud Management Products, Emerging Cloud Management Standards, understanding Service Oriented Architecture- Introducing Service Oriented Architecture.

UNIT V
Managing & Securing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, The security boundary, Security service boundary, Security mapping, Brokered cloud storage access, Establishing Identity and Presence.

UNIT VI
Cloud Computing Cost Analysis, Selecting an IaaS Provider, Capacity Planning and Disaster Recovery in Cloud Computing, basic AWS Cloud architectural principles, basic/core characteristics of deploying and operating in the AWS Cloud, the key services on the AWS Platform and their common use cases, Define the billing, account management, and pricing models, Introduction to Amazon EC2. Case Studies: Microsoft Azure, Dropbox

TEXT BOOKS:
1. Cloud Computing Bible, by Sosinsky B. Wiley India.
2. Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online by Miller Michael, Pearson Education India.

REFERENCE BOOKS:
1. Cloud Computing: Principles and Paradigm by Buyya R. Broberg, J. Goscinski, A. John Wiley & Sons.
2. Cloud Computing – A practical Approach by T. Velte , A. Elsenpeter, R. Tata McGraw Hill.
3. Cloud Computing and SOA Convergence in Enterprise by Linthicium D. Pearson Education India.
4. Enterprise Cloud Computing by Shroff G, Cambridge University Press
5. Private Cloud Computing by Smooth S. Tan, N. Morgan Kauffman.
6. Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online by Miller Michael, Pearson Education India .

7th Semester

CT1409	PEIII: Operations Research				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To provide knowledge about basic deterministic methods of operations research (linear programming, network flows, integer programming and nonlinear programming) and their applications to resource allocation problems in business and industrial organizations. 2. To develop an ability to analyze any engineering problem in a simple and logical manner and to apply appropriate basic principles to its solution.	1. Describe at an intuitive level the process of operations research: a real-time cycle of problem understanding, formulation, solution and implementation. 2. Identify and develop operational research models from the description of the real system. 3. Formulate simple reasoning, learning and optimization problems, in terms of the representations and methods presented. 4. Manipulate the basic mathematical structures underlying these methods, such as system state, search trees, plan spaces, model theory, constraint systems, linear programs and integer programs. 5. Demonstrate the hand execution of basic reasoning and optimization algorithms on simple problems. 6. Use the mathematical tools that are needed to solve optimization problems. 7. Use mathematical software to solve the proposed models.
PO, PSO MAPPING :- a, b, c, d, e, h, i, k, l, m	

UNIT I **MODELING APPROACH**
Definitions, Characteristics, Scope and Limitations of OR, phases of OR modeling OR tools and techniques of OR

UNIT II **LINEAR PROGRAMMING**
Linear Programming, assumptions and formulation of LP model, solution of LPP by graphical method, simplex method, Dual Simplex Method, Two Phase Simplex Method, Big M Method, Duality in LP.

UNIT III **ALLOCATION MODELS**
Assignment models: Definition and assumptions, formulation and solution, multiple optimum solutions, prohibited assignment.

UNIT IV **ALLOCATION MODELS**
Transportation model
Definition, Solution of Transportation Model, prohibited and preferred routes, and degeneracy in transportation problem.

UNIT V **INTEGER PROGRAMMING**
Definition, applications, Branch and Bound Method to solve Travelling Salesman Problem.

UNIT VI **Machine Sequencing:** n jobs through two machines, n jobs through three machines, n jobs through m machines, two jobs through m machines sequencing problem.
Constrained Optimization: Karush-Kuhn-Tucker Conditions for Constrained Optimization, exposure to tools e.g. Mathematica.

TEXT BOOKS:
1. Optimization technique by Radrin pearson ,Ed. Publication.
2. Problems in Operation Research by P.K.Gupta & Man Mohan ,Khanna Pub.
3. Mathematical Models in Operation Research by J. K. Sharma, Mac millan Pub.

REFERENCE BOOKS:
1. Introduction to Operation research by Hiller & Liberman (Holden Day Inc. San Francisco).
2. Operation Research by Kantiswaroop & Gupta, S.Chand Pub.
3. Principles of Operation Research by Wagner ,PHI Pub.
4. Operation Research by Dr. B. S. Goel & S. K. Mittal , Pragati Prakashan.
5. Optimization Technique by S. S. Rao.

7th Semester

CT1437	PE III : Parallel Computing				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To provide basics of concepts related to parallel computing 2. To understand principles of parallel algorithm design 3. To understand performance measuring metrics for parallel system 4. To understand basics of thread programming 5. To familiarize different directives of parallel programming framework i.e OpenMp To understand concepts of Dynamic Programming	1. identify areas where parallel computing is applicable 2. design parallel algorithm for real life problems 3. find the speedup factor by analyzing parallel programs 4. implement parallel programs using thread programming 5. implement different algorithms using OpenMp implement dynamic programming problems using parallel programming
PO, PSO MAPPING	

Unit I :
Introduction to Parallel Computing: Motivating Parallelism Scope, Applications, Parallel Programming Platforms: Implicit Parallelism: Limitations of Memory System Performance, Dichotomy of Parallel Com puting Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process Processor Mapping and Mapping Techniques

Unit II :
Principles of Parallel Algorithm Design: Preliminaries Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, Basic Communication operations: One to All Broadcast and All to One Reduction, All to All Broadcast and Reduction, All Reduce and Prefix Sum Operations, Scatter and her, All to All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations

Unit III :
Analytical Modeling of Parallel Programs: Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics, Programming Using the Message Passing Paradigm: Principles of Message Passing Programming, The Building Blocks: Send and Receive Operations , MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators,

Unit IV :
Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing synchronous Programs,

Unit V
OpenMP: a Standard for Directive Based Parallel Programming, Dense Matrix Algorithms: Matrix Vector Multiplication,Matrix Matrix Multiplication, Solving a System of Linear Equations Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort, Other Sorting Algorithms, Graph Algorithms: Minimum spanning tree Prims Algorithm, Single Source Shortest Paths: Dijkstra's Algorithm
Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search,Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms

7th Semester

CT1437	PE III: Parallel Computing				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

Unit VI

Dynamic Programming: Overview of Dynamic Programming, Serial Monadic DP Formulations, Monadic DP Formulations, The Longest Common Subsequence Problem, Serial Polyadic DP Formulations, Floyd's All Pairs Shortest-Paths Algorithm, Nonserial Polyadic DP Formulations, The Optimal Matrix Parenthesization Problem, Fast Fourier ransform:
The Serial Algorithm, The Binary Exchange Algorithm, The Transpose Algorithm 27

Books :
1.
Introduction to Parallel Computing, Ananth Grama, Pearson Education

Reference Books:
1. Fundamental of Paralle Processing, Harry F. Jordan, Gita Alaghband, Pearson Education
2. Parallel Programming, Michael Allen, Barry Wilkinson, Pearson Ed

7th Semester

CT1454	PE III : Machine Learning Techniques				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESEDuration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To introduce basic concepts of machine learning and eexplain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To introduce the concepts of decision tree machine learning 5. To understand the different methods of evaluation of machine learning algorithms 6. To introduce advance topics of machine learning	1. Analyze a problem and identify the machine learning algorithm appropriate for its solution 2. Able to apply supervised learning for the given set of samples and design the model to meet desired needs 3. Able to apply unsupervised for the given set of samples 4. Able to design predictive model 5. Able to compare the different machine learning techniques demonstrates comprehension of the trade-offs involved in design choices 6. Able to apply other hybrid machine learning techniques

UNIT I [7 Hrs]
Introduction to machine learning. Introduction, machine learning classes (i.e., supervised, unsupervised and reinforced), well posed and ill posed learning problems, designing a learning system, perspective and issues in machine learning, applications

UNIT II [8 Hrs]
Supervised Learning: Learning a class from Bayesian learning, learning theory (bias/variance tradeoffs; VC theory; large margins), Generative/discriminative learning, parametric/non-parametric learning, linear and logistic regression, SVM

UNIT III [7 Hrs]
Unsupervised Learning: Introduction, Density Estimation, Clustering, Dimensionality reduction, PCA, kernel methods

UNIT IV [8 Hrs]
Decision Tree Learning: Introduction, decision tree representation, appropriate problems for Decision Tree learning, the basics decision tree learning algorithm, hypothesis space search, inductive bias in decision tree learning, issues in decision tree learning.

UNIT V [8 Hrs]
Design and Analysis of Machine Learning Algorithms. Introduction, Factors, Response, and Strategy of Experimentation, Guidelines for Machine Learning Experiments, Cross-Validation and Resampling Method, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms, Comparing Multiple Algorithms: Analysis of Variance, Comparison over Multiple Datasets

UNIT VI [7 Hrs]
Advance Topics. Ensemble methods, Introduce the concepts behind deep learning and benefits of deep over shallow networks, introduce the concepts of reinforcement learning

7th Semester

CT1454	PE III : Machine Learning Techniques				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESEDuration		
	15	15	10	60	100	3Hrs		

Text Book:
1. "Introduction to Machine Learning", Ethem Alpaydin, The MIT Press, second edition.
2. "Machine Learning", Tom Mitchell, McGraw-Hill Science/Engineering/Math, 1997

Reference Book:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning. http://research.microsoft.com/en-us/um/people/cmbishop/prml/.
2. R. Sutton and A. Barto, An Introduction to Reinforcement Learning (http://webdocs.cs.ualberta.ca/~sutton/book/ebook/thebook.html)
3. C. Szepesvari, Algorithms for Reinforcement Learning (http://www.sztaki.hu/~szcsaba/papers/RLAlgsInMDPslecture.pdf)
4. Deep learning:
Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning (http://www.deeplearningbook.org/)

7th Semester

CT 1413	Industrial Training / CRT				L=0	T=0	P=0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
			100		100			

7th Semester

CT1414	Project Phase-i				L=0	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
			40	60	100			

8th Semester

GE1408	Cyber Laws				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
PO, PSO MAPPING:	

UNIT I
Evolution of the Law relating to information Technology –Legal environment in Information Age-Technology and law-The international regime, The National regime and initiatives in internet legislation-Issues of jurisdiction in cyber space – International Convention on cyber space 2001 OECD model treaty and E-commerce.Internet Juridction

UNIT II
The basics of IT Act - Objectives, Scope and application of the Act of 2000, Application of the IPCode as a measure of penal statute to regulate cyber activities and cyber contracts. Basic foundations in the Information Technology Act for the protection of E commerce, E Contracts and E documents, Digital signatures and identity-Access requirements, contract formation related nomenclature as defined in Section 2 of the IT Act.Basic Contract Law – Formation of contracts, performance and discharge of contractual obligations under the Indian Contract Act, 1872., SLA, KPI

UNIT III
Legal aspect of Digital signature and Electronic signature:
Authentication of electronic record by electronic signature (5.3 and 3A),Legal recognition of econtract sand e-documents of the governments-ss.4, 5, 6 ,7A and 10A, Securing e-records and e-signatures, Duties of subscriber ss.40-42 ss. 14 and 15, Certification of e-signature (s.35,36,37,38,39), Regulation of certifying authorities through licensing application for license ,renewal of license, procedure for grant or rejection of license, suspension or revolution of license. Esign, Digital Locker.

UNIT IV Privacy and Security, basic Principal of Data Protection Act, Health Insurance Portability Accountability Act, concepts of ISO 27001 security Audit, Payment Card Industry Data Security Standard (PCI DSS), Computer crime investigation process and evidence collection, Incident Response Procedures, Net Neutrality

UNIT V Treatment of cyber crimes under the IT Act -2008
Offence and penalties prescribed in I.T Act 2008, Controller"s powers with respect to offences And their regulation. Law relating to Cyber crime Under Indian Penal Code (IPC) 1860 Making false electronic record (S.464 IPC) Punishment for forgery (S.465 IPC); forgery of public record etc. (S.466 IPC) and Forgery for purpose of cheating (S.468) Forged document or electronic record (S.470); Using as genuine a forged document or electronic record (S.471); Counterfeiting device or mark used for authenticating documents or electronic record or possessing counterfeit marked material, Falsifying accounts. (S.474 and S.477A).

UNIT VI
Implication of cyber law on intellectual property related issues and commercial transaction Copyright Act-definition of computer and computer program (S.2ffb), Subsistence of copyright in computer programs, Copyright and Internet, Copyright in digital medium, Copyright in computer databases Trade mark Act –Search engine and meta tags- Domain Names: digital marks in the online medium, Resolving domain name disputes, Cyber Squatting /TYPO squatting Domain name in Indian law, Uniform dispute resoloution policy.Other important issue like IP PANAROMA., BITCOINS, digital divide, Global Commans, Auto SAR, GIWG Guide line
WIPO copyright treaty (WCT) 1996,WIPO performance and phonograms treaty (WPPT) 1996.

1. Satyam infoway Ltd. Vs Sifynet solution Pvt. Ltd (2004) 6SCC145
2. The Napster"s story
3. Other case study

8th Semester

CT1450	Object Oriented Modeling				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To distinguish between procedure oriented and Object Oriented Methodology. 2. To understand the features of Object Oriented Programming. 3. To Understand the basic building blocks of C++ language. 4. To Understand the Utility and difference of various Data Structure. 5. To Understand the need of Exception. 6. Exception Handling Mechanisms of OOP Methodology using C++. 7. To study the concept of Templates . 8. To Understand the OOP methodology and relate to it day to day applications. 9. To relate various practical examples with the OOP Methodology.	1. Compare different types of Programming Languages 2. Describe Real World object, Structure and Class. 3. Implement the Programming Examples. 4. Implement the Concept of abstract class Concept of Interface. 5. Define and classify Data Structure. 6. Implement the Mechanisms and Concept of Exception , Types of Exception 7. Define stream, the Concept of File, Opening and Closing of File
PO, PSO MAPPING: a,c,e,g,i,j,k,l,m	

UNIT I

Introduction: object orientation, Object Oriented development, modeling as a design technique, Class modeling:- the three models, object, classes, links and associations, navigation of class models, aggregation, abstract classes, metadata, packages.

UNIT II

State Modeling: events & states, transitions and conditions, state diagrams behavior, concurrency advanced state modeling concepts, nested state diagrams, concurrency, relation of class & state models. Interaction modeling: Use case. Sequence and activity models, relationships among the models.

UNIT III

System Analysis: Development life cycle and development style, system conception, domain analysis application analysis

UNIT IV

System Design: Overview, estimating performance, making are use plan, breaking into sub systems, identifying concurrency, allocation of sub systems, management of data storage, handling global resources, choosing software control strategy, handling boundary conditions, setting trade off priorities, common architectural styles.

UNIT V

Class Design, implementation modeling, object oriented languages.

UNIT VI

Databases: implementing structures basic and advanced, implementing functionality, object oriented databases. Object oriented programming style, reusability, extensibility, robustness.

TEXT BOOKS:

1. Object oriented modeling and design with UML by James Rumbaugh, Michal Blaha, Pearson Prentice Hall Second Edition.

REFERENCE BOOKS:

1. Practical Object Oriented Design with UML by Mark Priestley TMH 2nd Edition
2. The Unified Modeling Language user guide by Booch , Rumbaugh, Jacobson Addison Wesley 2nd Edition

8th Semester

CT1418	PE IV: Digital Image Processing				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To provide understanding of basics of Digital Image Processing, discuss fundamental concepts of neighborhood pixel, Spatial Domain Image Processing, provide insight of histogram processing, study the frequency Domain Image Processing, provide the details of segmentation and provide the regional and descriptors concept.	1. Apply Image Enhancement techniques in Spatial Domain. 2. Know and Apply Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging on images. 3. Perform Fourier Transform on images. 4. Understand and apply Homographic Filtering. 5. Apply different segmentation techniques on images.
PO, PSO MAPPING :- a,b,c,d,e,i,k,l	

UNIT I

Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception, Fundamentals of Image processing, A Simple Image Model, Sampling and Quantization, Some Basic Relationships. between Pixels, Image Geometry in 2D.

UNIT II

Image Enhancement in the Spatial Domain: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

UNIT III

Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Discrete Cosine Transform, Typical Applications

UNIT IV

Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering, Implementation.

UNIT V

Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.

UNIT VI

Image Representation: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models, introduction to image file formats: TIFF, JPEG, BMP, etc.

TEXT BOOKS:

1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
2. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing by A.K.Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya & Ajo y K. Ray, Wille y Inter-Science.

8th Semester

CT1419	Lab. : PE IV: Digital Image Processing	L=0	T=0	P=2	Credits=1
Evaluation Schem	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Sr.No.	Practical Name
1	Study Practical on basic gray level transformation.
2	Write a program to create a contrast of image.
3	Create a histogram of given image.
4	Resize a given Image.
5	Write a program to create negative of an image.
6	Create a Binary Image.
7	Write a program to smooth an image.
8	Write a program to Sharpe an image.
9	Segment a given image.
10	Create a skeleton of region.
Beyond Syllabus Practical List:	
1	Apply wavelet transform to decompose an image.
2	Apply gabor filter to enhance an image.

8th Semester

CT1420	PE IV: PATTERN RECOGNITION				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. The study of Pattern Recognition to equip the students with the brief knowledge of Statistica. 2. Decision Theory, Image processing, clustering, different error at esin pattern recognition, decision making techniques and application of pattern recognition in different fields.	1. Apply Pattern Recognition techniques for recognition n. 2. Know and Apply knowledge of Statistical Decision Theory. 3. Perform Image processing concepts on images. 4. Understand and apply clustering concepts on raw 5. Apply decision making techniques.
PO, PSO MAPPING: a,b,d,e	

UNIT I
Introduction: Statistical Decision Theory, Image Processing and Analysis, Probability- probabilities of events, random variables, joint distribution & densities.

UNIT II
Moments of random variables, estimation of parameters from samples, minimum risk estimators.

UNIT III
Non parametric decision Making- Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error, estimation functions, choosing a decision making technique.

UNIT IV
Linear Classifier Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Least Squares Methods, Mean Square Estimation Revisited, Support Vector Machines .

UNIT V
Feature Generation Introduction, Basis Vectors and Images, The Karhunen-Loeve Transform, The Singular Value Decomposition, Independent Component Analysis, The Discrete Fourier Transform, The Haar Transform.

UNIT VI
Clustering-Introduction, hierarchical clustering, partition clustering.

TEXT BOOKS:
1. Pattern recognition & Image Processing by Ealr Gose, Richard Johnson daugh & Steve Jost. (PHIPub).
2. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification" 2nd Edition, John Wiley.

REFERENCE BOOKS:
1. Pattern recognition by Sergios Theodoridis, Konstantinos Koutroumbas 3rd Ed.

8th Semester

CT1421	Lab. : PE IV: Pattern Recognition	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Sr.No.	Practical Name
1	Enhance an image using Average Filter.
2	Detect the edges using Sobel operator.
3	Plot a histogram of a given image.
4	Classify an objects based on adadptive desion boundary technique.
5	Classify an objects based on nearest neighbor classification techniques.
6	Implement The Perceptron Algorithm.
7	WAP to implement SVM.
8	Extract features using ICA.
9	Extract features using DFT.
10	Extract features using Haar Transform.

8th Semester

CT1441	PE IV: Mobile Communication				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
To provide an in depth understanding of wireless access, mobility in cellular, to study wireless networks using standards like GSM, CDMA, GPRS and IEEE 802.11 etc., to understand the quantitative techniques to evaluate the different, protocols, network architecture.	Students should be able to select appropriate standards for the given situation. evaluate different protocols using quantitative techniques.

PO, PSO MAPPING: a,b,c,d,e,i,k,l

UNIT I: **[7Hrs]**
Introduction to wireless communication, introduction to cellular system, wireless transmission: frequencies for radio transmission, signal prorogation. Introduction to medium access control: TDMA, CDMA GSM: System architecture protocols, localization and calling, handover, Modulation Techniques.

UNIT II: **[8Hrs]** Wireless LAN: IEEE 802.11, Bluetooth, Zigbee etc. Satellite Systems: GEO, LEO, MEO routing, localization and handover Mobile network Layer: Mobile IP, dynamic host, configuration protocol, adhoc networks, IPv6. Mobile transport layer: traditional TCP, indirect TCP & mobile TCP,

UNIT III: **[7Hrs]**
2G-Global System for mobile communication (GSM) Introduction, GSM Architecture, Database and Data Elements, GSM Interfaces, GSM Protocol Architecture, GSM Versions.

UNIT IV: **[7Hrs]**
2G: IS95 cellular system (CDMA): Introduction, Motivation for CDMA to use in Mobile Communication, IS95 cellular System (CDMA) forward Channel, Reverse Channel Parameters of CDMA, wireless Local Loop Radio System. 4G LTE, 5G Introduction, LIFI

UNIT V: **[8Hrs]**
2.5 G: General Packet Radio service (GPRS) Introduction, Advantages of GPRS, GPRS Application, GPRS Architecture, GPRS Interfaces Logical Channels in GPRS, Protocol Architecture, Internetworking with IP Networks, GPRS terminals

UNIT VI: **[8Hrs]**
3G: Universal Mobile Telecommunication System (UMTS) Introduction, UMTS Services, UMTS Architecture, UMTS Core Network, 4G introduction, Architecture of wireless Application protocol (WAP), Issues of Mobile Application.

TEXT BOOKS:
1. "Mobile communication", Jochen Schiller (Addison Wesley pub)
2. "Mobile Communication Systems", Krzysztof Wesolowski (Wiley Publication)
3. "Wireless Communication principles & Practice", T.S.Rappaport (PHI pub)

REFERENCE BOOKS:
1. "Mobile communications Design Fundamentals ", William C.Y.Lee (john Wiley & Sons pub)
2. "Wireless Sensor Network", Zhoo & Guibas

8th Semester

CT1442	Lab. : PE IV: Mobile Communication	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

LIST OF PRACTICAL

1. Installation of JDK1.6 and SDK1.3.
2. Study of JDK (Eclipse) Tool kit and software development kit.
3. Study of WML: Wireless Markup Language and its examples.
4. Develop an application in Android to store contacts in mobile handheld device.
5. Develop an application in Android to read an user input text.
6. Develop a Standup Timer in an Android that acts as a simple, stand-up meeting stop watch.
7. Study of Wireless Application protocol (WAP)
8. To study Pervasive Computing.

8th Semester

CT1455	PE IV :Cyber Forensics				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To study various accepts of Information security and protect the IT asset from outside word. 2. To study different modern techniques for with respect to Computer System and Networks 3. Ethical Hacking accepts for protecting information security. 4. To make comparative analysis of different forensics techniques for wireless technology 5. To study different legal web attacking technique for securing web servers 6. To study and compilation of report writing tool and technique used in digital forensics.	1. Able to apply various accepts of Information security and Information technology with respect to cyber laws 2. Able to analyse various tool and methodology for cyber forensics 3. Able to explorer ethical hacking and its countermeasure 4. Able to apply various technique for protecting data in wireless technology 5. Able to evaluate various web attacking technique and there countermeasure 6. Able to design report for different forensic cases for submitting in court of laws

Unit I **[7 Hrs]**
Types of Cyber Crime, security Attacks, Overview and Computer forensics in today's world computer hard ware basics Computer forensics investigation process, understanding hard disks and file systems, Types of computer forensics.

Unit II **[7 Hrs]**
Computer forensic: Data acquisition and duplication, Defeating anti-forensics techniques, operating system forensics, Log analysis and event viewer, File auditing, identifying rogue machines, Malware forensic Database forensic.

Unit III **[7 Hrs]**
IT fraud, Recovery of deleted files, Live Data collection and investigating Linux environment. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), email crimes.

Unit IV **[7 Hrs]**
Network forensics, investigating web attacks, Gathering Tools to create a response toolkit. Hidden files and unauthorized access points. Analyzing network traffic, sniffers Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc.

Unit V **[7 Hrs]**
Mobile Forensics, Live Data collection and investigating on android, ios, windows environment, Investigating report generation, investigation process, acquisition types, tools, report generation

Unit VI **[7 Hrs]**
Forensics report writing and presentation, Case studies

Text Books:
1. Mandia, K., Prosise, C., Pepe, M., Incident Response & Computer Forensics. 2nd edition, Tata-McGraw Hill,
2. Bill Nelson, Amelia Phillips, Frank Enfinger, and Chris Steuart, Guide to Computer Forensics and Investigations, 2nd edition, Thomson Learning

Reference Books:
1. Eoghan Casey ,Digital Evidence and Computer Crime, 2nd Edition , academic Press File System Forensic Analysis by Brian Carrier, addition Wesley
2. Harlan Carvey Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Syngress Publication
3 Steve Bunting, EnCE: The Official EnCase Certified Examiner Study Guide, 2nd Edition, Sybex Publication

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

8th Semester

CT1456	Lab : PE IV :Cyber Forensics	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
1. To study various accepts of Information security and protect the IT asset from outside word. 2. To study different modern techniques for with respect to Computer System and Networks 3. Ethical Hacking accepts for protecting information security. 4. To make comparative analysis of different forensics techniques for wireless technology 5. To study different legal web attacking technique for securing web servers 6. To study and compilation of report writing tool and technique used in digital forensics.	1. Able to apply various accepts of Information security and Information technology with respect to cyber laws 2. Able to analyse various tool and methodology for cyber forensics 3. Able to explorer ethical hacking and its countermeasure 4. Able to apply various technique for protecting data in wireless technology 5. Able to evaluate various web attacking technique and there countermeasure 6. Able to design report for different forensic cases for submitting in court of laws
Mapped Program Outcomes:	

List of Practical:

1. Study practical on cyber-crime and generation of Hash values on file system
2. Perform data accusation and imaging on digital evidences
3. Perform recovery and data carving on digital evidence
4. Explore and analyses tools on Email analysis an investigation
5. Password recovery tools, from RAR, DOC, PDF, windows password.
6. Mobile forensics SIM card analysis,
7. Mobile data Analysis AND Fraud Detection,
8. Vulnerability Analysis on Windows
9. Report and Evidence Submission using Tools

8th Semester

CT1432	PE V:Software Project Management				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1To learn basic concepts project contract and to get an overview of various activities under project planning. 2 To understand techniques for cost benefit analysis and risk evaluation. 3 To understand project scheduling and various network planning models. 4To understand Risk Management, Risk Planning and control. 5 To understand various activities like visualizing progress, earned value analysis etc. under monitoring and controlling of a project. 6 To understand the role of continuing training and learning, to improve group working and to select appropriate leadership styles.	1 To understand basic concepts about project, project management and project planning. 2 To assess given requirements and perform cost benefit analysis. 3 To create a project schedule using some network planning model for given requirements. 4 To identify and create a risk management plan for given requirements. 5 To perform earned value analysis for given requirements and current completion state of project. 6 To form teams for any given exercise, work as a team and understand leadership qualities.
PO, PSO MAPPING :- a,b,c,d,e,f,g,h,i,j,k,l,m	

UNIT I
Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered By Software Project Management, Overview of Project Planning, Stepwise Project Planning.

UNIT II
Project Evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation.

UNIT III
Activity Planning: Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks.

UNIT IV
Risk Management: Risk Management, Nature Of Risk, Types Of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning And Control.

UNIT V
Monitoring and Control: Creating Framework , Collecting The Data , Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting Project Back To Target, Change Control, Managing Contracts, Introduction, Types Of Contract, Stages In Contract Placement, Typical Terms of A Contract, Contract Management, Acceptance.

UNIT VI
Managing People and Organizing Teams: Introduction, Understanding Behavior, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods , Motivation, The Oldman – Hackman Job Characteristics Model, Working In Groups– Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety.

TEXT BOOKS:
1. Bob Hughes, Mikecotterell, "Software Project Management", Third Edition, Tata McGraw Hill.
REFERENCE BOOKS:
1. Ramesh, Gopalaswamy, «Managing Global Projects, Tata McGraw Hill.
2. Royce, "Software Project Management", Pearson Education.
3. Jalote, "Software Project Manangement in Practive", Pearson Education.

8th Semester

CT1433	Lab. : PE V : Software Project Management	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Sr.No.	Practical Name
1	Introduction to Software Project Management fundamentals.
2	To analyze requirements for a given case study .
3	To create a WBS for the given case study.
4	To perform risk management for the case study – 1.
5	To perform risk management for the case study – 2.
6	Overview of Planning tool.
7	To create Project Schedule for the case study -1.
8	To create Project Schedule for the case study -2.
9	To perform cost benefit analysis for case study.
10	To study contract management and contract document.
Beyond Syllabus Practical List:	
1.	To study and calculate Software Project Metrics.
2.	To study implementation of change control.

8th Semester

CT1443	PE V : Internet of Things				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		
OBJECTIVES				OUTCOMES				
To provide the details about the IoT(Internet of Things) and let understand and implements the emerging concepts about Internet of things				Students should be able to use, implements various platform from IoT and proficient to design and development of Smart Cites concepts.				
PO, PSO MAPPING :- a,b,c,e,h,k,l,								

UNIT I APPLICATION DEVELOPMENT

Introduction – Concepts behind the Internet of Things.

The IoT paradigm, Smart objects, Bits and atoms, Goal orientation, Convergence of technologies, In IoT architectures, IoT enabling technologies, IoT Big Data Analytics, IoT security and privacy concerns. Computing paradigms: Virtualization Vulnerabilities, Hypervisor Security-Related Issues, Side Channel Attacks, Data Segregation, ubiquitous, grid, cloud, pervasive, green, ad hoc (*mobile*, *vehicular*, *flying*) networks.

UNIT II

Governance of Inter of things, Bodies subjects to Governing principal, substantive Principe of IoT Governance IoT Infracture Governance, Future Governance Issue, implementation of Smart city and smart villages projects , challenges and issues in SMART Projects

UNIT III cloud computing enable technology

Radio frequency Identification technology

Radio frequency Identification technology overview, Principle of RFID, Components of RFID technology Overview, Wireless sensosor network tencnology overview, connecting node, networking securing communication, Power line communication technology overview, PLC Technology standard, archecture of home technology overview, RFID Research and related issue

UNIT IV Advance Cloud computing

Internet of things and cloud computing, IoT integration with Enterprise system, (XaaS) Everthing As a Services, Distributed business process in IoT, Distributed business processs in IoT, ubiquitous technology in cloud, middlewae for IoT, standards for SCDA, Standards for M2M, Unified mult tire WoT Architecture, SOA/EAI verus SODA MAI, Mobile cloud computing, four technology pillar, WoT Portal and Business Architectural

UNIT V ADVANCED SOCKETS-I

Routing sockets – Datalink socket address structure – Reading and writing – sysctl operations –get_ifi_info function – Interface name and index functions- Key Management sockets – Reading and writing – Dumping Security Association Database – Creating static Security Association – Dynamically maintaining SA's – Broadcasting – Broadcast addresses – Unicast versus Broadcast – (Client) Application development for broadcasting – Race conditions – Multicasting – Multicast addresses- Multicasting versus Broadcasting on a LAN – Multicasting on a WAN – Source specific Multicast – Multicast socket options – mcast_join, (Client) Application development for multicasting – Receiving IP multicast infrastructure session announcements – Sending and receiving.

UNIT VI Case Study and Projects

Introduction to Raspberry Pi, Setup and operate the Raspberry Pi ,Understand the basics of the Linux OS used on the Pi ,Understand the basics of the X Windows System (the GUI environment) , Program the Pi for a simple GUI-based game , Program the Pi to access a network, Raspberry Pi ARM ARM Architecture, ARM 11 future, Ardunio Basics Project and case study based on Ardunio and Pi

8th Semester

CT1443	PE V : Internet of Things				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

REFERENCES

1. W. Richard Stevens, "Unix Network Programming Vol-I", Second Edition, Pearson Education, 1998.
2. D.E. Comer, "Internetworking with TCP/IP Vol- III", (BSD Sockets Version), Second Edition, Pearson Education, 2003.
3. Michael Donahoo, Kenneth Calvert, "TCP/IP Sockets in C, A practical guide for programmers", Second Edition, Elsevier, 2009
4. Forouzan, " TCP/IP Protocol Suite" Second Edition, Tata MC Graw Hill, 2003.

8th Semester

CT1444	Lab. : PE V: Internet of Things	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

8th Semester

CT1445	PE V : Numerical Computing	L=3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives	Outcomes
To develop in the engineering students the ability to analyze any engineering problem in simple mathematical manner and to apply to its solution, to understand basic mathematical principles.	Students should be able to apply various numerical techniques to solve engineering problems.

Mapped Program Outcomes: a,b,c,e,g,i,k,l,m

UNIT I : [6Hrs]
Introduction to numerical computing: Characteristics of Numerical computing, Approximations and errors in numerical computations, types of errors, analysis, error estimation, numerical instabilities in computation, convergence (convergence of iterative method),

UNIT II: [8Hrs]
Roots of Non-linear equations: Methods of solutions, Iterative methods, Horner's rule, Bisection method, Regula Falsi method, Iteration method, Newton Raphson method, Secant method, Muller method.

UNIT III :[8Hrs]
Solutions to System of Linear Algebraic Equations:
Existence of Solution, Solution By Elimination, Cramers rule, Basic Gauss Elimination Method, Gauss Elimination With Pivoting, Gauss – Jordan Method, Tringularization Methods, Choleskey's Method, Gauss Siedel method of iteration. Round Off Errors And Refinement, Ill – Conditioned System, Matrix Inversion Method.

UNIT IV :[8Hrs]
Interpolation and Approximation: Linear interpolation and high order interpolation using Lagrange and Newton Interpolation methods, finite difference operators and interpolation polynomials using finite differences.

UNIT V: [8 Hrs]
Numerical Differentiation and Integration: Numerical differentiation and errors in numerical differentiation, Newton-Cotes formulae, trapezoidal rule, Simpson's rule, Double integrals by Trapezoidal and Simpson rule, Romberg Integration.

UNIT VI:[8Hrs]
Numerical Solution of Ordinary Differential Equation: Solution By Taylor's Series, Picard's Method Of Successive Approximation, Euler's Method, Error Estimates For The Euler Method, Runge-Kutta Method for 2nd and 4th order, Predictor-Corrector Methods, Initial and boundary value problems.
Matrix Eigen – Equations: Concept of Eigen-System, Polynomial Method, Power Method for Eigen Values and Eigen-vector,

Text Books:
1. Sastry, S. S. "Introductory Methods of Numerical Analysis", 3rd Edition. Prentice- Hall of India, New Delhi (2002).

Reference Books:
1."Numerical Methods" , E. Balagurusamy, Tata McGraw hill.

2."Schaum's Outlines: Numerical Analysis", 2nd Edition, Tata McGraw Hill Publishing Co. Limited.

3."Numerical Computational Methods" P.B. Patil, U.P. Verma, Narosa Publishing, New Dellhi, 2006.

8th Semester

CT1446	Lab. : PE V: Numerical Computing	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
To apply the numerical methods to real life scenario.	Students should be able to apply theoretical numerical methods to solve real life problems.
Mapped Program Outcomes: b,c,e,g,i,k,l,m	

COURSE OBJECTIVES

1. To apply the theoretical numerical methods to real life scenario.

LIST OF PRACTICAL

1. Write A Program To Find The Root Of The Equation X^3 - 2x - 5 = 0 By Using Bisection Method.
2. Write A Program To Find The Root Of The Equation X^3- 2x - 5=0 By Using False Position Method.
3. Write A Program To Find The Root Of The Equation X^2-3x + 2=0 By Using Newton Raphson Method
4. Write A Program To Find The Root Of The Equation X^2-3x + 2=0 By Using Muller Method.
5. Write A Program To Solve The System Of Equation By Using Gauss Elimination Method.
6. Write A Program To Solve The System Of Equation By Using Triangular Factorization Method.
7. Write A Program To Find The Square Root By Using The Second Order Lagrange Interpolation Polynomial Equation.
8. Write A Program To Fit A Line Y=A + Bx To Given Set Of Data Point By Least Squares Method
9. Write A Program For Integrating A Given Function By Using Simpson 1/3rd Rule
10. Write A Program To Estimate The Solution In The First Order Differential Equation Y=F(X,Y) At Given Point By Using Euler's Method

8th Semester

CT1425	Comprehensive Viva	L=0	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
		100	100	

8th Semester

CT1426	Project Phase-II	L=0	T=0	P=0	Credits=8

Evaluation Scheme	Continuous Evaluation	TA	ESE	Total	ESE Duration
		40	60	100	

8th Semester

CT1427	Extra / Co –curricular/ Competitive Examination	L=0	T=0	P=0	Credits=2

Evaluation Scheme	Continuous Evaluation	TA	ESE	Total	ESE Duration
			100	100	

Dean (Acad)
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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2014

3 to 8 Semester

Information Technology

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.E. SCHEME OF EXAMINATION 2014

Information Technology

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE-I	MSE-II	TA	ESE	
THIRD SEMESTER												
1	GE1201	Engineering Mathematics - III	3	1	0	4	4	15	15	10	60	3
2	IT1201	Introduction to Information Technology	3	0	0	3	3	15	15	10	60	3
3	IT1206	Microprocessor Based System Design	4	0	0	4	4	15	15	10	60	3
4	IT1207	**Lab:** Microprocessor Based System Design	0	0	2	2	1			40	60	
5	IT1204	Algorithms & Data Structures	3	1	0	4	4	15	15	10	60	3
6	IT1205	**Lab:** Algorithms & Data Structures	0	0	2	2	1			40	60	
7	EE1213	Digital Circuits & Switching Theory	4	0	0	4	4	15	15	10	60	3
8	EE1214	**Lab:** Digital Circuits & Switching Theory	0	0	2	2	1			40	60	
			17	**2**	**6**	**25**	**22**					
FOURTH SEMESTER												
1	GE1206	Discrete Mathematics & Graph Theory	3	1	0	4	4	15	15	10	60	3
2	IT1208	Computer Architecture & Organization.	4	0	0	4	4	15	15	10	60	3
3	IT1202	Object Oriented Programming	3	1	0	4	4	15	15	10	60	3
4	IT1203	**Lab:** Object Oriented Programming	0	0	2	2	1			40	60	
5	IT1209	Theory of Computation	3	1	0	4	4	15	15	10	60	3
6	IT1210	**Lab:** Computer Workshop	0	0	2	2	1			40	60	
7	ET1215	Information Theory and Communication	4	0	0	4	4	15	15	10	60	3
8	ET1216	**Lab:** Information Theory and Communication	0	0	2	2	1			40	60	
			17	**3**	**6**	**26**	**23**					

Chairperson	Dean (Acad. Matters)	Version	May 2015 Date of Release	Applicable for AY 2015-16 Onwards

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B.E. SCHEME OF EXAMINATION 2014

Information Technology

Sr. No.	Course Code	Course Title	CONTACT HOURS				Credits	%Weightage				ESE Duration Hrs.
			L	T	P	Total Contact		MSE-I	MSE-II	TA	ESE	
FIFTH SEMESTER												
1	GE1312	Fundamental of Economics	3	0	0	3	3	15	15	10	60	3 Hrs
2	IT1303	Operating Systems	3	1	0	4	4	15	15	10	60	3 Hrs
3	IT1304	**Lab:** Operating Systems	0	0	2	2	1			40	60	
4	IT1305	Software Engineering	4	0	0	4	4	15	15	10	60	3 Hrs
5	IT1306	**Lab:** Software Engineering	0	0	2	2	1			40	60	
6	IT1316	Data Base Management Systems	3	1	0	4	4	15	15	10	60	3 Hrs
7	IT1317	**Lab:** Data Base Management Systems	0	0	2	2	1			40	60	
8	**Professional Elective I**		4	0	0	4	4	15	15	10	60	3 Hrs
	IT1307	PE I :Computer Graphics										
	IT1309	PE I :Embedded System										
	IT1326	PE I :Digital Signal Processing										
	IT1327	PE I :Web Programming										
	IT1328	PE I : Data Analysis & Statistics										
9	**Open Elective I**		3	0	0	3	3	15	15	10	60	3 Hrs
	IT1322	OE I: Web Technology										
	IT1325	OE I: Object oriented programming (Java)										
10	IT1313	Seminar	0	0	2	2	1			100		
Total			**20**	**2**	**8**	**30**	**26**					

SIXTH SEMESTER												
1	GE1311	Fundamental of Management	3	0	0	3	3	15	15	10	60	3 Hrs
2	IT1338	Computer Networks	3	1	0	4	4	15	15	10	60	3 Hrs
3	IT1339	**Lab:** Computer Networks	0	0	2	2	1			40	60	
4	IT1330	Business Intelligence	4	0	0	4	4	15	15	10	60	3 Hrs
5	IT1331	**Lab:** Business Intelligence	0	0	2	2	1			40	60	
6	IT1318	Design & Analysis of Algorithms	3	1	0	4	4	15	15	10	60	3 Hrs
7	IT1332	**Lab:** Design & Analysis of Algorithms	0	0	2	2	1			40	60	
8	**Professional Elective II**		3	1	0	4	4	15	15	10	60	3 Hrs
	IT1311	PE II: Artificial Intelligence										
	IT1320	PE II: Digital Image Processing										
	IT1308	PE II: Mobile Communication										
	IT1333	PE II: Information Systems										
	IT1334	PE II: Internet of Things										
	IT1335	PE II: Distributed and Object Oriented Databases										
9	**Open Elective II**		3	0	0	3	3	15	15	10	60	3 Hrs
	IT1336	OE II: Introduction to E-Commerce										
	IT1337	OE II:Information Security										
10	IT1324	Mini Project	0	0	2	2	1			100		
Total			**19**	**3**	**8**	**30**	**26**					

Chairperson		**Version**	**1.00**
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B.E. SCHEME OF EXAMINATION 2014

Information Technology

Sr. No.	Course Code	Course Title	CONTACT HOURS				Credits	%Weightage				ESE Duration Hrs.
			L	T	P	Total Contact		MSE-I	MSE-II	TA	ESE	
SEVENTH SEMESTER (Group "A")												
1	IT1403	Principle of Compiler Design	3	1	0	4	4	15	15	10	60	3 Hrs
2	IT1404	**Lab:** Principle of Compiler Design	0	0	2	2	1			40	60	
3	IT1417	Network Programming	4	0	0	4	4	15	15	10	60	3 Hrs
4	IT1418	Lab: Network Programming	0	0	2	2	1			40	60	
5	IT1427	Data Mining	4	0	0	4	4	15	15	10	60	3 Hrs
6	IT1428	**Lab:** Data Mining	0	0	2	2	1			40	60	
7	IT1422	Network Security	3	0	0	3	3	15	15	10	60	3 Hrs
8	**Professional Elective III**		3	0	0	3	3	15	15	10	60	3 Hrs
	IT1407	PE III: Real Time Systems										
	IT1423	PE III: Human Computer Interaction										
	IT1429	PE III: Advanced Computer Architecture										
	IT1430	PE III: E-Commerce										
	IT1432	PE III: Cloud Computing										
	IT1436	PE III: Coding Standard and Technical Documentation										
9	**Professional Elective IV**		3	0	0	3	3	15	15	10	60	3 Hrs
	IT1415	PE IV : Neural Networks & Fuzzy Logic										
	IT1405	PE IV: Pattern Recognition										
	IT1421	PE IV: Distributed Systems										
10	**Lab: Professional Elective IV**		0	0	2	2	1			40	60	
	IT1416	Lab.: PE IV : Neural Networks & Fuzzy Logic										
	IT1439	Lab.: PE IV: Pattern Recognition										
	IT1440	Lab.: PE IV: Distributed Systems										
Total			**20**	**1**	**8**	**29**	**25**					
SEVENTH SEMESTER (Group "B")												
1	IT1424	**Industrial Project (Industry Visit / Training / Seminar)**	0	0	30	30	20			40	60	
2	IT1425	Comprehensive Viva-Voce	0	0	0	0	3				100	
3	IT1426	Extra Curricular Activities	0	0	0	0	2			100		
Total			**0**	**0**	**30**	**30**	**25**					
Total Group(A+B)			**20**	**1**	**38**	**59**	**50**					

Chairperson		**Version**	**1.02**	**Applicable for AY 2018-19 Onwards**
Dean (Acad. Matters)		**Date of Release**	**September 2017**	

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B.E. SCHEME OF EXAMINATION 2014

Information Technology

Sr. No.	Course Code	Course Title	CONTACT HOURS				Credits	%Weightage				ESE Duration Hrs.
			L	T	P	Total Contact		MSE-I	MSE-II	TA	ESE	
EIGHTH SEMESTER (Group "A")												
1	IT1424	Industrial Project (Industry Visit / Training / Seminar)	0	0	30	30	20			40	60	
2	IT1425	Comprehensive Viva-Voce	0	0	0	0	3				100	
3	**IT1426**	Extra Curricular Activities	0	0	0	0	2			100		
Total			**0**	**0**	**30**	**30**	**25**					
EIGHTH SEMESTER (Group "B")												
1	IT1403	Principle of Compiler Design	3	1	0	4	4	15	15	10	60	3 Hrs
2	IT1404	**Lab:** Principle of Compiler Design	0	0	2	2	1			40	60	
3	IT1417	Network Programming	4	0	0	4	4	15	15	10	60	3 Hrs
4	IT1418	Lab: Network Programming	0	0	2	2	1			40	60	
5	IT1427	Data Mining	4	0	0	4	4	15	15	10	60	3 Hrs
6	IT1428	**Lab:** Data Mining	0	0	2	2	1			40	60	
7	IT1422	Network Security	3	0	0	3	3	15	15	10	60	3 Hrs
8	**Professional Elective III**		3	0	0	3	3	15	15	10	60	3 Hrs
	IT1407	PE III: Real Time Systems										
	IT1423	PE III: Human Computer Interaction										
	IT1429	PE III: Advanced Computer Architecture										
	IT1430	PE III: E-Commerce										
	IT1432	PE III: Cloud Computing										
	IT1436	PE III: Coding Standard and Technical Documentation										
9	**Professional Elective IV**		3	0	0	3	3	15	15	10	60	3 Hrs
	IT1415	PE IV : Neural Networks & Fuzzy Logic										
	IT1405	PE IV: Pattern Recognition										
	IT1421	PE IV: Distributed Systems										
10	**Lab: Professional Elective IV**		0	0	2	2	1			40	60	
	IT1416	Lab.: PE IV : Neural Networks & Fuzzy Logic										
	IT1439	Lab.: PE IV: Pattern Recognition										
	IT1440	Lab.: PE IV: Distributed Systems										
Total			20	1	8	29	25					
Total Group(A+B)			**20**	**1**	**38**	**59**	**50**					

Chairperson	**Version**	**1.02**	**Applicable for AY 2018-19 Onwards**
Dean (Acad. Matters)	**Date of Release**	**September 2017**	

3rd Semester

GE 1201	Engineering Mathematics-III		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
The aim of this subject is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	After completion of this course : 1. Students will be able to know the techniques to find the missing terms in discrete data and numerical integrations for discrete value functions. 2. Students will be able to identify with Laplace transform & inverse Laplace transforms of various types of functions, its properties and its application to solve differential equations and acquire an ability to use it in Engineering subjects like control system, Network analysis and digital signal processing 3. Students will be able to find the z-transform, inverse z-transform of a sequence, identify its region of convergence and develop an ability to explore and solve problems in various branches of Engineering 4. Students will be able to recognize to determine the solution of linear systems of equations using matrices methods, find Eigen values and Eigen vectors and come across in solving applied problems. 5. Students will be able to work out the Fourier series representation of a periodic function in both exponential and sine-cosine forms and to solve partial differential equations. 6. Students will be able to develop an aptitude to evaluate the Fourier transform of continuous functions, to understand Parseval's relation in Fourier series.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
GE1201.1	Students know the techniques to find the missing terms in discrete data and numerical integrations for discrete value functions.	2.0	2.0												
GE1201.2	Students identify with Laplace transform & inverse Laplace transforms of various types of functions, its properties and its application to solve differential equations and acquire an ability to use it in Engineering subjects like control system, Network analysis and digital signal processing	2.0	2.0												
GE1201.3	Students are capable to find the z-transform, inverse z-transform of a sequence, identify its region of convergence and develop an ability to explore and solve problems in various branches of Engineering	2.0	2.0												

3rd Semester

GE 1201	Engineering Mathematics-III		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

GE1201.4	Students recognize to determine the solution of linear systems of equations using matrices methods, find Eigen values and Eigen vectors and come across in solving applied problems.	2.0													
GE201.5	Students are competent to work out the Fourier series representation of a periodic function in both exponential and sine-cosine forms and to solve partial differential equations.	2.0	2.0												
GE1201.6	Students develop an aptitude to evaluate the Fourier transform of continuous functions, to understand Parseval's relation in Fourier series.	2.0													
GE1201		2.0	2.0												

UNIT-1: Finite Differences **[8 hrs]**
Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT-2: Laplace Transform **[7 hrs]**
Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations

UNIT-3: Z-transform **[8 hrs]**
Z Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4: Matrices **[9 hrs]**
Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigen vectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation **[8 hrs]**
Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.
Partial Differential Equations – PDE of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations

UNIT-6 Fourier Transform **[6 hrs]**
Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.

3rd Semester

GE 1201	Engineering Mathematics-III		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Text books:				
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference books:				
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill.
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan

3rd Semester

IT 1201	Introduction to Information Technology		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
The student will 1. Study the basic concepts of information system & information processing 2. Study the evolution of computing machines, computer generation & understand different components of computer system 3. Understand program development methodologies & software development life cycle. 4. Study the concepts in operating systems & database management system. 5. Comprehend basics of computer network & internet technologies 6. Study different applications of internet technologies	After completion of this course: 1. Students will be able to Understand Basic aspects of Information System and Apply Data encoding/Decoding Techniques and compression Techniques. 2. Students will be able to analyze different computer Generations and Computer Systems, for development of software system. 3. Students will be able to apply program development Methodology and knowledge of software development life cycles for software development. 4. Students will be able to Understand basic concepts of operating system, analyze the problem definition and formulate queries in SQL. 5. Students will be able to understand basics on Computer networks, internet technology and will be able to apply knowledge for browsing and communication. 6. Students will be able to Understand E-Commerce and Various Application.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT 1201.1	Understand Basic aspects of Information System and Apply Data encoding/Decoding Techniques and compression Techniques.	3	2												
IT 1201.2	Analyze different computer Generations and Computer Systems, for development of software system.	3	2												
IT 1201.3	Apply program development Methodology and knowledge of software development life cycles for software development.	3													
IT 1201.4	Understand basic concepts of operating system, analyze the problem definition and formulate queries in SQL	2	3												
IT 1201.5	Understand basics on Computer networks, internet technology and will be able to apply knowledge for browsing and communication.	2													
IT 1201.6	Understand E-Commerce and Various Application.	3													
IT 1201		2.7	2.3												

3rd Semester

IT 1201	Introduction to Information Technology		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[08 Hrs.]**
Concepts in Information & Processing: Information Technology, An overview of Information Technology Application, Difference between data and information, Information Systems, Important data types, value of Information, Quality of Information, Data Compression, Encoding Vs Compression, Entropy of Information, Alphanumeric code

UNIT II **[08 Hrs.]**
Evolution of Computing Machines, Computer Generations, Era of Personal Computing, Digital Computers, Micro Com I/O Devices, Auxiliary Storage Devices, Programming Language, Application Program Vs System Program, Memory Hie File Organization, File Types.

UNIT III **[08 Hrs.]**
Overview of Program Development Methodologies, Object Oriented Programming, Proposition and predicate logic, Logic Programming, Introduction to software development life cycle, Software Quality Assurance

UNIT IV **[08 Hrs.]**
Introduction to operating systems features of modern operating systems, LINUX: Introduction to LINUX, Shell Programming, Basic database concepts and SQL

UNIT V **[08 Hrs.]**
Introduction to computer networks, Network topologies, LAN, WAN, MAN. Internet and World Wide Web: Introduction, Internet: A Global Network, TCP/IP, Common Protocol Used in Internet, World Wide Web, HTML, Web Browser, Internet Addresses, Electronic Mail, How E-mails are sent, How to get E-mail Address at Yahoo, Other services provided by Internet, External and Internal Modem, What Internet can do for you, Selecting an Internet Service Provider, Nature of Internet Accounts, Search Engine, Requirement for Internet Access, Managing E-Mail in MS-Windows, XP, NT, and in Linux, Proxy Server, Internet Protocols(HTTP, FTP, Telnet).

UNIT VI **[08 Hrs.]**
Introduction to E-commerce, Security threats to E-commerce, Information Technology Applications: Introduction, Information Technology for education and research, ERNET and NICNET, industrial information technology, Information Technology in Healthcare and Telemedicine, Information Technology for rural development

Text books:				
1	Foundations Technology of Information	Third Edition	D.S. Yadav	New Age Publications
Reference books:				
1	Information Technology Principles and Applications	2004	Ajoy Kumar Ray, TinkuAcharya	PHI

3rd Semester

IT1206	Microprocessor Based System Design		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. Students will Study the hardware and software components, different modes of working and accessing memory & I/O ports of a microprocessor based system work together to implement system–level features. 2. Students will Study the assembly language programming structure of 8086 & various types of instruction set with encoding format. 3. Students will Study the interrupt structure of 8086 & working principal of 8259 PIC. 4. Students will Study to Design & interface the memory & I/O with 8086 & Working principal of 8255 PPI. 5. Students will Study the serial communication systems using RS-232 protocol USART & Working principal of 8237 DMA Controller 6. Study to provide the solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems using timer 8254 & Keyboard Display Controller.	After completion of this course: 1. Students will be able to understand the architecture and organization of microprocessor along with instruction coding formats. 2. Students will be able to understand the addressing modes, Instructions sets of 8086 and write structured and well commented programs in assembly language. 3. Students will be able to understand software/ hardware interrupts and further write programs to perform I/O using handshaking and interrupts. 4. Students will be able to understand of software/ hardware interrupts with their priorities and further write programs to perform I/O using handshaking and interrupts. 5. Students will be able to understand serial communication techniques by using RS232 and 8051. 6. Students will be able to design the solution for real time applications by using co-processor IC's (8253/54, 8279 etc.)

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1206.1	Understand the architecture and organization of microprocessor along with instruction coding formats.	3	2			1								2	
IT1206.2	Understand the addressing modes, Instructions sets of 8086 and write structured and well commented programs in assembly language.	2	3			2								3	
IT1206.3	Understand the addressing and interfacing of Memory and I/O with 8086.	3	3											2	
IT1206.4	Understand of software/ hardware interrupts with their priorities and further write programs to perform I/O using handshaking and interrupts.	3	3			2								2	
IT1206.5	Able to understand serial communication techniques by using RS232 and 8051.	3	1			2								2	
IT1206.6	Design the solution for real time applications by using co-processor IC's (8253/54, 8279 etc.)	3	2			2								3	
IT1206		2.8	2.3			1.8								2.3	

3rd Semester

IT1206	Microprocessor Based System Design		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
Introduction: Internal architecture & pin diagram of 8086/8088 microprocessor, Minimum & Maximum mode, even & odd memory banks, Accessing memory & I/O ports, Memory mapping in minimum mode.

UNIT II **[08 Hrs.]**
Programming with 8086/8088: Addressing Modes, Instruction set, Instruction encoding format, Timing diagram Assembler directives, 8086 programming examples, String operations, File I/O processing, Far & Near procedures, Macros, Timing & delay loops

UNIT III **[07 Hrs.]**
Interfacing with 8086/8088: Memory interfacing, Programmable parallel ports, Intel 8255 PPI, Block diagram & interfacing, Modes & initialization.

UNIT IV **[07 Hrs.]**
Interrupt Structure: 8086 interrupt structure, 8259 priority interrupt controller, Interfacing & programming,

UNIT V **[07 Hrs.]**
Serial communication: Asynchronous & synchronous communication, RS-232C protocol, 8251 USART Interfacing & programming, 8237 Direct Memory Access (DMA) Interfacing & Programming

UNIT VI **[07 Hrs.]**
8253/8254 PIT, Interfacing & programming. Keyboard/Display controller 8279; block diagram, system

Text books:				
1	Microprocessor & Interfacing, Programming & Hardware.	2nd Edition , 2006.	Douglas Hall	Tata McGraw Hill
2	Microcomputer System: The 8086/8088 Family, Architecture, programming & Design	2nd Edition,1986.	Y. Liu, G. Gibson	Prentice Hall of India Ltd., New Delhi
3	Advanced Microprocessors & Peripherals: Architecture, Programming & Interfacing	2006	A. Ray, K.M. Bhurchandi	Tata McGraw Hill,
4	Microprocessors and Microcontrollers	2010	N. Senthil Kumar, M. Saravanan, S. Jeevananthan	OXFORD University Press

Reference books:				
1	An introduction to the Intel family of microprocessors	1996	James L. Antonakos	Prentice Hall
2	80x86 Family: Design, Programming & Interface	2Har/Dekt Edition, 1997	J. Uffenbeck	Prentice Hall
3	The Intel Microprocessors: 8086/8088, 80186, 80286, 80386, 80486, Pentium, Pentium Pro & Pentium II	5th Edition,2000.	Barry B. Brey	Prentice Hall

3rd Semester

IT 1207	Lab: Microprocessor Based System Design	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
1. The objective of this course is to become familiar with the architecture and the instruction set of an Intel microprocessor. 2. Assembly language programming will be studied as well as the design of various types of digital and analog interfaces. 3. The accompanying lab is designed to provide practical hands-on experience with microprocessor software applications and interfacing techniques	After completion of this course: 1. Students will be able to understand the basics of Intel 8086/8088 architecture. 2. Students will be able to gain knowledge of the 8086/8088 instruction set, addressing modes and ability to utilize it in programming. 3. Students will be able to understand the Intel 8086/8088 real mode memory addressing. 4. Students will be able to Ability to interface co-processors IC's/devices with microprocessor.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT 1207.1	Understand the basics of Intel 808 architecture.	3	2			1								2	
IT 1207.2	Knowledge of the 8086/8088 inst set, addressing modes and ability to it in programming.	2	3			3								3	
IT 1207.3	Understanding of the Intel 8086/808 mode memory addressing.	3	2			2								3	
IT 1207.4	Ability to interface co-proc IC's/devices with microprocessor.	3	2			2								3	
IT1207		2.8	2.3			2.0								2.8	

Sr. No.	Name of Practical
1	To study assembler, linker, MASM,TASM, 8086 Simulator and assembly language programming instructions of 8086 microprocessors.
2	To write & execute Assembly Language program to add and subtract two 8 bit numbers and 16 bit numbers.
3	To write & execute Assembly Language program to multiply two 16 bit numbers and Divide two numbers (16/8, 16/16, 8/8)
4	Write 8086 Assembly language program (ALP) to add array of N hexadecimal numbers stored in the memory. Accept input from the user.
5	To write & execute Assembly Language program to search a number in a string of N numbers.
6	To write & execute Assembly Language program to sort out even and odd numbers from the given data string.
7	To write & execute Assembly Language program to transfer block of data from one memory block to another.
8	Write a program for the addition of two 3*3 matrices. The matrices are stored in the form of lists (row wise) Store the result of addition in the third list.
9	To write & execute Assembly Language program to Print the message " The study of Micro-processing is Interesting " .
10	To write & execute Assembly Language program to find smallest/ largest number from array of n numbers.
11	Interfacing of 7-segment display with 8086 Microprocessor.
12	Generation of interrupts using 8259.
13	Interfacing of 8253 timer IC to generate square wave.

3rd Semester

IT1204	Algorithms & Data Structures		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will : 1. Understand common data structure and algorithmic strategies, algorithmic analysis and problem solving paradigms. 2. Introduce stacks and queue data structure and there basic operations and application 3. Study the concept of dynamic memory allocation and implement their basic operations and application of linked list. 4. Understand the trees data structure and its various applications. 5. Study the graphs data structure and its implementation 6. Introduce file system management and its allocation of memory	After completion of the course: 1. Student will be able to write and implement various algorithms of searching and sorting techniques. 2. Student will be able to implement stack, Queue and its application. 3. Student will be able to implement Linked List, its operations and application. 4. Student will be able to implement Tree, its operations and application. 5. Student will be able to implement Graph, its operation and its application. 6. Student will be able to classify the files based on its application and apply hashing techniques for searching data.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1204.1	Student will be able to write and implement various algorithms of searching and Sorting techniques.	3	2											3	
IT1204.2	Student will be able to implement stack, Queue and its application	3	3											3	
IT1204.3	Student will be able to implement Linked List, its operations and application.	3	2											3	
IT1204.4	Student will be able to implement Tree, its operations and application.	3	2											3	
IT1204.5	Student will be able to implement Graph, its operation and its application.	3	2											3	
IT1204.6	Student will be able to classify the files based on its application & apply hashing techniques for searching data.	3	2											2	
IT1204		3.0	2.2											2.8	

UNIT I **[10 Hrs.]**

Introduction to Algorithms: Basics of Algorithms, Sub algorithm: Procedure and Functions. Analysis of Algorithms: Time and Space complexity.

Programming aspects with respect to structured programming. Top down and Bottom-Up approach.

Arrays: Operations, types, representation of 1D, 2D arrays in memory, sparse matrices. Sorting: Quick Sort, Merge Sort, Insertion, Radix, Selection and Bubble Sort. Searching: Linear Search, Binary search.

3rd Semester

IT1204	Algorithms & Data Structures		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT II **[08 Hrs.]**

Stacks: Fundamentals, Operations: Push, Pop, Applications of Stacks: Evaluation of expressions, Recursion, Stack Machines, and Multiple Stacks.

Queues: Fundamentals, Operations: Add, Delete, Types of Queues: Priority Queues, Circular Queue, Dequeue.

UNIT III **[10 Hrs.]**

Fundamentals, Types: Singly, Doubly, Circular, Linked Stacks and Queues, Examples on linked list, Circular linked list, doubly linked list and Dynamic storage Management: Garbage Collection, Compaction, and Applications of Linked List: Operations on Polynomials, Generalized Linked List.

UNIT IV **[08 Hrs.]**

Basic terminology, Binary Tree Traversals, threaded storage representation, binary search tree, applications of tree, preliminary treatment of AVL Trees, B-Trees, B+ Trees, Heap sort.

UNIT V **[07 Hrs.]**

Basic terminology, Graph representation: matrix, list, Multi-list, Graph Traversals: Breadth first search, Depth first search, Minimum Cost Spanning trees, shortest path algorithm, Topological Sort, Critical Path.

UNIT VI **[05 Hrs.]**

File Organization: Different types of files and their organization, External Storage Devices, External Sorting: Sorting with Tapes and Disks, Hashing and Collision handling mechanism.

Note: Data Structure to be implemented in C

Text books:				
1	Fundamentals of Data Structure	2nd Edition	Ellis Horowitz, Sartaj Sahani and Andessian Freed	University Press (2008)
2	Data Structures, Schuam Series	Fifth reprint 2006	Seymour Lipschutz, G.A.V pai	TATA McGraw Hill

Reference books:				
1	C and Data Structures	2nd Eddition	P. S. Deshpande O.G. Kakde	Dreamtech Press (2003)
2	An Introduction to data Structures	2nd Edition	Tremblay and Sorenson	TATA McGraw-Hill
3	Data Structure Through C (A Practical Approach)	1nd Addition	G.S. Baluja	Dhanpat Rai Publications

3rd Semester

IT 1205	Lab: Algorithms & Data Structures	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will study : 1. To develop skills to design and analyze simple linear and nonlinear data structures 2. To Strengthen the ability to identify and apply the suitable data structure for the given real world problem 3. To Gain knowledge in practical applications of data structures	After completion of the course: 1. Students will be able to write a program using linear data structure. 2. Students will be able to write programs using nonlinear data structure. 3. Students will be able to build an application using appropriate data Structure.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT205.1	Students will be able to write a program using linear data structure.	3												3	
IT205.2	Students will be able to write programs using nonlinear data struct	3												3	
IT205.3	Students will be able to build an applications using appropriate data Structure.			3										3	
IT1205		3		3										3	

SR. NO.	Name of Practical
1	Write a program for following function using recursion. factorial() b. prtFibonacci() c. power() i.e. X^Y
2	Write a program to implement linear and binary search (use switch case).
3	Write a program to implement Insertion sort
	Write a program to implement bubble sort.
4	Implement a stack with following operations using Array a. isEmpty() b. isFull() c. returnTop() d. push() e. pop()
5	Implement a queue with following operations using Array. a. instElement() b. delElement() c. isEmpty() d. isFull() .
6	Write a program to implement infix to postfix expression evaluation
7	Write a program to implement a singly link list functions. a. insertFirst(), b. insertLast(), c insertMid(), d.delNode(), e. searchEle().
8	Write a program to implement a Circular linked list functions.
9	Write a program to implement Binary search tree.
10	Write a program to implement Breath first search & Depth first search.

3rd Semester

EE1213	Digital Circuits and Switching Theory		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. To acquaint students with knowledge of basic electronics using digital number systems, Boolean algebra, logic gates. 2. To understand combinational and sequential circuits and their applications in real time. 3. To make students capable of designing of combinational and sequential circuits for different applications using FSM.	After completion of the course: 1. Student will able to be to understand designing of basic circuits using logic gates, and basic combinational logic circuits. 2. Student will able to simplify combination logic circuits using Boolean algebra. 3. Student will able to understand Memory organization and basic working and of Flip-Flops and their conversation. 4. Student will able to understand designing of counters and registers. 5. Student will be able to demonstrate use of sequential logic and their applications. 6. Students will able to understand the state reduction technique of finite state machine.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
EE1213.1	Student will able to understand designing of basic circuits using logic gates, and basic combinational logic circuits.	2	2	2											
EE1213.2	Student will able to simplify combination logic circuits using Boolean algebra.				2								2		
EE1213.3	Student will able to understand Memory organization and basic working of Flip-Flops and their conversation	3				3									
EE1213.4	Student will able to understand designing of counters and registers.		2	2											
EE1213.5	Student will be able to demonstrate use of sequential logic and their applications.	3	3		3								3		
EE1213.6	Students will able to understand the state reduction technique of finite state machine.	3	3		3										
EE1213		2.8	2.5	2.0	2.7	3.0							2.5		

3rd Semester

EE1213	Digital Circuits and Switching Theory		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[06 Hrs.]**
Basic logic circuits, truth tables, Boolean laws, Demorgan's law, Simplification of function using algebraic methods, basic combinational logic circuits: Encoder, Decoder, Multiplexer, De-multiplexer, adders, substracters, carry look ahead adder, Totempole and tristate output.

UNIT II **[05 Hrs.]**
Simplification of sum of product and product of sum, K-maps (Up to 4 Variable), simplification of completely/ incompletely specified functions using K-maps & Quine McCluskey's method,

UNIT III **[07 Hrs.]**
Introduction to Flip Flops (RS, D, T, JK), Memory organization using Flip-Flops. Concepts of RAM, ROM, EPROM, and EEPROM. Racing Condition, J-K Master Slave Flip flop. Excitation tables, Conversion of one type to another type flips flop.

UNIT IV **[08 Hrs.]**
Excitation tables, Introduction to sequential Circuits, Counters, Registers, Synchronous/Asynchronous Designs, modulo N counter with Reset or Clear facility, Design of Mod N counters Using K-map, Lock Free Counters.

UNIT V **[08 Hrs.]**
Functional Decomposition by expansion and partition matrix method, identification of symmetric functions, Threshold logic: Introductory concepts, synthesis of threshold networks.
Sequential circuits: Introduction of finite state model, Mealy machine, Moore machine, designing synchronous sequential circuits/machines/detectors.

UNIT VI **[06 Hrs.]**
State equivalence and machine minimization in synchronous machines, simplification of incompletely specified machines. basic definitions, memory definition and their excitation functions, synthesis of synchronous sequential circuits, an example of a computing machine, iterative networks, Capabilities and limitations of FSM, Asynchronous sequential circuits: fundamental mode circuits, synthesis, state assignment in asynchronous sequential circuits, pulse mode circuits.

Text books:				
Fundamentals of Logic Design	5th Edition	Charles Roth	CENGAGE Learning	Fundamentals of Logic Design
Fundamentals of Digital Circuits	2nd Edition	Anand Kumar	PHI	Fundamentals of Digital Circuits
Digital Electronics Principles	6th edition,1998	Malvino	Career Education	Digital Electronics Principles
Switching and Finite Automata Theory	2007	ZVI KOHAVI	Tata Mgraw Hill	Switching and Finite Automata Theory

3rd Semester

EE1214	Lab.: Digital Circuits and Switching Theory	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
1. Student will understand basic digital circuit design and testing on breadboard using digital ICs and Electronic Components. 2. Student will understand digital components and circuits characteristics, analysis and interpretation.	1. After completion of the course: 2. Students will be aware of Digital IC's and its experimentation. 3. Students will be able to design and evaluate circuit performance on breadboard. 4. Student will be able to analyze and interpret more experiments relating to theoretical knowledge received during lecture hours.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
EE1214.1	Students will be aware of Digital IC's & it's working			3						2			2	3	
EE1214.2	Students will be able to design and evaluate circuit Performance on bread-board.		3	3		1				2			1	3	
EE1214.3	The student will be able to analyze and interpret more experiments relating to theoretical knowledge received during lecture hours	3	2										1	2	
EE1214		3.0	2.5	3.0		1.0				2.0			1.3	2.7	

Sr. No	Experiments Base On
1	Verify the Truth table for the basic logic gates and universal gates.
2	Verify Boolean Expression using Demorgan's Theorem
3	To verify Multiplexer and Demultiplexer functionality.
4	To Implement & verify Half adder and full adder circuit.
5	To Implement & verify Half subtractor and full subtractor circuit.
6	To Implement BCD to Seven segment Display combinational circuit.
7	To verify the truth table of Master-slave J-K flip-flop
8	To verify the truth table of Master-slave RS flip-flop
9	Verify ARITHMETIC LOGIC UNIT
10	To Design 2/3/4 bit binary synchronous counter.
11	To Design 2/3/4 bit binary asynchronous counter.
12	To Design left and right shift register.

4th Semester

GE1206	Discrete Mathematics And Graph Theory		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. The objective of this paper is to study mathematical, logic and set theory and their methods of solution and graph theory, group theory with simple applications and to introduce the essential concepts of probability and statistics.	After completion of the course: 1. Students will be able to understand the knowledge of this topic gives support to solve practical problems and improve logical thinking skill. 2. Students will be able to this familiarity, would enhance the skill of solving the engineering problems. 3. Students will be able to make use of the applications of these concepts in the field of computer technology. 4. Students will be able to distinguish various algebraic structure and improve logical thinking skill 5. Students will be able to these topics assist to develop imaginative and modeling skills. 6. Students will be able to the unit is used to determine mathematical expectation for the random variables define in real life problems and make available analytical techniques for getting standard deviation, dispersion etc.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
GE1206.1	Students will be able to solve practical problems and improve logical thinking skill.	3.0	3.0												
GE1206.2	Students will be able to enhance the skill of solving the engineering problems.	3.0													
GE1206.3	Students will be able to make use of the applications of these concepts in the field of computer technology.	3.0													
GE1206.4	Students will be able to distinguish various algebraic structure and improve logical thinking skill	3.0													
GE1206.5	Students will be able to develop imaginative and modeling skills.	3.0	3.0	3.0											
GE1206.6	Students will be able to determine mathematical expectation for the random variables define in real life problems and make available analytical techniques for getting standard deviation, dispersion etc.	3.0	3.0												
GE1206		3.0	3.0	3.0											

4th Semester

GE1206	Discrete Mathematics And Graph Theory		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[08 Hrs.]**
Mathematical, Logic & Set Theory: Statement & Notation, Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, The Power Set, Ordered Pairs & n-tuples, Operations on Sets , Partial order, Equivalence relations, mathematical induction. Propositions, Predicate logic, formal mathematical systems,

UNIT II **[07 Hrs.]**
Relations & Functions: Relation & Ordering, Properties of Binary in a set Relation Matrix & Graphs - a relation, Partition & Covering of a set, Equivalence relation, Partial ordering, Partially Ordered sets, Function (Definition & Introduction), Composition of functions, Inverse Functions, Characteristics function of a set.

UNIT III **[07 Hrs.]**
Group Theory: Groups (Definitions & Examples) Subgroups & Homomorphism, Cosets & Lagranges theorem, Normal subgroups, Codes & Group Codes. Semi groups & Monoids (definitions & examples). Homomorphism of semigropups & monoids, SubSemi groups & monoids.

UNIT IV **[07 Hrs.]**
Rings (Definitions & Examples): Integral domains ring homomorphisms, ideas of ring polynomial,Fields, Lattice.
Fuzzy Sets and Fuzzy Logic :Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzycompliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

UNIT V **[08 Hrs.]**
Graph Theory: Basic concepts of graph theory, Basic definitions, Paths & circuits Reach ability & connectedness, Matrix Representation of graphs, Tree & their representation & operations, Rooted trees, Path lengths in rooted trees, Multi graphs & weighted graphs, and graph isomorphism shortest paths in weighted graphs, Hypergraphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm

UNIT VI **[07 Hrs.]**
Joint probability density function and marginal probability density function, joint distribution functions and marginal distribution functions .
Mathematical Expectation , Co-variance and correlation and its applications**.**

Text books:				
1	Discrete Mathematics Structure with application	23rd. re-print, 2005	By J. P. Tremblay & R. Manohar	McGraw-Hills Publication Company Limited, New Delhi.
2	Probability and Statistics ,	2nd Edition,	M R Spiegel, John Schiller, R. Alu Shrinivasan	Tata McGraw-Hills Publication Company Limited, New Delhi.
Reference books:				
1	Discrete Mathematics	,2nd Edition	by Lipschutz Schaums's Outline series,	Tata McGraw-Hills Publication Company Limited, New Delhi.
2	Discrete Mathematical structures :-	3rd edition,2001	By Bernard Kolman ,Robert C.Busby,Sharon Ross	Prentice Hall of India, New Delhi.

4th Semester

IT1208	Computer Architecture & Organization		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will : 1. Study the fundamentals of computer organization and its relevance to classical and modern problems of computer Architecture. 2. Learn how to generate control signals for instructions using different architecture 3. Learn control units operations and its performance issues. 4. Study the different arithmetic operation including the algorithms & implementation for fixed-point and floating-point numbers. 5. Study the hierarchical memory system including cache memories and virtual memory 6. Study the different ways of communicating with I/O devices and standard I/O interfaces and advanced concept of computer architecture.	After completion of the course: 1. Students will be able to describe fundamentals of computer architecture and organization. 2. Students will be able to write control sequence for instructions. 3. Students will be able to identify control unit operations and understand performances issue in processor and memory. 4. Students will be able to perform arithmetic operations and describe its storage formats. 5. Students will be able to design main memory organization that uses banks for different word size operations and describe the concept of cache mapping techniques. 6. Students will be able to describe the concept of I/O organization and discuss some advanced methods for improving systems performance.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1208.1	Students will be able to describe fundamentals of computer architecture and organization	3.0												3.0	
IT1208.2	Students will be able to Write control sequence for instructions.	3.0	2.0											3.0	
IT1208.3	Students will be able to Identify control unit operations and understand performances issue in processor and memory.	3.0		2.0										3.0	
IT1208.4	Students will be able to Perform arithmetic operations and describe its storage formats.	3.0		3.0										3.0	
IT1208.5	Students will be able to Designmain memory organization that uses banks for different word size operations and describe the concept of cache mapping techniques.	1.0		3.0										3.0	
IT1208.6	Students will be able to Describe the concept of I/O organization and discuss some advanced methods for improving systems performance.	2.0												2.0	
IT1208		2.5	2.0	2.7										2.8	

4th Semester

IT1208	Computer Architecture & Organization		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[10 Hrs.]**
Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, Bus Structures, Software , Distributed Computing, addressing methods and machine program sequencing : Memory Locations , addressing and encoding of information, Main memory operation , Instructions and Instruction sequencing, addressing modes, Stacks, Subroutine.

UNIT II **[08 Hrs.]**
Instruction Sets: Instruction Format, limitations of Short word- length machines, High level language considerations, Motorola 68000 architecture. Processing Unit: Some fundamental concepts, Execution of a complete instruction, Single, two, three bus organization, Sequencing of control Signals.

UNIT III **[06 Hrs.]**
Hardwired Control : Design Micro-programmed Control: Microinstructions, Grouping of control signals, Micro program sequencing, Micro Instructions with next Address field, Perfecting microinstruction, Emulation, Bit Slices, Introduction to Microprogramming.

UNIT IV **[06 Hrs.]**
Arithmetic: Number Representation , Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction , Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm, Integer Division, Floating point numbers and operations.

UNIT V **[08 Hrs.]**
The main Memory: some basic concepts, semiconductor RAM memories, Memory system consideration, semiconductor ROM memories, Multiple module memories and interleaving, Cache Memory, Mapping techniques, Virtual memories, memory management requirements.

UNIT VI **[06 Hrs.]**
Components of system programming: Assembler ,linker, Loader, Computer Peripherals: I/O Devices, DMA, Interrupt handling, Online storage. Processors: Families of microprocessors Chips, Introduction to RISC and CISC Processors, Introduction to Pipelining.

Text books:				
1	Computer Organization	4th Edition	V. Carl Hamacher	McGrawHill
2	Computer Organization and Design(The Hardware/Software Interfaces)	4th Edition	David A. Patterson & John L. Hennessy	Morgan Kaufmann
Reference books:				
1	Computer Organization	5th Edition,2000	William Stalling	McGraw Hill
2	System Programming	1st Edition	John Donovan	TATA McGraw Hill

4th Semester

IT1202	Object Oriented Programming		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will : 1.Learn the Concepts of Java programming language 2.Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3.To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4.Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development 5.Understand How to handle exceptions appropriately. Become familiar with the concept of an I/O stream. 6.Learn and Understand development of JAVA applets vs. JAVA applications	After completion of the course: 1.Students will be able to understand basic features of object oriented-programming language. 2.Students will be able to write simple JAVA programs. 3.Students will be able to design systems using object oriented features. 4.Students will be able to understand data structures like Array, String and Vector. 5.Students will be able to understand concept of stream classes and Exception handling mechanism. 6.Students will be able to understand concept of Applet and Thread in object oriented language

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1202.1	Understand basic features of object oriented programming language.	1	2												
IT1202.2	Able to write simple JAVA programs		2	2											
IT1202.3	Able to design systems using object oriented features			2										2	
IT1202.4	Understand data structures like Array, String and Vector.	2													
IT1202.5	Understand concept of stream classes and Exception handling mechanism	2													
IT1202.6	Understand concept of Applet and Thread in object oriented language	2													
IT1202		1.8	2.0	2.0										2.0	

4th Semester

IT1202	Object Oriented Programming		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[06 Hrs.]**
Introduction to Programming Methodologies, Introduction to Object oriented programming, Objects and Classes, Characteristics of OOP, Encapsulation and data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Structured Versus Object oriented programming, Merits and demerits of object oriented methodology, introduction to Java as OOP language

UNIT II **[07 Hrs.]**
Building blocks of java, Data types, Variable declarations, operators and Assignments, control structures, Identifying objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control

UNIT III **[08 Hrs.]**
Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)

UNIT IV **[07 Hrs.]**
Arrays, Strings and vectors: Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Introduction to collection framework, Vectors, Array List , Wrapper Classes, Enumerated types.

UNIT V **[07 Hrs.]**
I/O Streams & exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses, Introduction to stream classes, use of stream classes, I/O stream, bytes stream, character stream, pre-defined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files ,transient and volatile modifiers

UNIT VI **[05 Hrs.]**
Applets and application Development: Introduction to applets, applet lifecycle, creating and executing applets, Basics of HTML, Embedding Images in applet, Introduction to multithreading, life cycle of Thread, Runnable interface and Thread class.

Text books:				
1	Thinking in Java	4th Edition (2006)	Bruce Eckel	Prentice Hall
Reference books:				
1	Programming with Java	4th Edition Dec-2009	E. Balagurusamy	TATA McGraw-Hill
2	Java2 Complete Reference	5th Edition,sep-2002	Herbert Schildt	McGraw-Hill

4th Semester

IT 1203	Lab: Object Oriented Programming	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will study : 1. Learn the Java programming language: its syntax, idioms, patterns, and styles. 2. Become comfortable with object oriented programming: Learn to think in objects 3. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	After completion of the course: 1. Students will be able to write simple JAVA programs. 2. Students will be able to design Java program to give the demonstration of how to use data types and control structures. 3. Students will be able to design Java program to create class and use the concept of Inheritance. 4. Students will be able to design a JAVA program to use data structures like Array, String and Interface. 5. Students will be able to design a JAVA program using the concept of Exception handling. 6. Students will be able to design a JAVA program for creating Applet and Thread.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1203.1	Able to write simple JAVA programs			2.0										2.0	
IT1203.2	Able to design Java program to give the demonstration of how to use data types and control structures.			2.0										2.0	
IT1203.3	Design Java program to create class and use the concept of Inheritance.			2.0										2.0	
IT1203.4	Design a JAVA program to use data structures like Array, String and Interface.			2.0										2.0	
IT1203.5	Design a JAVA program using the concept of Exception handling.			2.0										2.0	
IT1203.6	Design a JAVA program for Creating Applet and Thread.			2.0										2.0	
IT1203				2.0										2.0	

Ex. No.		Name of Practical	Remark
1		Introduction to Java as an Object-Oriented Programming Language, with sample program. a) Write a java program using Java Scanner class which reads the int, string and double value as an input b) Write a Java program for addition of two number using command line argument.	Simple java Program
2		Write a menu driven java program to give the demonstration of how to use data types and control structures. a) Calculate the simple interest b) Calculate the compound interest c) Find area and perimeter of circle d) Find entered number is prime number or not e) Print Fibonacci series.	Simple java Program

4th Semester

IT 1203	Lab: Object Oriented Programming	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

3	a)	Write a java program using concept of inheritance for performing following Banking transactions: • Deposit • Withdraw • Checking Balance • Recurring Deposit • Fixed Deposit	Classes and Object
	b)	Write a program to define a class Employee with four data members such as Emp_name, Emp_id, Salary. Define appropriate methods to initialize and display the values of data members. Also calculate total salary of employee based on Basic, TA, DA and HRA of employee.	
4	a)	Write a java program to implement a class to calculate the area of shape (like circle, triangle or rectangle), use overloaded method area().	Overloading method and constructor
	b)	Write a java program to implement following concept: 1) Default constructor 2) Parameterized constructor 3) Copy constructor 4) Constructor overloading	
	c)	Write a java program to demonstrate the use of "Super" and "This" keyword in Java	
5		Write a java program in which Bank is a class that provides functionality to get rate of interest. But, rate of interest varies according to banks. For example, BOI, SBI and TUCB banks could provide 6%, 7.5% and 8% rate of interest. Write a method get_rate_of_interest() to get the correct rate of interest according to type of bank. Use method overriding concept of Java.	Overriding
6	a)	Design an interface named Stack with the following methods. a. Push and Pop element from the stack. b. Check whether the stack is empty or not. Implement the stack with the help of arrays and if the size of the array becomes too small to hold the elements, create a new one. Test this interface by inheriting it in its subclass StackTest.java.	Interface
	b)	Write a java program to implement the concept of user defined interface and abstract class in Java.	
7	a)	Write a java program that implement a class to perform sorting of an array	Arrays and Strings
	b)	Write a java program that implement a class to demonstrate the weather given string is palindrome or not.	
8		Write a java program read a number and find its square root. The number should be non-negative. Define an exception named NegativeNumberException when a string entered by the user is translated to a negative number. Use the concept of exception handling in program.	Exception: user defined
9		Write a java program to implement the concept of vector that will store the different objects in vector display the stored values	Collection – Vectors
10		Write java program to implement class applet that consist various buttons and different font and text using param tag.	Applet

4th Semester

IT1209	Theory of Computation		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will : 1. Study the basic properties of formal languages & Finite Automata 2. Study basic properties of regular expression and the basic concept of Regular Grammar 3. Study of different types of grammars and the properties of Context Free Grammar 4. Study the basic properties of CFL & Designing of Push Down Automata 5. Study the basic properties of Turing machine and study of Recursive Language 6. Study the basic properties of concept of undeciadibility, post Correspondence problem & Recursive enumerable language	After completion of the course: 1. Students will be able to apply basic properties of formal languages & to design Finite automata. 2. Students will be able to analyze & formulate Regular Expression & Regular Grammar. 3. Students will be able to understand Context Free Grammar and construct CFG for the formal language. 4. Students will be able to apply properties of CFL & design of Push Down Automata. 5. Students will be able to analyze & design Turing machine & demonstrate basic concept of Recursive Language. 6. Students will be able to demonstrate the understanding of key notions such as undecidability, post Correspondence problem & Recursive enumerable language.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1209.1	To apply basic properties of formal languages & to design Finite automata.	2.0	2.0	3.0											
IT1209.2	To analyze & formulate Regular Expression & Regular Grammar.	2.0	2.0												
IT1209.3	Understand Context Free Grammar and construct CFG for the formal language	2.0	2.0	3.0											
IT1209.4	To apply properties of CFL & design of Push Down Automata	2.0	2.0	3.0											
IT1209.5	To analyze & design Turing machine & demonstrate basic concept of Recursive Language	2.0	2.0	3.0											
IT1209.6	To demonstrate the understanding of key notions such as undesirability, post Correspondence problem & Recursive enumerable language	2.0	2.0												
IT1209		2.0	2.0	3.0											

4th Semester

IT1209	Theory of Computation		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[10 Hrs.]**
Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Finite Automata, Acceptance of strings and languages, Non Deterministic Finite Automation , Deterministic Finite Automation Equivalence between NFA and DFA ,NFA with ε-transition, Minimization of FA

UNIT II **[08 Hrs.]**
Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets with proofs, Regular grammars, Right linear and left linear regular grammars, interconversion, Equivalence between regular grammar and FA, Interconversion between RE and RG, Decision Algorithms

UNIT III **[06 Hrs.]**
Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal Form, Greibach Normal Form, CYK algorithm, Decision Algorithms.

UNIT IV **[06 Hrs.]**
Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Interconversion, Closure of properties of CFL with proofs, DPDA & NDPDA.

UNIT V **[08 Hrs.]**
Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church's hypothesis, Chomsky hierarchy of language , Linear bounded automata and context sensitive language, Universal Turing Machine

UNIT VI **[06 Hrs.]**
Undecidable Problems related to Recursive enumerable language and Turing Machine, post correspondence problem, Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function –unbounded minimization and recursive function. Introduction to formal verification.

Textbooks:			
Introduction to languages and the Theory of Automata	3rd edition, 2003.	John C. Martin	Mcgraw-hill
Introduction to Automata Theory Languages and computation	2nd edition, 2000	Hop croft H.E. and Ullman, Motwani	Addison Wesley
Reference Book			
Theory of Computation	2nd edition, 2005	Sipser	Course Technology
Theory of Computation	2008	O.G. Kakde	USP

4th Semester

IT 1210	Lab: Computer Workshop	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
1. To study peripherals of computer System, architecture and assembly of computer. 2. To study Linux operating system and how to apply core concept of Linux operating system to the development of I.T.system. 3. To study the basic concept of Python Programming Language and how to apply it for the development of I.T. application. 4. To study the basic networking Accessories and how it is used for solving computer Networking Problem. 5. To study the Latex tool to create different technical documents.	**Students will be able to:** 1. Understand peripherals of computer System, architecture and assembly of computer. 2. Understand Linux operating system and how to apply core concept of Linux operating system to the development of I.T.system. 3. Understand the basic concept of Python Programming Language and how to apply it for the development of I.T. application. 4. Understand the basic networking Accessories and how it is used for solving computer Networking Problem. 5. Understand the Latex tool to create different technical documents.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1210.1	Understand peripherals of computer System, architecture and assembly of computer.	2.0												2.0	
IT1210.2	Understand Linux operating system and how to apply core concept of Linux operating system to the development of I.T.system.	2.0												2.0	
IT1210.3	Understand the basic concept of Python Programming Language and how to apply it for the development of I.T. application.	2.0												2.0	
IT1210.4	Understand the basic networking Accessories and how it is used for solving computer Networking Problem.	2.0												2.0	
IT1210.5	Understand the Latex tool to create different technical documents.	2.0				2.0								1.0	
IT1210		2.0				2.0								1.8	

4th Semester

IT 1210	Lab: Computer Workshop	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Sr. No	Practicals Based On
1	Computer Hardware
2	Linux/Unix Operation System
3	Linux shell commands
4	Introduction to Python and Its Installation
5	Data types in Python
6	Python decision control statements
7	Python looping statements
8	Python Functions
9	Networking Accessories
10	Introduction to Latex

4th Semester

ET1215	Information Theory and communication		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will : 1. Understand basics of signal, modulation 2. Understand types of analog and digital modulation. 3. Understand multiplexing techniques. 4. Application of the above mentioned concept in the real world.	After completion of the course : 1. Students will able to know the fundamentals of analog communication and modulation methods 2. Students will able to grasp basic of digital communication systems and modulation techniques 3. Students will able to apply the knowledge of probability and random processes on communication systems 4. Students will able to describe the terms entropy, information and design of source 5. Students will able to know the amplitude ,width ,and position modulation technique 6. Students will able to know the technique of pcm, dm, adm.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
ET1215.1	Students will able to Know the fundamentals of analog communication and modulation methods	2.0	2.0						2.0		2.0		3.0		
ET1215.2	Students will able to Grasp basic of digital communication systems and modulation techniques	2.0							2.0		2.0		3.0		
ET1215.3	Students will able to Apply the knowledge of probability and random processes on communication systems	3.0		3.0					2.0		2.0				
ET1215.4	Students will able to Describe the terms entropy, information and design of source	3.0							2.0		2.0		3.0		
ET1215.5	Students will able to Know the amplitude ,width ,and position modulation technique	3.0							2.0		2.0		3.0		
ET1215.6	Students will able to know the technique of pcm dm,adm	3.0							2.0		2.0		3.0		
ET1215		2.7	2.0	3.0					2.0		2.0		3.0		

4th Semester

ET1215	Information Theory and communication		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
Basic Communication system, Line communication, Radio communication, Frequency spectrum of EM waves, their properties, wave propagation. Noise: types, sources, noise figure. Modulation, Necessity of modulation, Types of modulation, Continuous wave modulation, Amplitude Modulation(AM), Frequency Modulation(FM), Phase Modulation(PM), Double sideband suppressed carrier(DSB-SC), Single sideband

UNIT II **[07 Hrs.]**
Digital communications: Introduction, digital data formats, digital amplitude modulation, frequency shift keying, phase shift keying, quadrature amplitude modulation, bandwidth efficiency, carrier recovery.

UNIT III **[07 Hrs.]**
Probability random variable and stochastic processes, review of probability theory, random variable, probability density and distribution function, random process, periodic processes, stationary processes, auto correlation cross correlation application to signal analysis.

UNIT IV **[08 Hrs.]**
Pulse Modulation: Sampling theorem, Natural and Flat Top Sampling, PAM, Pulse Time Modulation, Pulse Transmission over Band Limited Channel, Effect of Gaussian Type Noise on Digital Transmission, Crosstalk, Eye Diagram AMI Multiplexing: Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM).

UNIT V **[06 Hrs.]**
Pulse Code Modulation: Encoder and Decoder, PCM - TDM, TI Carrier System, Quantization Noise, Companding, DPCM, ADPCM, Delta modulation, Slope overload and Adaptive Delta Modulation, Scrambling, Digital Carrier Systems, Digital Multiplexing

UNIT VI **[06 Hrs.]**
Information and Coding: Measure of information, entropy, information rate, Shannon's theorems on channel capacity, Optimum Codes, Huffman Code, Code Efficiency, Error Control Coding, Methods of Controlling Errors, Types of Errors, Types of Codes, Linear Block Codes: Matrix Description of Linear Block Codes, Error detection and correction capabilities, Hamming Distance, Hamming Bound, Hamming Codes,

Textbooks:			
Digital Communication	Student Edition	Simon Haykin	John Wiley & sons publication
Electronic Communication system	Fourth edition,1999	Kennedy,Devis	TATA Mc GRAW –HILL publication
Reference books			
Communication System anolog digital Morden anolog and digital	2nd edition,2008 4th	R.P.Singh,S.D,Sapre	TATA Mc GRAW –HILL publication
Communication System	Edition	B.P.Lathi	Oxford University press

4th Semester

ET 1216	Lab: Information Theory and Communication	L = 0	T = 0	P = 2	Credits = 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will study : 1. Calculate and verify parameters of analog modulation techniques. 2. Understand and compare digital modulation techniques. 3. Understand and compare different pulse modulation methods. 4. Analyze the code modulation techniques.	After completion of the course : 1. Students will be able to analyze signal transmission and receiving fundamentals. 2. Students will be able to measure modulation index of different analog modulation techniques. 3. Students will be able to demonstrate the operation of time division multiplexing and frequency division multiplexing. 4. Students will be able to analyze different type digital pulse and code modulation system.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
ET1216.1	Students will be able to analyse signal transmission and receiving fundamentals	3.0	3.0						2.0	3.0	3.0		3.0		
ET1216.2	Students will be able to measure modulation index of different analog modulation techniques	3.0	3.0		2.0	3.0			2.0	3.0	3.0		3.0		
ET1216.3	Students will be able to demonstrate the operation of time division multiplexing and frequency division multiplexing	3.0	3.0		2.0	3.0			2.0	3.0	3.0		3.0		
ET1216.4	Students will be able to analyze different type digital pulse and code modulation system	3.0	3.0						2.0	3.0	3.0		3.0		
ET1216		3.0	3.0			3.0			2.0	3.0	3.0		3.0		

Sr. No.	Experiment based on
1	Amplitude modulation and demodulation
2	Frequency modulation and demodulation
3	Phase modulation
4	Pulse amplitude modulation
5	Pulse width modulation
6	Pulse position modulation
7	Amplitude shift keying
8	Frequency shift keying
9	Phase shift keying
10	Time division multiplexing
11	Sampling and reconstruction

5th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Sr. No.	Course Objectives	Course outcomes	Mapped Program Outcomes
1	It introduced the concept of economics and provides knowledge about consumer's rational behaviour.	It will helps for rational selection of goods and services.	12
2	This introduced various factors of production and its role in production process, gives idea about short run and long run production constraint, types of cost and depreciation.	It helps to prepare students being a businessman how to deal with various production constrain.	12
3	It provide knowledge to the students about various market structure, demand and revenue curves in it, How price and output determine in various forms of market and how price discriminate for consumer to consumer.	To make use of these concepts while performing the entrepreneurial operations.	12
4	It gives knowledge about various national products, its counting with respect to various factors and factors causes to economic growth and development.	Provide idea about national income accounting.	12,7
5	Provide knowledge of functioning of money, financial institution and various sources of public finance/revenue and its types.	Helps to create awareness about functioning of financial institutions and taxation system.	12,7
6	To provide knowledge about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institution.	It provides knowledge about international economics.	12

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

5th Semester

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

Text Books:
1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:
1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

5th Semester

IT1303	Operating System		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will : 1. To understand the role, components, history and designing issues associated with operating systems. 2. Evaluate processes and/or threads its representation, synchronization mechanisms and process management concepts including various scheduling methods. 3. To know the types of process and to manage its synchronization with available resources while communication. 4. Master concepts of memory management including virtual memory. 5. Master issues related to file system interface and implementation, disk management. 6. Be familiar with protection and security mechanisms.	After completion of the course: 1. Students will be able to describe the main components of a computer system and how these are managed by the operating system; identify the services provided by operating systems. 2. Students will be able to describe the need for scheduling the resources like CPU time and Disk and evaluate and compare the performance of scheduling algorithms for a given workload. 3. Students will be able to understand the problems involving process control, mutual exclusion, deadlock and synchronization. 4. Students will be able to list and differentiate various memory management techniques and understand the need for virtual memory management. 5. Students will be able to understand the organization of the file system and disk scheduling algorithms. 6. Students will become familiar with protection and security mechanisms used by OS.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1303.1	Students will be able to describe the main components of a computer system and how these are managed by the operating system; Identify the services provided by operating systems.	3												2	
IT1303.2	Students will be able to describe the need for scheduling the resources like CPU time and Disk and evaluate and compare the performance of scheduling algorithms for a given workload.	3	3											2	
IT1303.3	Students will be able to understand the problems involving process control, mutual exclusion, deadlock and synchronization	3	2											2	
IT1303.4	Students will be able to list and differentiate various memory management techniques and Understand the need for virtual memory management	3	2											2	
IT1303.5	Students will be able to understand the organization of the file system and disk scheduling algorithms	3												3	

5th Semester

IT1303	Operating System		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

IT1303.6	Students will become familiar with protection and security mechanisms used by OS.	2					3							3	
IT1303		2.8	2.3				3.0							2.3	

UNIT I **[05 Hrs.]**
Introduction to OS, evolution of OS, basic hardware support necessary for modern operating systems, Layered Structural of OS, Services provided by OS, system calls, Dual mode of operation.
Input-output Management : Basics of I/O hardware, Polling, Interrupts and DMA

UNIT II **[06 Hrs.]**
Process management-introduction, process control block, process states, process context switch, and threads: user level and kernel level, CPU scheduling, goals of scheduling, Algorithmic evaluation of CPU scheduling algorithms.

UNIT III **[10 Hrs.]**
Interposes communication: process cooperation and synchronization, race condition, critical region, mutual exclusion and implementation, semaphores, classic problems of Synchronization, monitors.

UNIT IV **[10 Hrs.]**
File systems-introduction, Access methods, Directory Structure disk space management and space allocation strategies, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, Selecting a disk scheduling algorithm.

UNIT V **[12 Hrs.]**

Memory management techniques-contiguous and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads, virtual memory and demand paging, page replacement algorithms, thrashing, working set model.

UNIT VI **[07 Hrs.]**
Deadlocks: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.
Protection and security: Goal of protection, Mechanism and policies, Domain of protection, access list Capability list access matrix and its implementation, dynamic protection structures, revocation.
Security: authentication, program and system threats

Text books:			
Operating system concepts	8th Edition	Silberchatz & galvin	Wiley
Operating System	5th Edition	William Staling	prentice hall
Reference books:			
Modern operating systems	2nd Edition	A.S. Tanenbaum	McGraw-Hill
Operating system concepts	2nd Edition	Milan MilenKovic	McGraw-Hill
Operating system	1st Edition	S.R. Sathe , A.S. Mokhade	McMillan publication

5th Semester

IT1304	Lab: Operating System	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will study : 1. To make learn students how to make simple programs in LINUX and administrative task of LINUX 2. To familiarize the students with the Operating System. 3. To demonstrate the process, memory, file and directory management issues under the UNIX/ LINUX operating system	After completion of the course : 1. Students will be able to understand working of processes practically in Linux and Windows. 2. Students will be able to learn process creation and process control practically. 3. Students will be able to apply the knowledge of CPU scheduling algorithms to simulate them by writing programs. 4. Students will be able to learn interposes communication and synchronization practically. 5. Students will be able to apply the knowledge of memory management algorithms to simulate them by writing programs. 6. Students will be able to study deadlocks and implement deadlock avoidance algorithm.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1304.1	Students will be able to understand working of processes practically in Linux and Windows.													3	
IT1304.2	Students will be able to learn process creation and process control practically.	3												3	
IT1304.3	Students will be able to apply the knowledge of CPU scheduling algorithms to simulate them by writing programs	3												2	
IT1304.4	Students will be able to learn interposes communication and synchronization practically													3	
IT1304.5	Students will be able to apply the knowledge of memory management algorithms to simulate them by writing programs	3												3	
IT1304.6	Students will be able to study deadlocks and implement deadlock avoidance algorithm	2												2	
IT1304		2.3												2.3	

5th Semester

IT1304	Lab: Operating System	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Expt. No.	Name of Experiment / Problem Statement	Topic
1	Study of Advanced Linux shell commands (Process management, Memory management, Networking, etc.)	Linux Shell Commands
2	Study of Window task manager (about its applications, processes, services, networking etc.)	Windows Task Manager
3	i) Write a program that illustrates the creation of child process using fork system call. Each child and parent Processes perform different task. OR ii) Write a program to implement a given process hierarchy using fork() calls.	Linux Process Control
4	Write a multithreaded program to multiply two given matrices.	Linux Threads
5	Simulate any two of the following CPU Scheduling Algorithms (One each from preemptive and non-preemptive types) a. FCFS b. SJF c. Round Robin d. Preemptive priority e. Non-preemptive priority	CPU Scheduling
6	i) Write a program to simulate Banker's Deadlock avoidance algorithm. OR ii) Write a program for simulating detecting deadlock algorithm	Deadlock
7	Write a program that solves two process Producer-Consumer problem with i) bounded buffer using semaphores. OR i) Write a program that gives a deadlock and starvation free solution to the Dining philosophers problem using semaphores	Semaphore
8	Write a program to perform Inter-Process-Communication using shared memory OR, pipes OR message queues.	Inter-Process Communication
9	Simulate any one of the following Dynamic Memory allocation algorithms First Fit, Best Fit, Worst Fit.	Memory Allocation algorithms
10	Simulate any one of the following Page replacement algorithms: FIFO, LRU, Optimal	Page Replacement Algorithms

5th Semester

IT1305	Software Engineering		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will study : 1. To learn the complete Software life cycle and differentiate between various models. 2. To learn various aspects of effective and efficient system design and to understand various design approaches and models. 3. To differentiate between various testing methods. 4. Comprehending the various techniques of software cost estimation and risk assessment metrics. 5. To understand UML Components 6. To understand various case studies for learning new trends of software engineering.	After completion of the course: 1. Students will be able to understand various process models and it's utility in real world, and able to design and prepare SRS documents. 2. Students will be able to understand different design models, software architecture and designs. 3. Students will be able to understand and apply different testing methods for software testing and able to write good test cases. 4. Students will be able to understand Project management and use proper methods for project management. 5. Students will be able to analyze and design various UML diagrams for the problem statements. 6. Students will be able to understand and design case studies for the development and management of software.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1305.1	Students will be able to differentiate between various process models and its utility in real world. Able to write proper SRS document	3	3	3										3	
IT1305.2	Able to Understand different design models, software architecture and designs	3												3	
IT1305.3	To understand and apply different testing methods for software testing and able to write good test cases.	3	3											3	
IT1305.4	To understand management and use proper methods for management.	3													
IT1305.5	Analyze and design various UML diagrams f problem statements.	3	3	3										3	
IT1305.6	To understand and design case studies for the development and management of software.	3	3	3						3				3	
IT1305		3.0	3.0	3.0						3.0				3.0	

IT1305	Software Engineering		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[08 Hrs.]**

Introduction to Software Engineering .A Generic View of process, and project management, Process model, CMM, Requirement Engineering : Eliciting Requirement ,Developing Use Case ,Analysis Model, Negotiation, Validation , Building the Analysis model : Requirement Analysis ,Analysis Modeling Approaches, Data Modeling

UNIT II **[08 Hrs.]**

Design Engineering: Design Concept, Design Model, Pattern Based Software Design, Architectural Design: Software Architecture., Data Design, Architectural style, Architectural design , Mapping Data Flow into a Software Architecture ,Component Level Design , User Interface Analysis and Design ,Interface Analysis ,Interface Design steps, Design Evaluation

[06 Hrs.]

UNIT III

Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Validation Testing, Testing Tactics: White Box Testing, basic Path testing, Control Structure Testing, Black Box Testing, Object Oriented Testing Method, Testing Method applicable at class Level, Interclass Test Case Design. Metrics: Software Quality.

UNIT IV **[06 Hrs.]**

Project Management, KPES for project management, Metrics for Process and Projects, Project Estimation, Project Scheduling, Risk Management, Quality Management and Change Management

UNIT V **[07 Hrs.]**

Overview of UML, Conceptual Models of the UML, UML and Design Patterns, Applying the UML, UML Diagrams for Payroll processing systems, ATMS, small companies etc

UNIT VI **[05 Hrs.]**

Advanced Topics in Software Engineering: Case studies based on recent Trends, Reengineering, and CASE tools, client server software Engineering. CORBA

Text books:				
1	Software Engineering -A Practitioner's Approach	Seventh Edition	Roger S. Pressman	McGraw Hill
2	Object Oriented Software Engineering	1st Edition,2004	Lethbridge and Pearson	Pearson Education
3	Object Oriented Software Engineering	2nd Edition,2005	Lethbridge and Pearson	Pearson Education
Reference books:				
1	Software engineering university press	10th Edition, 2014	I. Somerville	Oxford university press
2	An integrated approach to software Engineering'	3rd Edition, 1991	Dr. PankajJalota	Narosa Pub
3	The Unified Modeling Language user guide	2nd Edition(2005)	Booch, Rambaugh, Jacobson	Addison Wesley

5th Semester

IT 1306	Lab: Software Engineering	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will study : 1. To develop skills to perform analysis of a real world problem and identify the requirements. 2. To strengthen the ability to identify and draw suitable diagrams for given real world problem. 3. To Gain knowledge in practical applications of software engineering.	After completion of the course: 1. Students will be able to analyze and design SRS Document for Problem definition using knowledge of SRS elements and Software Development Life Cycle. 2. Students will be able to analyze and design /Develop Different UML Diagrams using Rational Rose Tool.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1306.1	Analyze and design SRS Document for Problem definition using knowledge of SRS elements and Software Development Life Cycle.	2	2	3						3				3	
IT1306.2	Analyze and design / Develop Different UML Diagrams using Rational Rose Tool.	2	3	3		3				3				3	
IT1306		2.0	2.5	3.0		3.0				3.0				3.0	

Sr. No	Name of Practical
1	Identify the elements of Software Requirement Specification Document and prepare SRS document for any one of the following statements.
2	Draw Use Case Diagram for the given problem statements.
3	Draw Data Flow Diagram for a problem Statement.
4	Design an Interface for a problem Statement.
5	Design Test Cases for a problem Statement.
6	Study Project Estimation & scheduling also, design a timeline Chart for a problem Statement.
7	Draw Class Diagram for a Problem Statement.
8	Sequence Diagram and Collaboration Diagram for ATM Transaction.
9	Draw State Diagram and Activity Diagram for a problem statements.
10	Study and Implement any of the following problem statement in CASE tools.
	1. Draw Component Diagram for a problem statements 2. Deployment and Package diagram for a problem statements.

5th Semester

IT1316	Database Management System		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. To understand the different issues involved in the design and implementation of a database system 2. 2A. To Study physical and logical database designs, database modelling. 2B. To use SQL to create database objects, populate tables, and retrieve data 3. To design and build a simple database system and demonstrate competence with the fundamental task involved with modelling, designing, and implementing a database. 4. Learn to maintain work concurrently and maintain Data robustness at the same time. 5. Understand and explain the terms like Deadlocks, Transaction Processing and Concurrency Control. 6. Learn how to provide security and database recovery by using different protocols.	After completion of the course: 1. Students will be able to understand the concepts of Data Abstraction, Data Independence, construction of ER-model, and different issues involved in the designing. 2. Students will be able to understand the concept of Relational model ling with the help of Relational algebra and calculus also can populate a database query using DDL, DML and DCL commands. 3. Students will be able to understand the relational database design with the concept of functional dependency and normalization. 4. Students will be able to understand the Query processing. 5. Students will be able to understand the working and implementation of transaction with concurrency control protocol. 6. Students will be able to implement secure and robust database with the help of application based security and database auditing concept.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1316.1	To be Able to understand the concepts of Data Abstraction ,Data Independence, construction of ER-model, and different issues involved in the designing.	3	2	3										2	
IT1316.2	To be Able to understand the concept of Relational model ling with the help of Relational algebra and calculus, Also can populate a database query using DDL ,DML and DCL commands.	2	3	3											
IT1316.3	To be able to understand the relational database design with the concept of functional dependency and normalization.	2	3	3											
IT1316.4	Able to understand the Query processing.	2													
IT1316.5	Able to understand the working and implementation of transaction with concurrency control protocol.	2	2												
IT1316.6	Able to implement secure and robust database with the help of application based security and database auditing concept.	2					2								
IT1316		2.2	2.5	3.0			2.0							2.0	

5th Semester

IT1316	Database Management System		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[08 Hrs.]**
Introduction to Database Management System: General File System vs. DBMS, Relational Model, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence. Entity-Relationship Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Reducing E-R Diagrams to Tables, Generalization, Aggregation

UNIT II **[10 Hrs.]**
Relational Model: Structure of Relational Databases, The Relational Algebra, The Tuple Relational Calculus, The domain Relational Calculus.
Relational Commercial Languages: SQL (DDL, DML, DCL), Query-by-Example.
Integrity Constraints: Domain Constraints, Referential Integrity, Assertions

UNIT III **[08 Hrs.]**
Relational Database Design: Pitfalls in Relational Database Design, Normalization using Functional Dependencies, Normalization from 1NF to 5NF, Domain-Key Normal Form, Normalization using Multivalued Dependencies, Normalization Using Join Dependencies,.

UNIT IV **[10 Hrs.]**
Query Processing: overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, and Evaluation of Expressions.

UNIT V **[06 Hrs.]**
Transactions: Transactions, Transaction model, ACID Properties, Implementation of ACID Properties, Schedules, Testing of Serializability.
Concurrency Control Protocol: Two phase locking protocol, TimeStamp Based Ordering Protocols, Multiple granularities.

UNIT VI **[06 Hrs.]**
Database Security, Application based security, Controlling resource usage, Database auditing, Various Auditing Levels, Triggers, views

Text books:				
1	Database System Concepts	6th Edition	Avi Silberschatz Henry F. Korth S. Sudarshan	Mcgraw-Hill
2	Fundamentals of Database System	5th Edition	ShamkantB.Navathe ,Elmasri	Addison Wesley Publishing Company
Reference books:				
1	Principles Of Databases	2nd Edition,	Jeffrey D. Ullman	W. H. Freeman & Co,2nd Edition,1983
2	An Introduction To Database Systems	6th Edition,	C.J. Date	Adison Wesley-Nerosa
3	Database systems A practical approach to design, implementation and management	5th Edition	Thomas Connolly, Carolyn Begg	Pearson education

5th Semester

IT1317	Lab: Database Management System	L = 0	T = 0	P = 2	Credits =1 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
1. Review the theory concepts of database and basics of oracle. 2. Hands on experience on DDL Commands 3. Hands on experience on DML Commands 4. Learn how to provide security tools by using the queries related to security and protection. 5. To perform various database operation using SQL for different tasks.	After completion of the course: 1. Students will be able to understand the basics of Database designing and construct the ER diagram for Real world Enterprise. 2. Students will be able to : I. Learn to create table, enforce integrity constraints on a database. II. Populate database query using DDL, DML, TCL commands. 3. Students will be able to perform practical using DCL commands to create a secure and protected database.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1317.1	To understand the basics of Database designing and construct the ER diagram for Real world Enterprise.	2	3	3		3									
IT1317.2	I. Learn to create table,enforce integrity constraints on a database. II. Populate database query using DDL,DML,TCL commands		3	3		2									
IT1317.3	Perform practical using DCL commands to create a secure and protected database.		2	2		2									
IT1317		2.0	2.7	2.7		2.3									

Sr.No.	Experiments Base On
1	Database design using E-R Model for: Payroll processing system, Banking system Library Information System Student Information System, etc.
2	Mapping of E-R model to relational Schema and creation of Tables using DDL (Data Definition Language).
3	Modification of Database objects using DDL and DML (Data Manipulation Language).
4	Querying the Database based on Set, Arithmetic and Logical operator.
5	Querying the Database based on Mathematical, character and Date Based Queries.
6	Querying the Database based on sorting and Restricting data.
7	Querying the Database based on aggregate function and various Clauses.
8	Querying the Database based on Join operation. (it covers all types of Join)
9	Implementation of VIEWS.
10	Implementation of Grant and Revoke Command.

5th Semester

IT1307	PE I : Computer Graphics		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will study : 1. To introduce basic concepts of computer graphics. 2. To understand various algorithms of object drawing and various transformation and apply them. 3. To camphene the basic operations on segments, windowing and viewing transformations. 4. Understand some classic 3D graphics algorithms. 5. To understand the basic knowledge of curves and splines. 6. To understand the basic functions of animation.	After completion of the course: 1. Students will be able to understand basics of computer graphics. 2. Students will be able to apply basic algorithms for line, circle and, apply polygon filling algorithms, and 2D transformation. 3. Students will be able to effectively use methods of segmentation and windowing and clipping. 4. Students will be able to understand and apply 3D graphics algorithms. 5. Students will be able to draw curve and splines. 6. Students will be able to understand various tools and apply it to design the animation.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1307.1	Understand basics of computer graphics.	3													
IT1307.2	Apply basic algorithms for line, circle and, Apply polygon filling algorithms. and 2D transformation	3		3											
IT1307.3	Effectively use methods of segmentation and windowing and clipping	3		3											
IT1307.4	Understand and apply 3D graphics algorithms.	3		3											
IT1307.5	To draw curve and splines.	3		3											
IT1307.6	Understand various tools and apply it to design the animation.	3		3										3	
IT1307		3.0		3.0										3.0	

UNIT I **[08 Hrs.]**

Geometry and line generation: points, lines, pixels, planes and frame buffers, types of display devices: Raster Scan display, Flat Panel, LCD, LED Display, 3D Viewing devices, Virtual Reality Systems.Introduction of GPU.Illumination Models.

UNIT II **[08 Hrs.]**

DDA and Bresenham's line algorithms, Bresenham's algorithm for circle generation, algorithm for ellipse generation.Algorithms for polygon generation, polygon filling algorithms, NDC (normalized device co-ordinates), pattern filing, 2D transformation: scaling, rotation, translation, rotation about arbitrary point reflection, zooming.

5th Semester

IT1307	PE I : Computer Graphics		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT III **[08 Hrs.]**
3D Graphics: 3D primitives, projection, parallel perspective, isometric, viewing transformations, hidden surfaces and line removal, painter's algorithm, Z-buffers, Warnock's algorithm.

UNIT IV **[08 Hrs.]**
Graphics primitives: displays file, Segment tables, operations on segments, Graphics file formats (jpeg, Tiff, Bmp, etc). Windowing and clipping: Window, view port, viewing transformation, clipping, line and polygon clipping.

UNIT V **[08 Hrs.]**
Bezier and B-spline, sweeping, method of interpolation, Cubic Splines.

UNIT VI **[08 Hrs.]**
Animation: Definition & introduction to animation, Basics: Animation target objects, Types, animation timings. Design of an animation sequence, general computer animation functions, raster animation, computer animation language.

Textbooks:			
1	Computer Graphics C Version	Second Edition (1997)	Donald Hearn & M. Pauline Baker
2	Computer Graphics Principles and Practice	2nd edition,1996	Foley, Vandam, Feiner and Huges
Reference Books:			
1	Procedural Elements for Computer Graphics	1998	David F. Rogers
2	Computer Graphics, A Programming Approach	2nd edition, 1987	Steven Harrington

5th Semester

IT1309	PE I : Embedded System		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. To understand the basic functions of embedded system 2. To understand the requirements & the general structure of a real time system. 3. To define the unique design problems and challenges of real-time systems. 4. To understand the development of embedded software. 5. To introduce different peripheral interfaces to embedded systems. 6. To Understand and design embedded systems and real-time systems.	After completion of the course students will be able to: 1. Students will be able to understand the differences between the general computing system and the embedded system also recognize the classification of embedded systems with its applications and challenges. 2. Students will be able to understand and design of embedded systems for different applications. 3. Students will be able to study of Real time system Environment. 4. Students will be able to understand and use the different software and debugging tools for embedded system 5. Students will be able to understand the 8051 architecture and basics of the ARM processors. 6. Students will be able to understand the 8051 interfacing and define the unique design problems and challenges of real time systems.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1309.1	Understand the differences between the general computing system and the embedded system also recognize the classification of embedded systems with its applications and challenges..	3	2												3
IT1309.2	Understand and design of embedded systems for different applications.	3	2	3											2
IT1309.3	Study of real time system environment	1													2
IT1309.4	Understand and use the different software and debugging tools for embedded system development	3	3	2		3									3
IT1309.5	Understand the 8051 architecture and basics of the ARM processors	3													2
IT1309.6	Understand the 8051 interfacing and Define the unique design problems and challenges of real time systems	2	2	3		3									2
IT1309		2.5	2.3	2.7		3.0									2.3

5th Semester

IT1309	PE I : Embedded System		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[08 Hrs.]**
Introduction: Definitions of embedded systems, Real time operating Systems and embedded computing platform. Applications of embedded system. Challenges for embedded system design, Debugging tools: Use of assemblers, debugger kernels, Cross compilers.

UNIT II **[07 Hrs.]**
Embedded system design: Requirement analysis, Hardware and software design co-design, I/O Interface co-design for distributed systems, Examples of embedded system.

UNIT III **[09 Hrs.]**
Real Time Environment : Real time I/O, R/T Multitasking and multithreading, processes, O/S, RTOS task scheduling models Use of Semaphores for a task or for Critical section of code use of message queues, mailboxes, pipes, Events, Memory management.

UNIT IV **[08 Hrs.]**
Embedded software development tools & debugging technologies, Host & Target machines, Linker/Loader for embedded software, Study and use of simulators, EPROM emulator, In circuit emulator, getting embedded software into target system.

UNIT V **[09 Hrs.]**
Architecture of micro controller 8051. Introduction, architecture, memory organization, pin definitions and functions timing parallel ports, timers/counters, and serial port interrupt system, introduction to ARM Processors.

UNIT VI **[07 Hrs.]**
Interfacing 8051 with analog circuits, digital circuits and personal computer, Instruction set & programming 8051. Networking: Routing interfacing with OS. Wireless Communication Protocols. Queuing model for networking traffic management, Routing methodologies.

Text books:				
1	An Embedded Software Primer	2006	David E. Simon	Pearson Edu.
2	Computers as Components: Principles Embedded Computing System Design	1st edition, 2000	Wayne Wolf	PHI pub
Reference books:				
1	Time Systems: Design Principles for Distributed Embedded Applications Design Fundamentals	1st edition,1997	Kopetz,'Real	Springer
2	Embedded Systems, Architecture, Programming & Design	1st edition,2006	Rajkamal	McGraw-Hill

5th Semester

IT1328	PE I : Data Analysis & Statistics		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. Provide a basic understanding of data analysis using statistics and probability, and types of probability distribution. 2. Understand the concept of the sampling distribution of a statistic, and in particular describe the behaviour of the sample mean. 3. Understand the foundations for hypothesis testing. 4. Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit 5. Understand correlation and regression analysis. 6. Understand various components of time series. And concepts and utility of Index numbers	After completion of the course students will be able to: 1. Demonstrate the ability to apply fundamental concepts in exploratory data analysis and concepts of probability distribution. 2. Differentiate between sample and population, Recall the sampling distribution of the mean of a sample from a Normal distribution and Apply the Central Limit Theorem to problems involving sums and averages of variables from arbitrary distributions 3. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values and also perform ANOVA and F-test 4. Perform Chi-Square test for Independence as well as Goodness of Fit 5. Compute and interpret the results of Regression and Correlation Analysis, for forecasting 6. Identify components of time series and perform time series analysis and discuss how indices are used to monitor changes in levels over time

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1328.1	Students will able to demonstrate the ability to apply fundamental concepts in exploratory data analysis and concepts of probability distribution.	3	2												
IT1328.2	Students will able to differentiate between sample and population, Recall the sampling distribution of the mean of a sample from a Normal distribution and Apply the Central Limit Theorem to problems involving sums and averages of variables from arbitrary distributions.	3	2		2										
IT1328.3	Students will able to perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values and also perform ANOVA and F-test.	3	2		2										2
IT1328.4	Students will able to perform Chi-Square test for Independence as well as Goodness of Fit.	3	2												2

5th Semester

IT1328	PE I : Data Analysis & Statistics		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

IT1328.5	Students will able to compute and interpret the results of Regression and Correlation Analysis, for forecasting.	3	2		2										
IT1328.6	Students will able to identify components of time series and perform time series analysis and discuss how indices are used in practical applications.	3	2		2										
IT1328		3.0	2.0		2.0										2.0

UNIT I INTRODUCTION TO STATISTICS & PROBABILITY **[06 Hrs.]**
Statistics,–Definition, Types. Types of variables– organizing data, Descriptive Measures. Basic definitions and rules for probability, conditional probability independence of events, Baye's theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION **[06 Hrs.]**
Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size

UNIT III TESTING OF HYPOTHESIS **[07 Hrs.]**
Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. ANOVA one and two way –Design of experiments.

UNIT IV NON-PARAMETRIC METHODS **[08 Hrs.]**
Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit. Sign test for paired data. Rank sum test. Kolmogorov-
Smirnov –test for goodness of fit, comparing two populations. Mann –Whitney U test and Kruskal Wallis test. One sample run test, rank correlation

UNIT V CORRELATION, REGRESSION **[06 Hrs.]**
Correlation analysis, estimation of regression line, multivariate regression, nonlinear regression

UNIT VI INDEX NUMERS AND TIME SERIES ANALYSIS **[07 Hrs.]**
Time series analysis: Variations in time series, trend analysis, cyclical variations, seasonal variations and irregular variations, ARIMA model, Index Numbers –Laspeyre's, Paasche's and Fisher's Ideal index

Text books:			
Statistics for Management	7th edition,	Levin R.I. and Rubin D.S	Prentice Hall India Pvt Ltd., New Delhi, 2001
Business forecasting	8th Edition	John Hanke, Dean W. Wichern	Prentice Hall India

5th Semester

IT1326	PE I : Digital Signal Processing		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. To Classify signals and systems and to describe sampling theory and various operations on discrete time signals such as convolution, correlation etc. 2. To interpret discrete time signals and systems in frequency domain and to summarize properties of Fourier transform. 3. Understanding the Z-transform and its application to identify system properties, solving difference equations and determining the frequency response of a system to predict the stability of the system through pole-zero analysis. 4. To analyze the frequency response of LTI system and block diagram representation and signal flow graph representation of IIR and FIR systems. 5. To design Digital FIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation. Design digital FIR filters using the window method. 6. To analyze signals using discrete Fourier transform (DFT), Understand circular convolution, its relationship to linear convolution and how linear convolution can be achieved via the discrete Fourier transform. To develop the Decimation in time and frequency FFT algorithms for efficient computation of the DFT.	After completion of the course: 1. Students will be able to understand digital to analog (D/A) and analog to digital (A/D) conversion and to operate on a signal and model these operations mathematically. 2. Students will be able to apply DSP techniques to real-world signal acquisition, spectral analysis and signal filtering. 3. Students will be able to analyze and characterize the signals and system through Z-transform. 4. Students will be able to understand system characterization and able to classify and design it. 5. Students will be able to design digital IIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation. 6. Students will be able to understand Discrete Fourier Transform and improved algorithms for fast DFT calculation.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1326.1	Students will able to understand digital to analog (D/A) and analog to digital (A/D) conversion and to operate on a signal and model these operations mathematically.	3	2												
IT1326.2	Students will able to apply DSP techniques to real-world signal acquisition, spectral analysis and signal filtering.	3	2												
IT1326.3	Students will able to analyze and characterize the signals and system through Z-transform.	3	2												
IT1326.4	Students will able to understand system characterization and able to classify and design it.	3	2												

5th Semester

IT1326	PE I : Digital Signal Processing		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

IT1326.5	Students will able to design digital IIR filters by designing prototypical Analog filters and then applying analog to digital conversion techniques such as the bilinear transformation.	3	2	3											
IT1326.6	Students will able to understand Discrete Fourier Transform and improved algorithms for Fast DFT calculation.	3	2												
IT1326		3.0	2.0	3.0											

UNIT I **[08 Hrs.]**
Basics of Signals & Systems, Discrete time signals and systems, linearity, time variance, causality, stability properties of LTI casual system, response of LTI system to various input, convolutions.

UNIT II **[08 Hrs.]**
Frequency Domain description of signals & systems, Fourier Transform of Discrete time signal, Properties of DFT, DFT's of typical discrete time signals.

UNIT III **[07 Hrs.]**
The Z-Transform properties, ROC's relation with Fourier Transform, System function, Inverse Z-Transform, solution of difference equation using unilateral Z-transform.

UNIT IV **[07 Hrs.]**
Introduction to FFT algorithms: Decimation in time- FFT algorithms, decimation in frequency FFT algorithms

UNIT V **[07 Hrs.]**
Digital filter design techniques: Design of FIR Filters based on Windows, Design of IIR digital filters from analog filters

UNIT VI **[06 Hrs.]**
Introduction to 2-D signal processing, 2-D transforms: DFT, FFT, DCT, Wavelet

Text books:			
Digital Signal Processing	2003	Alen V. Oppenheim, W. Schaffer	PHI
Digital Signal Processing	4th Edition (2007)	John G. Proakis, Dimitris G. Manolakis	Pearson Prentice Hall
Reference books:			
Theory & Application of Signal Processing'	1975	Rabiner& Gold	Prentice-Hall
Digital Filter Design & Analysis	1993	Andreas Antoniou	McGraw-Hill

5th Semester

IT1327	PE I : Web Programming		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. Students will study the Non-programming technologies that are fundamental to understanding communication between web browsers and servers as well as how information is displayed by browser 2. Students will study & learn to design web pages 3. Students will study the basic information about cascading style sheets (CSS), a style sheet technology designed to work with HTML and XML documents. 4. Students will study the JavaScript as a programming language, largely independently of how it might relate to a web browser. 5. Students will study the different technologies related to XML as presentation script. 6. Students will study the fundamentals of ASP.NET and how all of them work.	After completion of the course: 1. Students will be able to understand the internet communication technologies & Web browser tools. 2. Students will be able to understand the html and Design & develop of web sites by using html. 3. Students will be able to design & develop dynamic web sites by using DHTML. 4. Students will be able to develop to design JavaScript Webpages through HTML. 5. Students will be able to understand markup languages and create an XML application. 6. Students will be able to understand ASP.NET used to Design interactive websites & promote it online.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1327.1	Understand the internet communication technologies & Web browser tools	3	3											1	
IT1327.2	Understand the html and Design & develop of web sites by using html	3		2						2				2	
IT1327.3	Design & develop dynamic web sites by using DHTML	3		2						3				3	
IT1327.4	Develop to design JavaScript WebPages through HTML	2		3						3				2	
IT1327.5	Understand markup languages and Create an XML application.	2		3						2				3	
IT1327.6	Understand ASP.NET usedto Design interactive websites & Promote it online.	3		3						2				3	
IT1327		2.7	3.0	2.6						2.4				2.3	

5th Semester

IT1327	PE I : Web Programming		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
History of the internet, internet address and domains, Basic tools of internet access, Domain name system (DNS), email, ftp, TELNET(Remote Login),news, Introduction to World Wide Web(WWW):The basics of www and browsing working of web browser and web server, Web browser Architecture, Web server and its deployment

UNIT II **[08 Hrs.]**
Web Page Designing: Standard use for www documents on internet, HTTP, MIME, SGML, DTD, MTNL, URL, Static and Dynamic Web sites, Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames

UNIT III **[07 Hrs.]**
Dynamic HTML (DHTML):
Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections

UNIT IV **[07 Hrs.]**
Scripting Languages:- Java Script objects and forms, server side and client side scripting languages

UNIT V **[07 Hrs.]**
XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing

UNIT VI **[07 Hrs.]**
ASP.NET-An Overview: Introduction, Popular Web Technologies, What is ASP. NET, An overview of the .NET Framework,ASP.NET Details, Server Controls and Web Controls, Validation Controls, Database Processing, ActiveX Controls

Textbook				
1	Web Technology A Developer's Perspective	Eastern Economy Edition	N.P.Gopalan and J.Akilandeswari	PHI Pub
2	ASP.net made simple	1st Edition	BPB editorial board	BPB Pub
3	XML in action web technology	Eastern Economy Edition	William J. Pardi	PHI Pub
4	The Complete Reference HTML and XHTML	4th Edition	Thomas A.Powell	McGraw Hill Pub
Reference Books				
1	Designing Interactive Web sites	2nd edition	James I. Mohler& John M. Duff	Thomson Learning
2	Step by Step XML	2nd Edition	Michael J. Young	PHI

5th Semester

IT1322	OE I : Web Technology		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. Non-programming technologies that are fundamental to understanding communication between web browsers and servers as well as how information is displayed by browser 2. To understand & learn to design web pages 3. Presents basic information about cascading style sheets (CSS), a style sheet technology designed to work with HTML and XML documents. 4. Study of JavaScript as a programming language, largely independently of how it might relate to a web browser. 5. Considers several different technologies related to XML as presentation script. 6. Understand the fundamentals of ASP.NET and how all of them work.	After completion of the course: 1. Students will be able to understand the internet communication technologies & Web browser tools. 2. Students will be able to understand the html and Design & develop of web sites by using html. 3. Students will be able to design & develop dynamic web sites by using DHTML. 4. Students will be able to develop to design JavaScript WebPages through HTML. 5. Students will be able to understand mark-up languages and create an XML application. 6. Students will be able to understand ASP.NET used to Design interactive websites & promote it online.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1322.1	Understand the internet communication technologies & Web browser tools.	3	3											1	
IT1322.2	Understand the html and Design & develop of web sites by using html	3		2								2		2	
IT1322.3	Design & develop dynamic web sites by using DHTML	3		2								3		3	
IT1322.4	Develop to design JavaScript Web Pages through HTML	2		3								3		2	
IT1322.5	Understand markup languages and Create an XML application.	2		3								2		3	
IT1322.6	Understand ASP.NET used to Design interactive websites & Promote it online.	3		3								2		3	
IT1322		2.7	3.0	2.6								2.4		2.3	

5th Semester

IT1322	OE I : Web Technology		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
History of the internet, internet address and domains, Basic tools of internet access, Domain name system (DNS), email, ftp, TELNET(Remote Login),news, Introduction to World Wide Web(WWW):The basics of www and browsing working of web browser and web server, Web browser Architecture, Web server and its deployment

UNIT II **[08 Hrs.]**
Web Page Designing: Standard use for www documents on internet, HTTP, MIME, SGML, DTD, MTNL, URL, Static and Dynamic Web sites, Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames

UNIT III **[07 Hrs.]**
Dynamic HTML (DHTML):
Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections

UNIT IV **[07 Hrs.]**
Scripting Languages:- Java Script objects and forms, server side and client side scripting languages

UNIT V **[07 Hrs.]**
XML: XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well-formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing

UNIT VI **[07 Hrs.]**
ASP.NET-An Overview: Introduction, Popular Web Technologies, What is ASP. NET, An overview of the .NET Framework,ASP.NET Details, Server Controls and Web Controls, Validation Controls, Database Processing, ActiveX Controls

Textbook			
Web Technology A Developer's Perspective	Eastern Economy Edition	N.P.Gopalan and J.Akilandeswari	PHI Pub
ASP.net made simple	First Indian Edition 2001	BPB editorial board	BPB Pub
XML in action web technology	Eastern Economy Edition	William J. Pardi	PHI Pub
The Complete Reference HTML and XHTML	4th Edition	Thomas A.Powell	McGraw Hill Pub
Reference Books:			
Designing Interactive Web sites	2nd edition	James I. Mohler& John M. Duff	Thomson Learning
Step by Step XML	2nd Edition	Michael J. Young	PHI

5th Semester

IT1325	OE I : Object Oriented programming (JAVA)		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development 5. Understand How to handle exceptions appropriately. 6. Become familiar with the concept of an I/O stream.	After completion of the course: 1. Students will be able to understand basic features of JAVA as an object oriented-programming language. 2. Students will be able to write, compile, test and run simple Java programs 3. Students will be able to think write object based programs with object oriented features 4. Students will be able to demonstrate the ability to use simple data structures like arrays in a Java program. Use and explain the difference between a String and String Buffer object 5. Students will be able to demonstrate exceptions that can be recognized and handled by the Java programming language. 6. Students will be able to understand stream classes, Use it to save and read the data in a file.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1325.1	Students will able to understand basic features of JAVA as an object oriented-programming language	1	2										2	1	
IT1325.2	Students will able to write, compile, test and run simple Java programs	2	3										2	2	
IT1325.3	Students will able to demonstrate exceptions that can be recognized and handled by the Java programming language	3	1										2	1	
IT1325.4	Students will able to demonstrate the ability to use simple data structures like arrays in a Java program. Use and explain the difference between a String and StringBuffer object	3	2										2	2	
IT1325.5	Students will able to demonstrate exceptions that can be recognized and handled by the Java programming language	2	2										2	1	
IT1325.6	Students will able to understand stream classes, Use it to save and read the data in a file	2	1										2	2	
IT1325		2.2	1.8										2.0	1.5	

5th Semester

IT1325	OE I : Object Oriented programming (JAVA)		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
Introduction to Programming Methodologies, Introduction to Object oriented programming, Objects and Classes, Characteristics of OOP, Encapsulation and data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Structured Versus Object oriented programming, Merits and demerits of object oriented methodology, introduction to Java as OOP language

UNIT II **[08 Hrs.]**
Building blocks of java: Data types, Variable declarations, operators and Assignments, control structures, Identifying objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control

UNIT III **[07 Hrs.]**
Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances

UNIT IV **[07 Hrs.]**
Arrays and Strings: Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes

UNIT V **[07 Hrs.]**
Exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses

UNIT VI **[07 Hrs.]**
I/O Streams: Introduction to stream classes, use of stream classes, I/O stream, bytes stream, character stream, pre-defined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files ,transient and volatile modifiers

Text books:				
1	Thinking in Java	4th Edition (2006)	Bruce Eckel	Prentice Hall
Reference books:				
1	Programming with Java	4th Edition Dec-2009	E. Balagurusamy	TATA McGraw-Hill
2	Java2 Complete Reference	5th Edition,sep-2002	Herbert Schildt	McGraw-Hill

5th Semester

IT1313	Seminar		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	-	-	100	-	100	-

6th Semester

GE1311	Fundamental of Management		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
GE1311.1	Familiarize the students with the basic concepts and principles of management. This course will facilitate students to understand and describe specific theories related to perception, motivation, leadership. This will help the students to demonstrate effective management skill by knowing the various functions of management like planning, organizing, directing, coordinating and controlling.	1	2				2		2	3	2	3			
GE1311.2	The present course aims at familiarizing the students with various legal aspects of business, contract, partnership and companies. It aims at providing a rich fund of contemporary knowledge, time tested principles, basic concepts, emerging ideas and practices in the field of law in a comprehensive way.	1					3	1	2		1	1			
GE1311.3	The objective of this course is to endow the student with a broad perspective on themes and issues of Human Resource Management, Human Resource Development, Training and Development activities, Job Analysis, Performance Appraisal, disciplinary and grievance procedure. It will help the students to build up and refine decision making skill so that they can help organizations effectively manage employee relations.	1	1				2	2	1	3	1	2			
GE1311.4	The course is intended to develop the knowledge of the students in the management of projects, special emphasis will be provided on project formulation as also on various tools and techniques for project appraisal and control so that they are able to draft the project proposal in any area of management and evaluate the projects.	1	2				1	1	1	2	2	3			

6th Semester

GE1311	Fundamental of Management		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

GE1311.5	This course intends to provide an experienced-based approach to marketing concept and its practical application. The course is designed to enable the students to learn the basic of marketing, customer behavior, marketing research & sales promotion. Topics of the syllabus shall be addressed and discussed from an application oriented perspective	1	1	1			1		1	2	2	1			
GE1311.6	The present course aims at familiarizing the participants with the skills related to basic principles, tools and techniques of financial management. This will help the students to demonstrate their skill in understanding the budgets and budgetary control, balance sheet, and profit and loss statement.	1	1						1	1	1	3			
GE1311		1.0	1.4	1.0			1.8	1.3	1.3	2.2	1.5	2.2			

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

6th Semester

GE1311	Fundamental of Management		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT-5: Money, Banking and Public Finance

Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

Text Books:

3. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
4. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:

7. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
8. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
9. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
10. Economics: Samuelson,
11. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
12. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

6th Semester

IT1338	Computer Networks		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will : 1. Master the terminology and concepts of the OSI reference model and the TCP-IP reference model and types of computer networks. 2. Understand the basic knowledge of hardware, software and types of transmission media used in computer networks 3. Understand the basics of Internet, its applications and network security. 4. Understand Addressing and routing algorithms. 5. Study the concepts of protocols, network interfaces, and design/performance issues in local area networks 6. Understand the basics of Internet, its applications and network security.	After completion of the course: 1. Students will be able to understand the fundamental of Computer Network. 2. Students will be able to understand data link layer issues, protocols and devices. 3. Students will be able to analyze different error detection mechanism in network layer. 4. Students will be able to understand and apply different routing algorithm for solving computer network Problem. 5. Students will be able to analyze the performance of computer Networks and elements of transport protocol. 6. Students will be able to understand cryptography mechanism to make secure Network and understand application level layer concepts.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1338.1	Students will able to understand the fundamental of Computer Network	3													
IT1338.2	Students will able to understand data link layer issues ,protocols and devices.		2												
IT1338.3	Students will able to analyze different error detection mechanism in network layer		2												
IT1338.4	Students will able to understand and apply different routing algorithm for solving computer network Problem.	2	2												
IT1338.5	Students will able to analyze the performance of computer Networks and elements of transport protocol	2													
IT1338.6	Able to understand cryptography mechanism to make secure Network and understand applicationlevel layer concepts.	2		2			2								
IT1328		2.3	2.0	2.0			2.0								

6th Semester

IT1338	Computer Networks		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[05 Hrs.]**

Introduction: The use of computer networks, LAN's, MAN's, WAN's. topologies and their characteristics, wireless networks, protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference model, x.25 network, frame relay, Asynchronous transfer mode.

UNIT II **[05 Hrs.]**

Physical layer: theoretical basis for data communication, Guided transmission media, wireless transmission: electromagnetic spectrum, radio transmission, infrared transmission. Communication satellites: orbits, satellites Vs. fibers. Switching techniques: circuit, packet and message, virtual circuits and datagram. Mobile telephone system: I, II and III generation.

UNIT III **[07 Hrs.]**

Data link layer: design issues, error detection and correction codes, sliding window protocols.
Medium access layer: channel allocation problems, multiple access protocols: ALOHA, CSMA, collision free protocols, limited contention protocols, Ethernet MAC sublayer.
Data link layer switching: local internetworking, repeaters, hubs, bridges, switches, routers and gateways, virtual LAN.

UNIT IV **[09 Hrs.]**

Network layer: design issues, Classful and classless Internet Addresses, subnet addressing, implementation of subnet with mask, supernetting, Address block and CIDR notation, examples.
Routing algorithms, congestion control algorithms, quality of service, internetworking, network layer in Internet: IP protocol, Internet control protocols, OSPF, BGP, Internet multicasting.

UNIT V **[08 Hrs.]**

Transport layer: services, elements of transport protocol, User Datagram Protocol (UDP), Reliable Stream Transport Service (TCP), TCP connection establishment and release, flow control in TCP, TCP segment format. Performance issues: performance problems in networks, network performance measurement

UNIT VI **[06 Hrs.]**

Application layer : DNS, remote logging, Electronic mail, file transfer, world wide web, HTTP
Network security: cryptography, introduction to symmetric and public key algorithms, digital signatures, authentication protocols, e-mail and web security.

Text books:				
1	Computer Networks	5th Edition	Andrew Tanenbaum	Pearson Prentice Hall
2	Data Comminication & Networking	4th Edition (2007)	Behrouz Forouzan	TMH
Reference books:				
1	Data & Computer Communication	8th Edition	William Stallings	PHI
2	Internetworking with TCP/IP	5th Edition	Douglas Comer	Prentice Hall of India.
3	TCP/IP protocol Suite	4th Edition	Behrouz Forouzan	TMH

6th Semester

IT 1339	Lab: Computer Networks	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will study : 1. To study the different Computer Networks 2. The students will study different general techniques for networking tasks, such as error control. 3. The students will gain an understanding of how existing and next-generation communication networks work	After completion of the course: 1. Students will be able to Understand and describe the services and features of the Computer networks. 2. Students will be able to detect Errors in data transfer and configure the DNS and DHCP Servers.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT 1339.1	Students will be able to Understand and describe the services and features of the Computer networks .	2	2											1	
IT 1339.2	Students will be able to detect Errors in data transfer and configure the DNS and DHCP Servers	2	2		1	3								2	
IT 1329		2.0	2.0		1.0	3.0								1.5	

Sr. No	Name of Practical
1.	To Study different types of network & networking commands in Linux.
2.	To Configure DNS Server using CISCO Packet Tracer
3.	To implement client-server application using java network programming.
4.	Write a program to perform Bit stuffing.
5.	Write a program to implement CRC.
6.	Write a program to implement Hamming Code.
7.	To Configure DHCP using CISCO Packet Tracer
8.	To Configure RIP server using CISCO Packet Tracer.
9.	To Configure Simple VLAN server using CISCO Packet Tracer.
10.	To Study campus networking of YCCE.

6th Semester

IT1330	Business Intelligence		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will : 1. Understand the business relevance and technical basics of business intelligence (BI), knowledge management (KM), and decision support and describe how OLAP is different from OLTP. 2. Understand principles of dimensional modeling. 3. Understand Business intelligence system architecture, its building blocks. 4. Understand life cycle of a typical BI project and applications of BI. 5. Appreciate the use of SQL for BI 6. Get acquainted to Enterprise class BI tool	After completion of the course students will be able to: 1. Describe BI as a Process, its application in various domains and functional area , compare and contrast OLTP vs. OLAP 2. Apply multi-dimensional modeling techniques for designing fact based decision making systems, identify various dimensions, metrics, and aggregation strategies. 3. Describe the basic building blocks along with their functions in N_tier BI system, and describe BI ecosystem. 4. Identify and Apply different stages in the lifecycle of a BI project. 5. Apply SQL as a universal language for BI. 6. Recognize the different levels of abstraction in data warehouse, build schema objects, and generate different reports using BI tool.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1330.1	Students will be able to describe BI as a Process, its application in various domains and functional area , compare and contrast OLTP vs. OLAP	2					3								3
IT1330.2	Students will be able to apply SQL as a universal language for BI.	3	3												
IT1330.3	Students will be able to apply multi-dimensional modeling techniques for designing fact based decision making systems, identify various dimensions, metrics, and aggregation strategies.	2	3	3											
IT1330.4	Students will be able to describe the basic building blocks along with their functions in N_tier BI system, and describe BI ecosystem.	2				2									
IT1330.5	Students will be able to identify and Apply different stages in the lifecycle of a BI project	2	3												
IT1330.6	Students will be able to recognize the different levels of abstraction in data warehouse, build schema objects, and generate different reports using BI tool.		3			3									
IT1330		2.2	3.0	3.0		2.5	3.0								3.0

6th Semester

IT1330	Business Intelligence		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I Introduction to Business Intelligence **[03.5 Hrs.]**

What is business intelligence, why do we need BI, EIS,MIS,DSS & BI, information pyramid-data, information, Knowledge & intelligence. basis tor operational, tactical & strategic decision making , OLTP vs. OLAP
Requirement gathering in BI through business question BI in various domains and functional area.

UNIT II Principles of Dimensional modeling **[03.5 Hrs.]**

Foundation for fact based decision making ,The star and snowflake schema,Pros & cons of the star/snowflake schema dimensional model,Slowly changing dimension tables,Fact-less fact strategy ,Time dimension.

UNIT III Business intelligence system architecture **[04 Hrs.]**

Need for enterprise class business intelligence infrastructure,The BI ecosystem,Building blocks of a n- tier BI system-servers & communication protocols ,The central repository-metadata,Information consumption user interfaces-desktop vs. web vs. Mobile.
Open architecture,Scalability, performance in BI-in memory analytics.

UNIT IV BI project lifecycle **[04 Hrs.]**

Typical BI project lifecycle, Requirements gathering & analysis-functional & non- functional requirements,Reports and dashboards design- mock – up and storyboarding,Testing in a BI project,BI project deployment Post production support, Applications of BI, BI best practices

UNIT V SQL the universal language for Business Intelligence **[08 Hrs.]**

Introduction to RDBMS,Language for retrieving data from a database,various clauses in a SQL retrieving data from multiple tables- joins filtering, sorting & grouping datasets,Introduction to DDL & DML statements ,various built- in functions in SQL,Use of sub- queries,data dictionary and dynamics SQL,SQL project

UNIT VI Introduction to Enterprise class BI tool **[07 Hrs.]**

First level of abstraction of the data warehouse in micro strategy, Building the schema objects- attributes, facts, transformation & hierarchies,Building reusable application objects- metrics, filters, prompts,Five styles of BI,Building reports- grids and graphs,Report manipulation over the web- pivoting, sorting, drilling, exporting etc.,Setting up report distribution,Report project

Text books:				
1	Business Intelligence: The Savvy Manager's Guide	2nd Edition	David Loshin	Morgan Kaufmann, 2003

Reference books:				
1	Data Warehousing ETL toolkit	Indian edition.	Ralph Kimball and Margy Ross	John Wiley & Sons, 2013

6th Semester

IT 1331	Lab: Business Intelligence	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will 1. Understand the details of different algorithms made available by popular commercial BI Tools 2. Get acquainted with one BI tool 3. hands on experience with some popular data BI Tool	After completion of the course: 1. Students will able to apply SQL as a universal language for BI. 2. Students will able to obtain hands on experience with some popular BI software And demonstrate the ability to use BI tool for analysis, designing schema, reporting, visualization of results (excel , micro strategy)

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT 1331.1	Students will able to apply SQL as a universal language for BI.	3	3												2
IT 1331.2	Students will able to obtain hands on experience with some popular BI software And demonstrate the ability to use BI tool for analysis, designing schema, reporting , visualization of results (excel ,micro strategy)		3	3		3									2
IT1331		3.0	3.0	3.0		3.0									2.0

Sr. No	Experiments Base On
1	Study of open source BI tool
2	Design a conceptual multidimensional model for the given data.
3.	Implementation of the algorithm to clean the data according to business requirement.
4.	Transform the data into final „ready to load" form.
5.	Implement the algorithm to load the data in the multidimensional format
6.	Solve the given business queries from the multidimensional model

6th Semester

IT1318	Design And Analysis Of Algorithms		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. Fundamental understanding of the mathematics used to formulate recurrence relation. 2. Understand the correctness and compute the running time of the different algorithms. 3. To design, analyze and implement algorithms using Divide and conquer and greed method. 4. To understand the concept of dynamic programming and apply it. 5. Familiarizing with specific algorithms for a number of important computational problems like searching and graphs etc. 6. Introducing the concepts of NP problems and different techniques to deal with them.	After completion of the course: 1. Students will able to formulate and choose the appropriate method, solve recurrence relation. 2. Students will able to analyze asymptotic run time complexity of algorithm. 3. Students will able to ability to understand, distinguish and give examples for the different types of algorithm development strategies. 4. Students will able to analyze design and implement algorithms using dynamic programming. 5. Students will able to analyze design and implement major graph and searching algorithms and their analysis. 6. Students will able to apply different algorithm design techniques to solve certain NP- problems.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1318.1	To formulate and choose the appropriate method to solve recurrence relation.	3	3	2											
IT1318.2	Analyze asymptotic run time complexity of algorithm.		3	2										3	
IT1318.3	Ability to understand, distinguish and give examples for the different types of algorithm development strategies.		3	2										3	
IT1318.4	To analyze design and implement algorithms using dynamic programming.		3	2										3	
IT1318.5	To analyze design and implement major graph and searching algorithms and their analysis.		3	2										3	
IT1318.6	Apply different algorithm design techniques to solve certain NP- problems.	1	2	3	2									3	
IT1318		2.0	2.8	2.2	2.0									3.0	

6th Semester

IT1318	Design And Analysis Of Algorithms		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[08 Hrs.]**
Mathematical foundations, summation of arithmetic and geometric series, Σn, Σn^2, recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions.

UNIT II **[10 Hrs.]**
Asymptotic notations of analysis of algorithms, analyzing control structures, worst case and average case analysis, amortized analysis, External Sorting, lower bound proof.

UNIT III **[08 Hrs.]**
Divide and conquer basic strategy, quick sort, merge sort etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.

UNIT IV **[08 Hrs.]**
Dynamic Programming basic strategy, multistage graphs, all pair shortest path, optimal binary search trees, Matrix-chain Multiplication, traveling salesman problem.

UNIT V **[06 Hrs.]**
Connected components, Branch and bound, Backtracking basic strategy, 8 – Queen's problem, graph coloring, Hamiltonian cycles etc.

UNIT VI **[07 Hrs.]**
NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook's Theorem, decision and optimization problems, polynomial reduction

Text books:				
1	Computer Algorithms	2nd Edition	Horowitz, Sahani, Rajsekharan	Silicon Press
2	Introduction to Algorithm	3rd Edition, 2009.	Thomas H. Cormen	MIT
3	Fundamentals of Algorithms	1st edition,1995	Brassard, Bratley	
Reference books:				
1	The Algorithm Design Manual	2nd Edition	Steven S. Skiena	Springer

6th Semester

IT1332	Lab: Design and Analysis of Algorithm	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will study : 1. Study of different analysis method 2. Study of different techniques of algorithm like divide and conquer, greedy and dynamic.	After completion of the course: 1. Students will able to implement different classic sorting techniques and analyze its time complexity. 2. Students will able to implement different algorithms using divide and conquer, greedy, dynamic and backtracking strategies.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1332.1	Implement different classic sorting techniques and analyze its time complexity		3												
IT1332.2	Implement different algorithms using divide and conquer, greedy, dynamic and backtracking strategies .			3										3	
IT1332			3.0	3.0										3.0	

SR. NO	Name of Experiment / Problem Statement
1.	Analyze Selection Sort algorithm on different input of size. Use random function to generate input sequence
2.	Analyze marge sort algorithm on different input of size. Use random function to generate input sequence
3.	Basic Graph algorithm a. Breadth-first search Greedy Programming
4.	Shortest Path Graph Algorithms a. Implement Dijkstra Algorithm
5.	Implement the minimum cost spanning tree algorithm. a. Implement Kruskal's Algorithm
6.	Dynamic Programming a. All pair shortest path
7.	Backtracking Algorithms b. 4-Queen's Problem

6th Semester

IT1311	PE II : Artificial Intelligence		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. Familiarity with basic concept, and task domain of AI 2. Understand the strengths and limitations of various state-space search algorithms, and choose the appropriate algorithm for a problem. 3. Represent domain knowledge in propositional and first-order logic and in various knowledge represent. 4. Understand probabilistic reasoning techniques and use them to solve problems with noise, incomplete information, and uncertainty. 5. Learn the various types of learning and ability to implement the rule base system. 6. Understand the approaches to syntax and semantics in NLP and some modern machine learning techniques.	After completion of the course: 1. Students will able to demonstrate understanding of AI and its task domains 2. Students will able to understand, apply and choose proper state space search algorithm for the given problem. 3. Students will able to understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets conceptual dependency) inference and theorem proving. 4. Students will able to demonstrate working knowledge of reasoning techniques in the presence of incomplete and/or uncertain information. 5. Students will able to demonstrate and understand the various learning methods and know how to build simple knowledge-based systems 6. Students will able to describe briefly a fundamental concept, techniques for processing language, game playing and introduce some of machine learning techniques using fuzzy logic, genetic algorithm and neural networks.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1311.1	Demonstrate understanding of AI and its task domains	3													
IT1311.2	Understand, apply and choose proper state space search algorithm for the given problem.	3	2	2											
IT1311.3	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets conceptual dependency) inference and theorem proving.	3	2	2										2	
IT1311.4	Demonstrate working knowledge of reasoning techniques in the presence of incomplete and/or uncertain information.	2													
IT1311.5	Demonstrate and understand the various learning methods and Know how to build simple knowledge-based systems.	3		2										3	
IT1311.6	Describe briefly a fundamental concept, techniques for processing language, game playing and introduce some of machine learning techniques using fuzzy logic genetic algorithm and neural networks.	1													
IT1311		2.5	2.0	2.0										2.5	

6th Semester

IT1311	PE II : Artificial Intelligence		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[08 Hrs.]**
Introduction: - : What is AI? , History, Overview, Intelligent Agents – Agents and environments - Good behavior – The nature of environments – structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.

UNIT II **[09 Hrs.]**
Informed Search: depth first and breadth first search, backtracking, problem characteristics, issues in the design of search programs.
Heuristic search techniques: generate and test, hill climbing, best-first search, problem reduction, Genetic algorithm.

UNIT III **[09 Hrs.]**
Constraint Satisfaction Problems, Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs, Adversarial Search, Games, The minimax algorithm, Alpha-Beta pruning, Imperfect Real-Time Decisions, Games that include an Element of Chance.

UNIT IV **[08 Hrs.]**
Knowledge Based Agents: Logic, Propositional Logic, Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, DPLL algorithm, Local search algorithms, First Order Logic, Models for first order logic, Symbols and Interpretations, Terms, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

UNIT V **[07 Hrs.]**
Knowledge Representation: - Knowledge representation using semantic nets, frames, conceptual dependency and scripts. Uncertainty, handing uncertain knowledge, rational decisions, basics of probability.

UNIT VI **[08 Hrs.]**
Learning: general learning model, types of learning, rote learning, learning by taking advice, learning by analogy, induction learning, learning by observation and discovery. Expert System: Rule based system architectures, expert system shell, knowledge acquisition and validation, knowledge system building tools.

Text books:				
1	Artificial Intelligence	2nd Edition	E.Rich and K.Knight	McGraw-Hill
Reference books:				
1	Introduction To Artificial Intelligence and Expert System	1998	D.W Patterson	PHI
2	Principles of Artificial Intelligence	1980	N.J Nilsson	Narosa
3	'Artificial Intelligence'	4th Edition	George F. Lugar	Pearson Education
4	The Sciences of the Artificial	3rd Edition	Herbert A. Simon	MIT Press

6th Semester

IT1320	PE II : Digital Image Processing		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. To introduce basic concept of Image processing. 2. Inculcate the knowledge of image enhancement and filtering in spatial domain 3. To comprehend basics of DFT and DCT of 2-D signal(images) 4. To apply DFT for image enhancement and filtering techniques in frequency domain 5. To understand different issues and techniques of image segmentation 6. To inculcate the knowledge of image representation and description.	After completion of the course students will be able to: 1. Students will able to understand basics of image processing and IP systems. 2. Students will able to understand and apply image enhancement and filtering techniques in spatial domain for given a set of noisy images. 3. Students will able to understand basics of image processing in frequency domain using transforms like DFT & DCT. 4. Students will able to understand and apply image enhancement and filtering techniques in spatial domain for given a set of noisy images. 5. Students will able to understand, compare and apply different image segmentation techniques to image. 6. Students will able to understand and apply internal and external representation of an image region and understand Color Image Processing.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1320.1	Understand basics of image processing and IP systems.	3	2	2									2		
IT1320.2	Understand and apply image enhancement and filtering techniques in spatial domain for given a set of noisy images.	3	3	3	2										
IT1320.3	Understand basics of image processing in frequency domain using transforms like DFT & DCT.	3	2	2											
IT1320.4	Understand and apply image enhancement and filtering techniques in spatial domain for given a set of noisy images	3	3	3	2										
IT1320.5	Understand, compare and apply different image segmentation techniques to image.	3	3	3	2										
IT1320.6	Understand and apply internal and external representation of an image region and understand Color Image Processing	3	3	3	2										
IT1320		3.0	2.7	2.7	2.0								2.0		

6th Semester

IT1320	PE II : Digital Image Processing		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception. Fundamentals of Image processing: A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels.

UNIT II **[08 Hrs.]**
Image Enhancement in the Spatial Domain: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

UNIT III **[05 Hrs.]**
Introduction to the Fourier Transform, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2D FT, inverse Fourier transform, Discrete Cosine Transform, Typical Applications**.**

UNIT IV **[07 Hrs.]**
Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering, Implementation.

UNIT V **[06 Hrs.]**
Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Threshold, Region-oriented Segmentation.

UNIT VI **[07 Hrs.]**
Image Representation: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region, Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models, introduction to image file formats: TIFF, JPEG, BMP, etc.

Notes: Assignments in TA should be based on Programming on Image Processing concepts learned.

Text books:				
1	Digital Image Processing	3rd edition 2007	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall
Reference books:				
1	Fundamentals of Digital Image Processing	1988	A K Jain	Prentice Hall, 1988
2	Image Processing Principles & Applications	2005	TinkuAcharya&Ajoy K. Ray	Willey Inter-Science

6th Semester

IT1308	PE II: Mobile Communication		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To study the concept of frequencies and introduction to fundamentals of wireless & cellular communication. 2. To Study various medium access issues and techniques used in different communication systems. 3. To study different Modulation, Equalization and diversity reception techniques 4. To study additional wireless communication system i.e satellite systems and generations of of mobile computing. 5. To study the role of Mobile IP and Mobile Transport layer 6. To study WAP and understand various issues of mobile application	After completion of the course: 1. Students will be able to understand the basic of wireless communication and transmission. 2. Students will be able to understand GSM architecture in wireless communication. 3. Students will be able to distinguish and compare various technologies used in radio spread spectrum. 4. Students will be able to understand the satellite communications and wireless technologies. 5. Students will be able to Understand the mobile IP and Transport layer protocol, 6. Students will be able to understand WAP and different issues in Mobile application.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1308.1	Students will able to understand the basic of wireless communication and transmission	2													
IT1308.2	Students will able to understand GSM architecture in wireless communication.	2													
IT1308.3	Students will be able to distinguish and compare various technologies used in radio spread spectrum	2													
IT1308.4	Students will able to understand the satellite communications and wireless technologies.	2													
IT1308.5	Students will able to Understand the mobile IP and Transport layer protocol	2													
IT1308.6	Students will able to understand WAP and different issues in Mobile application.	2	2												
IT1308		2.0	2.0												

6th Semester

IT1308	PE II: Mobile Communication		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[05 Hrs.]**
Introduction: Introduction to wireless communication, introduction to cellular system, wireless transmission: frequencies for radio transmission, signal prorogation

UNIT II **[07 Hrs.]**
Introduction to medium access control: TDMA, CDMA FDMA, SDMA.
GSM: System architecture, GPRS architecture protocols, localization and calling, handover, SMS & MMS service architecture

[12 Hrs.]
UNIT III
Modulation Techniques: QPSK, MSK, GMK, M-ary QAM, FSK transmission and detection techniques, quadrature amplitude modulation (QAM), transmitter & receiver.
Spread spectrum: direct sequence and frequency hopping, OFDM, slow-flat fading channels, equalization technique, diversity technique, RAKE receivers.

UNIT IV **[08 Hrs.]**
Wireless LAN: IEEE 802.11, Bluetooth, Zigbee etc. Satellite Systems: GEO,LEO,MEO, routing, localization and handover,1G,2G,3G wireless networks stds. WLL, IS-95 and DECT.

UNIT V **[10 Hrs.]**
Mobile network Layer: Mobile IP, dynamic host, configuration protocol, adhoc networks, IPv6. Mobile transport layer: traditional TCP, indirect TCP & mobile TCP.

UNIT VI **[06 Hrs.]**
Architecture of wireless Application protocol (WAP), Issues of Mobile Application

Text books:				
1	Mobile communication	2nd Edition (2003)	Jochen Schiller	Addison Wesley ,PHI/Pearson Pub
2	Wireless Communication principles & Practice	3rd Edition	T.S.Rappaport	PHI pub
Reference books:				
1	Mobile communications Design Fundamentals	2nd edition (1993)	William C.Y.Lee	Wiley Interscience
2	Wireless Communication & Networks	5th Edition (2002)	William Stallings	PHI
3	Wireless and mobile network architecture	1st edition (2000)	Yi-Bing Lin Wiley & Sons	Wiley

6th Semester

IT1333	PE II : Information System		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To study basic concept of MIS and ERP required for different organization 2. To understand the different planning strategies and role of MIS. 3. Study of management organizational theory and different decision making for MIS. 4. To study the conceptual designs and its functionality for MIS and ERP. 5. To study different manufacturing and nonmanufacturing industries required for implementation of ERP and Information system. 6. To study the organization standards, policies, testing and report generation.	After completion of the course students will be able to: 1. Students will able to apply the basic concept of MIS and ERP for implementing information system 2. Students will able to apply different planning strategies & role for implementing MIS. 3. Students will able to design MIS using Management organizational theory and different decisions. 4. Students will able to understand conceptual design and its functionality for MIS and ERP. 5. Students will able to apply the knowledge of ERP and Information system in industries. 6. Students will be able to do testing of MIS and generate its reports.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1333.1	Understand the basic concept of Management information system	1													
IT1333.2	Understand different planning strategies & role for implementing MIS.	1	1												
IT1333.3	To design MIS using Management organizational theory and different decisions.			2										2	
IT1333.4	Understand conceptual design and its functionality of MIS.	2													
IT1333.5	Understand the Hardware and Software documentation for designing and implementing MIS.	2													
IT1333.6	Understand the testing of MIS and reports generation mechanism.	2													
IT1333		1.6	1.0	2.0										2.0	

6th Semester

IT1333	PE II : Information System		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
Introduction to MIS, decision support system, systems approach, the system view of business, MIS organization with in industrial and business unit, Business needs and ERP, Benefits of ERP, ERP and related technologies, ERP architecture, Managers views of information system, development of management organizational theory, data and Information.

UNIT II **[07 Hrs.]**
Planning with MIS, need for planning, characteristic of plan, strategy & development of plan, role of MIS in strategy development & strategy planning decision, from strategic plans to short range plans, project management and monitoring

UNIT III **[08 Hrs.]**
Meaning, nature & feature of organization, organization and information system structure, management & decision making and MIS, MIS as a technique for mailing programmed decision & non-programmed decision assisting information system, materials management, quality management sales and distribution.

UNIT IV **[08 Hrs.]**
Nature of conceptual design of an MIS. Preparing member of the organization for change, studying, determining information needs, determining information sources, Selection of ERP, SWOT analysis of various ERP products ERP implementation life cycle.

UNIT V **[07 Hrs.]**
Outlining general information flow and database system, documenting the conceptual design, General File System, Electronic Data Interchange (EDI) integration, ERP in manufacturing and non-manufacturing industries.

UNIT VI **[06 Hrs.]**
Organization for implementation, planning the implementation, organization training and development, acquisition, conversion, testing, operation, evaluation and maintenances, ISO procedure, planning, documentation, Crystal report generation, Case studies of MIS and ERP

Text books:				
1	Management Information Systems Concepts & Design	3rd Edition	Robert G. Murdic	PHI Publication
2	ERP Demystified	Second Edition(2003)	Alexis Leon	TMH Pub., 2000
Reference books:				
1	Management Information Systems	1st Edition	S. Sadagopan	PHI Publication
2	Management Information Systems	3rd Edition(1994)	Galgotia Publication	

6th Semester

IT1334	PE II: Internet of Things		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To understand the Industry relevance and technical basics of Internet of Things (IoT), architecture, and management. 2. To understand IoT Communication Protocol, its building blocks 3. Understand web architecture of Internet of things with various applications 4. To Appreciate the use of IOT and Cloud 5. To Understand Security issues, Challenges, and various control in IoT 6. To study various application of IoT in recent era.	After completion of the course: 1. Students will be able to describe IOT as a Process, its architecture and Management, compare and contrast old and new challenges. 2. Students will be able to describe various communication protocol and its building blocks. 3. Students will be able to identify the various building blocks of architecture. 4. Students will be able to describe relevance of IoT with cloud. 5. Students will be able to identify the security challenges and describe various control strategies. 6. Students will be able to describe use of IoT in various applications.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1334.1	Students will able to describe IoT as a Process, its architecture and Management, compare and contrast old and new challenges	2												2	2
IT1334.2	Students will able to describe various communication protocol and its building blocks.	3													
IT1334.3	Students will able to identify the various building blocks of architecture.	3		3			2								
IT1334.4	Students will able to describe relevance of IoT with cloud.	2		3											
IT1334.5	Students will able to identify the security challenges and describe various control strategies.	2													
IT1334.6	Students will able to describe use of IoT in various applications.			3			3						3	3	3
IT1334		2.4		3.0			2.5						3.0	2.5	2.5

6th Semester

IT1334	PE II: Internet of Things		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I Introduction To IoT **[08 Hrs.]**
History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, The 6LoWPAN, Domains of IOT, M2M vs IOT, Management of IOT, IOT Platforms, IOT Languages, IOT Physical Systems, Tools for IOT

UNIT II IoT Communication Protocols **[08 Hrs.]**
Protocol Standardization for IOT, Issues with IOT Standardization, M2M and WSN Protocols, SCADA and RFID Protocols, IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Unified Data Standards.

UNIT III Web of Things **[07 Hrs.]**

Web of Things versus Internet of Things, The Two Pillars of the Web, Architecture Standardization for Web of Things, Platform Middleware for Web of Things, Unified Multitier Web of Things Architecture, Web of Things Portals and Business Intelligence.

UNIT IV Cloud of Things **[07 Hrs.]**
Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards, Cloud Providers & Systems, Mobile Cloud Computing, Cloud of Things Architecture. Models of Implementation, Service Level Agreement (SLA), Examples of Applications.

UNIT V Security Aspects **[07 Hrs.]**
Security in IOT: Introduction, Purpose, Issues, Challenges. IOT Threats to Individual and Organizations, Challenges to Secure IOT Development, Recommended Security Controls. Cybersecurity and IOT. Layered Security Protections to Defend IOT Assets.

UNIT VI IoT applications **[07 Hrs.]**
IOT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IOT electronic equipment. Use of Big Data and Visualization in IOT. Role of IOT for Increased Autonomy and Agility in Collaborative Production Environments, Resource Management in the IOT.

Text books:				
1	Internet of Things: A Hands-on-Approach	1st Edition	Arshdeep Bahga & Vijay Madisetti,	Orient Blackswan Publisher
2	The Internet of Things: Key Applications and Protocols	2015	Olivier Hersent, David Boswarthick & Omar Elloumi	Wiley publication
Reference books:				
1	Designing the Internet of Things	1st Edition	Adrian Mcewen, Hakin Cassimally	Wiley publication
2	Getting Started with the Internet of Things	1st Edition	Cuno Pfister	Shroff Publication
3	The Internet of Things in the Cloud: A Middleware Perspective	2012	Honbo Zhou,	CRC Press
4	The Internet of Things: Applications to the Smart Grid and Building Automation	2nd Edition	Olivier Hersent, Omar Elloumi & David Boswarthick	Wiley publication

6th Semester

IT1335	PE II: Distributed and Object Oriented Databases		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able 1. To expose students to the basic features, principles and architectures of distributed database and also the different levels of visibility provided by a DDBMs. 2. Understand the objectives in designing distributed databases and issues in fragmentation and allocation of data at different sites of computer network. 3. Understand the subject of efficiently accessing a distributed database i. e distributed query processing and optimization. 4. Learn the basics of distributed transaction management and techniques for distributed concurrency control. 5. Become familiar with the Object-oriented database, its applications, architecture and performance issues 6. Understand how a relational model has been extended to incorporate the object-oriented features in it.	After completion of the course: 1. Students will be able to define the need for distributed database technology, introduce basic principles, architecture and implementation techniques of distributed database systems and apply fragmentation 2. Students will be able to identify design phases of a distributed database, their related issues and should be able to design fragments and applications for the distributed database. 3. Students will be able to transform database operations required by application into semantically equivalent operations appropriate for accessing a distributed database and identify issues in distributed query processing and optimization. 4. Students will be able to outline a model for transaction processing in a distributed database and describe techniques for concurrency control in distributed database system 5. Students will able to describe features, architecture, performance issues and query language supported by object oriented DBMS and compare Object Oriented Database model with relational model. 6. Students will be able to identify and demonstrate how the relational model has been extended to support object-oriented features and differentiate between RDBMS, OODBMS, and ORDBMS.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1335.1	Students will able to define the need for distributed database technology, introduce basic principles, architecture and implementation techniques of distributed database systems and apply fragmentation	3	2												
IT1335.2	Students will able to identify design phases of a distributed database, their related issues and should be able to design fragments and applications for the distributed database		3	3											
IT1335.3	Students will able to transform database operations required by application into semantically equivalent operations appropriate for accessing a distributed database and identify issues in distributed query processing and optimization.	2	2												

6th Semester

IT1335	PE II: Distributed and Object Oriented Databases		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

IT1335.4	Students will able to outline a model for transaction processing in a distributed database and describe techniques for concurrency control in distributed database system	2	2												
IT1335.5	Describe features, architecture, performance issues and query language supported by object oriented DBMS and compare Object Oriented Database model with relational model.	3	2												
IT1335.6	Students will able to identify and demonstrate how the relational model has been extended to support object-oriented features and differentiate between RDBMS, OODBMS, and ORDBMS.	2	2			2									
IT1335		2.4	2.2	3.0		2.0									

UNIT I **[08 Hrs.]**

Distributed database concepts: Distributed database management systems-Review of databases and computer networks, Advantages and disadvantages of DDBMSs, Homogeneous and heterogeneous DDBMSs, references architecture, Component Architecture. Distributed relational database design: Data allocation, fragmentation, Transparencies in DDBMS, levels of distribution transparency

UNIT II **[07 Hrs.]**

Distributed database design: Distribution transparency for read only applications and update applications, Distributed database access primitives and integrity constraints. A frame work for distributed database design, the design of database fragmentation, the allocation of fragments

UNIT III **[07 Hrs.]**

Distributed Query processing and Optimization: phases of query processing , translation global queries to fragment queries, equivalence transformation for queries, transforming global queries into fragment queries, distributed grouping and aggregate function evaluation, parametric queries Query optimization, distributed query transformation, distributed joins

UNIT IV **[08 Hrs.]**

Transaction and concurrency control: Concurrency control: concept of two phase commit protocol, Resolving distributed transaction, concept of replication, snapshot on replication and multimaster replication, conflict resolution in multimaster replication concurrency control in distributed database

UNIT V **[08 Hrs.]**

Object Oriented DBMS: concepts and architectures : Characteristics of an object-oriented data model, object schemas, class-subclass relationship, Similarities & differences between OODM and other data models , ADTs ,object identity, nested collections, Features of an object-oriented databases management system, OODBMS architecture, performances issues in OODBMS, Object definition language and object query language.

6th Semester

IT1335	PE II: Distributed and Object Oriented Databases		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

[07 Hrs.]

UNIT VI

Object Relational DBMS: Introduction to Object Relational Database system, Comparison of RDBMS, ODBMS, ORDBMS. Object oriented extensions in oracle: user defined data types, manipulating object tables, object views.

Text books:				
1	Distributed data bases principle and systems	1984	Ceri &Pelagatti	McGraw Hill Pub
2	Object Oriented Databases System – Approaches & Architectures	2nd revised edition	C.S.R. Prabhu	PHI Pub.
3	Database systems A practical approach to design, implementation and management	5th Edition	Thomas Connolly, Carolyn Begg	Pearson education
4	Fundamental of Databases System	5th Edition (2006)	Elmasri & S.B. Navathe	Pearson pub.
Reference books:				
1	Databases System – Design Implementation & Management	10th Edition	Peter rob & Carlos Coronel	Course Tech.
2	Databases Management Systems	2003	Raghu R Ramakrishnan & Johannes Gehrke	McGraw Pub.

6th Semester

IT1336	OE II : Introduction to E-Commerce		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To understand the scope of e-commerce in the realm of modern Business. 2. To learn the marketing methods& Business strategies used in e-commerce. 3. To know how the electronic data interchange and how to manage-commerce solutions. 4. Recognize the business impact and potential of e-Commerce 5. Assess the impact of the Internet and Internet technology on business-electronic commerce and electronic business 6. Understand the security threats &electronic payment system.	After completion of the course: 1. Students will be able to understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web. 2. Students will be able to analyze and understand the human, technological and business environment associated with e-commerce. 3. Students will be able to define and analyze the concept of electronic data interchange and its legal, social and technical aspects. 4. Students will be able to evaluate the key aspects of B2C e-commerce. 5. Students will be able to discuss the trends in e-Commerce and the use of the Internet. 6. Students will be able to define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1336.1	Students will able to understand of contemporary commerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web.	2	1												
IT1336.2	Students will able to analyze and understand the human, technological and business environment associated with e-commerce.	3	3												
IT1336.3	Students will able to define and analyze the concept of electronic data interchange and its legal, social and technical aspects.	3	3				3								
IT1336.4	Students will able to evaluate the key aspects of B2C e-commerce.	2	1												
IT1336.5	Students will able to discuss the trends in e-Commerce and the use of the Internet.	1	1												
IT1336.6	Students will able to define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system.	2	3				3							2	
IT1336		2.2	2.0				3.0							2.0	

6th Semester

IT1336	OE II : Introduction to E-Commerce		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**

Internet &Introduction to Electronic Commerce: Introduction to Traditional commerce and E commerce The basics of internet access, email, FTP, TELNET, Introduction to WWW: The basics of WWW & browsing working of Web Browser & Web Server, Web Browser architecture. Introduction to Electronic Commerce: The scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade Cycle, Electronic Markets, Electronic Data Interchange, Internet Commerce, Advantage and disadvantages of e-Commerce.

UNIT II **[07 Hrs.]**

Business Models of e – commerce and Strategy: Model Based on Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C. Strategic Methods for developing E -commerce, the Value Chain System. Porters value chain Model.

UNIT III **[08 Hrs.]**

E-commerce Payment Systems (EPS) :- Payment through card systems, E – Cheque, E – Cash, E – Payment Threats & Protections. e-credit accounts, e-money, marketing on the Web, Marketing strategies, Advertising on the Web, Customer service and support, Introduction to m-commerce, Case study: e-commerce in passenger air transport.

UNIT IV **[07Hrs.]**

E – Marketing And Electronic Data Interchange (EDI): Home –shopping, E-Marketing, Tele-marketing. Electronic Data Interchange (EDI): Concepts, Benefits and Applications; EDI Model, EDI Protocols (UN EDI FACT).

UNIT V **[07 Hrs.]**

The Elements of e-Commerce& e-Business: Elements, e-Visibility, The e-shop, Online Payments, Delivering the Goods, After-Sales Service.

e-Business: Introduction, Internet Bookshops, Software Supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the Net.

UNIT VI **[08 Hrs.]**

Overview, Security for E – Commerce, Security Standards, secure electronic payment protocols, Password Systems, Digital certificates, Digital signatures

Text books:				
1	E-Commerce	2001	David Whiteley	McGrew Hill Pub
2	Electronic Commerce	2nd Edition	Gary P. Schneider & James T. Perry	Course Technology
Reference books:				
1	Teach Yourself Web Technologies - Part 1	2003	Ivan Bayross	BPB Publications
2	Web Technologies TCP/IP Architecture, and Java Programming	2nd Edition	Achyut S. Godbole and Atul Kahate	McGraw-Hill Education (India)

6th Semester

IT1337	OE II : Information Security		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To focus on the foundations Computer Security and Threats to security 2. The basic concepts of Threats and Intruders, 3. To demonstrate Communication security and understanding standards 4. To know the working of Server security 5. To know various System and Application Security 6. To understand secure programming languages	After completion of the course: 1. Students will be able to focus on the fundamentals of Network Security, common attacks against network assets, the associated threats and vulnerabilities. 2. Students will be able to understand how to protect information and provide authentication. 3. Students will able to effectively use of encryption standards and its implementation. 4. Students will be able to understand various technologies and Internet Application. 5. Students will be able to understand Security threads and its implementations. 6. Students will be able to understand how to implement multiprogramming.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1337.1	To focus on the fundamentals of Network Security, common attacks against network assets, the associated threats and vulnerabilities.	2													
IT1337.2	To understand how to protect information and provide authentication.	2	2												
IT1337.3	To effectively use of encryption standards and its implementation.	2	2												
IT1337.4	To understand various technologies and Internet Application.	2	2												
IT1337.5	To understand Security threads and its implementations.	2													
IT1337.6	To understand how to Implement multiprogramming.	2											2		
IT1337		2.0	2.0										2.0		

6th Semester

IT1337	OE II : Information Security		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
Introduction- Computer Security, Threats to security, History of Computer security, Computer System Security and Access Controls (System access and data access).

UNIT II **[08 Hrs.]**
Threats – Viruses, worms , Trojan horse, bombs, trap doors, spoofs, email virus, macro viruses, remedies, Intruders, Malicious software, Firewalls, vulnerabilities & threats, Network Denial of service attack.

UNIT III **[08 Hrs.]**
Communication security- Encryption, classical encryption techniques, data encryptions standards, advance encryption techniques Network Security-Kerberos, X.509

[08 Hrs.]
UNIT IV
Server security- security for network server, web servers, mobile technologies (java and java script etc) Intrusion detection techniques – techniques to provide privacy in Internet Application and protecting digital contents(music, vedio, software) from unintended use, authentication.

UNIT V **[07 Hrs.]**
System and Application Security- mail security (PGP etc) file System security, program and security, memory security, Sandboxing. Security threads protection intruders- Viruses-trusted system
.

UNIT VI **[07 Hrs.]**
Secure programming languages- concepts structured multiprogramming, shared classes, cooperating sequential processes, structure of multiprogramming system RC-4000

Text books:				
1	Computer Security	2nd Edition	Dieter Gollmann	John Wiley & Sons
2	Computer Security: Art and Science	1st Edition	Matt Bishop	Addison Wesley
Reference books:				
1	Introduction to computer Security	1st Edition	Mathew Bishop	Pearson
2	Network Security: Private Communication in a Public World (Prentice Hall Series in Computer Networking and Distributed)	2nd Edition	Charlie Kaufman, Radia Perlman, Mike Speciner	Pearson Education
3	Cryptography and Network Security	6th Edition	william Stallings	Pearson Education

6th Semester

IT1324	**Mini Project**		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	-	-	100	-	100	

7th & 8th Semester (Group A & B)

IT1403	Principles of Compiler Design		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To study the basic concept of compiler fundamentals & design of lexical analysis 2. To study the different parsing techniques. 3. To study the construction of parsers for different CFG. 4. To study Syntax Directed Translation of different programming language constructs. 5. To study symbol table organization & error detection & recovery 6. To study code optimization & designing of code generation scheme.	After completion of the course: 1. Students will be able to understand the designing approaches of compiler & designing of Lexical analyzer. 2. Students will be able to apply & design Top Down Parser for the recognition of Programming Language constructs. 3. Students will be able to apply &design Bottom Up parser for CFG & simulation of Language. 4. Students will able Analyze and Apply Syntax Directed Translation scheme to CFG & development of Three Address Code Statement. 5. Students will be able to understand the Symbol Table Organization & able to apply error detection and recovery methods. 6. Students will be able to Understand& apply different code optimization techniques for the development of target code.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1403.1	To understand the designing approaches of compiler & designing of Lexical analyzer.	3.0	2.0	3.0											
IT1403.2	To apply & design Top Down Parser for the recognition of Programming Language constructs	2.0		3.0											
IT1403.3	To apply &design Bottom Up parser for CFG & Simulation of Language.	2.0		3.0											
IT1403.4	Analyze and Apply Syntax Directed Translation scheme to CFG & development of Three Address Code Statement.	3.0	3.0	3.0											
IT1403.5	To understand the Symbol Table Organization & able to apply error detection and recovery methods	2.0	3.0												
IT1403.6	To Understand& apply different code optimization techniques for the development of target code.	3.0	2.0	3.0											
IT1403		2.5	2.5	3.0											

7th & 8th Semester (Group A & B)

IT1403	Principles of Compiler Design		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[05 Hrs.]**

Introduction to Abstract Model & Grammar , Introduction to Compilation Process, Compilers & Translators, Linker & Loader Phase structure of Compiler, Role of Lex, Design of Lexical Analysis.

UNIT II **[08 Hrs.]**

Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, and Bottom up Parsing, Predictive Parsers, and Recursive Decent Parser.

UNIT III **[07 Hrs.]**

Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table

[08 Hrs.]

UNIT IV

Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/Flex, Yacc /Biason).

UNIT V **[06 Hrs.]**

Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase

UNIT VI **[08 Hrs.]**

Introduction to Code Optimization, The principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.

Textbooks:			
Compilers Principles, Techniques & Tools	2nd Edition	Alfred V. Aho , Ravi Sethi , Jeffrey D.	Addison Wesley.
Principles of Compiler Design	2nd Edition	Alfred V. Aho ,Jeffrey D. Ullman	Addison Wesley.
Reference Book			
Compiler Design	4th edition	O.G. Kakde	Laxmi Publication
Introduction to Compiling Techniques: First Course Using ANSI C, LEX and YACC	2nd Revised edition Edition	J.P. Bennett	Alfred Waller Ltd

7th & 8th Semester (Group A & B)

IT 1404	Lab: Principles Compiler Design	L = 0	T = 0	P = 2	Credits =1 1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will study: 1. To study the different phases and passes of compiler design. 2. To write a program using Lex Tool. 3. To write a program using YACC Tool	After completion of the course: 1. Students will be able to understand and apply Lex Tool for the development of program. 2. Students will be able to understand and apply YACC Tool for the development of program.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1404.1	To understand and apply Lex Tool for the development of program.					3									
IT1404.2	To understand and apply YACC Tool for the development of program.	2				3									
IT1404		2.0				3.0									

Sr. No.	Name Of The Practical
1	Study of lex.
2	Write a lex program that contains no patterns and no actions. Thus, any string matches and default action, i.e. printing takes place.
3	A lex program which adds line numbers to the given file and displays the same onto the standard output
4	A lex program that replaces all the occurrences of "rama" with "RAMA" and "sita" with "SITA.
5	Write lex program to count and print the number of pages lines, words and characters in a given file.
6	Write lex program to count all instance of she and he, including the instances of he that are included in she.
7	Write lex program to count the number of printf and scanf statements
8	Write lex program to find simple and compound statements
9	Write lex program to count the number of identifiers
10	Write lex program to find the number of constants
11	STUDY OF YACC
12	Write Yacc and Lex specification programs are used to generate a Calculator.
13	Study of latest compilers (BEYOND SYLLABUS)

7th & 8th Semester (Group A & B)

IT1417	Network Programming		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To focus on the foundations of network Models and the application of IP addressing in real world 2. To introduce the network layer and various services related to network LAYER and protocols working. 3. To demonstrate Transport layer via TCP and UDP protocols 4. To know various Routing protocols and its working 5. To know the working of Application Layer and its protocols and services 6. To understand real time managing and securing of network.	After completion of the course: 1. Understand the basics of TCP/IP model and IP Addressing scheme and design IP scheme for a given network. 2. Understand the working of network layer protocols. 3. Understand the working of TCP & UDP protocols and its packages and operation. 4. Understand interposes communication in Unix. 5. Understand the concept of Socket Programming and its functions. 6. Able to apply knowledge of socket programming to develop network based application.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1417.1	Students will be able to understand the basics of TCP/IP model and IP Addressing scheme and design IP scheme for a given network.	3	3	3											
IT1417.2	Students will be able to understand the working of network layer protocols	2													
IT1417.3	Students will be able to Effectively use protocols and understanding its headers for the formation of segments	2													
IT1417.4	Students will be able to understand the basics of routing mechanism and study various routing algorithms.	2													
IT1417.5	Students will be able to understand client- server Models and also analysing various protocols for communication such FTP, SMTP, etc	2													
IT1417.6	Students will be able to build systems based on basics network design and managing ; also securing it form internet	3												3	
IT1417		2.3	3.0	3.0										3.0	

7th & 8th Semester (Group A & B)

IT1417	Network Programming		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**

Internetworking- Concepts, architecture and Protocol, Comparison of OSI model and TCP/IP model. Internet Protocol (IPv.4)- IP addresses, Classful and Classless IP addresses, IP datagrams, IP datagram Forwarding. ARP, RARP. Problems on IP address, Internet Protocol (IPv.6)-Characteristics of features, datagram frame format, base address format, addressing. Problems: IP addressing , Subnet mask, IP configuration commands, IP Packet Headers

UNIT II **[08 Hrs.]**

IP, ICMP and IGMP : Datagram, fragmentation, options, checksum, IP package, ICMP, messages, formats, error reporting, query, checksum, ICMP package, IGMP, messages, operation, encapsulation, IGMP package. Problems: Headers of protocols

UNIT III **[07 Hrs.]**

UDP: UDP datagram, checksum, operation, uses, UDP package. TCP: TCP, Services, flow, congestion and error control, TCP package and operation. Problems: Headers of protocols such as TCP and UDP.

UNIT IV **[08 Hrs.]**

Unicast And Multicast Routing Protocols: unicast routing protocols, RIP, OSPF, BGP, multicast routing, trees, protocols, MOSPF, CBT, PIM .Problems : Routing.

UNIT V **[06 Hrs.]**

Application Layer, Sockets: Client server model, concurrency, processes, sockets, byte ordering, socket system calls, TCP and UDP client-server programs, BOOTP -DHCP, Services: Domain Name System , name space, resolution, types of records, concept, mode of operation, , FTP, TFTP and electronic Mail: SMTP, MIME, IMAP, POP. Problems: Headers of protocols

UNIT VI **[07 Hrs.]**

Network management: SNMP, Middleware: RPC, RMI. Internet Security: IPSec, PGP, Firewalls, SSL.
Live Demo: RPC, SNMP, RMI, PGP, Firewall configuration, SSL, Network management on Ether

Textbooks:			
TCP/IP protocol suite	4th edition	Behrouz Forouzan	Tata McGrawhill
Internetworking with TCP / IP	4th edition (2000)	Douglas Comer	PHI
Reference Book			
Computer networks	4th edition	Andrew S.Tanenbuam	PHI
TCP/IP illustrated Volume 2	2003	W.Richard Stevens	Pearson Education

7th & 8th Semester (Group A & B)

IT 1418	Lab: Network Programming	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Students will be able : 1. To develop skills to configure various protocols 2. To develop skills and able to configure and monitor real time networks To Gain knowledge in practical applications of data structures 3. To develop and analysis of data at various layers	After completion of the course: 1. Students will be able to understand and solve the concepts of Interprocess Communication in network programming using JAVA. 2. Students will be able to understand the use of client/server architecture and apply the knowledge for application development.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1418.1	Students will be able to understand and solve the concepts of Intercrosses Communication in network programming using JAVA.	2.0	2.0		2.0									3.0	
IT1418.2	Students will be able to understand the use of client/server architecture and apply the knowledge for application development.	3.0	3.0	3.0										3.0	
IT1418		2.5	2.5	3.0	2.0									3.0	

Sr. No	List of Practical
1	Study of Different Networking Commands in Windows and Linux.
2	To Implement Client-Server application using Java Networking Programming.
3	Implementation of TCP/IP
4	Implementation of E-mail Service
5	Implement the Following forms of IPC a) PIPE b)FIFO
6	Design a TCP Concurrent Server to convert a given text into uppercase using multiplexing system call "SELECT".
7	Design RPC application to add and subtract a given pair of integer
8	Program to determine host byte order

7th & 8th Semester (Group A & B)

IT1427	Data Mining		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student able to: 1. Introduce the data mining fundamentals, different techniques and identify the scope and necessity of Data Mining for the society. 2. Understand the basic concepts of data mining functionality Association mining, its algorithms and applications. 3. Understand the basic concepts of data mining functionality: classification and prediction, its algorithms and applications. 4. Understand the basic concepts of data mining functionality: clustering its algorithms and applications. 5. Understand the importance of web mining, and its types. 6. Get acquainted with analysis and mining of text data and different approaches for text mining.	After completion of the course: 1. Students will be able to describe basic concepts in data mining, Identify the scope and necessity of Data Mining for the society and effectively apply data mining technique in variety of business applications. 2. Students will be able to derive association rules for a given data set by applying appropriate algorithm. 3. Students will be able to describe the basic concepts in classification, use decision trees for classification and apply regression techniques for prediction, compare classification with prediction and clustering. 4. Students will be able to describe the basic concepts in clustering, apply clustering techniques for a given data set. 5. Students will be able to describe the concepts in web data mining, its types and its importance. 6. Students will be able to describe the techniques of mining text data and its applications

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1427.1	Students will be able to describe basic concepts in data mining, Identify the scope and necessity of Data Mining for the society and effectively apply data mining technique in variety of business applications.	3.0					3.0							2.0	2.0
IT1427.2	Students will be able to derive association rules for a given data set by applying appropriate algorithm	3.0	3.0												
IT1427.3	Students will be able to describe the basic concepts in classification, use decision trees for classification and apply regression techniques for prediction, compare classification with prediction and clustering.	3.0	3.0												
IT1427.4	Students will be able to describe the basic concepts in clustering, apply clustering techniques for a given data set	3.0	3.0												
IT1427.5	Students will be able to describe the concepts in web data mining, its types and its importance	3.0	2.0												
IT1427.6	Students will be able to describe the techniques of mining text data and its applications	3.0	2.0												
IT1427		3.0	2.6				3.0							2.0	2.0

7th & 8th Semester (Group A & B)

IT1427	Data Mining		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[08 Hrs.]**
Introduction to data mining: Data mining definitions & task, data mining on what kind of data ,Knowledge Discovery vs. Data mining, DBMS vs. Data Mining, Data mining functionalities, data mining task primitives , Major issues in data mining , applications of data mining.

UNIT II **[08 Hrs.]**
Association Rule Mining: what is Frequent itemsets, closed itemsets, and association rules, frequent pattern mining, applications of Association Rule mining, The Apriori algorithm for finding frequent itemset using candidate generation, generating association rules from frequent itemsets .Improving effieciency of Apriori , FP- growth algorithm.

UNIT III **[08 Hrs.]**
Classification and prediction: What is classification , prediction., Issues regarding Classification and prediction, Decision tree construction principle, Decision tree construction algorithms ID3, C4.5, Classification using decision tree Induction , prediction using Linear regression.

UNIT IV **[08 Hrs.]**
Cluster Analysis : What is cluster analysis, its applications, clustering paradigms, Partioning algorithms: K- means, K-medoids, Hierarchial clustering: Agglomerative and Divisive hierarchical clustering.

UNIT V **[08 Hrs.]**
Web Mining: Introduction, web content mining, web structure mining, web usage mining, mining multimedia data on web.

UNIT VI **[08 Hrs.]**
Text mining: Text data analysis and Information retrieval, Unstructured texts, text mining approaches, episode rule discovery for texts, Hierarchy of categories, text clustering.

Text books:				
1	Data mining Techniques	2nd edition,	Jiawei Han and Micheline Kamber	Elsevier
2	Data mining techniques	2nd edition	Arun Pujari	University press (India) 2010

Reference books:				
1	Introduction to data mining	ISBN: 0321321367.	Pang-Ning Tan, Michael Steinbach, vipin kumar	Addison- Wesley 2005
2	Data mining methods and models	second reprint 2007	Daniel Larose	Wiley Interscience

7th & 8th Semester (Group A & B)

IT 1428	Lab: Data Mining	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Student will able: 1. To be able to differentiate between RDBMS schemas & Data Warehouse Schemas. 2. To understand the concept of Analytical Processing (OLAP) and its similarities & differences with respect to Transaction Processing (OLTP). 3. Understand the details of different algorithms made available by popular commercial data mining software; 4. Understand the regression analysis and its application 5. Understand data visualization	After completion of the course: 1. Students will be able to demonstrate the ability to perform data preprocessing tasks, data cleaning, and integration. 2. Students will be able to demonstrate the ability to implement and apply the principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction on different types of datasets. and Analyze their results 3. Students will be able to demonstrate the ability to interpret the results using different visualization techniques.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1428.1	Demonstrate the ability to perform data preprocessing tasks	3.0	3.0			3.0									
IT1428.2	Demonstrate the ability to implement and apply the principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction on different types of datasets. and Analyze their results	3.0	3.0			3.0								3.0	
IT1428.3	Demonstrate the ability to interpret the results using different visualization techniques		3.0			3.0									
IT1428		3.0	3.0			3.0								3.0	

Sr. No	Experiments Base On
1	Study WEKA tool
2	Creation of .ARFF file for applying data mining techniques on following data sets (in ARFF file Format)i.e customer's data, weather forecasting data, agricultural data etc 1
3.	Usage of WEKA for Data cleaning task(filtering, discretization)
5.	Implementation / Usage of WEKA for classification of above mentioned data set
6.	Implementation / Usage of WEKA for Association rule mining
7.	Implementation / Usage of WEKA for clustering
8.	Implement a regression analysis and show the prediction on sample data. Compare predicted and actual value and calculate error in your system
9.	Draw scatter plot of your data and find whether linear regression can be used or not

7th & 8th Semester (Group A & B)

IT1422	Network Security		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student able to: 1. To focus on the foundations of Security 2. The basic concepts of public key encryption and number theory 3. To demonstrate network security tools and applications 4. To know the working of authentication and hash functions- 5. To know various authentication and security features 6. To understand managing and securing of network	After completion of the course: 1. Students will be able to understand the Security Attacks, mechanism and encryption techniques. 2. Students will be able to Analyze and understand the knowledge of Conventional Encrypting Algorithm and Encryption function for solving the Network Security Problems. 3. Students will be able to Analyze and understand the various types of Cryptographic. 4. Students will be able to Able to apply different authentication and authorization services for identification of User. 5. Students will be able to Able to understand various aspects of IP security. 6. Students will be able to Able to identify & understand various threats & can apply preventive measure to ensure system security.

Course Outcomes	Statement	Mapped PO											PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1422.1	Understand the Security Attacks, mechanism and encryption technique's	3.0	2.0												
IT1422.2	Analyze and Understand the knowledege of Conventional Encrypting Algorithm and Enyption function for solving the Network Security Problems.	2.0	2.0	2.0											
IT1422.3	Analyze and understand the various types of Cryptographic algorithms and Cryptographic hash functions	2.0	2.0	2.0											
IT1422.4	Able to apply different authentication & authorization services for identification of User	3.0		2.0											
IT1422.5	Able to understand various aspects of IP security	2.0		2.0										2.0	
IT1422.6	Able to identify & understand various threat& can apply preventive measure to ensure system security.	2.0	2.0	2.0			2.0								
IT1422		2.3	2.0	2.0			2.0							2.0	

7th & 8th Semester (Group A & B)

IT1422	Network Security		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
Introduction- attacks services, mechanisms, security attacks, security services, model for internet work security, conventional encryption- classical techniques- encryption model, steganography, classical encryption techniques, modern techniques-simplified DES, differential and linear cryptanalysis, block cipher design principles, Block Cipher modes of operation

UNIT II **[08 Hrs.]**
Conventional encryption-algorithm RC5, Blowfish, DES, triple DES etc. characteristics of advanced symmetric block cipher, confidentiality using conventional encryption- placement of encryption function, traffic confidentiality, key distribution, random number generation.

UNIT III **[08 Hrs.]**
Public key encryption- principle of public –key cryptosystems, the RSA algorithm, key management, Diffie-Hellman key exchange ,Ellipse Curve Cryptography, Introduction to number theory prime and relatively prime numbers, modular arithmetic, Fermats and Euler's theorems ,testing for primarily, discrete Logarithms.

UNIT IV **[08 Hrs.]**
Message authentication and hash functions- authentication requirements, functions, codes, hash functions, security of hash functions and MACs, SHA-1, HMAC, digital signatures, authentication protocols, digital signature standard.

UNIT V **[07 Hrs.]**
Authentication applications-Kerberos, Directory authentication service, E-mail security-pretty good privacy, S/MIME, IP security-overview, architecture, authentication header, encapsulating security pay load, combining security associations, key management.

UNIT VI **[07 Hrs.]**
Web security-requirements, secure sockets layer, secure electronic transaction, network management security-SNMP, System security-intruders, viruses and related threats, firewall-design principles, trusted systems.

Text books:				
1	Cryptography and Network Security	6th Edition	William Stallings	Pearson Education
2	Network Security	2008	Behrouz A. Forouzan	McGraw-Hill Higher Education
Reference books:				
1	Networks Security Essentials, applications and standards	5th Edition	William Stallings	Pearson Education
2	Cryptography in C and C++	2nd Edition	Michael Welschenbach	Apress

7th & 8th Semester (Group A & B)

IT1407	PE III : Real Time Systems		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To study the concepts of Real Time Systems and the different design issues of Real Time Systems. 2. To learn and understand the techniques for real time scheduling. 3. To study and understand formal specification and verification of timing constraints and properties. 4. To study and understand the concepts of priority driven scheduling and schedulability test. 5. To learn and understand the concepts of scheduling aperiodic & sporadic jobs in priority-driven systems. 6. To study the techniques resource access control and validation and Provide experience in the implementation of typical algorithms used in real time systems	After completion of the course: 1. Students will be able to understand the basics and importance of real-time systems and explain & address the fundamental problems of real-time systems. 2. Students will be able to analyze real-time scheduling and systems designs. 3. Students will be able to apply formal methods for scheduling real-time systems. 4. Students will be able to know the various task assignment and scheduling methods. For example RM and DM scheduling. 5. Students will be able to Analyze and Design basic multi-task scheduling algorithms for periodic, aperiodic, and sporadic tasks as well as understand the impact of the latter two on scheduling. 6. Students will be able to Analyze and examine how resource contention affects the execution behavior and Schedulability of jobs.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1407.1	Understand the basics and importance of real-time systems and explain & address the fundamental problems of real-time systems.	3.0	2.0												
IT1407.2	Analyze real-time scheduling and systems designs.	3.0	2.0	2.0											
IT1407.3	Apply formal methods for scheduling real-time systems.		3.0	2.0											2.0
IT1407.4	Know the various task assignment and scheduling methods. For example RM and DM scheduling		3.0	3.0											2.0
IT1407.5	Analyze and Design basic multi-task scheduling algorithms for periodic, aperiodic, and sporadic tasks as well as understand the impact of the latter two on scheduling.		3.0	3.0											2.0
IT1407.6	Analyze and examine how resource contention affects the execution behavior and Schedulability of jobs.	2.0	2.0												
IT1407		2.7	2.5	2.5											2.0

7th & 8th Semester (Group A & B)

IT1407	PE III : Real Time Systems		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[06 Hrs.]**
Introduction to real time systems: Digital control, high-level controls, signals processing, real time applications. Hard and soft real time system: Jobs & processors, release times, deadlines, timing, constraint, Hard & Soft timing constraint, Hard real time systems, soft real time systems. Modeling of real time systems.

UNIT II **[06 Hrs.]**
Approach to real time scheduling: Clock-driven approach, weighted round-robin approach, priority-driven approach, dynamic versus static systems, effective release times and deadlines, optimality of EDF & LST algorithms, non-optimality of the EDF & LST, challenges in validating timing constraints in priority-driven systems, off line versus on-line scheduling.

UNIT III **[07 Hrs.]**
Clock driven scheduling: Notations & assumptions, static timer-driven scheduler, general structure of cyclic schedules, cyclic executives, improving the average response time of a periodic jobs, scheduling sporadic jobs, practical consideration and generalizations, algorithms for constructing static schedules, pros-cons of clock-driven scheduling.

UNIT IV **[08 Hrs.]**
Priority-driven scheduling: Static assumptions, fixed-priority versus dynamics priority algorithms, maximum schedulable utilization, optimality of the RM & DM algorithms, a schedulability test for fixed priority tasks with short response times & with arbitrary response times, sufficient schedulability conditions for the RM & DM algorithms.

UNIT V **[08 Hrs.]**
Scheduling aperiodic & sporadic jobs in priority-driven systems: assumptions & approaches, deferrable servers, sporadic servers, constant utilization, total bandwidth and weighted fair-queuing servers, slack stealing in dead-line driven systems, slack stealing in fixed-priority systems, scheduling of sporadic jobs

UNIT VI **[07 Hrs.]**
Resources and resource access control : assumption on resources and their usage, effects of resource contention & resource access control, non-preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack-based priority –ceiling protocol, use of priority-ceiling protocol in dynamic-priority systems, preemption-ceiling protocol, controlling accesses to multiple-unit resources, controlling concurrent accesses to data object.

Text books:			
1	Real Time Systems	Jame W.S.Liu	Pearson education
Reference books:			
1	Real Time Systems	C.M. Krishna & Kang G. Shin	McGraw Pub.

7th & 8th Semester (Group A & B)

IT1423	PE III :Human Computer Interaction		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To study and understand interface design tools 2. To study and demonstrate the Interaction between the human and computer components 3. To study and understand the screen designing and its various concepts. 4. To Study Design rules. 5. To study and understand software tools related to HCI process. 6. To understand the interaction devices.	After completion of the course: 1. Students will be able to apply the knowledge of human components for interaction with computer. 2. Students will be able to understand basics of Computer components functions regarding interaction with human. 3. Students will be able to demonstrate Understanding of Interaction between the human and computer components using screen designing concept. 4. Students will be able to apply Design rules to various interfaces 5. Students will be able to apply the knowledge of software tools for HCI. 6. Students will be able to Produce Implementation supports for HCI by using various tools.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1423.1	Apply the knowledge of human components for interaction with computer	2.0	2.0												
IT1423.2	To understand basics of Computer components functions regarding interaction with human.	2.0	2.0												
IT1423.3	Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept.	3.0	2.0								2.0		1.0		
IT1423.4	Apply Design rules to various interfaces.			2.0											
IT1423.5	Apply the knowledge of software tools for HCI.	2.0													
IT1423.6	To Produce Implementation supports for HCI by using various tools.	3.0						1.0							
IT1423		2.4	2.0	2.0				1.0			2.0		1.0		

7th & 8th Semester (Group A & B)

IT1423	PE III :Human Computer Interaction		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**
Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design, a brief history of Screen design, The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, Principles of user interface

UNIT II **[07 Hrs.]**
Design process –The Human, Human interaction with computers, importance of human characteristics, human consideration, Human interaction speeds, and understanding business functions.

UNIT III **[08 Hrs.]**
Screen Designing:- Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information–focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics– Technological consideration in interface design.

UNIT IV **[06 Hrs.]**
Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT V **[06 Hrs.]**
Software tools – Specification methods, interface – Building Tools.

UNIT VI **[06 Hrs.]**
Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

Text books:				
1	Human Computer Interaction	3rd Edition	Janet Finlay, Gregory D. Abowd, Russell Beale Alan Dix	Prentice Hall
2	The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques	3rd Edition	Wilbert O. Galitz	John Wiley & Sons
Reference books:				
1	Interaction Design: Beyond Human - Computer Interaction	3rd Edition	Yvonne Rogers, Helen Sharp, Jenny Preece	Wiley

7th & 8th Semester (Group A & B)

IT1429	PE III : Advanced Computer Architecture		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To understand the basic concept of different computer architecture and parallelism. 2. To study of different pipelining processor and its applications. 3. To understand the basic concept of array processor and SIMD. 4. To understand basic concept of Multiprogramming/Multiprocessing Architecture. 5. To study different data dependence for improvement of system performance. 6. To understand different techniques of parallelism and its extraction.	After completion of the course: 1. Students will be able to analyze classification of Computer architecture and its parallelism. 2. Students will be able to apply different pipelining techniques in an application. 3. Students will be able to Design solution for solving complex problems using Array processor and SIMD. 4. Students will be able to Apply the knowledge of Multiprogramming/Multiprocessing for the improvement of system performance. 5. Students will be able to Analyze different data flow dependent and its effects on parallelism. 6. Students will be able to Apply different parallelism techniques and its extraction to application.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1429.1	Analyze classification of Computer architecture and its parallelism		2.0												2.0
IT1429.2	Apply different pipelining techniques in an application	3.0													2.0
IT1429.3	Design solution for solving complex problems using Array processor and SIMD			3.0											2.0
IT1429.4	Apply the knowledge of Multiprogramming/Multiprocessing for the improvement of system performance	3.0													3.0
IT1429.5	Analyze different data flow dependent and its effects on parallelism		3.0												2.0
IT1429.6	Apply different parallelism techniques and its extraction to application	2.0													2.0
IT1429		2.7	2.5	3.0											2.2

7th & 8th Semester (Group A & B)

IT1429	PE III : Advanced Computer Architecture		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[10 Hrs.]**
Introduction to parallel processing : memories and IO subsystem : Evolution of computer system, parallelism in uniprocessor system, parallel computer structure, architecture classification schemes, parallel processing application, Hierarchical memory structure, virtual memory system, memory allocation and , management, I/O subsystem.

UNIT II **[08 Hrs.]**
Pipelining and vector processing : Pipeline, overlapped pipelining, instruction and arithmetic pipelining, pipelined processor, vector processing, vector processor, architecture of cray-1, parallel memory organization

UNIT III **[08 Hrs.]**
Array Processor : SIMD array processor, (organization and inter connection networks), Parallel algorithms for array processor, SIMD matrix multiplication, parallel sorting on array processor, associative array processing, associative memory organization associative processors.

UNIT IV **[08 Hrs.]**
SIMD Computer and Multiprocessor Architecture : III iac-IV System architecture and its applications, performance enhancement methods, parallel memory allocation, array processing, languages, multiprocessors, loosely and tightly coupled multiprocessor, time shared and crossbar interconnection networks, parallel memory organization, interleaved memory configuration.

UNIT V **[08 Hrs.]**
Multiprocessing control and Data Flow Computers: Interprocess communication mechanisms system deadlocks and protection parallel algorithms for multiprocessors, classifications of parallel algorithms data driven computing, data flow computer architecture.

UNIT VI **[05 Hrs.]**
Techniques for Extraction of parallelism.

Text books:				
1	Advanced Computer Architecture	2nd edition,	Kai Hwang	McGraw-Hill
Reference books:				
1	Computer Architecture and Parallel Processing	1st edition	Hwang & Briggs	Mc-Graw Hill Pub

7th & 8th Semester (Group A & B)

IT1430	PE III : E-Commerce		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To understand the scope of e-commerce in the realm of modern Business. 2. To learn the marketing methods& Business strategies used in e-commerce. 3. To know how the electronic data interchange and how to manage-commerce solutions. 4. Recognize the business impact and potential of e-Commerce 5. Assess the impact of the Internet and Internet technology on business-electronic commerce and electronic business 6. Understand the security threats &electronic payment system.	After completion of the course: 1. Students will be able to understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web. 2. Students will be able to analyze and understand the human, technological and business environment associated with e-commerce. 3. Students will be able to define and analyze the concept of electronic data interchange and its legal, social and technical aspects. 4. Students will be able to evaluate the key aspects of B2C e-commerce. 5. Students will be able to discuss the trends in e-Commerce and the use of the Internet. 6. Students will be able to define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1430.1	Students will able to understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web.	2	1												
IT1430.2	Students will able to analyze and understand the human, technological and business environment associated with e-commerce.	3	3												
IT1430.3	Students will able to define and analyze the concept of electronic data interchange and its legal, social and technical aspects.	3	3				3								
IT1430.4	Students will able to evaluate the key aspects of B2C e-commerce.	2	1												
IT1430.5	Students will able to discuss the trends in e-Commerce and the use of the Internet.	1	1												
IT1430.6	Students will able to define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system.	2	3				3							2	
IT1430		2.2	2.0				3.0							2.0	

7th & 8th Semester (Group A & B)

IT1430	PE III : E-Commerce		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[07 Hrs.]**

Internet &Introduction to Electronic Commerce: The basics of internet access, email, FTP, TELNET, Introduction to WWW: The basics of WWW & browsing working of Web Browser & Web Server, Web Browser architecture. Introduction to Electronic Commerce: The scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade.

UNIT II **[07 Hrs.]**

Business Strategy in an Electronic Age: The Value Chain System, Competitive Advantage, Business Strategy.

[08 Hrs.]

UNIT III

Business to Business Electronic Commerce: Inter-organisational Transactions, Electronic Markets, Electronic Data Interchange, EDI: EDI Technology, EDI Standards, EDI, Communication, EDI Implementation, EDI Security, EDI and Business, Inter-organisational e-Commerce.

UNIT IV **[07Hrs.]**

Business to Consumer Electronic Commerce: Consumer Trade transactions, What you want, when you want it, internet e-commerce, Internet Shopping and the Trade cycle, Advantage and Disadvantage of Consumer e-commerce.

UNIT V **[07 Hrs.]**

The Elements of e-Commerce& e-Business: Elements, e-Visibility, The e-shop, Online Payments, Delivering the Goods, After-Sales Service.

e-Business: Introduction, Internet Bookshops, Software Supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the Net.

UNIT VI **[08 Hrs.]**

Security Threats to E-Commerce, Electronic Payment Systems (EPS).

Text books:				
1	E-Commerce	2001	David Whiteley	McGrew Hill Pub
2	Electronic Commerce	2nd Edition	Gary P. Schneider & James T. Perry	Course Technology
Reference books:				
1	Teach Yourself Web Technologies - Part 1	2003	Ivan Bayross	BPB Publications
2	Web Technologies TCP/IP Architecture, and Java Programming	2nd Edition	Achyut S. Godbole and Atul Kahate	McGraw-Hill Education (India)

7th & 8th Semester (Group A & B)

IT1432	PE III :Cloud Computing		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
1. To study the different Computing Systems with the comprehensive and in-depth knowledge of Cloud Computing. 2. To study the basics of Cloud Computing Concepts and Technology 3. To study the Cloud Computing architecture and its applications, Fundamental issues and Technologies. 4. To Study of Cloud application design considerations and its methodology 5. To Study basics of Cloud Computing Security mechanisms. 6. To Study applications of Hadoop and MapReduce in Cloud Computing	After completion of the course students will be able to: 1. Understand different computing Environment and apply the knowledge of cloud computing for solving Engineering Problems 2. Understand and Elaborate the various concepts and techniques in cloud computing 3. Identify and apply cloud computing architectures for the development of applications 4. Develop solutions for the designing of cloud applications 5. Apply cloud computing security mechanism to make computing system more secure 6. Apply Hadoop and MapReduce techniques for the development of cloud applications

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1432.1	Understand different computing Environment and apply the knowledge of cloud computing for solving Engineering Problems	3													
IT1432.2	Understand and Elaborate the various concepts and techniques in cloud computing	2													
IT1432.3	Identify and apply cloud computing architectures for the development of applications	3	2												2
IT1432.4	Develop solutions for the designing of cloud applications			3											2
IT1432.5	Apply cloud computing security mechanism to make computing system more secure	3													3
IT1432.6	Apply Hadoop and MapReduce techniques for the development of cloud applications					3									3
IT1432		**3**	2	3		3									3

7th & 8th Semester (Group A & B)

IT1432	PE III :Cloud Computing		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[06 Hrs.]**
Overview of Computing Paradigm, Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Fog computing, Cloud Computing, Sky Computing; Introduction to Cloud Computing: Defining Cloud Computing, Characteristics of Cloud Computing, Cloud Models: Service Model, Deployment Model, Benefits and Disadvantages of Cloud computing

UNIT II **[07 Hrs.]**
Cloud Concepts and Technology: Virtualization, Load Balancing, Scalability& elasticity, Deployment, Replication, Monitoring, Software Define network, Network Function Virtualization, Identify and Access Management, Service Level Agreement, Billing

UNIT III **[09 Hrs.]**
Cloud Computing Architecture: Cloud computing stack, Comparison with traditional computing architecture (client/server)
Infrastructure as a Service(IaaS): Introduction to IaaS,IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM),Resource Virtualization: Server, Storage, Network ,Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service) with Example, Platform as a Service (PaaS): Introduction to PaaS, What is PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management: Computation, Storage, Software as a Service (SaaS) Introduction to SaaS, Web services, Web 2.0

UNIT IV **[08 Hrs.]**
Cloud Application Design: introduction, Design Consideration for Cloud applications: Scalability, Reliability and Availability, Security, maintenance and Upgradation, Performance; Reference Architecture for Cloud application, Cloud application Design methodology, Data storage Approaches: Relational Approach and Non-Relational Approach

UNIT V **[07 Hrs.]**
Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity & Access Management, Data Security: Securing Data at rest, Securing Data in Motion, Key Management, Auditing

UNIT VI **[08 Hrs.]**
Hadoop and Map reduce: apache Hadoop, Hadoop job reduce job execution: Name node, Secondary Name Node, Job Tracker, Data node, MapReduce job execution Workflow; Hadoop scheduling ,Hadoop Cluster Setup

Text books:				
1	Cloud Computing A hands-on Approach	2014	Arshdeep Bahga, VijayMadisetti	University press
Reference books:				
1	Cloud Computing: Principles and Paradigms	1st Edition	Rajkumar Buyya, James Broberg , Andrzej M. Goscinski	Wiley-Blackwell
2	Cloud Security: A Comprehensive Guide to Secure Cloud Computing,	1st Edition	Ronald L. Krutz, Russell Dean Vines	John Wiley

7th & 8th Semester (Group A & B)

IT1436	PE III: Coding Standards & Technical Documentation		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To learn various concepts of coding & document standards. 2. To understand various coding guidelines. 3. To learn basic programming elements of Java programming. 4. To learn various coding standards. 5. To understand various technical documents needed in software development. 6. To understand basics of report writing.	After completion of the course: 1. Students will be able to differentiate between various programming standards and styles of programming. 2. Students will be able to write good programs based on the guidelines of the coding. 3. Students will be able to write efficient Java programs based on styles of Java. 4. Students will be able to differentiate between different patterns and standards of coding in Java. 5. Students will be able to prepare better manuals, case reports and software documents. 6. Students will be able to write proper reports

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1436.1	Students will be able to differentiate between various programming standards and styles of programming	3.0	3.0	2.0											
IT1436.2	Students will be able to write good programs based on the guidelines of the coding	3.0		3.0	3.0										
IT1436.3	Students will be able to write efficient Java programs based on styles of Java	3.0	3.0		2.0	2.0									
IT1436.4	Students will be able to differentiate between different patterns and standards of coding in Java	3.0	3.0	2.0		2.0									
IT1436.5	Students will be able to prepare better manuals, case reports and software documents	3.0				3.0									2.0
IT1436.6	Students will be able to write proper reports			2.0	2.0	3.0									
IT1436		3.0	3.0	2.3	2.3	2.5									2.0

7th & 8th Semester (Group A & B)

IT1436	PE III: Coding Standards & Technical Documentation		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[05 Hrs.]**
Introduction to general coding standards, Internal document Standards, Coding Standards: Indentation, Inline comments, procedure oriented programming, Object based programming, Structured Programming, Classes, Function, Subroutines, Methods, Source Files, and Variable Names**.**

UNIT II **[05 Hrs.]**
Coding Guidelines: Line Length, Spacing, Wrapping Lines, Variable declarations, Program Statements, use of parentheses, Coding for efficiency vs. Coding for readability, Meaningful error messages, Reasonable sized Functions and Methods, Number of routines per File, Elements of Programming Style.

UNIT III **[06 Hrs.]**
The elements of Java Style: Introduction, General Principles, Formatting Conventions, Naming Conventions: Package Names, Method Names, Constant Names. Documentation Conventions, Programming Conventions: Type safety, Statements & Expressions, Construction, Exception Handling, Assertions, Concurrency, Synchronization, Efficiency. Packaging Conventions.

UNIT IV **[08 Hrs.]**
Java Coding Standards: The Prime Directive: Naming conventions, Documentation, Java comments, Standards for member functions, Member function visibility, Documenting Member Functions, Techniques for writing clean code, standards for fields (Attributes/Properties), standards for local variables, Standards for parameters, Standards for classes, standards for Interfaces, standards for Packages, standards for Compilation Units (Source code file).

UNIT V **[08 Hrs.]**
Introduction to Technical Writing: Prewriting, Writing & Rewriting, Objectives in technical writing, correspondence: Memos, Letters, Writing effective resumes, Visual appeal: document design, graphics, electronics communication: writing email, online help & websites, writing instructions & user's manuals

UNIT VI **[08 Hrs.]**
Report strategies: writing research reports, feasibility reports, Lab reports, Progress reports, Writing proposals

Text books:				
1	The elements of Programming Style	2nd edition	Brain W. Kernighan and P.J. Plauger	MGraw Hill
2	The elements of Java Style	2000	Allan Vermeulen, Scoff W. Ambler, Greg Bumgardner, Eldon Metz, Trevor Misfeldt, Jim Shur, Cao Tieou	Cambridge University
3	Technical Writing Process & Product	5th edition, 2005	T Sjaron J. Gerson & Steven M. Gerson	Prentice Hall

7th & 8th Semester (Group A & B)

IT1415	PE IV : Neural Networks & Fuzzy Logic		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To focus on the foundations of neural network theory and the application of neural network models in engineering, cognitive science, and artificial intelligence 2. To introduce the neural networks as means for computational learning and to present the basic network architectures and learning algorithms for classification and regression 3. To demonstrate neural network applications on real-world tasks 4. To emphasize the need for fuzzy logic as a means to model linguistic knowledge in human experts 5. To know fuzzy Arithmetic and inference techniques 6. To understand fuzzy inference and reasoning so as to build systems based on fuzzy control	After completion of the course: 1. Students will be able to focus on the mathematical foundations of neural network theory and to understand the working of Neural Networks as pattern classifier. 2. Students will be able to comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for supervised learning. 3. Students will be able to comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for unsupervised learning. 4. Students will be able to understand the basics of fuzzy sets, its operations and the need for fuzzy logic. 5. Students will be able to understand fuzzy numbers, fuzzy relations and extension principle. 6. Students will be able to understand fuzzy inference system and to design a fuzzy controller.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT415.1	Students will be able to focus on the mathematical foundations of neural network theory and to understand the working of Neural Networks as pattern classifier.	3	3												
IT415.2	Students will be able to comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for supervised learning.	3	3	3											
IT415.3	Students will be able to comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for unsupervised learning.	3	3	3											
IT415.4	Students will be able to understand the basics of fuzzy sets, its operations and the need for fuzzy logic.	3													

7th & 8th Semester (Group A & B)

IT1415	PE IV : Neural Networks & Fuzzy Logic		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

IT415.5	Students will be able to understand fuzzy numbers, fuzzy relations and extension principle.	3													
IT415.6	Students will be able to understand fuzzy inference system and to design a fuzzy controller.	3	3	3											
IT415		3.0	3.0	3.0											

UNIT I **[07 Hrs.]**

Fundamentals concepts and models of artificial neural systems: Biological neurons and their artificial models, models of artificial neural networks, learning and adaption, neural network learning rules, feed forward and feedback networks, single-layer perceptron classifiers, Discriminant functions, linear machine and minimum distance classification, training and classification using the perceptron, SDTA algorithm, MCPTA algorithm.

UNIT II **[06 Hrs.]**

Single layer perceptron networks for linearly separable classification, RDPTA algorithm. Multilayer feed forward networks: linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors.

UNIT III **[07 Hrs.]**

Mathematical foundations of Discrete time Hopfield networks,, Hopfield learning algorithm, clustering and similarity measures, Self-Organizing Feature Maps, Applications of artificial neural networks

UNIT IV **[06 Hrs.]**

From classical (CRISP) sets to fuzzy sets, characteristics and significance of the paradigm shift, fuzzy sets versus crisp sets, representation of fuzzy sets, properties of fuzzy sets. Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersection s-norms, fuzzy unions: t-Conorms.

UNIT V **[07 Hrs.]**

Fuzzy Arithmetic: fuzzy numbers, Linguistics variables, arithmetic operations on fuzzy numbers, Fuzzy relations, extension principles for fuzzy sets.

UNIT VI **[07 Hrs.]**

Fuzzy rules and reasoning, fuzzy inference, fuzzification, evaluation of fuzzy rules, aggregation of output fuzzy sets Defuzzification methods, design of a fuzzy controller

Text books:				
1	Introduction to Artificial Neural Systems	2nd Edition	J. M. Zurada	Jaico Publishing House.
2	Fuzzy sets and Fuzzy logic, Theory and Applications	1st Edition	George J. Klir and Bo Yuan	Prentice Hall,
Reference books:				
1	Fuzzy Logic With Engineering Applications	2004	T. J. Ross	McGraw Hill
2	An introduction to Fuzzy Control	2nd Edition	D. Driankov	Narosa Pub. House,
3	Artificial Neural Networks	1999	Yegnanarayan	PHI
4	Neuro-fuzzy and Soft Computing	1996	Jang.Sun and E. Mizutani	Prentice Hall

7th & 8th Semester (Group A & B)

IT1405	PE IV : Pattern Recognition		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able to: 1. Understand basic principles of pattern recognition system. 2. Understand probabilistic distributions and to estimate parameters of density from the data available in the training samples. 3. Understand parametric classification/ decision making concept and to determine optimal boundary between two classes. 4. Comprehend non-parametric classification/ decision making concept and to choose an appropriate decision making technique for solving the classification problem. 5. Understand basic principles of different clustering methods. 6. Understand concept of artificial neural networks & its application to pattern recognition.	After completion of the course: 1. Students will be able to understand the fundamentals of pattern recognition, design cycle, application. 2. Students will be able to analyze classification problems probabilistically and estimate classifier performance. 3. Students will be able to understand the principles of Bayesian parameter estimation and apply them in relatively simple probabilistic models. 4. Students will be able to understand and analyze methods of classification techniques, able to choose a decision-making technique. 5. Students will be able to select appropriate clustering method for solving the given problem. 6. Students will be able to Understands Nets with & without Hidden Layers, Back-Propagation Algorithm, and Hopfield Nets.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1405.1	Students will able to understand the fundamental of pattern recognition, design cycle, application.	3.0												2.0	2.0
IT1405.2	Students will able to analyze classification problems probabilistically and estimate classifier performance.	3.0	3.0												
IT1405.3	Students will able to understand the principles of Bayesian parameter estimation and apply them in relatively simple probabilistic models.	3.0	3.0												
IT1405.4	Students will able to understand and analyze methods of classification techniques, able to choose a decision-making technique.	3.0	3.0												
IT1405.5	Students will be able to select appropriate clustering method for solving the given problem.	3.0	3.0												
IT1405.6	Students will be able to Understands Nets with & without Hidden Layers, Back-Propagation Algorithm, and Hopfield Nets.	2.0													
IT1405		2.8	3.0											2.0	2.0

7th & 8th Semester (Group A & B)

IT1405	PE IV : Pattern Recognition		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I **[06 Hrs.]**
Introduction: Machine perception, Components of Pattern recognition systems, the design cycle, Statistical Decision Theory, Applications of Pattern Recognition.

UNIT II **[07 Hrs.]**
Probability: probabilities of events, random variables, joint distribution & densities, moments of random variables, estimation of parameters from samples.

UNIT III **[07 Hrs.]**
Statistical Decision Making: Baye's Theorem, Decision boundaries, estimation of error rates.

UNIT IV **[08 Hrs.]**
Non parametric decision Making: Histograms, kernel and window estimators, nearest neighbour classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error, estimation functions.

UNIT V **[07 Hrs.]**
Clustering: Introduction, hierarchical clustering, partition clustering

UNIT VI **[06 Hrs.]**
Artificial Neural Networks: Introduction, Nets without Hidden layer, Nets with Hidden Layers, The Back-Propagation Algorithm, Hopfield Nets

Text books:				
1	Pattern recognition & Image processing	2003	EarlGose, Richard Johnsonbaugh & Steve Jost	Pearson Education
Reference books:				
1	Pattern Classification	2nd Edition	Richard Duda, Peter Hart and David G. Stork	Wiley

7th & 8th Semester (Group A & B)

IT1421	PE IV : Distributed Systems		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Learning Objective	Course Outcomes
Student will able: 1. To study the different design issues of Distributed Systems, and Create an awareness of the major technical challenges in distributed systems design and implementation; 2. To study and understand the concepts of Distributed Objects, Distributed file system and Remote Procedure Calls; 3. To study the concepts of Clock synchronization & Timing models; 4. To gain knowledge on Distributed systems concepts that includes architecture and Mutual exclusion algorithms. 5. To study the safety and progress properties of concurrent and distributed algorithms. 6. To study and understand the concepts of failure recovery and fault tolerance in distributed environment.	After completion of the course: 1. Students will be able to define distributed systems & identify models of distributed computing. 2. Students will be able to describe the message communication, remote procedure call and Remote method invocation (RPC and RMI) along with group communication. 3. Students will be able to analyze algorithms for coordination, communication, and synchronization in distributed systems. 4. Students will be able to demonstrate the Mutual exclusion protocols of Distributed Systems. 5. Students will be able to design distributed algorithms for deadlocks detection and Agreement. 6. Students will be able to specify the use of fault tolerance and failure recovery in the design of distributed application software.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1421.1	Define distributed systems & Identify models of distributed computing.	2.0	3.0												
IT1421.2	Describe the message communication, remote procedure call and Remote method invocation (RPC and RMI) along with group communication.	3.0	2.0												
IT1421.3	Analyze algorithms for coordination, communication, and synchronization in distributed systems.	3.0	2.0	3.0											2.0
IT1421.4	Demonstrate the Mutual exclusion protocols of Distributed Systems.		3.0	3.0											2.0
IT1421.5	Design distributed algorithms for deadlocks detection and Agreement.		3.0	3.0											
IT1421.6	Specify the use of fault tolerance and failure recovery in the design of distributed application software.		3.0	2.0											
IT1421		2.7	2.7	2.8											2.0

7th & 8th Semester (Group A & B)

IT1421	PE IV : Distributed Systems		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

UNIT I Architecture of Distributed Systems **[06 Hrs.]**
Characteristics of Distributed System, Motivation, challenges /Issues in the design & development of Distributed System. Architecture Model, System Architecture, Types of Architectural Model: Client server model, Search engine, Proxy server & caches, Variation on client server model: mobile code, mobile agents. Fundamental Models: Interaction model, failure model, Security model,

UNIT II Distributed Objects & Distributed file system **[06 Hrs.]**
Inter-process communication, Sockets, middleware, Group communication, and Remote procedure calls. CORBA, RMI, Distributed file system, Name services, Directory services, File Service types, download/upload model, File sharing semantics, session semantics, Server design: stateless & stateful server, Cache update policies. Case studies on Distributed file system: NFS, AFS.

UNIT III Theoretical Foundations **[07 Hrs.]**
Inherent limitations of distributed systems, Timing issues, clock synchronization, Network time protocol, Lamport's logical clocks, Vector clocks, Casual ordering of messages, Global state, Cuts of Distributed computation, Termination detection.

UNIT IV Distributed Mutual Exclusion **[08 Hrs.]**
Classification of mutual exclusion algorithms, Requirements and performance measures of mutual exclusion algorithms, Leader election, Chang Robert: Ring based leader election algorithm, Bully algorithm. Non Token Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm.Token Based Algorithms: Suzuki-Kasami's Algorithm, Raymond's Algorithm, Comparative performance analysis

UNIT V Distributed Deadlock Detection & Agreement Protocols **[08 Hrs.]**
Resource vs Communication deadlocks, graph theoretic model, deadlock prevention, avoidance, detection, Issues in deadlock detection, Centralized deadlock detection algorithms, distributed deadlock detection algorithms
Agreement Protocols
Synchronous vs. asynchronous computations, model of process failures, authenticated vs. non-authenticated messages. A classification of Agreement problems, Solutions to Byzantine Agreement problem, Lamport –Shostak-Pease algorithm.

UNIT VI Failure recovery and Fault Tolerance **[06 Hrs.]**
Classification of failures. Backward and forward error recovery, Basic approaches of backward error recovery, recovery in concurrent systems, consistent set of checkpoints, synchronous check pointing and recovery, asynchronous check pointing and recovery. Fault Tolerance: Atomic actions and committing, commit protocols, non-blocking commit protocols, Voting protocols, Dynamic voting protocols, Dynamic Vote Reassignment Protocols.

Text books:				
1	Advanced Concepts In Operating Systems: Distributed, Multiprocessor and Database Operating Systems	1993	Mukesh Singhal and Niranjan G. Shivaratri	McGraw Hill
2	Distributed Operating Systems Concepts and Design	3rd Edition	G Coulouris, Jean Dollimore, Tim Kindberg	Addison Wesley
Reference Books				
1	Distributed Algorithms	2013	Lynch N	Morgan Kaufman
2	Modern Operating Systems	4th Edition	Tanenbaum	Pearson Education
3	Distributed Operating Systems: Concepts and Design	1st Edition	Pradeep K. Sinha	Prentice-Hall of India Pvt.Ltd

7th & 8th Semester (Group A & B)

IT1416	Lab Course Name: Neural Network and Fuzzy Logic	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
1. To familiarize with neural networks and learning methods for neural networks 2. To introduce the neural networks as means for computational learning and to present the basic network architectures and learning algorithms for classification 3. To demonstrate neural network applications on real-world tasks 4. To introduce the ideas of fuzzy sets, fuzzy logic and to emphasize the need for fuzzy logic to model linguistic knowledge in human experts 5. To know fuzzy Arithmetic and inference techniques along with its applications 6. To understand fuzzy inference and reasoning to build systems based on fuzzy control and to understand of Neuro-Fuzzy Systems	Students who complete this course will be able to 1. Focus on the mathematical foundations of neural network theory and to understand the working of Neural Networks as pattern classifier 2. Comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms 3. Effectively use existing software tools to solve real problems using a neural network approach\ 4. To understand the basics of fuzzy sets, its operations and the need for fuzzy logic 5. To apply fuzzy numbers, their operations and fuzzy inference techniques to model the human intelligence 6. To build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning and Neuro-Fuzzy Systems

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1416.1	Focus on the mathematical foundations of neural network theory and to understand the working of Neural Networks as pattern classifier		3												
IT1416.2	Comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms	2		3		3							3	2	
IT1416.3	Effectively use existing software tools to solve real problems using a neural network approach\						2								
IT1416.4	To understand the basics of fuzzy sets, its operations and the need for fuzzy logic	2		2									2		
IT1416.5	To apply fuzzy numbers, their operations and fuzzy inference techniques to model the human intelligence	3		3		2							3		
IT1416.6	To build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning and Neuro-Fuzzy Systems	3													
IT1416		3	3	3		3	2						3	2	

7th & 8th Semester (Group A & B)

IT1416	Lab Course Name: Neural Network and Fuzzy Logic	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Sr. No	Problem Statements
1	Implement McCulloch-Pits Neuron Model using NAND and NOR gate.
2	Implement two-layer Feedforward Neural Network.
3	Implement Feedback Neural Network.
4	Implement A-Z character recognition using Feedforward Neural Network.
5	Implement clustering algorithm.
6	Implement Dichotmizer using threshold logic unit (TLU).
7	Implement T-norms and S-norms.
8	Implement fuzzy system for dilation and concentration.
9	Implement a fuzzy system for Fan Speed Controller.
10	Implement classical relationship between Fuzzy set.
11	Implement following relation of composition Min-max Max-product Max-average
12	Implement neuro fuzzy system

7th & 8th Semester (Group A & B)

IT 1439	Lab: PE IV : Pattern Recognition	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Student will able: 1. To develop skills to understand, design and analyze simple concepts of pattern recognition system 2. To strengthen the ability to identify and apply the suitable model of pattern recognition for the given real-world problem 3. To gain knowledge in practical applications of pattern recognition	After completion of the course: 1. Students will be able to understand, design and analyze the basics of pattern recognition system. 2. Students will be able to capable to identity the appropriate model of pattern recognition for given problem. 3. Students will be able to have practical knowledge on the application of pattern recognition.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT 1439.1	Students will be able to understand, design and analyze the basics of pattern recognition system	3.0	3.0											2.0	2.0
IT 1439.2	Students will be able to capable to identity the appropriate model of pattern recognition for given problem.	3.0	2.0												
IT 1439.3	Students will be able to have practical knowledge on the application of pattern recognition.	3.0	3.0											2.0	2.0
IT 1439		3.0	2.7											2.0	2.0

Sr. No.	Name of Practical
1	Study of Design Cycle of Pattern Recognition.
2	To Plot Histogram for two Classes & find a Decision Boundary. To Plot Scatterplot for each Feature Vector of two Classes & find a Decision Boundary.
3	To Plot Binomial Distribution Function P(k) for n = 6 &Θ = 0.6. To Plot Poisson Distribution Function P(n) for λ = 1.5 up to n.
4	To Plot Uniform Density & Cumulative Distribution Function. To Plot Exponential Density & Cumulative Distribution Function.
5	To Study & Perform Experiment on Bayes' Theorem.
6	To Plot Two-Dimensional Decision Boundary Between Two Classes.
7	To study & perform experiments on Single Linkage Clustering Technique.
8	To study & perform experiments on Complete Linkage Clustering Technique.
9	To study & perform experiments on Average Linkage Clustering Technique.
10	To study Artificial Neural Networks

7th & 8th Semester (Group A & B)

IT1440	Lab: PE IV : Distributed Systems	L = 0	T = 0	P = 2	Credits =1
Evaluation Scheme	CA		ESE	Total	ESE Duration
	40		60	100	3 Hrs

Course Learning Objective	Course Outcomes
Student will able: 1. Understand the fundamentals of distributed computing. 2. Learn the Concepts of Socket Programming; 3. Understand the concepts of Remote procedure calls and IPC mechanisms in distributed systems environment. 4. Understand the concepts of timing and event relation in distributed environment.	After the completion, of course: 1. Students will be able to create applications using techniques such as forking, multithreading. 2. Students will become familiar with several common programming interfaces for network communication; and have a detailed knowledge of the TCP/UDP Sockets. 3. Students will be able to implement timing and event relation in distributed environment.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1440 .1	Create applications using techniques such as forking, multithreading.	2.0													
IT1440 .2	Familiar with several common programming interfaces for network communication; and have a detailed knowledge of the TCP/UDP Sockets.			3.0											
IT1440 .3	Implement timing and event relation in distributed environment			3.0											
IT1440		2.0		3.0											

Sr. No	Experiments Base On
1	Concepts of process creation and communication
2	Simulate the functioning of Lamport's Logical Clock .
3	Simulate the functioning of Lamport's Vector Clock .
4	Simulate the Distributed Mutual Exclusion.
5	Implement a Distributed Chat Server using TCP Sockets.
6	Implement a Distributed Chat Client using TCP Sockets.
7	Implement a Distributed Chat Server using UDP Sockets.
8	Implement a Distributed Chat Client using UDP Sockets.
9	Implement RPC mechanism for a file transfer across a network.
10	Implement 'Java RMI' mechanism for accessing methods of remote systems.
11	Implement CORBA mechanism by using 'C++' program at one end and 'Java' program on the other.

7th & 8th Semester (Group A & B)

IT1424	Industrial Project (Industry Visit / Training / Seminar)		L=0	T=0	P=30	Credits=20
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	-	-	40	60	100	

IT1425	Comprehensive Viva-Voce		L=0	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	-	-	-	100	100	-

IT1426	Extra Curricular Activities		L=0	T=0	P=0	Credits=2
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	-	-	100	-	100	-

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

PG SoE & Syllabus 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

SoE & Syllabus 2018-19

M. Tech. Environmental Engineering

28 June 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. SCHEME OF EXAMINATION 2018-19

Environmental Engineering

SN	Sem	Sub Code	Subject	T/P	Contact Hours				Credits	% Weightage				ESE Duration Hours
					L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
I SEMESTER														
1	1	GE2901	Statistical and Computational Methods	T	3	0	0	3	3	15	15	10	60	3
2	1	CV2961	Environmental Chemistry and Microbiology	T	3	0	0	3	3	15	15	10	60	3
3	1	CV2962	**Lab** Environmental Chemistry and Microbiology	P	0	0	2	2	1			40	60	
4	1	CV2963	Water Supply and Waste Water Collection System	T	3	0	0	3	3	15	15	10	60	3
5	1	CV2964	**Lab :-** Water Supply and Waste Water Collection System	P	0	0	2	2	1			40	60	
6	1	CV2965	Municipal Water Treatment	T	3	0	0	3	3	15	15	10	60	3
7	1	CV2966	Municipal Waste Water Treatment and Disposal	T	3	0	0	3	3	15	15	10	60	3
Total					**15**	**0**	**4**	**19**	**17**					
II SEMESTER														
1	2	CV2971	Industrial Waste Water Treatment and Disposal	T	3	0	0	3	3	15	15	10	60	3
2	2	CV2972	Envrionmental Management	T	3	0	0	3	3	15	15	10	60	3
3	2	CV2973	Air Pollution and its Control	T	3	0	0	3	3	15	15	10	60	3
4	2	CV2974	Municipal Solid Waste Management	T	3	0	0	3	3	15	15	10	60	3
5	2		Professional Elective-I	T	3	0	0	3	3	15	15	10	60	3
6	2	CV2978	Seminar	P	0	0	2	2	1			100		
Total					**15**	**0**	**2**	**17**	**16**					

List of Professional Electives-I

2	CV2975	PE I: Hazardous Waste Management
2	CV2976	PE I: Water Resource Management
2	CV2977	PE I: Advanced Water Treatment

III SEMESTER														
	3		Professional Elective-II	T	3	0	0	3	3	15	15	10	60	3
	3		Professional Elective-III	T	3	0	0	3	3	15	15	10	60	3
	3	CV2989	Project Phase - I	P	0	0	14	14	8			100		
Total					**6**	**0**	**14**	**20**	**14**					

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List of Professional Electives-II

3	CV2981	PE II: Rural Water Supply and Sanitation
3	CV2982	PE II: Environmental Biotechnology
3	CV2983	PE II: Application of Remote Sensing & GIS in Environmental Engineering

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List of Professional Electives-III

3	CV2986	PE III: Energy Conversion and Environment
3	CV2987	PE III: Environmental Optimization and Modeling
3	CV2988	PE III: Water Reuse and Recycling

IV SEMESTER														
1	4	CV2990	Project Phase-II	P	0	0	20	20	20			40	60	
Total					**0**	**0**	**20**	**20**	**20**					
Total Credits									**67**					

		June 2018	**1.00**	**Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards**
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I Semester

GE2901	Statistical and Computational Methods	L=3	T=0	P=0	CREDITS =3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To bring into focus those aspects of chemistry that are particularly valuable for solving problems of environmental monitoring and pollution control 2. To give a fundamental perspective of the microbial technology for adopting cleaner environmental practices.	1. An ability to make analysis and decision about the population by learning the topic sampling theory and Hypothesis testing. 2. An ability to develop skills for solving mathematical problems related to Environmental engineering. 3. An ability to apply the knowledge of various optimization techniques in solving industrial problem

UNIT – I **[7 Hrs.]**
Probability distribution—Binomial, Poisson, Normal, Chi-squares, Students t and F -distribution.
Sampling Theory: Population Parameter, Sample Statistics, Sampling distributions, Sample mean, Sampling distribution of means, the sample variance, the sampling distribution of variance.

UNIT – II **[6 Hrs.]**
Estimation Theory: Point estimate and interval estimates, reliability, confidence interval estimates of population parameters, confidence intervals for means, proportions and variance.

UNIT – III **[7 Hrs.]**
Tests of Hypothesis and Significance: Statistical decisions, tests of hypotheses and significance, Type I and Type II errors, level of significance, one tailed and two tailed tests. Tests involving small samples and large samples, fitting theoretical distributions to sample frequency distribution, The chi-square test for goodness of fit.

UNIT – IV **[6 Hrs.]**
Linear Programming-I: Formulation of linear programming problem, Graphical solution- simplex method

UNIT – V **[7 Hrs.]**
Linear Programming-I I:Big M method, two phase Simplex method method dual simplex method, revised simplex method.

UNIT – VI **[7 Hrs.]**
Environmental Microbiology
Transportation problem: existence of solution-degeneracy- MODI method

Text Books:
1. Probability and Statistics by M.R. Spiegel, Publisher- McGraw Hill.
2. Operation Research by H.A. Taha, Publisher- Prentice Hall of India Pvt. Ltd.

Reference Books:
1. Introduction to Optimization : Operations Research by J.C. Pant, Publisher- Jain Brothers, New Delhi.
2. Probability and Statistics for Engineers by Miller and Freund
3. Fundamentals of Mathematical Statistics, Gupta, S.C. and Kapur, V.K., Publisher- Sultan Chand & Sons, New Delhi..
4. Problems and Solutions in Operations Research by Kapoor. V.K., Publisher- Sultan Chand & Sons, New Delhi

		June 2018	1.00	Applicable for AY2018-19 Onwards
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Semester - I

CV2961	Environmental Chemistry and Microbiology			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

COURSE OBJECTIVES	COURSE OUTCOMES
1. To bring into focus those aspects of chemistry that are particularly valuable for solving problems of environmental monitoring and pollution control 2. To give a fundamental perspective of the microbial technology for adopting cleaner environmental practices.	1. An ability to understand the concepts Environmental chemistry & to learn how the concepts of environmental chemistry can be put to practical applications. 2. An ability to understand microbial technology in environmental engineering practices

UNIT – I **(07 Hours)**
General Chemistry: -Theory of valency, oxidation, numbers, oxidation-reduction reaction, law of mass action, Stoichiometry, gas laws. Physical Chemistry: - Types of solutions, Buffer solution, electrical conductivity, indicators. Amphoteric hydroxide, chemical equilibrium Osmosis, Dialysis.

UNIT – II **(06 Hours)**
Organic Chemistry: -Organic compounds of interest to environmental engineers, general properties of the functional groups of organic compounds.

UNIT – III **(07 Hours)**
Biochemistry: Enzymes, classification of enzymes catalyzed reaction, energy considerations, coupling of reaction. Breakdown and synthesis of carbohydrates, fats, proteins under aerobic and anaerobic conditions. CNP cycles under aerobic and anaerobic conditions. Concept of BOD, COD, TOC.

UNIT – IV **(06 Hours)**
Colloidal Chemistry: -Colloids, dispersion of colloids, general and electro-kinetic properties of colloids, colloidal solution and mixtures.

UNIT – V **(07 Hours)**
Environmental Chemistry: -Chemistry involved in water treatment procedure like coagulation, softening, defluorination, iron and manganese removal, demineralization, analysis of pesticide and heavy metals.

UNIT – VI **(06 Hours)**
Environmental Microbiology
Introduction of microbiology, Haeckel's classification and characterization of microorganisms, viruses. Morphology and structure of bacteria, nutrient requirement, growth of bacteria. Basic microbiology of water and sewage. Basic principals involved in the analysis of faecal indicator bacteria – coliforms and streptococci, plankton analysis, analysis of pseudomonas & streptococci. Kinetics of microbial growth.

Text Book:-
1. Sawyer, C.N. and McCarty, P.L., and Parkin, G.F. Chemistry for Environmental Engineers, 4th Edn. McGraw Hill, New Delhi, 1994.
2. Benefield, Judkins and Weand – Process Chemistry for Water and Wastewater Treatment, Prentice Hall
3. Maier R M, Pepper I L and Gerba C P. Environmental Microbiology, Second Edition, Elsevier- AP, 2009.
4. Pelczar, Jr, M.J., Chan, E.C.S., Krieg, R.N., and Pelczar M. F, Microbiology, 5th Edn., Tata McGraw-Hill Publishing Company Limited, New Delhi, 1996.
5. Rittman B, McCarty P L McCarty P, Environmental Biotechnology: Principles and Applications, 2nd edition, McGraw-Hill, 2000

References:-
1. Powar & Daginawala, General Microbiology Vol. I &II, Himalaya Publishing House, Latest.

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Semester - I

CV2962	Lab: Environmental Chemistry and Microbiology			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
--	--	40	60	100	--		

Any TEN experiments of the following will be performed.

1. To determine Alkalinity of a water sample.
2. To determine Available Chlorine in given bleaching powder sample
3. To determine Total, Calcium and Magnesium hardness of given water sample.
4. To determine Dissolved Oxygen concentration in given water sample.
5. To determine Sulphates concentration in given water sample.
6. To determine Biochemical Oxygen Demand (B.O.D.) of a wastewater sample.
7. To determine Chemical Oxygen Demand (C.O.D.) of a wastewater sample.
8. To determine Maximum Probable Number (MPN) of coli form bacteria present in water sample by Multiple Tube Dilution (MTD) technique-presumptive test.
9. To determine Density of bacteria in a water sample pour plate (Standard Plate Count) method.
10. To determine concentration of Chlorides in a given water sample.
11. To determine Hydrogen ion concentration (pH) of a solution
12. To determine Turbidity of a solution using Nepheloturbidimeter.
13. To determine optimum coagulant dose by Jar test.
14. To determine effective size and co-efficient of uniformity of a given sand sample and to separate required sand from given stack of sand for required effective size and coefficient of uniformity.
15. To determine total, dissolved and suspended solids in given water sample.

Semester - I

CV2963	Water Supply and Waste Water Collection System			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

COURSE OBJECTIVES	COURSE OUTCOMES
1. To Learn the water transmission and distribution system 2. To provide an understanding of analysis, design, and operation of water distribution system 3. To provide and understanding of sewer Networks and storm water drains.	1. An Ability to understand fundamental of design of the pipe in water distribution system and wastewater collection system 2. An Ability to understand different methods of analysis of pipe network for water distribution. 3. Ability to design of water distribution system and sewerage system

UNIT – I **(07 Hours)**

Analysis of Water Supply System
Components of water Supply system, Water use and demand estimation Flow through pipes- Continuity principle, and energy principle, Equation for flow through pipes, Moody diagram, Maintenance of distribution System, Water hammer Analysis.

UNIT – II **(06 Hours)**

Analysis of Water Distribution System
Analysis of flow through pipe network through various method such as
1. Hardy cross method 2. Newton Raphson's method 3. Linear Theory method

UNIT – III **(07 Hours)**

Design of Water Distribution System
Types of Reservoirs and design parameter, Importance and design of pumps and different valves in the distribution system, Node flow analysis. Rising Main, water hammer, cause, and prevention. Maintenance of distribution system, Critical path method for design of water distribution networks.

UNIT – IV **(07 Hours)**

Design of Water Distribution System,
Design of Rising Main, Critical path method for design of water distribution networks and its cost analysis.

UNIT – V **(06 Hours)**

Waste Water Collection
General – Objectives, types of system and sewers, requisites for sewerage system design – survey and investigations. Hydraulics of sewer – flow equations, pipe and open channel flow, self-cleansing and scouring velocities through sewer, flow in partially filled sewers, velocity of equal cleansing, sewer shape vis-a-vis their usefulness, sewer invert drop.

UNIT – VI **(06 Hours)**

Design of wastewater Collection system
Separate, Combined, and semi-combined sewers Sewer Pipe hydraulics: size and design of pipes, Manholes, street inlets, catch basins, sewer junctions, inverted siphon, flushing tanks, air ejectors, design and operations**.**

Text Book:-

1. Bhave P. R. And Gupta R, Analysis of Water Distribution Networks, Narosa Publishing Co., New Delhi (2006).
2. Fair G. M., Geyer J. C. & Okun D. A., Water & Wastewater Engg. Vol.I & II, John-Willey & Sons, New York.
3. McGhee N. J. & Steel E. W., Water supply and sewerage, McGraw hill publications, 1991.
4. Bhave P.R, Optimal design of water distribution networks, Narosa Publishing Co., New Delhi (2003).

Reference:-

1. CPHEEO, Manual on water supply and treatment, Ministry of urban development, GoI.
2. CPHEEO, Manual on Sewerage and Sewage Treatment, Ministry of urban development, GoI.

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Semester - I

CV2964	Lab: Water Supply and Waste Water Collection System			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

COURSE OBJECTIVES	COURSE OUTCOMES
1. To Learn the water transmission and distribution system 2. To provide an understanding of analysis, design, and operation of water distribution system 3. To provide and understanding of sewer Networks and storm water drains.	1. An Ability to understand fundamental of design of the pipe in water distribution system and wastewater collection system 2. An Ability to understand different methods of analysis of pipe network for water distribution. 3. Ability to design of water distribution system and sewerage system

Minimum Four assignments in the field of

1. Water Distribution system and its design
2. Design of sewerage system
3. Analysis of water distribution and sewerage system
4. Cost Benefit Analysis

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Semester - I

CV2965	Municipal Water Treatment			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide a basic description and understanding of the principal unit operations used in the treatment of municipal water including coverage of the scientific basis of each unit process, as well as the conventional approach to their engineering design	1. An ability to understand the fundamentals related to water treatment 2. An Ability to design different water treatment Units

UNIT I **(06 Hours)**

Water quality criteria and standards, Requirement of water treatment facilities, Unit operation & Unit process, Site selection, Process selection.
Aeration: Objective, Principles, Types of aerator, Design of aerators.

UNIT II **(07 Hours)**

Coagulation: History, need of coagulation, Chemistry of coagulation, Various coagulants used in process, Factors affecting efficiency of coagulation process, Operation of feeders, Types of rapid mixing devices, design of flash mixer.
Flocculation: Theory of flocculation, Slow mixing devices.

UNIT III **(06 Hours)**

Sedimentation: Principle, Stoke' law, working of ideal sedimentation tank, Types of sedimentation tank, Design and working of clariflocculator, Operational problems in sedimentation tank.

UNIT IV **(07 Hours)**

Filtration: Theory of filtration, Types of filters, working of slow and rapid sand filter, operational difficulties and design of rapid sand filter.

UNIT V **(06 Hours)**

Disinfection: Methods of disinfection, Kinetics of chemical disinfection, Chlorination, Chemistry of chlorination, Methods of chlorination.

UNIT VI **(07 Hours)**

Adsorption: Theory, Granular and powder activated carbon, Performance and reactivation. Adsorption of organic compounds. Defluorination, Ion Exchange, Materials and reactions, Kinetics, Applications.

Text books:

1. N.J. McGhee, Steel E.W., Water Supply and Sewerage, McGraw hill 1991.
2. N.J. Weber, Physicochemical Process for Water Quality Control, John Wiley & Sons 1972.
3. Fair Geyer & Okun, Water and Waste Water Engineering, Vol I and II, John Wiley & Sons 1st.

Reference Book: -

1. Nordel, E, Water Treatment for Industrial And Other Uses, Reinhold Publishing Corporation, N.Y.
2. CPHEEO, Manual on Water supply and Treatment, Govt. of India Publication

		June 2018	1.00	Applicable for AY2018-19 Onwards
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Semester - I

CV2966	Municipal Waste Water Treatment and Disposal			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

COURSE OBJECTIVES	COURSE OUTCOMES
1. Fundamentals of treatment processes 2. Working of different sewage treatment units 3. Design of various units for sewage treatment	1. An ability to understand basics of different wastewater treatment processes 2. An ability to understand working of different sewage treatment units 3. An ability to design different sewage treatment units. 4. An ability to understand different methods of treatment and disposal of biosolids.

UNIT I **(07 Hours)**

General objectives of sewage treatment, sewage characteristics, Reactor types and their hydraulic characteristics, mass balance analysis, reaction order, rates and coefficients.

UNIT II **(06 Hours)**

Conventional sewage treatment flow sheet, functions of different unit processes. Physical treatment: screening, gravity separation theory, types of settling, grit removal, primary sedimentation tank and its design.

UNIT III **(07 Hours)**

Chemical Treatment: chemical coagulation and precipitation, removal of phosphorus, heavy metals and dissolved organic substances.

UNIT IV **(06 Hours)**

Biological treatment: fundamentals, basic terminologies Activated sludge process: process description, recent developments, process analysis, design of conventional activated sludge process unit.

UNIT V **(07 Hours)**

Tricking filter: process description, classification, process design considerations. Biological phosphorous removal, aerated lagoons.

UNIT VI **(06 Hours)**

Treatment of biosolids: process flow diagram, thickening, aerobic and anaerobic digestion, conditioning, dewatering.

Text Books:

1. S.J. Arceivala, Wastewater Treatment and Disposal, Marcel Dekker,1981.
2. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third edition McGraw – hill 1991.
3. Qasim S.R. Wastewater Treatment Plant Planning, Design and Operation, Holt, Rinehart and Winston, N.Y.

References: -

1. N.F. Grey Activated Sludge Process, Theory and Practices, Oxford University Press

Semester – II

CV2971	Industrial Wastewater Treatment and Disposal			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know importance of industrial wastewater treatment 2. Fundamentals of various treatment processes 3. Design various treatment units for treatment of industrial wastewater.	1. An ability to understand importance of industrial wastewater treatment. 2. An ability to understand the fundamentals of various treatment processes. 3. An ability to understand treatment methodologies for various industrial wastewaters. 4. An ability to design various treatment units for Industrial wastewater

UNIT I **(06 Hours)**

Environmental impact due to industrial water pollution, problems associated with industrial wastewater, characterization of industrial wastewater.

UNIT II **(07 Hours)**

Sampling and analysis of wastewater, toxicity testing, statistical analysis of data, standards for waste disposal.
Common effluent treatment plant.

UNIT III **(06 Hours)**

Equalization and proportioning of wastewater, design of equalization tank. Neutralization of wastewater, Oil and grease removal, Floatation.

UNIT IV **(07 Hours)**

Stabilization pond, oxidation ponds, biological de-nitrification processes, membrane biological reactors. Anaerobic treatment, UASB, attached growth processes.

UNIT V **(06 Hours)**

Recycle and reuse of industrial waste, volume and strength reduction, concept of zero liquid discharge
Introduction to new technologies and new materials.

UNIT VI **(07 Hours)**

Treatment of specific industrial wastes: textile, dairy, tanning, sugar, brewery and distillery, iron and steel, food industries.

Text Books:

1. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third Edition McGraw Hill 1991.
2. W.W. Eckenfelder, Industrial Pollution Control, McGraw Hill Int. Edition 1990.
3. W.J. Weber, Physicochemical Processes for Water Quality Control, John Wiley and Sons, 1972.
4. Nemerow, N.L. Theories and Practices of Industrial Waste Treatment. New York: Addison Wisely.
5. Bess Elivievre, E.B. The Treatment of Industrial Wastes, McGraw Hill Book co.
6. Culp R L et al, Handbook of Advanced Wastewater Treatment Van No Strand Reinhold Publ. N.Y.
7. Arceivala, S.J., (1998) "Wastewater Treatment for Pollution Control ", Tata McGraw Hill.

References:

1. Central pollution control board, India, comprehensive industry document series.
2. World Bank Group (1998) "Pollution Prevention and Abatement Handbook – Towards Cleaner Production ", World Bank and UNEP, Washington D.C.

Semester – II

CV2972	Environmental Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand environmental policies of Government of India. 2. Understand different methods of environmental impact assessment. 3. Understand different national and international environmental laws	1. An ability to grasp the fundamentals and identify the tools used for Environmental Management 2. An ability to understand environmental impact assessment (EIA) as an environmental management tool 3. An ability to understand the evolution of environmental policies and laws and implications of international policies and laws for India.

UNIT I **(07 Hours)**

Development and Environment, Global and Indian scenario.
National Environmental Policy, Environmental organizations for planning and implementation sustainable development. Concept of carrying capacity, assimilative and supportive capacity.

UNIT II **(06 Hours)**

Preventive and reactive strategies for environmental pollution control, Nature of impact – primary, secondary, tertiary, short –term long-term, local and regional, reversible & irreversible impacts.

UNIT III **(07 Hours)**

Environmental impact Methodologies: Ad hoc, check-lists, network, matrix etc. Environmental Management plan. Typical case studies of environmental impact assessment. MoEF questionnaire for environmental clearance.

UNIT IV **(06 Hours)**

Environmental Audit definition, concept of EA, types of environmental audit, audit scope, procedural aspects of conducting environmental audit, water audit, wastewater audit, health and safety audit.

UNIT V **(07 Hours)**

Eco Labeling, Concept of Cleaner Technology, Life Cycle assessment, waste minimization, international standards.

UNIT-VI **(06 Hours)**

Environmental Legislations and its basic concepts, critical issues, civil liability, various enactment, and their provisions – Water Act (1974, 1988), forest Conservation Act (1980), Air Act (1981, 1988), Water (Cess) Act 1977, Environmental Protection Act 1986, and other environmental legislations.

Text Books: -

1. S. Musharraf, Legal Aspects of Environmental Pollution and Its Management, C.B.S. publishers, Delhi
2. R. K. Jain, L.V. Urban G.S. Stacey, H.E. Balbach, Environmental Assessment McGraw – Hill, Inc. N.Y.
3. Rao, J.G. and Wooten, Environmental Impact Analysis, Handbook, 1980.
4. Canter, L.W. Environmental Impact Assessments, -- N.Y. McGraw – hill book Co.1977.

Reference

1. Rosencrannz, S. Divan, M.L. Noble, Environmental Law and Policy in India, Cases, Materials and Statutes, Tripathi Pvt. Ltd. Bombay.

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Semester – II

CV2973	Air Pollution and its Control			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To make insight into the knowledge of major air pollutants; their sources and their effects (environmental, economic and health), standards and limits 2. To understand the dispersion phenomenon of air pollutants covering diffusion and advection, meteorological components, stability of atmosphere and corresponding plume shapes 3. To understand the techniques and instrumentation of ambient air monitoring, establishment of ambient air monitoring stations; stack monitoring and experimental analysis of air gaseous and particulate air pollutants; 4. To understand the principles of air pollution control and various control equipment's at source 5. To understand the indoor air pollution, sources, causes and effects 6. To understand the elements of urban air pollution, odour and noise pollution	1. An ability to understand air pollution and its control 2. An ability to understand various meteorological factors and its influence on air pollution. 3. An ability to understand the basic principles, equipment, and methods used to control particulate matter, gaseous emission and automobile emission 4. An ability to understand basics of urban air pollution, odour and noise pollution

UNIT I **(07 Hours)**

Introduction to Air Pollution: Sources & classification of air pollutants, Industrial processes causing air pollution, Ambient air quality standards, Air pollution control legislation, Effects of pollutants on health, vegetation, materials & atmosphere.

UNIT II **(06 Hours)**

Meteorological aspects: Meteorological parameters, Temperature lapse rate, Plume behavior. Gaussion diffusion model for finding ground level concentration. Plume rise. Formulae for stack height and determination of minimum stack height.

UNIT III **(07 Hours)**

Air sampling and analysis: Air pollution survey, basis and statistical considerations of sampling sites, devices and methods used for sampling gases and particulars. Stack emission monitoring, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Ambient air quality monitoring

UNIT IV **(06 Hours)**

Control of air pollution: Air pollution control equipment for particulate and gaseous pollutants. Design of control equipment as Settling chamber, Cyclone, Fabric filter, Electro static precipitator and Wet scrubber. Control of air pollution from automobiles.

UNIT V **(07 Hours)**

Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, changes in indoor air quality, control of indoor air pollutants and air cleaning systems. Air pollution Index.

UNIT VI **(06 Hours)**

Urban Air Pollution- Air Pollution from vehicles; Air Pollution from Biomass burning; Air Pollution from landfills
Noise pollution: Theory, sources, measurement, and methods of control of noise pollution.
Odour pollution: Theory, sources, measurement and methods of control of odour pollution.

Text Book:

1. Air Pollution, M.N. Rao., Tata McGraw Hill, 2006.
2. Fundamentals of Air Pollution, Stern, Wohlers, Bouble and Lower, Academic Press, 1984.
3. Air Pollution and Control, P. P. Mowli and N. Venkata Subbayya., Divyajyoti Prakashan, Jodhpur, 1989.
4. Environmental Pollution Control Engineering, C.S. Rao, New Age International, 2007
5. Environmental Noise Pollution, PE Cunniff, McGraw Hill, New York, 1987

References:-

1. Air Quality Monitoring- A Course Manual, NEERI, 1981.
2. Air Pollution, Vol. I to IX, A. C. Stern, Academic, New York, 1968

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Semester – II

CV2974	Municipal Solid Waste Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To develop insight into the collection, transfer, and transport of municipal solid waste. 2. To examine the engineering and scientific principles of municipal solid waste (MSW) management. 3. To Processing and disposal methods for solid waste.	1. An ability to understand different characteristics of solid waste. 2. An ability to understand different methods of collection, transfer and transport of solid waste. 3. An ability to understand different Processing and disposal methods for solid waste.

UNIT I **(06 Hours)**

Problems and impacts of solid waste in developing countries, Solid waste management and organization. Sources, Types, Quantity and Composition of municipal solid waste.

UNIT II **(07 Hours)**

Characteristics of solid waste – Sampling – physical, chemical, and biological Analysis. Functional Elements of MSW.

UNIT III **(06 Hours)**

Storage, Collection, Transportation, Optimization of roots, Tools and equipment, Transfer station, Volume reduction.

UNIT IV **(07 Hours)**

Composting – Process microbiology, Aerobic and anaerobic composting. Sanitary Landfill – Process, mechanism, Classification, types, site considerations, Maintenance of site. Incineration- Mechanism, types, and Operation.

UNIT V **(07 Hours)**

Future processing method, Pyrolysis, Refuse derived fuel.

UNIT VI **(06 Hours)**

Legislation on Management and Handling of Municipal Solid Waste Management.

Text Books:

1. Solid waste management in developing countries – A.D. Bhide, B.B. Sudresan
2. Solid waste water management – D. Joshep Hangertey, Joseph L. Pavoni.
3. George Techobanoglous, "Integrated Solid Waste Management", McGraw-Hill Publication, 1993.

Reference

1. Municipal Refuse Disposal – Institute of America Public Health Association, Interstate printer and publisher inc – Tanvil Elinoy
2. CPHEEO manual on MSW, GoI, New Delhi

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Semester – II

CV2975	PE-I Hazardous Waste Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide insight into sources of hazardous waste & the treatment given thereafter. 2. To Provide knowledge of generation, characteristic and composition of hazardous Waste 3. To enumerate and describe different disposal and treatment methods	1. An ability to understand principle of methods given to hazardous waste. 2. An ability to understand the common functional elements of waste management system 3. An ability to suggest suitable waste processing technologies and disposal methods.

UNIT I **(07 Hours)**

Definition of hazardous waste, U.S.E.P.A. classification, global scenario, episodes. Hazardous waste (management and handling) rules, 1989 and Indian Scenario.

UNIT II **(06 Hours)**

Source of hazardous waste, effect of Hazardous waste on human health, Sampling and analytical procedures, Overview of treatment and disposal method – waste minimization.

UNIT III **(07 Hours)**

Physicochemical method and biological method. Thermal Processes. Solidification/stabilization and innovation techniques.

UNIT IV **(06 Hours)**

Solidification/stabilization and innovation techniques. waste Inventorization procedures.

UNIT V **(07 Hours)**

Secure landfill**.**
Site selection methodology for establishing treatment and disposal methods and EIRA methodology.

UNIT VI **(06 Hours)**

Legislation on Management & Handling rules based on Hazardous Waste Management.

Text Books:

1. Charles A. Wentz; " Hazardous Waste Management ", McGraw-Hill Publication, 1995

Reference:-

1. The safe disposal of hazardous waste. Vol. I, II, & III Bat stone, Smith, Wilson, Joint study Sponsored by the world bank, the WHO, & UN Environmental Program UNEP,
2. The World Bank Freeman H.M. standard Handbook of Hazardous Waste Treatment and Disposal, 1989.

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Semester – II

CV2976	PE-I Water Resources Management			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand water resources planning 2. To understand water policies and application of remote-sensing. 3. To understand different methods of conservation and recharging of water resources 4. To understand inter-basin transfer and EIA of water Resource development projects	1. An ability to understand water resources planning 2. An ability to understand water policies and application of remote-sensing. 3. An ability to understand different methods of conservation and recharging of water resources 4. An ability to Understand inter-basin transfer and EIA of water Resource development projects

UNIT I **(07 Hours)**

Introduction: water resources planning, multi–objective planning role in national development.

UNIT II **(06 Hours)**

Basic concepts of hydrology and hydrogeology, River monitoring, gauging silting, silt load.

UNIT III **(07 Hours)**

National water policy. Water resources planning and processes. Management of water bodies. Application of remote sensing Techniques. Integrated approach – carrying capacity based planning.

UNIT IV **(06 Hours)**

Water resources conservation: quantity aspects, surface and ground water development, Rain water harvesting, ground water recharge, conjunctive use of ground and surface water.

UNIT V **(07 Hours)**

Water resources development in coastal areas. Basic concepts of economics, welfare economics. Inter basin transfer of water.

UNIT VI **(06 Hours)**

EIA of water Resource development projects.
Case study related to water conservation and resources Development.

Text Books:

1. Linsey, R. K. &Franzini, J.B. water resources Engineering. New Delhi : McGraw Hill
2. Grigg N.S. Water Resources planning McGraw Hill Book company.

Reference

1. Neil S. Grigg, Water resource management – principles, regulations, and cases New Delhi: McGraw Hill

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Semester – II

CV2977	PE-I Advanced Water Treatment			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide insight into various advanced methods used for the treatment of municipal and industrial water including coverage of the scientific basis of each operation/process, as well as their engineering design	1. An ability to understand the fundamental, scientific basis governing the design and performance of the treatment technologies. 2. An ability to understand the role of each unit operation /process within typical treatment process trains and their interaction

UNIT I **(06 Hours)**

Significance of Advanced water treatment, water quality requirement and specific treatment for industries.

UNIT II **(06 Hours)**

Softening of water, Boiler feed water, lime soda process, ion exchange process.

UNIT III **(07 Hours)**

Desalination: Theory of desalination, various methods of Desalination- Distillation, Electro dialysis, Freezing, Demineralization, Solar evaporation. Membrane filtration process.

UNIT IV **(06 Hours)**

Adsorption: Theory, Granular and powder activated carbon, Performance, and Reactivation. Materials and Reactions, Kinetics, Applications.

UNIT V **(07 Hours)**

Fluoride Removal, Arsenic Removal, Fe and Mn removal, Taste, odor and colour removal.

UNIT VI **(07 Hours)**

Alge control, Corrosion control, Water treatment for Swimming Pool.

Text Book:

1. N.J. McGhee, Steel E.W., Water Supply and Sewerage, McGraw hill 1991.
2. N.J. Weber, Physicochemical Process for Water Quality Control, John Wiley & Sons 1972.
3. Fair Geyer & Okun, Water and Waste Water Engineering, Vol I and II, John Wiley & Sons 1st.

Reference Book: -

1. Nordel, E, Water Treatment for Industrial and Other Uses, Reinhold Publishing Corporation, N.Y.
2. CPHEEO, Manual on Water supply and Treatment, Govt. of India Publication.

Semester – II

CV2978	Seminar			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
--	--	100		100		--	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the students various aspects of presentation skills 2. To provide the students the academic environment to carry out literature survey 3. To teach the students the various aspects of effective technical paper writing like compilation of literature data.	1. An Ability to understand various aspects of presentation skills 2. An ability to carry out literature survey, compilation of literature data 3. An ability to understand effective technical paper writing

Seminar on any related topic to environmental engineering will be presented by the student. The topic of seminar will be approved by the teacher in charge. Evaluation will be based on the subject contents and skill of presentation. Evaluation will be done by a panel of teachers from the department.

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Semester – III

CV2981	PE-II Rural Water Supply and Sanitation			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand scheme of rural water supply and sanitation. 2. To understand improvised method of treatment of wastewater 3. To understand compact systems of treatment and disposal.	1. An Ability to understand the knowledge regarding rural water supply and sanitation scheme. 2. An Ability to understand different compact units of rural water treatment and supply. 3. An Ability to tell simple wastewater treatment for rural water supply.

UNIT I **(07 Hours)**

Concept of environmental and scope of sanitation in rural areas. Magnitude of problem of water supply and sanitation, National policy.

UNIT II **(06 Hours)**

Various approaches for planning of water supply systems in rural areas. Selection and development of preferred sources of water, springs, wells, Infiltration wells, radial wells, and infiltration galleries.

UNIT III **(07 Hours)**

Collection of raw water from surface source. Specific problems in rural water supply and treatment e.g. iron, manganese, fluorides, Low cost treatment.

UNIT IV **(06 Hours)**

Improvised methods and compact system of treatment of surface and ground waters such as MB settlers, slow sand filter, chlorine diffusion cartridges.

UNIT V **(07 Hours)**

Water supply through spot sources, hand pumps, open dug wells Planning of distribution system in rural areas Water supply during fairs, festivals and emergencies, Treatment and disposal of wastewater/sewage various methods of collection and Disposal of night soil Onsite sanitation system and community latrines

UNIT VI **(06 Hours)**

Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tank and soakage pits, Disposal of solids waste: Composting and Biogas plants

Text Books

1. Wagner, E.G. and Lanoik, J.N., Water supply for Rural areas and small communities, Geneva:

Reference

1. Manual of water supply and treatment, 3rd Edition, CPHEEO, GOI, New Delhi
2. Low cost on site sanitation option, Hoffman and Heijno Occasional Nov.1981 Paper No.21 P.O. Box 5500 2280 HM Rijswijk, the Netherlands offices,J.C.Monkeniaan,5Rijswijk(The Haque)

		June 2018	1.00	Applicable for AY2019-20 Onwards
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Semester – III

CV2982	PE-II Environmental Biotechnology			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To learn basic concepts of microbial biochemistry and microbial interaction. 2. To learn basic concepts of genetic engineering and mutation of DNA.	1. An Ability to understand the fundamental concept of microbial biochemistry and biotechnology 2. An Ability to understand the Relationship between cell signaling and gene transcription.

UNIT-I **(07 Hours)**

Basic concept of microbial biochemistry-carbohydrates, proteins, fats, and nucleic acids.

UNIT-II **(06 Hours)**

Basic concept of biodegradation, biotransformation, biobenification, biorestoration / bioreclammation, microbial interaction, Environmental monitoring-signification of monitory bacterial viral and protozoan pathogens.

UNIT-III **(07 Hours)**

Technique of monitoring-standard methods of monitoring viral bacterial and protozoan pathogens, Advance techniques-gene probes biosensor, immunoassay.

UNIT-IV **(06 Hours)**

Basic concept of genetic engineering-chromosomal DNA, plasmid DNA transformation, mutation recombinant DNA techniques

UNIT-V **(07 Hours)**

Transudation conjugation, protoplast fusion, Biotransformation of biomass/organic waste into value added chemicals, energy, fertilizers, and single cell protein

UNIT-VI **(06 Hours)**

Aerobic and anaerobic waste treatment processes-microorganisms involved, and biochemical changes of different pollutants present in liquid and solid waste, reactor technology.

Text Books:

1. C.S. Forster and D.A. John Wase, Environmental Biotechnology, Ellis Harwood, 1987
2. Trehan K. Biotechnology, New Delhi, Willey Eastern Ltd.1990

Reference Books:

1. Forster C.F.N Biotechnology and Wastewater Treatment, Cambridge 1992
2. N.F. Grey, Biology of Wastewater Treatment Oxford University Press ,1989

Semester – III

CV2983	PE-II Application of Remote Sensing and GIS in Environmental Engineering	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION
15	15	10	60	100	3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To learn basic concepts of Remote sensing process and GIS 2. To Carry out spatial analyses for resource management	1. Able to Apply basic principles of remote sensing for resource mapping and evaluation 2. Able to Develop geospatial database of water resources and environmental engineering systems

UNIT-I **(07 Hours)**

Introduction to remote sensing and Geographical Information Systems (GIS), Databases and Management systems, spatial databases, Coordinate systems and geo-referencing.

UNIT-II **(06 Hours)**

Interpolation methods:
Deterministic and Statistical, Digital elevation models and their applications

UNIT-III **(07 Hours)**

Surface-Water Hydrologic Data, Spatial techniques for Surface-Water Hydrology Modeling, Applications of Geoinformatics for spatial management of resources: Run-off estimations, infiltration characteristics.

UNIT-IV **(06 Hours)**

Watershed management, Sediment yield estimation, reservoir capacity studies. groundwater potential and recharge characteristics, GIS-Based Wastewater Collection System Design and Management Applications

UNIT-V **(07 Hours)**

Geospatial techniques for planning and design of Water-Supply and Irrigation Systems, Spatial Database Development for Wastewater, and Storm Water Systems,

UNIT-VI **(06 Hours)**

Geographic Data for Environmental Modeling and Assessment, Land Use Planning and Environmental Impact Assessment Using Remote sensing and Geographic Information Systems.

Text Books:

1. Agarwal, C. S., Garg P. K., Remote Sensing in Natural Resources Monitoring and Management, A. H. Wheeler & Co. Ltd., New Delhi.
2. C.P LO Albert KW Yeung Concepts and techniques of Geographic Information Systems Pritince Hall of India, 2002.

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Semester – III

CV2986	PE-III Energy Conversion and Management		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION	
15	15	10	60	100	3 Hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the concept of efficient energy forming technologies for sustainable use of resources. 2. To know the Resources Conversion Strategies and Policies.	1. An Ability to Understand and apply basic concept of waste to energy technology and environmental protection. 2. An Ability to Understand the concept of environmental appraisal, energy audit and assessment of energy potential of energy sources

UNIT I **(06 Hours)**

Significance of Energy Conversion and Environment, Overview of Global and Indian Energy Scenario; Environmental Impacts of Energy Conversion, Principles of Waste Minimization, and Energy Recovery.

UNIT II **(07 Hours)**

Renewable and Non-Renewable Energy Sources; Estimation of Potential of Energy Recovery from various Sources, Energy economics.

UNIT III **(07 Hours)**

Energy Conversion Methods: Thermal, hydro, nuclear, solar, wind, tidal etc. their principles and application

UNIT IV **(06 Hours)**

Waste to Energy options: physical, thermochemical and bio chemical processes: palletization, briquetting, Combustion, Gasification, pyrolysis; Fuels Derived anaerobic digestion, Biogas Technology, Future Technologies for Waste to Energy Systems

UNIT V **(07 Hours)**

Introduction to Microbial Fuel cell, Gas generations and collection in landfills, Measurements, and Control.

UNIT VI **(06 Hours)**

Energy and Resources Conservation Strategies and Policies, concept of energy management, Intelligent Green Building, Green Rating Systems Alternative Construction Materials & methods Testing and Verification.

Text Book:

1. D. O. Hall, G. W. Barnard and P. A. Moss, Biomass for Energy in the Developing Countries, Current Roles, Potentials, Problems, Prospects, Pergamos Press Ltd, 1st edition.
2. W. C. Turner, Energy Management Handbook Wiley Newyork 1st edition.
3. P. Meier, Energy System Analysis for Developing countries, Sringer Verlag 1st edition.
4. Dorthy J De Renzo, Energy from Bioconversion of Waste materials, Noyes data Corporation USA 1st edition.

Reference :

1. G.D. Rai, Non-Conventional Energy Source, Standard Publishers Distributors.
2. Fowler J. M. Energy and the Environment McGraw Hill New York 2nd edition.
3. B.H. Khan, Non-Conventional Energy Resources, 2nd Edition, McGraw Hill Companies.

		June 2018	1.00	Applicable for AY2019-20 Onwards
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Semester – III

CV2987	PE-III Environmental Optimization and Modeling			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide an emphasis on the role and nature of modeling environmental system 2. To learn the numerical techniques for solving the system equations 3. To brief the balance approach for prediction of air and solid quality.	1. An Ability to understand the contaminant transport model for natural systems 2. An Ability to Provide Knowledge of various optimization technique to design various environmental system 3. An Ability to estimate the concentration of pollutants in air and solid quality.

UNIT I **(06 Hours)**
Computational methods in Environmental modeling, Definition; Classification; Examples and Models of Environmental Systems.

UNIT II **(07 Hours)**
Principles of environmental economics and analysis, Optimization Method for environmental engineering system such as pumping mains, water transmission system.

UNIT III **(06 Hours)**
Environmental Optimization related to Solid waste management system and Air pollution control system.

UNIT IV **(07 Hours)**
Introduction to river, estuarine and lake thermodynamics, Stratification of lakes, Dissolved Oxygen Model for streams, Temperature Models, Prediction of fate of organisms and toxic substances.

UNIT V **(06 Hours)**
Models for predicting water quality changes in water distribution systems.

UNIT VI **(07 Hours)**
Environment model for Stationary and mobile sources.

Text Book:-
1. Introduction to Environmental Engineering and Science, Gilbert M. Masters Practice hall, India
2. Principles of Surface Water Quality Modelling and Control, Thomann R. V. And Muller J.A,Harper, International edition,1987

Reference
1. Water Quality, Technobangolous G., Schroader E.D., Addison Wesley publishing co., Reading Massachusetts

		June 2018	1.00	Applicable for AY2019-20 Onwards
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Semester – III

CV2988	PE-III Water Reuse and Recycling			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
15	15	10	60	100	3 Hours		

COURSE OBJECTIVES	COURSE OUTCOMES
1. To learn the principles, applications, and facilities involved in the field of water reclamation and reuse 2. To brief the various methodologies involved in water reuse planning. 3. To Introduce important considerations influencing water reuse planning and implementation	1. An Ability to understand the concept of sustainable water resources management as a foundation for water reclamation and reuse 2. An Ability to understand the various technologies and systems available for reclaimed water 3. An Ability to understand the Water reuse applications including agricultural uses, landscape irrigation, industrial uses, environmental and recreational uses, groundwater recharge.

UNIT-I **(07 Hours)**
Hydrological cycle, Water Reuse Past and Current Practices, water Reuse Application.

UNIT-II **(06 Hours)**
Environmental Issues in water Reuse, Water Reclamation criteria in national and international scenario.

UNIT-III **(06 Hours)**
Water reuses treatment methods and technologies.

UNIT-IV **(07 Hours)**
Storage of reclaimed water, water quality discharge requirements, Problems involved in storage system and its Management.

UNIT-V **(06 Hours)**
Water reuse regulation and guidelines, Health and risk management assessment in water reuse application.

UNIT-VI **(07 Hours)**
Water reuses application in agriculture, industrial, urban, groundwater recharge.

Text Books:

1. Cohn, P. D., M. Cox, and P. S. Berger (1999) "Health and Aesthetic Aspects of Water Quality," in Water Quality & Treatment, A Handbook of Community Water Supplies, American Water Works Association, McGraw-Hill, Inc., New York
2. T. Asano, Water Reclamation and Reuse, Water Quality Management Library 10, CRC Press, Boca Raton, FL

Semester – III

CV2989	Project Phase I			L=0	T=0	P=16	CREDITS =8
EVALUATION SCHEME							
MSE – I	MSE – II	CA	ESE	TOTAL		ESE DURATION	
--	--	100		100		--	

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students with the academic environment to carry out literature survey of advanced topics in Environmental engineering 2. To motivate the students to use the modern tools and softwares 3. To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	1. An ability to understand the advances in Environmental engineering. 2. An ability to understand the use of modern tools. 3. An ability to work independently and in a team for effective communication 4. An ability to understand the importance of lifelong learning.

The Project Phase – I shall start in semester III, and should preferably be literature survey.

The work shall be continuously evaluated as per the norms/ guidelines set up by the B.O.S. for its assessment of 100 marks.

Evaluation of Project Phase – I shall consist of submission of report in a prescribed format based on review of literature related to the topic selected for dissertation. Report should cover introduction, literature review, objective and scope of investigation and pilot studies carried out during the semester. The student will deliver the seminar thereon which will be assessed by panel of examiners.

Semester – IV

CV2990	Project Phase II			L=0	T=0	P=24	CREDITS = 12
EVALUATION SCHEME							
MSE – I	MSE – II	CA	ESE	TOTAL	ESE DURATION		
--	--	40	60	100	--		

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the students the academic environment to carry out literature survey of advanced topics in Environmental engineering 2. To provide the students the understanding of real world Environmental engineering problems and their solution. 3. To motivate the students to use the modern tools and software's 4. To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	1. An ability to understand the advances in Environmental engineering. 2. An ability to solve real world Environmental engineering problems 3. An ability to understand the importance of lifelong learning and the use of modern tools. 4. An ability to work independently and in a team for effective communication.

Project Phase – II shall consist of detailed study of a work that the student has executed in continuation with report submitted by the student in the Project Phase – I and should involve scientific research, design, collection and analysis of data, determining solutions and must preferably bring out the individuals contribution.

The work shall be continuously evaluated as per the norms/ guidelines set up by the B.O.S. for its assessment of 40 marks.

End Semester Evaluation of Project Phase –II shall consist of submission of dissertation in a prescribed format. The student shall present the entire work on Dissertation, followed by viva-voce which will be assessed by panel of examiners.

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
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Y.C. COLLEGE OF ENGINEERING
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NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

SoE & Syllabus 2018-19

M. Tech. Structural Engineering

28 June 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. SCHEME OF EXAMINATION 2018-19

Structural Engineering

SN	Sem	Sub Code	Subject	T/P	Contact Hours				Credits	% Weightage				ESE Duration Hours
					L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
			I SEMESTER											
1	1	CV2901	Numerical Methods	T	3	0	0	3	3	15	15	10	60	3
2	1	CV2902	Theory of Elasticity and Elastic Stability	T	3	0	0	3	3	15	15	10	60	3
3	1	CV2903	Structural Dynamics	T	3	0	0	3	3	15	15	10	60	3
4	1	CV2904	**Lab:** Structural Dynamics	P	0	0	2	2	1	-	-	40	60	-
5	1	CV2905	Matrix Analysis of Structures	T	3	0	0	3	3	15	15	10	60	3
6	1	CV2906	**Lab:** Matrix Analysis of Structures	P	0	0	2	2	1	-	-	40	60	-
7	1	CV2907	Design of Substructures & Foundations	T	3	0	0	3	3	15	15	10	60	3
8	1	CV2908	Research Practice	P	0	0	2	2	1	-	-	40	60	-
			Total		**15**	**0**	**6**	**21**	**18**					
			II SEMESTER											
1	2	CV2911	Finite Element Method	T	3	0	0	3	3	15	15	10	60	3
	2	CV2912	**Lab:** Finite Element Method	P	0	0	2	2	1	-	-	40	60	-
2	2	CV2913	Theory of Plates and Shells	T	3	0	0	3	3	15	15	10	60	3
3	2	CV2914	Earthquake and wind effects on Structures	T	3	0	0	3	3	15	15	10	60	3
4	2	CV2915	Advanced Concrete Structures	T	3	0	0	3	3	15	15	10	60	3
5	2		Professional Elective-I	T	3	0	0	3	3	15	15	10	60	3
6	2	CV2919	**Lab:** RCC Design Studio	P	0	0	2	2	1	-	-	40	60	-
7	2	CV2920	Seminar		0	0	2	2	1	-	-	100		-
			Total		**15**	**0**	**6**	**21**	**18**					

List of Professional Electives-I

2	CV2916	PE I: New Engineering Materials
2	CV2917	PE I: Prestressed Concrete
2	CV2918	PE I: Smart Structures and Applications

			III SEMESTER											
1	3	CV2931	Advanced Steel Structures	T	3	0	0	3	3	15	15	10	60	4
2	3	CV2932	**Lab:** Steel Design Studio	P	0	0	2	2	1	-	-	40	60	-
3	3		Professional Elective-II	T	3	0	0	3	3	15	15	10	60	3
4	3		Professional Elective-III	T	3	0	0	3	3	15	15	10	60	3
5	3	CV2939	Project Phase-I	P	0	0	12	12	6	-	-	100		-
			Total		**9**	**0**	**14**	**23**	**16**					

List of Professional Electives-II

3	CV2933	PE II: Tall Building
3	CV2934	PE II: Composite Strucutres
3	CV2935	PE II: Bridge Engineering

List of Professional Electives-III

3	**CV2936**	PE III: Plastic Analysis and Design of Structures
3	**CV2937**	PE III: Seismic Analysis and Design of Structures
3	**CV2938**	PE III: Design of Industrial Structures

			IV SEMESTER											
1	4	CV2940	Project Phase-II		0	0	20	20	10			40	60	
			Total		**0**	**0**	**20**	**20**	**10**					
			Total Credits						**62**					

		June 2018	**1.00**	**Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

I SEMESTER

CV2901	Numerical Methods		L=3	T=0	P=0	Credits = 3
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
15	15	10	60	100	3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
Introduce students to the area of usefulness of numerical methods for engineering applications. • Provide a solid understanding of the basic elements underlying development and use of numerical methods in engineering applications. • Develop numerical skills and proficiency in solving the problems of structural engineering using numerical methods. • Provide a training environment in use of computational tools / languages	1. An ability to understand the basic elements underlying development and use of numerical methods in engineering applications. 2. An ability to provide numerical solution of various types of problems such as Roots of equations, Systems of linear simultaneous equations, Numerical Differentiation and integration, Eigen value problems etc. 3. An ability to formulate algorithms to solve problems using modern computational tools.

UNIT – I **[06 Hrs.]**
Solution of algebraic and transcendental equation:
RegulaFalsi Method, Newton-Raphson method, Development of Computer Program

[07 Hrs.]
UNIT – II
Solution of linear algebraic equations:
Gauss elimination, Cholesky method, Given's method, Householder's method.

[07 Hrs.]
UNIT – III
Eigen values problems:
Direct, Jacobi, Rutishauser's LR method, QR method.

[06 Hrs.]
UNIT – IV
Initial &two point boundary value problem:
Euler's, Runge-Kutta, Milne's Methods, Development of Computer Program.

[06 Hrs.]
UNIT – V
Numerical Integration:
Trapezoidal Method, Simpson's Method, Gauss Quadrature method, Development of Computer Program.

[07 Hrs.]
UNIT – VI
Direct Integration Methods:
Central difference method, Houbolt method, Newmark's method, Wilson - θ method.

Text Books
1. BalachandraRao S., Santha C. K. ;Numerical Methods with programs in BASIC, FORTRAN and Pascal, University Press (India) Limited, Hyderabad 1992.
2. Bathe K. J., Wilson E. L., Numerical Methods in Finite Element Analysis, Prentice-Hall of India Private Limited, New Delhi, 1987

Referrence Book
1. KandasamyP. ,Thilagavathy K, Gunavathi K.; Numerical Methods, S. Chand & Company Ltd, New Delhi, Edition-I,1997.
2. Chapra S.C. and Canale,R.P., " Numerical Methods for Engineers with Programming and Software Applications"- 3 Ed., Tata McGraw Hill, New Delhi, 2009
3. Salvadori M., "Numerical Mehtods"- PHI learning Pvt., ltd., New Delhi, 1987
4. Jain, Iyanger& Jain "Numerical Methods for Scientific Engineering computation"- Wiley Eastern Ltd., 1985
5. Gupta S. K.; Numerical Methods for Engineers, New Age International Limited Publishers, New Delhi, 1997

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I SEMESTER

CV2902	Theory of Elasticity and Elastic Stability		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
15	15	10	60	100	3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
1. To define plane stress and plane strain condition. 2. To derive differential equations, boundary conditions and compatibility conditions for 2D and 3D stress analysis. 3. To study the effect of bending of beams and torsion of non-circular sections. 4. To analyze the beam column, beam on elastic foundation. **5.** To study the buckling of column and simply supported rectangular plate.	1. An ability to define plane stress and plane strain condition. 2. An ability to derive differential equations, boundary conditions and compatibility conditions for 2D and 3D stress analysis. 3. An ability to understand the effect of bending of beams and torsion of non-circular sections. 4. An ability to analyze the beam column, beam on elastic foundation. 5. An ability to understand the buckling of column and simply supported rectangular plate. 6. An ability to understand the effect of shear on critical load on column.

UNIT- I **[07 Hrs.]**
Introduction to Two Dimensional Stress Analysis, Types of forces, Components of stresses and strains, Stress-strain relation, Plane stress and plane strain, Strain at a point, Differential equation of equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Airy's stress function.

UNIT- II **[06 Hrs.]**
Introduction to Three Dimensional Stress Analysis, Components of stress, Principal stresses, Stress invariants, Maximum shearing stress, Differential equation of equilibrium, Boundary conditions and compatibility equations.

UNIT- III **[06 Hrs.]**
Bending of cantilever of narrow rectangular section loaded at end, bending of simply supported beam with uniform load, torsion of non-circular and elliptical cross section.

UNIT- IV **[07 Hrs.]**
Differential equation for beams columns with concentrated loads, continuous lateral loads and couples for simply supported ends, Application of trigonometric series, Lateral buckling of beams.

UNIT- V **[07 Hrs.]**
Energy method for elastic bucking of columns, Approximate method, Buckling of Columns on elastic foundation, Columns with intermediate compressive forces and distributed axial load, Columns with varying cross section.

UNIT- VI **[06 Hrs.]**
Effect of shearing force on critical load, Buckling of built up columns, Buckling of simply supported rectangular plates uniformly compressed in middle plane.

Text Books

1. Timoshenko, S.P. and Goodier, J.N., Theory of Elasticity, 3rd Edition, Mc-Graw Hill Book Company, New Delhi, 1963
2. Timoshenko, S.P. and Gere J. M., Theory of Elastic Stability , 2nd Edition, Mc-Graw Hill Book Company, New Delhi,1963

Reference Books

1. Srinath, L.S., Advanced Mechanics of Solids India, 2nd Edition, Tata Mc-Graw Hill Book Company, 2003.
2. Ameen, M., Computational Elasticity—Theory of Elasticity, Finite and Boundary Element Methods, 1st Edition, Narosa publication, 2007
3. Mikhait Filonenkoborodich, Theory of Elasticity, 1st Edition, University press of pacific, 2003

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I SEMESTER

CV2903	Structural Dynamics		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
15	15	10	60	100	3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students clear and thorough understanding of modeling of discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems. 2. To provide the students clear and thorough understanding of Calculation of the mode shapes and frequencies for the free response of continuous vibratory systems and use modal methods to calculate the forced response of these systems. 3. To provide the students understanding of modeling continuous vibratory systems – vibration of strings, axial and torsional vibration of bars and beams. 4. To provide the student with a basic understanding of IS codes related to earthquake loading.	1. An ability to apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response. 2. Ability to identify, formulate and solve engineering problems having motions varying with time. This will be accomplished by having students model, analyze and modify a vibratory structure, in order to achieve specified requirements. 3. Understanding professional and ethical responsibilities. This will be accomplished by emphasizing the importance of understanding how structural vibrations may affect safety and reliability of engineering systems. 4. An ability to Understand IS codes related to earthquake loading.

UNIT - I **[07 Hrs.]**
Fundamentals of Rigid / Deformable body dynamics, Analysis of undamped and viscously damped single degree freedom systems.

UNIT - II **[06 Hrs.]**
Response of single degree freedom systems to harmonic loading, support motion and transmissibility, Duhamel's integral.

UNIT - III **[06 Hrs.]**
Multiple degree of Freedom system: Vibration of undamped 2 DOF systems; Response of 2 DOF to harmonic excitation, mode superposition, vibration absorber, Free vibration of MDOF (up to 3 DOF) systems, Dynamic response of MDOF (2 DOF) systems-modal superposition method. Energy Principle, Rayleigh's method (2 DOF)

UNIT - IV **[06 Hrs.]**
Dynamic analysis of systems with distributed properties, Approximate design method, Transformation factors.

UNIT – V **[07 Hrs.]**
Response spectra, generation and types of response spectra, Vibration of Continuous Systems: Free vibrations of Continuous systems-axial and transverse vibration of bars / beams. Response of continuous systems to dynamic loads.

UNIT - VI **[06 Hrs.]**
Introduction to vibrations due to earthquake, Study of IS 1893 applicable to Buildings and Water Tanks.

Text Books:
1. Mario Paz, Structural Dynamics Theory & Application, CBS Publ.; N-Delhi, 1995.
2. Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2nd Edition., Pearson Education (Singapore) Pvt. Ltd, New Delhi, 1995

Reference Books:
1. Clough / Penzien, "Dynamics of Structures", McGraw Hill, 1993
2. Humar, J. L., "Dynamics of Structures", Prentice Hall, 1993
3. Timoshenko, S., "Advanced Dynamics", McGraw Hill Book Co; NY, 1948
4. Biggs, J.M., "Introduction to Structural Dynamics", McGraw Hill; NY, 1964
5. Damodarasamy and Kavitha," Basics of structural Dyanamics and Aseismic design, Phi Publisher, New Delhi.

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I SEMESTER

CV2904	Lab: Structural Dynamics		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
--	--	40	60	100	--	

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students clear and thorough understanding of modeling of discrete single-degree and multiple-degree vibratory systems and calculate the free response of these systems. 2. To provide the students clear and thorough understanding of damping of systems and their relevance 3. To demonstrate phenomenon of soil liquefaction and mode shapes in water medium 4. To provide the students clear and thorough understanding of IS codes related to earthquake loading for buildings and elevated water tanks	1. An ability to understand the behavior of vibratory system during cyclic loading. 2. An ability to understand phenomenon like damping and its relevance in actual structural applications. 3. An ability to understand the effect of earthquake phenomenon on water media and subsoil. 4. An ability to understand provision of various Indian standards for design of structures from seismic safety point of view.

PRACTICALS

1. To study various instruments for imparting dynamic forces.
2. To study various instruments for the response of vibrating structure.
3. To study the response of a single degree of lumped mass system subjected to base excitation.
4. To study the response of a two degree of freedom system building frame subjected to base motion.
5. To study the response of a multi degree of lumped mass system.
6. Verification of natural frequency of SDOF model under free vibration.
7. To study the liquefaction of soil structure.
8. To study the Earthquake induced waves in rectangular water tank.
9. To calculate horizontal seismic force of building using IS-1893.
10. To calculate the lateral forces in water tank due to Earthquake when water tank is empty and water tank is full by IS-1893.

I SEMESTER

CV2905	Matrix Analysis of Structures	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
After completion of syllabus students will able to, 1. Understand basic concepts of stiffness method of matrix analysis. 2. Analyse the structures using stiffness method. 3. Apply softwares of structural analysis based on this method.	1. An ability to understand the different types of structures 2. An ability to apply the matrix stiffness method to model the behavior of planar trusses, beams, and frames; 3. An ability to analyze any multistoried building using approximate methods of structural analysis. 4. An ability to implement the method developing their own computer program to analyze structures.

UNIT - I **[07 Hrs.]**
Introduction to stiffness and flexibility approach, Stiffness matrix for spring, Bar, torsion, Beam (including 3D), Frame and Grid elements, Displacement vectors, Local and Global co-ordinate system, Transformation matrices, Global stiffness matrix and load vectors, Assembly of structure stiffness matrix with structural load vector, application to spring and bar problems.

UNIT - II **[06 Hrs.]**
Analysis of Plane Truss, Space Truss by Stiffness Method

UNIT - III **[06 Hrs.]**
Analysis of Beam, Plane Frame, Space Frame by Stiffness Method

UNIT - IV **[07 Hrs.]**
Analysis of building systems for horizontal loads, Buildings with and without rigid diaphragm, various mathematical models and introduction to Solution techniques.

UNIT - V **[06 Hrs.]**
Analysis of Plane Grid by Stiffness Method

UNIT - VI **[07 Hrs.]**
Analysis for member loading (self, Temperature & Imposed) Inclined supports, Lack of Fit, Initial joint displacements. Effect of shear deformation, internal member end releases

Text Books:-
1. Gere, W. and Weaver; J. M., Matrix Method of Structural Analysis 3rd Edition, Van Nostrand Reinhold; New York; 1990
2. Meghre A.S.& Deshmukh S.K. ; Matrix Method of Structural Analysis, 1st edition, Charotar publishing house, Anand, 2003
3. Kanchi, M. B., Matrix Method of Structural Analysis, 2nd Edition; John Willey & Sons, 1999
4. Godbole P., Sonparote R., Dhote S. Matrix Methods of Structural Analysis, PHI Learning Pvt. Ltd. 2014

Reference Books:-
1. Cheng, F.Y., M. Dekke; Matrix Analysis of Structural Dynamics, NY 2000
2. Bathe, K.J., Finite Element Procedures, 2nd Edition Springer,; 2002
3. Cook, R.D Concepts and Applications of Finite Element Analysis, et. al, John Willey &Sons; NY 1995
4. Martin; H.C., Introduction to Matrix Method of Structural Analysis, McGraw Hill Book Co. 1966
5. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
6. Kassimali A., Matrix Analysis of Structures SI Version, Cengage Learning, 2011
7. Livesley R. K. Matrix Methods of Structural Analysis: Pergamon International Library of Science, Technology, Engineering and Social Studies, Elsevier, 2013
8. McGuire W. Gallaghar R. H. & Zimian R. D., Matrix Structure Analysis. John Willey Publication
9. Przemieniecki J. S., Theory of Matrix Structural Analysis, Dover Publication Inc. New York

I SEMESTER

CV2906	Lab: Matrix Analysis of Structures	L= 0	T= 0	P= 2	CREDITS = 1

EVALUATION SCHEME

MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION
--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide knowledge to develop models of various structures in the software package, and apply the required properties, boundary conditions and forces in the developed models 2. To provide knowledge to analyse various structural elements by stiffness method of structural analysis. 3. To provide knowledge to execute the programme using standard software package without any error 4. To provide knowledge to understand the comparison of result between manual analysis and software analysis.	1. An ability to understand the latest computational techniques and software used for structural analysis. 2. An ability to analyze beam for various loading and boundary conditions using Stiffness Method. 3. An ability to analyze truss for various loading and boundary conditions using Stiffness Method. 4. An ability to analyze plane frame and grid for various loading and boundary conditions using Stiffness Method

1. Analyze a continuous beam with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
2. Analyze a continuous beam with sinking of support with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
3. Analyze a plane truss with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method. Conclude it from both the result.
4. Analyze a plane truss subjected to inclined roller support with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
5. Analyze a plane truss subjected to temperature effect and lack of fit with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
6. Analyze a space truss with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
7. Analyze a rigid sway frame one bay one story with maximum three degree of Kinematic Indeterminacy, using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
8. Analyze a plane grid using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
9. Analyze a multi storied frame structure subjected to horizontal forces using software package.

I SEMESTER

CV2907	Design of Substructures & Foundations	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students knowledge of different types of foundation structures. 2. To provide the students knowledge of different types of loading applied on foundation structures. 3. To provide the students knowledge of different methods used for the analysis of foundation structures. 4. To provide the students, knowledge of different codal provisions applicable to advanced design of foundation structures. 5. To provide the students knowledge of design of deep foundation systems, machine foundations etc.	1. Ability to identify the type of foundations to be used for various site conditions 2. An ability to analyze and design different types of foundation structures. 3. An ability to draw RCC detailing and to prepare working drawing. 4. An ability to understand the importance of various codes used for different types of foundation structures.

[07Hrs.]

UNIT – I
Introduction to soil structure interaction, Bearing Capacity of Foundations, Theories, In-situ tests; Settlement Analysis, factors affecting settlement, control of excessive settlements; Soil classification, Geotechnical design parameters. Design of different isolated and combined footings including eccentric loading.

[06 Hrs.]

UNIT – II
Design of raft foundation. Types of rafts, Design of beam and slab raft foundation. Introduction to Design of Flat slab raft foundation.

[07 Hrs.]

UNIT – III
Function and Classification of piles, Static point and skin resistance capacity of a Pile, pile load tests, Pile settlements, design of RCC piles, Various pile group patterns, Efficiency of Pile in group, Negative skin friction, Pile Cap design, Under reamed pile foundation, Introduction to design of well foundation. IS 2911 Part I to Part V

[06 Hrs.]

UNIT – IV
Introduction to machine foundations and its practical considerations for construction IS code of practice, introduction to analysis and design of simple machine foundation. Theory of sub grade reaction, beam on elastic foundation.

[06 Hrs.]

UNIT – V
Effects of earthquakes on foundation structures, IS1893-2016 recommendations for layout of foundation. Ground improvements: Various methods, sand drains, stone columns, stabilization, grouting, reinforced earth, geotextiles, diaphragm walls, reinforced earth retaining walls, skin walls.

[07 Hrs.]

UNIT – VI
Analysis and design of Cantilever, counter fort and basement retaining walls and abutments

Text Books

1. Sawmi Saran, " Analysis and Design of Substructures", , Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
2. Kurain N. P," Design of foundation systems- Principles and Practice", Narosa Publishing house, New Delhi, 2005.
3. Poulose H.G. and Davis E.H.," Pile foundation Analysis and Design", John-Wiley Sons, NY, 1980.
4. Karuna Moy Ghosh , "Foundation Design in practice", PHI Learning Pvt. Ltd, New Delhi 2012
5. P. C. Varghese, "Design of Reinforced Concrete Foundations", PHI Learning Pvt. Ltd., New Delhi, 2009.

References Books

1. J. E. Bowles, "Foundation Analysis and Design", Tata McGraw Hill New York
2. Kurain N.P," Modern Foundations: Introduction to Advance Techniques", Tata McGraw Hill, 1982
3. Winterkorn H.F. and Fang H.Y. Ed., "Foundation Engineering Hand Book", Van-Nostrand Reynold, 1975
4. Bowles J.E., "Foundation Analysis and Design" (4th Ed.), Mc.Graw –Hill, NY, 1996
5. Sreenivasalu&Varadarajan, "Handbook of Machine Foundations", Tata McGraw Hill
6. Hetenyi, M. "Beam on Elastic Foundation", University of Michigan Press, 1946.
7. Swami Saran, "Soil Dynamics and machine Foundations", Galgotia Publications (P) Ltd, New Delhi, 1999.

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I SEMESTER

CV2908	Research Practice	L=0	T=0	P=2	CREDITS = 1

EVALUATION SCHEME

MSE – I	MSE – II	CA	ESE	TOTAL	ESE DURATION
----	---	100		100	----

COURSE OBJECTIVE	COURSE OUTCOMES
1. To make the students aware about various aspect of research methodology with special emphasis on literature review and research objective framing 2. To provide the students the knowledge about technical paper writing with special emphasis on abstract drafting 3. To teach the students various aspect of preparing and presenting effective power point presentation of technical paper 4. To make students aware about effective research data compilation, graphical presentation of data and interpretation from the graphs.	1. An ability to carry out literature review and frame objectives of research. 2. An ability to understand essential of technical paper writing and drafting good abstract. 3. An ability to prepare and deliver effective power point presentation. 4. An ability draw different graphs, effectively use trends line equation and interpret graphs.

Contents

1. General concept of Research Methodology, developing objectives of research
2. Essential of effective technical paper writing, writing of technical paper abstract
3. Presentation of technical paper, effective power point presentation.
4. Research data analysis and interpretation

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II SEMESTER

CV2911	Finite Element Method	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the student with knowledge and analysis skills in applying basic laws and steps used in solving the problem by finite element method. 2. To provide the student the knowledge of various interpolation functions and elements to solve simple problems by finite element method. 3. To provide the student the knowledge of is oparametric transformation. 4. To provide students the knowledge of mathematical modelling techniques. 5. To develop the student's skills in applying FEM solution steps by using software.	1. An ability to derive element matrix equation by different methods by applying basic laws in structural analysis. 2. An ability to apply the knowledge of finite element method to solve simple problems. 3. An ability to extend the knowledge of finite element method to solve complex problems using various elements. 4. An ability to understand solution and modeling techniques used in finite element method.

UNIT – I **[06 Hrs.]**
Principles and discretization, Elements stiffness formulation based on direct and, variational techniques, Rayleigh Ritz Method for Bar and Beam analysis.

UNIT – II **[07 Hrs.]**
Shape functions, Finite Element Formulation using Cartesian Coordinates, Application to 1D problems, Convergence criteria

UNIT – III **[06 Hrs.]**
Triangular and Rectangular element formulation using Cartesian Coordinates, Application to 2D stress analysis.

UNIT – IV **[07 Hrs.]**
Natural coordinates, Isoparametric elements, Application to 1D Problems, Isoparametric elements for two-dimensional stress analysis.

UNIT – V **[07 Hrs.]**
Shape Functions for three Dimensional Stress analysis, Axi-symmetric Stress Analysis.

UNIT – VI **[06 Hrs.]**
Modelling techniques and solution techniques, Computer Implementation of FEM Procedure for 1D & 2D problems, Numerical integration.

Text Books:
1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Rajasekaran S, Finite Element Analysis in Engineering Design, S. Chand &Co. Ltd. New Delhi, 1999.

Reference Books:
1. Zienkiewicz O.C. and Taylor R.L., The Finite Element Method (Volume -I), 1st Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1989
2. Cook R. D. , Concepts and Applications of Finite Element Analysis, 3rd Edition, Wiley India Text books, Wiley India Pvt. Limited, New Delhi, 1989.
3. Krishnamurthi C.S., Finite Element Analysis: Theory and Programming , 2nd Edition, Tata McGraw Hill Publishing Company Limited, 1994, Reprint 2005.
4. Bathe K. J., Finite Element Procedure, Prentice-hall of India, New Delhi, 1997.

II Semester

CV2912	**Lab: Finite Element Method**	**L=0**	**T=0**	**P=2**	**CREDITS = 1**

EVALUATION SCHEME					
MSE – I	**MSE – II**	**CA**	**ESE**	**TOTAL**	**ESE DURATION**
-----	-----	40	60	100	-----

COURSE OBJECTIVE	**COURSE OUTCOMES**
1. To provide the students the academic environment to conduct a structural analysis using finite element software 2. To motivate the students to use the modern tools and software. 3. To provide the students the basic skills in using commercial finite element software and effective presentation of their analysis results. 4. To provide the students the knowledge of finite element method for the analysis of structural engineering problems and their solution.	1. An ability to identify the information required to conduct a structural analysis using finite element software 2. An ability to interpret the solutions obtained from finite element analyses. 3. An ability to have basic skills in using commercial finite element software and effective presentation of their analysis results. 4. An ability to communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained.

Minimum **Six** practical based on theory syllabus

1. Analysis of 2D truss
2. Analysis of Bar subjected to various loading conditions
3. Analysis of beam subjected to various loading conditions
4. Analysis of Plane Stress problem (Plate, Plate with hole) using triangular & Quadrilateral element
5. Analysis of Plain Strain problem (Retaining wall, Culvert) using triangular & Quadrilateral element
6. Analysis of Axisymmetric problem (Cylinder, foundation) using triangular & Quadrilateral element
7. Analysis of 3D beams (Cantilever and Simply Supported) subjected to various loading conditions

		June 2018	1.00	Applicable for Sem 1 & 2 AY2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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II SEMESTER

CV2913	Theory of Plates and Shells	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To correlate moment curvature relation in pure bending and to derive equation of deflection for circular and thin rectangular plates. 2. To derive Lagrange's equation and Navier's solution for thin plates. 3. To explain the concept of finite difference method and its application. 4. To study the shear deformation theories for plates. 5. To classify the shells and its geometry and to explain the concept of various theory for shells.	1. An ability to correlate moment curvature relation in pure bending and to derive equation of deflection for circular and thin rectangular plates. 2. An ability to derive Lagrange's equation and Navier's solution for thin plates and explain the concept of finite difference method and its application. 3. An ability to understand the shear deformation theories for plates. 4. An ability to Classify the shells and its geometry and to explain the concept of membrane theory for shells 5. An ability to explain concepts of bending theory. 6. An ability to apply the fundamentals of beam theory

UNIT – I **[07 Hrs.]**
Development of governing differential equations by Kirchoff'stheory with reference to thin rectangular plates with various boundary conditions. Symmetrical bending of laterally loaded circular plates with different boundary conditions.

UNIT- II **[06 Hrs.]**
Study of Simply supported plates under different loadings. Navier's solution. Introduction to Levis solution. Finite difference method.

UNIT – III **[06 Hrs.]**
Introduction to shear deformation theories for plates.

UNIT – IV **[07 Hrs.]**
Classification of Shells. Membrane theory of cylindrical shells with different directrix such as circular, cycloidal, catenary, and parabolic.

UNIT – V **[06 Hrs.]**
Bending theory of cylindrical shells, Finster walder, Schorer's, and D-K-J theory.

UNIT – VI **[07 Hrs.]**
Approximate analysis of cylindrical shells by beam arch method.

Text Books

1. Timoshenko S.P and Krieger S.W, Theory of Plates and Shells, 2nd Edition, McGraw-Hill Book Company, New Delhi, 1970.
2. Chadrashekhara K, Theory of Plates, 1st Edition, Universities Press (India) Ltd, Hyderabad, 2001.
3. Ramaswamy, G.S, Design of Concrete Shells, Krieger Publ. Co., 1984

Reference Books

1. Ramachandran S., Thin Shells (Theory and Problems) 1st Edition, Universities Press (India) Ltd, Hyderabad
2. Szilard R., Theory and Analysis of Plates, Prentice Hall Publication, 1974.
3. Philipee G Ciarlet, Mathematical elasticity Vol.II: Theory of plates, 1st Edition, Elsevier Science B V, 1997

II SEMESTER

CV2914	Earthquake & Wind Effects on Structures		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
15	15	10	60	100	3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
1. After completion of syllabus students will able to 2. Understand basic concepts of earthquake engineering 3. Understand behavior of structural components under earthquake and wind loading 4. Understand concepts of earthquake resistance design 5. Understand various codes related to earthquake and wind effects on structures 6. Understand Wind Characteristics and concept of Mathematical Modeling.	1. An ability to apply the knowledge of geological feature, plate tectonics in understanding occurrence of earthquake. 2. An ability to understand causes and sources of earthquake damages and possible response of structure and system to earthquake. 3. An ability to understand characteristics of wind and its static and dynamic effects on structures 4. An ability to understand relevant I.S. codes and philosophy in design of earthquake& Wind resistant structure

UNIT – I **[07 Hrs.]**
Origin of earthquake, Engineering geology of earthquakes, faults, Propagation of earthquake waves, quantification of earthquake (magnitude, & intensity of earthquake), Measurement of earthquake (accelerograph, accelogram recording and analysis of earthquake records), determination of magnitude, epicenter distances, Seismicity of the world.

UNIT- II **[07 Hrs.]**
Causes or sources of earthquake damage, damage due to ground failure, History of past Earthquakes, generation of response spectrum from available earthquake records, Earthquake design spectrum and inelastic spectrum. Evolution of seismic risk.

UNIT – III **[06 Hrs.]**
Concepts of earthquake resistance design, Design philosophy, and four virtues of earthquake resistance design (stiffness, strength, ductility and configuration). Introduction to capacity design concept, Study of IS: 1893, Study of IS: 13920 for analysis and ductile design of RCC structures.

UNIT – IV **[05 Hrs.]**
Wind Characteristics: Historical Wind Speed Data, Wind Speed Map of India, Practical Knowledge of Cyclones and Tornadoes.

UNIT-V **[07 Hrs.]**
Static Wind effects and Building Codes with particular reference to IS – 875 (Part III).

UNIT-VI **[07 Hrs.]**
Dynamic Wind Effects: Wind Induced Vibrations, Self excited motion, Analysis for dynamic wind loads, Vibration Control and Structural Monitoring.

Text Books:
1. Kramer, S.L, "Geotechnical Earthquake Engineering", Prentice Hall, New Jersey, 1996.
2. Arya A. S., "Introduction to earthquake engineering structures".
3. C. Scruton, "An Introduction to Wind Effects on Structures", Oxford University Press, Oxford, UK., 1981

Reference books
1. Murthy, C.V.R, "Earthquake tips", IIT Kanpur documents.
2. Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2nd Edition., Pearson Education (Singapore) Pvt. Ltd, New Delhi, 1995
3. Dowrick, D.J, "Earthquake Resistant Design for Engineers and Architects", 2nd Edition; 1987
4. Peter Sachs, "Wind Forces in Engineering", Pergamon Press. Oxford UK, 1972
5. Lawson T. V., "Wind Effects on Buildings", Applied Science Publishers, London, UK, 1980
6. Emil Simiu and R. H. Scanlan, "Wind Effects on Structures – An Introduction to Wind Engineering", John Wiley and Sons, New York., 1986
7. Cook, N. J., The designer's guide to wind loading of building structures. Part 1 Background, damage survey, wind data and structural classification. Building Research Establishment, Butterworths, U. K., 1985
8. Cook, N. J., Designer's guide to wind loading of building structures. Part 2: Static structures. Building Research Establishment, Butterworths, U. K., 1990
9. Simiu, E., Scanlan, R. H. Wind Effects on Structures: fundamentals and applications to design. 3rd Edition., John Wiley & Sons, New York, 1996.
10. Dyrbye, C., Hansen, S. O., Wind loads on structures., John Wiley, New York, 1997

Reference IS codes:
IS 1893-2016 Part I Earthquake criteria
IS 13920-2016 ductile detailing

II SEMESTER

CV2915	Advanced Concrete Structures		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
15	15	10	60	100	3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
After completion of syllabus students will able to get the knowledge about the design of 1. Bridges. 2. Water tanks. 3. Multistoried buildings. 4. Silos & Bunkers.	1. Ability to identify the type of structure to be used for various site conditions 2. An ability to understand the importance of various codes used for different structures. 3. An ability to analyze and design advanced concrete structures 4. An ability to draw RCC detailing and to prepare working drawing.

UNIT – I **[09 Hrs.]**
Analysis and design of Multistoried buildings, calculation of loads, Approximate analysis, Preliminary sizing, Ductile detailing as per IS 13920 :2015

[10 Hrs.]
UNIT – II
Analysis and Design of Elevated service Reservoirs, IS Recommendations for wind & earthquake, Ductile detailing. as per IS 13920 :2015

[10 Hrs.]
UNIT – III
IRC Recommendations, Analysis, Design & Detailing of bridges and Culverts.

[10 Hrs.]
UNIT – IV
Analysis and design of, Silos, and Bunkers, IS recommendations.

Text Books:
1. Bhavikatti S. S., Advanced R. C. C. Design Volume-II, New age international publisher, New Delhi, Ist edition - 2006
2. Krishna Raju N, Advanced R. C. C. Design, CSB Publisher and Distributor, New Delhi, 2nd edition-2005
3. Ramaswamy, G.S, Design of Concrete Shells, Krieger Publ. Co., 1984

Reference Books:
1. Johnson and Victor, "Essentials of Bridge Engineering" Oxford and IBH publisher, 1980
2. Jain O.P. and Jai Krishna, Plain and Reinforced concrete structures–Volume –II, Nemchand and brothers, 1987
3. Chattergee, B K, "Theory and design of Concrete Shells" Oxford and IBH publisher, 1978
4. Chen, W.F. and Duan, L. "Bridge engineering Handbook"

II SEMESTER

CV2916	PE-I New Engineering Materials		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
15	15	10	60	100	3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
1. Understand various civil engineering materials 2. Understand various methods of testing of materials 3. Understand and use various codes related to the civil engineering materials	1. An ability to introduce different high quality materials for civil engineering applications. 2. An ability to use engineering materials for better and durable Civil Engineering Structures.
Mapped program outcomes:	

UNIT-I **[09 Hrs.]**
Steel fiber reinforced concrete, Properties, Aspect ratio, strength and durability.
Fiber reinforced plastics, other types of fibers and their applications.

[10 Hrs.]
UNIT-II
Light weight concrete, foam concrete, flyash concrete, workability, durability, and application.

[10 Hrs.]
UNIT-III
High-grade concrete, high strength performance concrete, trimix concrete.
New engineering materials like light weight steel profile, aluminum profile, pressed steel sections

[10 Hrs.]
UNIT-IV
Introduction to steel concrete composite including infill, encased section, properties of shear connectors, use of IS:11384, IRC 22.

Text books:
1. Neville A. M., Properties of Concrete, Pearson Education Limited.
2. Rafat Siddequi , Special Concretes, Galgotia Publications.
3. M Gambhir, Concrete Technology, Tata Mcgraw Hill Education Private Limited.

Reference books:
1. Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
2. Shetty M. S, Concrete Technology, S. Chand Publisher.

II SEMESTER

CV2917	PE I: Prestressed Concrete	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the basic concepts of Prestressed concrete. 2. To study various devices used for Prestressing. 3. To analyse and design the basic structural members in Prestressed concrete 4. To analyse and design the special structures like Prestressed Concrete Pipes, Liquid Storage Tanks and Ring Beams	1. An ability to apply basic concepts of prestressed concrete in construction industry. 2. An ability to identify, formulate and solve engineering problems pertaining to prestressed concrete. 3. An ability to Understand IS codes related to prestressed concrete. 4. An ability to design special prestressed structures.

UNIT – I **[06 Hrs.]**
Introduction to prestressed concrete, types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads

UNIT – II **[07 Hrs.]**
IS1343 – 2012 codal provisions, Limit state of collapse and serviceability for analysis and design of rectangular, I and box sections for flexure and shear, control of deflection, Transmission of pre-stress in pre-tensioned members; Anchorage zone stresses for post-tensioned members.

UNIT – III **[07 Hrs.]**
Statically indeterminate structures - analysis and design of continuous beams and frames Choice of cable profile - linear transformation - concordancy.

UNIT – IV **[06 Hrs.]**
Composite construction with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage, deflection effects. Partial prestressing - principles, analysis and design concepts, crack-width calculations

UNIT – V **[07 Hrs.]**
Analysis and design of prestressed concrete slabs – one way and two way
Analysis and design of prestressed concrete pipes, tanks

UNIT – VI **[06 Hrs.]**
Intoduction to prestressed concrete flat slabs, grids, folded plates and shells, railway sleepers
(No numerical problems).

Text Books:

1. N. Krishnaraju, Prestressed Concrete, 3rd edition, Tata McGraw Hill Publishing Co., 2004
2. S.K. Mallick and A.P.Gupta, Prestressed concrete, Oxford and IBH Publishing Co., New Delhi.
3. Praveen Nagarajan, "Prestressed Concrete Design", PEARSON Publishing Co., Delhi, 2013
4. K.U.Muthu, Azmi Ibrahim, MagantiJanardhana, M. Vijayananad, " Prestressed Concrete", PHI Learning Pvt. Ltd., Delhi 2016

Reference Books:

1. Lin, T.Y. and Burns, N.H. , Design of Prestressed Concrete Structures, , 3rd edition, John Wiley &Son's, 2004
2. IS : 1343 – 2012, Code of Practice of Prestressed Concrete, Indian Standards Institution.
3. Guyon Y., Prestressed Concrete vol.I and II, Contractors Record Ltd., London.
4. Abels P.W., An Introduction to Prestressed Concrete, Vol.I and II', Concrete Publications Ltd., London.
5. DayaratnamP. ,Prestressed Concrete Structures, , 5th edition, Oxford & IBH, 1996

		June 2018	1.00	Applicable for Sem 1 & 2 AY2018-19 & Sem 3 & 4 AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

II SEMESTER

CV2918	PE I: Smart Structures and Applications	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand smart system 2. To understand characteristics and behavior of smart materials 3. To understand control system and its applications 4. To understand modeling of control system and its applications	1. An ability to understand passive and active systems. 2. An ability to understand the characteristics and behavior of smart materials 3. An ability to understand control system and its applications 4. An ability to understand modeling of control system and its applications

UNIT – I
Introduction to passive and active systems – need for active systems– smart systems – definitions and implications - active control and adaptive control systems – examples. **[10 Hrs.]**

UNIT – II
Components of smart systems– system features and interpretation of sensor data – pro active and reactive systems – demo example in component level – system level complexity Materials used in smart systems – characteristics of sensors – different types smart materials – characteristics and behavior of smart materials – modeling smart materials – examples **[09 Hrs.]**

UNIT – III
Control Systems – features – active systems – adaptive systems – electronic, thermal and hydraulic type actuators – characteristics of control systems – application examples. **[10 Hrs.]**

UNIT – IV
Integration of sensors and control systems – modeling features – sensor-response integration– processing for proactive and reactive components – FE models – examples. **[10 Hrs.]**

References Books

1. Srinivasan, A.V. and Michael McFarland, D., Smart Structures: Analysis and Design, Cambridge University Press, 2000.
2. Yoseph Bar Cohen, Smart Structures and Materials 2003, The International Society for Optical Engineering 2003.
3. Brian Culshaw, Smart Structures and Materials , Artech House, Boston, 1996.
4. M.V.Gandhi and B.S.thompson, Smart Materials and Structures , Chapman and Hall 1992

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II SEMESTER

CV2919	Lab: RCC Design Studio	L=0	T=0	P=2	CREDITS = 1

EVALUATION SCHEME

MSE – I	MSE – II	CA	ESE	TOTAL	ESE DURATION
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the students clear & thorough understanding of IS code related to reinforced concrete structures. 2. To provide the students clear & thorough understanding of reinforcement of essential parts of R. C. structures as per SP 34. 3. To provide the knowledge to understand the comparison of results between manual analysis & design and software analysis & design of simple member of R. C. structure.	1. An ability to demonstrate basic knowledge of structural engineering to advanced concrete structure. 2. An ability to understand the various parameter considered in analysis & design of simple members R. C. structures 3. An ability to design advanced concrete structures 4. An ability to present analysis and design result in schematic way

PRACTICALS

1. Review of IS 456, IS 962 Basics of Limit State Design (Beams, Columns, Slabs) Design of Multistoried buildings
2. Design for axial force, flexural, shear and combined effects Slabs (one way & two way) and slabs on grades. Preliminary sizing, modeling, designing & detailing of R. C. C. structures
3. Design of Bunker/ Design of Bridge (Any One)

Reference Books:

1. Bhavikatti S. S., Advanced R. C. C. Design Volume-II, New age international publisher, New Delhi, Ist edition – 2006
2. Krishna Raju N, Advanced R. C. C. Design, CSB Publisher and Distributor, New Delhi, 2nd edition-2005.

II SEMESTER

CV2920	**SEMINAR**	**L=0**	**T=0**	**P=2**	**CREDITS = 1**

EVALUATION SCHEME

MSE – I	**MSE – II**	**CA**	**ESE**	**TOTAL**	**ESE DURATION**
-----	-----	100	-----	100	-----

COURSE OBJECTIVE	**COURSE OUTCOMES**
1. To provide the students the academic environment to carry out literature survey of advanced topics in structural engineering. 2. To provide the students the academic environment for effective communication skills, working independently and in a team and the importance of lifelong learning.	1. An ability to understand the advances in structural engineering. 2. An ability to understand the importance of lifelong learning. 3. An ability to communicate effectively. 4. An ability to work independently and in a team.

Contents:

1. Literature review on current topic related to the structural engineering.
2. Preparation and presentation of progress seminars on topic based on the reviewed literature.
3. Submission of hard copy of the paper to the Department.

III SEMESTER

CV2931	Advanced Steel Structures	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	4 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand basic principles of reliability based design on steel structures 2. To understand the effect of natural phenomenon (wind and earthquake), for structural engineering applications 3. To have an experience in the complete design of an industrial building 4. To learn design of storage vessel 5. To be able to learn method of analysis of truss bridge and design of its structural components 6. To be able to analyze multistoried frame structures by approximate methods and design of structural component of multistoried frame structures	1. An ability to understand the configuration (component of structures civil\structural engineering drawing etc.)of structures 2. An ability to understand the effect of natural phenomenon (wind and earthquake), in structural engineering applications 3. An ability to analyze and design the industrial building by applying the provision of Indian Standard Code 4. An ability to analyze and design the storage vessel by applying the provision of Indian Standard Code 5. An ability to analyze and design the of truss bridge by applying the provision of Indian Standard Code 6. An ability to analyze and design the component of multistoried building frame bridge by applying the provision of Indian Standard Code

UNIT – I **[10 Hrs.]**
Design of steel industrial buildings

UNIT – II **[09 Hrs.]**
Design of Steel Storage Vessels

UNIT – III **[10 Hrs.]**
Design of steel Bridges.

UNIT – IV **[10 Hrs.]**
Design of steel multistoried building

Text Books:

1. Arya A.S and Ajmani J.L. Design of Steel Structures, Nemchand&bross, Roorkee, new edition
2. Duggal S.K., Design of Steel Structures, Mc Graw Hill publication, 2007
3. Dayaratnam P., Design of Steel Structures, Wheeler Publications, Allahabad, 1992

Reference Book :

1. Ram Chandra Design of Steel structures Vol-I & Vol-II Std. book house / Rajsons Publication Pvt. Ltd.,, Delhi, 2006
2. Gaylords, E.H. & Gaylords, C. N., Design of Steel Structures, Blackwell, 1994.
3. Ghosh, "Analysis and Design practice of Steel Structure", (Forthcoming), Phi Publisher, New Delhi

III SEMESTER

CV2932	Lab: Steel Design Studio	L=0	T=0	P=2	CREDITS = 1

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand the basic concepts and fundamentals of steel design 2. To provide basic knowledge of steel structural design and apply its principles to design complex steel structures. 3. To study modeling, analysis and design aspects of steel structures using commercial software.	1. An ability to understand the basic knowledge of structural steel structure 2. An ability to develop plane frame models for analyze and design of structure using software for different loading condition and present analysis and design result in schematic way. 3. An ability to develop space frame models for analyze and design of structure using software for different loading condition and present analysis and design result in schematic way. 4. An ability to develop space frame models of storage vessel structure for analyze and design using software and present analysis and design result in schematic way. 5. An ability to develop space frame models of truss type bridge structure for analyze and design using software and present analysis and design result in schematic way.

Any Four
Analysis & Design of Plane frame for gravity load
Analysis & Design of Plane frame for gravity & horizontal forces.
Analysis & Design of multistoried building structure.
Analysis & Design of storage vessels
Analysis & Design of truss type bridge.

Reference Book :

1. Duggal S.K., Design of Steel Structures, Mc Graw Hill publication, 2007
2. Arya A.S and Ajmani J.L. Design of Steel Structures Nemchand&bross, Roorkee, New Edition
3. Inglekrik
4. Subramanyam

III SEMESTER

CV2933	PE II: Tall Buildings	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand earthquake load acting on a building and design the building for above loading by providing shear walls 2. To understand various aspects of high rise buildings such as the effect of torsion, soft storey effect, p- delta effect and drift index. 3. To understand detailing of RCC members for ductile behavior as IS Code provisions	1. An ability to understand fundamental concept, principle and application of earthquake engineering. 2. An ability to analyze and design RCC structures with ductile detailing as per Indian standards. 3. An ability to apply technical design principles and techniques such as P-delta effect, soil structure interaction for a design of high rise structures. 4. An ability to apply various provisions for earthquake resistance design of structures as per Indian standards.

UNIT – I **[10 Hrs.]**
Earthquake load Calculations along with dead load & live loads by Static analysis as per IS 1893-2016
Introduction to Frame – shear wall buildings, Mathematical modeling of buildings with different Structural systems. Analysis & Design of shear walled buildings with ductile detailing as per IS 13920-2016

UNIT – II **[10 Hrs.]**
Special aspects in Multi- Story buildings like effect of torsion, flexible first storey, P- delta effect, Soil – Structure Interaction on building response, drift limitations.
Ductility of reinforced members subjected to flexure.
Design of braced columns using codal provisions.

UNIT – III **[10 Hrs.]**
Beam – column jointed for ductile behaviors.
Multistory building with bracings & infills.

UNIT – IV **[09 Hrs.]**
Introduction to Diaphragm. Seismic design of floor diaphragm.

Text Books:
1. Agrawal P. & Shrikhande M., Earthquake Resistant Design of Structures, Prentice hall India, New Delhi, 4th Edition, 2007.
2. Verghese P.C., Advance Reinforced Concrete Design, Prentice hall of India, New Delhi, 2001
3. S.K. Duggal , Earthquake – Resistant Design of Structures , Oxford university Press second edition 2013

Reference Books:
1. Park, R. & Paulay, T., Reinforced Concrete Structures, John Willey & Sons; 2nd Edition, 1975
2. Paulay, T. & Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
4. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
5. Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

III Semester

CV2934	PE II: Composite Structures	L=3	T=0	P=0	CREDITS =3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the student knowledge of basic concepts and characteristics of Composite materials 2. To provide the student the knowledge of behavior of lamina 3. To provide the student with knowledge of various failure theories 4. To provide students the knowledge of analysis of laminated plates under bending and vibration.	1. An ability to understand basic concepts and characteristics of Composite materials. 2. An ability to understand elastic behavior of lamina. 3. An ability to understand various failure theories. 4. An ability to analyse laminated plates under Bending and vibration.

Unit I **[Hrs.]**

Introduction: definition, Classification and characteristics of Composite materials, advantages and limitations. Current Status and Future Prospects; Basic Concepts and characteristics: Homogeneity and Heterogeneity, Isotropy, Orthotropy and Anisotropy; Characteristics and configurations of lamina, laminate, micromechanics and macro-mechanics.

Unit II **[Hrs.]**

Constituent materials and properties; Elastic behavior of unidirectional lamina: Anisotropic, separately orthotropic and transversely isotropic materials, stress-strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, Strength of unidirectional lamina

Unit III **[Hrs.]**

Macro-mechanical failure theories- Maximum stress theory, maximum strain theory, Deviatoric strain energy theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu); Elastic Behavior of multidirectional laminates: Basic assumptions, Stress-strain relations, load deformation relations, symmetric and balanced laminates, laminate engineering properties.

Unit IV **[Hrs.]**

Bending and vibration of laminated plates: Governing equations, Deflection of simply supported rectangular symmetric angle-ply, specially orthotropic, anti-symmetric cross-ply laminates; Recent advances: Functionally graded materials, Smart materials.

Text / Reference Books:

1. R.M. Jones, Mechanics of Composite materials, Taylor and Francis, 1999.
2. M. Daniel and O. Ishai, Engineering mechanics of Composite materials, Oxford university press, 1999
3. P.K. Mallick, Fiber-reinforced Composites, Marcel Dekker Inc, 1988.
4. D. Hull and T.W. Clyne, An introduction to composite materials, Cambridge university press, Second Edition, 1996.
5. J.N. Reddy, Mechanics of laminated composite plates and shells-Theory and Analysis, CRC Press, BocaRaton, Second Edition, 2003.

III SEMESTER

CV2935	PE II: Bridge Engineering	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students clear and through understanding of various types of bridges and loadings. 2. To provide the students the knowledge of design philosophy for bridges and design of its components. 3. To provide the concept of earthquake behavior and design philosophy for retaining wall and abutments. 4. To provide the students a thorough understanding of IRC codes related to bridges.	1. An ability to identify the types of bridge to be used for various site and loading conditions. 2. An ability to analyze and design various types of bridges and its components. 3. An ability to draw RCC detailing and to prepare working drawing. 4. An ability to understand IRC codes related to bridges.

UNIT – I **[10 Hrs.]**
Types of bridge superstructure and introduction to their design, sub-structure, bearings, IRC / IRS Bridge loadings and other codal recommendations

UNIT – II **[09 Hrs.]**
Seismic design philosophy for Bridges, State of art modeling of bridges, Seismic Design of Substructures, Capacity design of substructures and ductile detailing, Seismic design of well and pile foundations.

UNIT – III **[10 Hrs.]**
Earthquake behavior and Design of retaining wall and Abutments, IS code recommendations.

UNIT – IV **[10 Hrs.]**
Design of Bearings (Free, Guided and Restrained). Introduction to long span bridges: cable stayed bridges and suspension bridges.

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Text Books:

1. N. Krishna Raju, Design of bridges, Oxford & IBH publishing Co. Ltd., New Delhi.
2. D. Johnson Victor, Essentials of bridge engineering, Oxford & IBH publishing Co. Ltd., New Delhi.
3. Jagdeesh R. and Jairam M., " Design of bridges", PHI Publication New Delhi, 2nd edition,

Reference Books

1. IRC: 5 -1970, Standard specifications and code of practice for road bridges, Sections I to V, Indian Roads Congress, New Delhi.
2. Chen, W.F. and Duan, L., Bridge Engineering Handbook, CRC Press, 1999
3. Indian railway standard code of practice for the design of steel or wrought iron bridge carrying rail, road or pedestrian traffic, Govt. of India, Ministry of Railways, 1962.
4. Hambly, E.C., Bridge deck behaviour, Chapman and Hall, London
5. O'Brien E.J. and Keogh D.L., Bridge deck analysis, E& FN Spon, New York

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III SEMESTER

CV2936	PE III: Plastic Analysis& Design of Steel Structure		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
15	15	10	60	100	3 hours	

COURSE OBJECTIVE	COURSE OUTCOMES
After completion of syllabus students will able to 1. Understand behavior of steel structural members beyond yield point, understand the theories of plastic analysis and will be able to design steel structures considering plastic design approaches	1. An ability to understand behavior of steel structure elements beyond yield point loading and basic concepts of plastic analysis. 2. An ability to understand techniques for estimation of collapse loads on steel structures 3. To understand the effects of axial and shear forces on plastic moment of resistance 4. To understand philosophies of plastic design of steel structural elements

UNIT I: **[07 Hrs.]**
Plastic behavior, review curves of structural steel, plastic moments, shape factors, load factors, plastic hinge, types of collapse, collapse mechanism, collapse load factor.

UNIT II: **[07 Hrs.]**
Upper and lower bound, uniqueness theorem, principle of virtual work, statical method, minimum and maximum theorems, step by step method.

UNIT III: **[06 Hrs.]**
Methods of release of restrains, load interaction diagrams, method of inequalities.

UNIT IV: **[06 Hrs.]**
Plastic Moment distribution applied to continuous beams & portal frames (Max. two bays single storey)

UNIT V: **[07 Hrs.]**
Effect of Axial force & Shear force on Plastic moment of resistance, Design of simply supported and continuous beams.

UNIT VI: **[06 Hrs.]**
Design of portal frames up to single storey – two bays. Minimum weight design.

Text Book:
1. Steel Skeleton, J. F. Baker, Volume II, Cambridge University Press 196
2. B.G. Neal – Plastic Method of Structural Analysis, Chapman & Hall

Reference Books:
1. "Limit state Design of Steel Structures", S K Duggal , McGraw Hill education, 2010
2. "Limit State Design of Steel Structures", Dr. M R Shiyekar, PHI Publication, 3rd Print
3. A.S. Arya and J.L. Ajmani – Design of Steel Structures, Nemchand& Bros., Roorke
4. Ramchandra – Design of Steel Structures Vol – II, Standard Book House, Delhi
5. L.S. Beedle – Plastic Design of Steel Frames, John Willey & Sons
6. Structural design in steel by SalwarAlamRaz New Age International Publishers 15/44
7. Steel Designers Manual – ELBS

General Reading Suggested:
1. Codes: IS: 800 - 2007 Code of Practice for General Construction in SteelHand books
2. SP: 6 (6) – 1972 Handbook for Structural Engineers: Application of plastic Theory in Design of Steel Structures
3. Handbook for Structural Engineers SP 6 (8) 1972 (Reaffirmed 1993) – Bureau of Indian Standards.
4. NPTEL
5. Teaching Resource for Structural Steel Design – INSDAG Kolkatta

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III SEMESTER

CV2937	PE III: Seismic Analysis and Design of Structures	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students clear and through understanding of the basic concepts of earthquake resistance design. 2. To provide the students clear and through understanding of analysis and design aspects of RCC and steel members subjected to earthquake loads. 3. To provide the students clear and through understanding of detailing of RCC and steel members for ductile behavior. 4. To provide the students clear and through understanding of various Indian codes related to earthquake engineering.	1. An ability to apply basic concepts Earthquake resistant design in construction industry. 2. An ability to identify, formulate and solve engineering problems pertaining to earthquake effects on structures. 3. An ability to understand IS codes related to static as well as dynamic analysis of high rise buildings. 4. An ability to design special structures subjected to more effective earthquake forces.

RCC Structures

[07 Hrs.]

UNIT - I
Review of IS 1893:2016 Part I , IS 13920:2015 Performance of RC buildings, behavior of RC buildings in past earthquakes, influence of unsymmetry, infill walls, foundations, soft story, confinement of concrete, and ductility.

[06 Hrs.]

UNIT - II
Capacity Design of RC Members, Design for Strong column & weak beam, Design of Beam-Column Joints.

[06 Hrs.]

UNIT - III
Shear wall with ductile detailing. Preliminary sizing and Modeling of RC Buildings, Ductility and factors affecting ductility of RC members.

Steel Structures

[06 Hrs.]

UNIT - IV
Performance of steel structures in past earthquakes, basics of Steel Design, introduction to plastic analysis and design, design philosophy for steel structures.

[07 Hrs.]

UNIT - V
Capacity design concept, Ductility of steel buildings, Seismic behavior of steel structures, Stability considerations.

[07 Hrs.]

UNIT - VI
Seismic Design and detailing of Moment Resistant Frames, Beams and Columns.

Text Books:

1. Agrawal P. & ,Shrikhande M., Earthquake Resistant Design of Structures, Prentice hall India, New Delhi, 4th Edition, 2007.
2. Agrawal P. &, Shrikhande M., Earthquake Resistant Design of Structures, PHI Publisher, New Delhi.
3. Bruneau, M.; Uang, C.M.; & Whittaker, A Ductile Design of Steel Structures McGraw Hill.
4. Mazzolani, F.M.; &Piluso Theory and Design of Seismic Resistant Steel Frames E&FN Spon

Reference Books:

1. Paulay, T. &Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
2. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
3. Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

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III Semester

CV2938	**PE III: Design of Industrial structures**	**L=3**	**T=0**	**P=0**	**CREDITS = 3**

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	**COURSE OUTCOMES**
1. To provide the students the knowledge of various aspects of industrial structures. 2. To provide the knowledge of analysis and design of large span structures. 3. To provide the knowledge of stability of silos and bunkers under dynamic loads. 4. To provide the knowledge of analysis and design of foundations for industrial structures	1. An ability to understand planning of industrial structures. 2. An ability to analyse large span structures. 3. An ability to understand stability of silos and bunkers under dynamic loads. 4. An ability to analyse and design foundations for industrial structures.

UNIT-I: **[10 Hrs.]**
PLANNING OF INDUSTRIAL STRUCTURES :
Classification of industries and local regulations - Factors affecting planning - General Aspects – Civil Engineering Aspects - Light and Ventilation

[09 Hrs.]
UNIT-II:
LARGE SPAN STRUCTURES IN INDUSTRIES
Cable roofs - Types of cable roofs - Analysis of a cable subjected to concentrated loads and uniformly distributed load, Complexities in the analysis of a cable roof, Overview of deep beams, Virrendel Girder, Castellated Girders - Introduction to earthquake forces.

[10 Hrs.]
UNIT-III
SILOS AND BUNKERS
Concept of Angle of Repose - Pressure distribution - Dynamic loads - Stability of bunkers – Foundations.

[10 Hrs.]
UNIT-IV:
FOUNDATIONS FOR INDUSTRIAL STRUCTURES
Machine foundations - General requirements - Design criteria - General analysis - Design of a block foundation for vertical compressor - Vibration Isolation - Foundations for Chimney and Microwave Towers.

Text books:
1. Srinivasula P. Hand Book of Machine Foundation Tata McGraw Hill Publications, New Delhi. First Edition, 2000
2. Ramchandra Design of Steel Structures Standard Book House, New Delhi Seventh Edition, 2000
3. Raghupati M. Design of Steel Structures Tata McGraw Hill Publication, Delhi First Edition, 2003
4. Dayaratnam P. Design of Steel Structures Wheelr's Publishers, Allahabad1995
5. AnandArya&Ajmani J. L. Design of Steel Structures Nemchand& Bros., Roorkee, U.P., IndiaForth Edition, 2004
6. Lambert F.W. The Theory & Practical Design of Bunkers The British Constructional Steelwork Association Ltd., London, UK2000

III Semester

CV2939	Project Phase I	L=0	T=0	P=12	CREDITS = 6

EVALUATION SCHEME					
MSE – I	**MSE – II**	**CA**	**ESE**	**TOTAL**	**ESE DURATION**
		100		**100**	

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students the academic environment to carry out literature survey of advanced topics in structural engineering 2. To motivate the students to use the modern tools and software. 3. To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	1. An ability to understand the advances in structural engineering. 2. An ability to understand the use of modern tools. 3. An ability to work independently and in a team for effective communication 4. An ability to understand the importance of lifelong learning.

Contents:

1. Literature review on current topic related to the structural engineering.
2. Preparation and presentation of progress seminars on topic selected for dissertation.
3. Submission of project report including introduction, literature review, objective and scope of investigation and pilot studies carried out during the semester.

IV SEMSTER

CV2940	Project Phase II	L=0	T=0	P=20	CREDITS = 10

EVALUATION SCHEME

MSE – I	MSE – II	CA	ESE	TOTAL	ESE DURATION
-----	-----	40	60	100	-----

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students the academic environment to carry out literature survey of advanced topics in structural engineering. 2. To provide the students the understanding of real world structural engineering problems and their solution. 3. To motivate the students to use the modern tools and software. 4. To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	1. An ability to understand the advances in structural engineering. 2. An ability to solve real world structural engineering problems. 3. An ability to understand the importance of lifelong learning and the use of modern tools. 4. An ability to work independently and in a team for effective communication.

Contents:

1. The of detailed study of a work including collection and analysis of data, determining solution, design, scientific research on topic selected for dissertation.
2. Preparation and presentation of progress seminars on topic selected for dissertation.
3. Submission of project report on the entire studies carried out during the semester

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

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SoE & Syllabus 2018-19

M. Tech. CAD / CAM

28 June 2018

Nagar Yuwak Shikshan Sanstha's

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(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. SCHEME OF EXAMINATION 2018-19

CAD / CAM

SN	Sem	Sub Code	Subject	T/P	Contact Hours				Credits	% Weightage				ESE Duration Hours
					L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
I SEMESTER														
1	1	ME2901	Stress Analysis	T	3	0	0	3	3	15	15	10	60	3
2	1	ME2902	Computer Integrated Manufacturing	T	3	0	0	3	3	15	15	10	60	3
3	**1**		**Professional Elective- I**	**T**	3	0	0	3	3	15	15	10	60	3
4	1	ME2907	Computer Graphics and Solid Modeling	T	3	0	0	3	3	15	15	10	60	3
5	1	ME2908	Lab: Computer Graphics and Solid Modeling	P	0	0	2	2	1			40	60	
6	1	ME2909	CNC Technologies	T	3	0	0	3	3	15	15	10	60	3
7	1	ME2910	Lab: CNC Technologies	P	0	0	2	2	1			40	60	
Total					**15**	**0**	**4**	**19**	**17**					

List of Professional Electives-I

1	ME2903	PE I: Project Engineering
1	ME2904	PE I: Tool Design
1	ME2905	PE I: Object Oriented Programmings
1	ME2906	PE I: Reliability Engineering

II SEMESTER														
1	2	ME2911	Robotics	T	3	0	0	3	3	15	15	10	60	3
2	2	ME2912	Modelling & Simulation	T	3	0	0	3	3	15	15	10	60	3
3	2	ME2913	Finite Element Method	T	3	0	0	3	3	15	15	10	60	3
4	2	ME2914	Lab: Finite Element Method	P	0	0	2	2	1			40	60	
5	2	ME2915	Artificial Intelligence	T	3	0	0	3	3	15	15	10	60	3
6	**2**		**Professional Elective-II**	**T**	3	0	0	3	3	15	15	10	60	3
7	2	ME2920	Seminar	P	0	0	2	2	1			100		
Total					**15**	**0**	**4**	**19**	**17**					

List of Professional Electives-II

2	ME2916	PE II: Product Data Management
2	ME2917	PE II: Mechatronics
2	ME2918	PE II: Machine Tool Design
2	ME2919	PE II: Plant Design

III SEMESTER														
1	3	ME2931	Product Design & Development	T	3	0	0	3	3	15	15	10	60	3
2	**3**		**Professional Elective - III**	**T**	3	0	0	3	3	15	15	10	60	3
3	3	ME2939	Project Phase -I	P	0	0	16	16	8			100		
Total					**6**	**0**	**16**	**22**	**14**					

List of Professional Electives-III

3	ME2932	PE III: Computational Fluid Dynamics
3	ME2933	PE III: Design Optimization Techniques
3	ME2934	PE III: Rapid Prototyping
3	ME2935	PE III: Design for Manufacturing and Assembly

IV SEMESTER														
1	4	ME2940	Project Phase-II	P	0	0	24	24	12			40	60	
Total					**0**	**0**	**24**	**24**	**12**					
Grand Total of Credits									**60**					

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I Semester

ME2901	Stress Analysis		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:

- To develop the student understands of the foundations of stress and strain.
- To develop students skills in analyzing two dimensional problems.
- To provide the student with knowledge stress & strain analysis

Unit-I

Two Dimensional Problems in. Cartesian Coordinate system -Fundamentals of stress & strain, stress-strain relationship, Elastic constant, plane stress, plane strain., differential equation of equilibrium Boundary conditions, Saint Venant's principle, compatibility equation, Airys stress function. Stress analysis of cantilever subjected to concentrated load at its end and simply supported beam subjected to uniformly distributed load.

[7hrs]

Unit-II

Two dimensional problem in polar coordinate systems -General equations of equilibrium in polar coordinate compatibility equation, stress distribution about symmetric. axis, stress analysis of cylinder subjected to internal & external pressure, Pure bending of curved beams, effect of hole on the stress distribution in plates, Stress analysis of rotating circular disk

[7hrs]

Unit-III

Two Dimensional Photoelasticity - Introduction to basic optics related to photo elasticity, stress optic law, plane & circular polariscope arrangements, effect of stressed model in plane & circular polariscope, Isoclinic & Isochromatics, stress trajectories, calibration of photo elastic material (determination of fringe constant). Various photoelastic materials and their properties, Casting of photoelastic models, Tardy's compensation technique, Separation techniques like, shear difference, oblique incidence & electrical analogy.

[8hrs]

Unit-IV

Introduction to 3-D photo elasticity -Phenomenon of Stress freezing, Method of stress freezing, slicing techniques, determination of material fringe constant at critical temperature. Scaling Model- Prototype relations. Birefringerent coating method - Reflection polariscope. Introduction to fringe sharpening & fringe multiplication.

[8hrs]

Unit V

Strain gage technique for stress & strain analysis -Introduction to electrical resistance strain gages, gage . factor, bridge circuit, bridge balance, output voltage of Wheatstone bridge, balancing of bridge, temperature compensation, various bridge configurations, bonding of strain gages to the specimen, determination of principle strains & stresses using strain rosettes. Environmental effects on performance of strain gages, Strain gages response to dynamic strains, Effect of lead wires. Introduction to Strain measurement on rotating components, Static & Dynamic Strain Measurement introduction to semiconductor gages, high temperature strain gages & self-temperature compensated gages. Introduction to Commercial strain indicators.

[8hrs]

Unit VI

Grid technique of strain analysis, Brittle coating method for stress & strain analysis, Moire fringe method for stress & strain analysis implementation, ACIS & DXF.

[7 hrs]

Suggested books:

1) Theory of Elasticity -S.P. Timoshenko
2) Experimental Stress Analysis -Dally & Riley
3) Experimental Stress Analysis -T.K. Ray
4) Experimental Stress Analysis -L.S. Srinath
5) Cook and Young, "Advanced Mechanics of Materials", Prentice Hall, 2nd edition (August 28, 1998).
6) Richard G Budynar, "Advanced strength and Applied stress analysis", McGraw Hill.
7) Boresi/Schmidt/Sidebottom, "Advanced Mechanics of Materials", Willey.
8) Timoshenko and Goodier, "Theory of elasticity", McGraw Hill, 1970.
9) Timoshenko, "Advance Strength of Materials", vol 1 & 2, CBS.
10) Den Hartog, "Advance Strength of Materials" McGrawHill, 1952.
11) Advanced strength of material – Timoshenko.
12) Photoelasticity vol I & II – M. M. Frocht.

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I Semester

ME2902	Computer Integrated Manufacturing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem related to CIM, introduction of Group Technology, Material handling systems and integrated process planning system and its components

UNIT 1 Concept and scope of CIM, components of CIM, benefits, limitations, selection criteria for CIM. **[7hrs]**

UNIT 2 Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT .cellular manufacturing system. **[7 hrs]**
Part families , classification and coding , Production flow analysis , Machine cell design , Benefits.

UNIT 3 Introduction & Components of FMS , Application work stations , Computer control and functions , selection criteria for FMS,Planning, scheduling and control of FMS , Scheduling , Knowledge based scheduling , Hierarchy of computer control , Supervisory computer Manufacturing data systems , data flow , CAD/CAM considerations , Planning FMS database, case studies on practical applications. **[8 hrs]**

UNIT 4 Automated material handling systems, AS/RS, general considerations , selection, evaluation and control . Inspection and Quality control, CAQC ,CMM types, working, applications. **[8 hrs]**

UNIT 5 Process Planning in the Manufacturing cycle , Process Planning and Production Planning Process Planning and Concurrent Engineering, CAPP, Variant process planning , Generative approach , Forward and Backward planning, Input format, **[8 hrs]**
Logical Design of a Process Planning , Implementation considerations ,manufacturing system components,

UNIT 6 Totally integrated process planning systems , An Overview , Modulus structure , Data Structure, operation , Report Generation, Expert process planning. **[7 hrs/]**
Agile manufacturing ,Introduction to ERP concept(SAP).

Books for Reference:

1. Nanua Singh,"Systems Approach to Computer Integrated Design and Manufacturing", John Wiley & Sons, 1996.
2. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
3. Jha, N.K., "Handbook of Flexible Manufacturing Systems", Academic Press Inc., 1991.
4. Burbidge, J.L. "Group Technology in Engineering Industry", Mechanical Engineering pub. London, 1979.
5. Askin, R.G. and Vakharia, A.J., "G.T Planning and Operation, in The automated factory-HandBook: Technology and Management", Cleland, D.I. and Bidananda, B (Eds), TAB Books, NY, 1991.
6. Irani, S.A. "Cellular Manufacturing Systems", Hand Book.
7. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), " Planning, design and analysis of cellular manufacturing systems" , Elsevier, 1995.
8. Gideon Halevi and Roland D. Weill, " Principles of Process Planning", A logical approach, Chapman & Hall, 1995.
9. Parashar BSN," Cellular Manufacturing" (PHI).
10. R.V.Rao, "Decision making in manufacturing".

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I Semester

ME2903	**PE I: Project Engineering**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

To understand the project identification, planning and execution techniques. To learn the designing and erection of steel structure. To plant layouts, cost estimations, material handling and design and selection of pumps, blocks, compressors, etc.

Unit 1 INTRODUCTION **[7 hrs]**
The nature of projects. Project Identification considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project.

Unit 2 PROJECT PLANNING **[7 hrs]**
Basic Scheduling, Critical Path. Scheduling under probabilistic durations, Time Cost tradeoffs, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion

Unit 3 DESIGN OF STEEL STRUCTURE **[8 hrs]**
Introduction to stability and buckling concepts; Structural steel and properties; Riveted, bolted and welded connections; Working stress and plastic design Methods.

Unit 4 DESIGN OF STEEL STRUCTURE **[8 hrs]**
Design of tension, compression and flexural members (including built-up members); Column bases; Roof trusses Specification and design of simple structural members;

Unit 5 PLANT DESIGN **[8hrs]**
Plant layout, Flow sheeting, Auxiliaries, Cost estimation, Selection and detailed design of equipments e.g Pumps, Blowers and compressors ,Mixers, etc.;

Unit 6 MATERIAL HANDLING SYSTEM DESIGN **[7 hrs]**

Materials handling equipments, offsite facilities, Selection and detailed design of equipments e.g Conveyors etc.

Reference Books:

- **Prasanna Chandra- Project Management**
- **Couper, Penny, Roy-Chemical Process Equipment (Selection and Design)**
- **Iger karasik- Pump Handbook**

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I Semester

ME2904	**PE I: Tool Design**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

To learn the mechanism of metal cutting and the design of metal cutting tools. Also to understand various presses working operations along with tools to dies design with the help of computer software.

Unit 1 **[8 Hrs]**

Theory of metal Cutting. Cutting tool materials, dynamics of metal cutting, Single point cutting tool, Merchant's Theory, Cutting power, Energy consideration in metal cutting, Tool life and dynamometry, Tool life criteria, variable affecting tool life, Machinability.

Unit 2 **[8 Hrs]**

Design of single Point Cutting Tool .Form tools- design of form tools. Design of milling cutters. Design of Gauges, Materials, heat treatments, Taylor's Principals of gauge design, design of limit gauges. Design of broaching and reamers.

Unit 3 **[10 Hrs]**

Press tool Design
Introduction, Press operations - Press working equipment - Classification, Rating of a press, Press tool Equipment, working of dies and their components.

Unit 4 **[10 Hrs]**

Bending Forming & Drawing dies Bending methods, Design Principles, Design consideration.

Unit 5 **[7 Hrs]**

Forging Die Design .Die design for machine forging Tools for flash trimming & hole piercing, materials & manufacture of forging dies. Mould Design.

Unit 6 **[10 Hrs]**

Design of jigs & fixture: - Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures. Drilling Jigs: - Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures, Automatic clamping Devices.

Books for reference:

1. Donaldson, "Tool design"
2. ASTME, "Fundamentals of Tool design"
3. Pollock, "Fundamentals of Tool design"
4. Grant, "Unconventional Clamping Systems"
5. Kempster, "Fundamentals of Tool design"

I Semester

ME2905	**PE I: Object Oriented Programmings**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

This engineering course focuses on detail study of various data structures used in computer environment. Also learning the concept of OOPs and programming for data structures using OOPs.

UNIT1 Review of basic Concepts of OOPs, objects, classes, polymorphism, inheritance, application in CAD/CAM codes **[7 hrs]**

UNIT 2 Introduction to data structures, abstract data types, array as an adt, using one-dimensional arrays, arrays as parameters, character string operations, multi-dimensional arrays, structures and classes. **[8 hrs]**

UNIT 3 Stack and its Application, Definition and Examples, Primitive Operations, Recursion, Fibonacci sequence, Binary Search, Recursive Chains, Recursive Definition of Algebraic Expressions **[8 hrs]**

UNIT 4 Queues and Lists, the queues representation insert operation, priority queue, array implementation of a priority queue, linked lists, inserting and removing nodes from a list, linked implementation of stacks, linked implementation of queues, linked list as a data structure, non integer and non homogeneous lists, dynamic and array implementation of lists, simulation using linked lists simulation process, data structures, other list structures, circular lists, doubly linked lists , multiple linked lists **[7 hrs]**

UNIT 5 Trees, Binary Trees Operations, Applications Representations of Binary Tree. Internal and External Nodes, Implicit Array Representation of Binary Trees, Choosing a Binary Tree Representation, Binary Tree Traversals, Heterogeneous Binary Trees, **[7 hrs]**

UNIT 6 Sorting, Efficiency Considerations, O Notation, Efficiency of Sorting, Exchange Sorts, Bubble sort, Quick sort, Selection and Tree Sorting, Straight Selection Sort, Binary Tree sorts, Heap sort, Insertion Sorts, Simple Insertion, Shell Sort,
searching, basic search techniques, algorithmic notation, sequential searching, reordering a list searching an ordered table, indexed sequential search, binary search, interpolation search, tree searching, inserting/deleting in a binary search tree **[7 hrs]**

Books for Reference:

1. Langsam Y., Augenstein M. J. And Tenenbaum A. M., "Data Structures Using C and C++", Prentice Hall of India Pvt. Ltd.
2. Trembly J. P. And Sorenson P. G., "An Introduction to Data Structures with Applications", Tata McGraw Hill Pub. Co. Ltd.
3. Horowitz E. And Sahani S., "Fundamentals of Computer Algorithms", Galgotia Publications Ltd.

I Semester

ME2906	**PE I: Reliability Engineering**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

Unit 1: Introduction to reliability- Reliability definition, Failure rate, hazard rate, Reliability function and their variation with respect to time, MTTF and its calculations for discrete data. Reliability analysis and its relation with other parameters like strength etc.
[8 Hrs]

Unit 2: Reliability analysis for continuous data. Probability density function, failure rate and derivation of Reliability for various types of failures like constant failure rate, logarithmic failure rate in increasing/ decreasing failure rate etc. and there physical significance
[8 Hrs]

Unit 3: System Reliability series parallel and mixed configuration, system Reliability for complex systems using various tech. like successful path method, composite method etc. Redundancy, various types, parallel operations.
[7 Hrs]

Unit4: Reliability allocation and improvement, life cycle estimation, fault tree analysis, FMEA, FMECA etc,
[8 Hrs]

Unit 5: Reliability testing, accelerated life testing, sequential testing.
[7 Hrs]

Unit 6 : Reliability availability, maintainability, maintainability improvement, Reliability economics.
[7 Hrs]

Suggested Books:-

1. Introduction to Reliability Engineering by E.E.lewis and John wiley and sons
2. Reliability Engineering by L.S. Srinath
3. Reliability and engineering systems by L. Ryabinir
4. Practical Reliability Engineering by Patric Dtoconnor

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I Semester

ME2907	Computer Graphics And Solid Modeling		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To educate the students on main concepts of computer aided design, representation of curves, surface and solids.

UNIT-I: CAD TOOLS

Definition of CAD Tools, Types of system CAD/CAM system evaluation Criteria, functional areas of CAD, Modeling and viewing, efficient use of CAD software.

Wire frame modeling -Types of mathematical representation of curves, wire frame models, wire frame entities, parametric representation of analytical and synthetic curves – Hermite cubic splines, Bezier curves, B-Splines, rational curves-NURBS.

[8hrs]

UNIT-II: SURFACE MODELING

Mathematical representation of surfaces, Surface model, Surface entities, surface representation, parametric representation of surfaces, plane surface, ruled surface, surface of revolution, Tabulated surface.

[7hrs]

UNIT-III: PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES

Hermite Bicubic surface, Bezier surface, B-Spline surface, COONs surface, Blending surface, Sculptured surface, Surface manipulation - Displaying, Segmentation, Trimming, Intersection, Transformations - 2D and 3D, Orthogonal and Perspective transformations.

[9hrs]

UNIT-IV: SOLID MODELLING

Solid Representation - Boundary Representation (B-rep), Constructive Solid Geometry (CSG) and other methods, Design Applications: Introduction to Feature based and Assembly modelling.

[7hrs]

UNIT V:ADVANCED MODELING CONCEPTS

Feature Based Modeling, Assembly Modeling, Behavioral Modeling, Conceptual Design & Top-down Design. Techniques for visual realism – hidden line – Surface removal – Algorithms for shading and Rendering. Parametric and variational modeling, Feature recognition, Design by features, Assembly and Tolerance Modeling, Tolerance representation – specification, analysis and synthesis, AI in Design.

[8hrs]

UNIT VI: CAD/CAM DATA EXCHANGE

Evaluation of data- exchange formats, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.

[6 hrs]

Text books:

1	CAD/CAM, Theory & Practice	1st Edition (1991)	Ibrahim Zeid	McGraw-Hill
2	Procedural elements for computer Graphics	1st Edition (1998)	D Rogers	WCB/McGraw-Hill
3	Introduction to Finite Elements in Engineering	2nd Edition (2002)	Chandrupatla&Belegundu A.D	Prentice Hall
4	Optimization for Engineering Design	1st Edition (2005)	Kalyanmoy Deb	Prentice Hall
5	P. N. Rao,	-	CAD/CAM	McGraw Hill
6	Martenson, E. Micheal	1995	Geometric Modelling	John Wiley & Sons
7	P. Radhakrishnan, S. Subramanyam		CAD/CAM/CIM	New Age International

Reference books:

1	Computer Graphics	McGraw-Hill	Hearn D. & Baker M.P	Prentice Hall
2	Computer Graphics	2nd Edition (1987)	S. Harrington	Mcgraw-hill Professional
3	Mathematical Elements for Computer Graphics	1st Edition (1990)	RoggersDravid F., Adams J. Alan	McGraw-Hill
4	Theory & Problems of Computer Graphics	1st Edition (1986)	Roy A. Plastock, Gordon Kalley	McGraw-Hill
5	V. Ramamurti	1992	Computer Aided Mechanical Design and Analysis	Tata Mc Graw Hill-

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I Semester

ME2908	**LAB : Computer Graphics and Solid Modeling**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	--	**--**	**40**	**60**	**100**	

List of Practical

1) Introduction to CAD softwares.
2) Generation of at least two simple solid models showing geometric properties using any CAD software.
3) To generate at least two simple assembly model using any CAD software
4) Simulate assemble model using any CAD software
5) Programs on 2 D transformations – scaling, rotation, reflection, translation

I Semester

ME2909	**CNC Technologies**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines their components, functions, functions, programming and applications and integration of machines with the computers , PLC , machine control through computers, data acquisition.

UNIT 1 **Introduction** to Numerical control. Development of NC system. Concepts of NC, CNC, DNC. Classification of CNC machines, Machine configurations, Advantagges and limitations. . **[6 hrs]**

UNIT 2 **Constructional Features of CNC Machines**: Structure, Drive Mechanism, gearbox, Main drive, feed drive, Spindle Motors, Axes motors. Timing belts and pulleys, Spindle bearing, Arrangement and installation. Slide ways. Re - circulating ballscrews, Backlash measurement and compensation, linear motion guide ways. Tool magazines, ATC, APC, Chip conveyors **[6 hrs]**

UNIT 3 **Control Systems, Feed Back Devices and Tooling** **[9 hrs]**
Description of a simple CNC control system. Types of control, CNC controller's characteristics, Interpolation systems. Incremental and absolute rotary encoders, linear scale – resolver – Linear inductosyn – Magnetic Sensors for Spindle Orientation. Carbide inserts classification, qualified; semi qualified and preset tooling , Principles of location, Principles of clamping–Workholdingdevices.

UNIT4 **Programming CNC machines**, Part print analysis and Process planning,. APT part programming using CAD/CAM, Parametric Programming. Manual part programming for CNC turning, milling and machining center.. Computer assisted part programming techniques, Conversational and Graphics based software, Solids based part programming. Freeform surface machining. Simulation and Verification of CNC programs, **[8 hrs]**

UNIT 5 **Advanced Programming features**, Canned cycles, Subroutines, Macros, special cycles etc for CNC lathe and milling machines. **[8hrs]**

UNIT 6 Adaptive CNC control techniques, types and benefits. Integration of CNC machines for CIM. Introduction to multiaxes CNC machines. **[8 hrs]**
Case studies of completed jobs.

Books Recommended::

1. Krar, S., and Gill, A., "CNC Technology and Programming", McGraw Hill publ Co, 1990.
2. Gibbs, D., "An Introduction to CNC Machining", Casell, 1987.
3. Seames, W.S., "Computer Numerical Control Concepts and Programming", Delmar Publishers, 1986.
4. Lynch, M., "Computer Numerical Control for Machining", McGraw Hill, 1992.
5. Koren Y, "Computer Control of Manufacturing Systems", McGraw, 1986.
6. Fu K.S., Gonzalez R.C., and Lee C.S.G.," Robotics control, sensing, vision, and intelligence", McGraw-Hill Book Co., 1987.
7. Klafter R.D., Chmielewski T.A. and Negin M.," Robot Engineering An Intergrated approach", Prentice Hall of India, New Delhi, 1994.
8. Craig J.J., "Introduction to Robotics Mechanics and Control", Addison-Wesley, 1999.

Reference Books:

- Richard D. Klafter , Thomas A. Chemielewski, Michael Negin, Robotic Engineering : An Integrated Approach , Prentice Hall India, 2002.

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I Semester

ME2910	**LAB : CNC Technologies**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	0	**0**	**40**	**60**	**100**	**3 Hrs**

LIST OF PRACTICALS:

1. Study of Automation through development in machines.
2. Numerical control – Fundamental & Application.
3. Manual Part Programming.
4. APT Part Programming.
5. CNC- Lathe – Features, Specification,
6. CNC Lathe – Programming , Simulation & Actual Machining of Part.
   (Facing , Turning , Multiple turning cycles, etc.)
7. CNC Lathe – Programming , Simulation & Actual Machining of Part.
   (Advance programming like Thread Cutting , Grooving etc.)
8. CNC- Milling – Features, Specification,
9. CNC Milling – Programming , Simulation & Actual Machining of Part.
   (Profile Cutting , Various Interpolation , etc.)
10. CNC Milling – Programming , Simulation & Actual Machining of Part.
    (Advanced programming like Pocketing , Mirroring, etc.)

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II Semester

ME2911	**Robotics**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

To understand Robots, their components, functions, functions, programming and applications.

UNIT 1 Robotics, Basic concepts, Robot configurations, Basic robot motions, Types of drives, End effectors, Classification, Mechanical, Magnetic, Vacuum, and Adhesive, Drive systems, Force analysis and Gripper design **[7 hrs]**

UNIT 2 Manipulator Kinematics Transformation matrices and their arithmetic, link and joint description, Denavit-Hartenberg parameters, frame assignment to links, solvability, algebraic and geometrical methods, Velocities and Static forces in manipulators Motion of the manipulator links, Jacobians, singularities, static forces, Jacobian in force domain. **[9 hrs]**
Robot Applications :-Spray Painting
- Assembly
- Welding
- Material Handling
- Processing etc

UNIT 3 Manipulator Dynamics Iterative Newton-Euler dynamic formulation, structure of the manipulator dynamic equations, introduction to the Lagrangian formulation and generalized D'Alembert's equations of motion, Trajectory Generation Considerations in path description and generation, joint space schemes, paths with via points, Cartesian space schemes, geometrical problems with Cartesian paths **[6 hrs]**

UNIT 4 Manipulator Control: Introduction to closed loop control, second order linear systems and their control, control law partitioning, trajectory-following control, modeling and control of a single joint. Introduction to non-linear control, non-linear and time-varying systems, the control problem of manipulators, practical considerations, present industrial robot control systems, introduction to force control, brief introduction to robot actuators, need for sensors and vision system in the working and control of a robot, **[8 hrs]**

UNIT 5 Programming: Methods of robot programming, lead through programming, motion interpolation, branching capabilities, WAIT, SIGNAL and DELAY commands, subroutines, RAIL and VAL II programming languages **[8 hrs]**

UNIT 6 Sensory devices, Non optical and optical position sensors , Velocity and Acceleration , Range , Proximity , touch , Slip , Force ,Torque. **[7 hrs]**
Machine vision , Image components , Representation , Hardware , Picture coding , Object recognition and categorization
Integration of Robots with CNC machines for CIM.

Books for Reference:

1. Fu K.S., Gonzalez R.C., and Lee C.S.G.," Robotics control, sensing, vision, and intelligence", McGraw-Hill Book Co., 1987.
2. Klafter R.D., Chmielewski T.A. and Negin M.," Robot Engineering An Intergrated approach", Prentice Hall of India, New Delhi, 1994.
Deb S.R., "Robotics Technology and Flexible Automation", Tata McGraw-HillPublishing Co.,Ltd., 1994.
4. Craig J.J., "Introduction to Robotics Mechanics and Control", Addison-Wesley, 1999.
5. L. Sciavicco, B. Siciliano "Modelling and control of robot manipulators", The McGraw-Hill Co. Inc., 1996.
6. R.J. Schillin, "Fundamentals of Robotics: Analysis and Control", Prentice Hall.
7. K.S. Fu, R.C. Gonzales, C.S.G. Lee, "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill,1987.
8. Groover, "Industrial Robotics: Technology, Programming and Applications", McGraw Hill, 1986.
9. R. K. Mittal – Fundamentals of robotics, PHI.

Tutorials
1) Numericals on kinematics and dynamics using MatLab.

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II Semester

ME2912	**Modeling and Simulation**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES
The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various modeling techniques leading to complete understanding and simulation the processes including its optimization is envisaged in this course. Students are able to design the electronic and informatic means to implement them on control systems.

Unit 1 Introduction to mathematical modeling, Need, Advantages, Limitations, Disadvantages & Applicable to mechanical, manufacturing, process, Automotive, Electrical & Control System, Software tools available for modeling [Matlab-Simulink, AutoLISP, ADAMS/Pro-Mechanica/ Visual Nastran/Working Model 4D, MathCAD/Mathematica, Lab View and computer languages [C/C++/Fortran/AutoLISP/ Simula /SIMSCRIPT/GASP/GPSS] for mathematical modelling **[7 hrs]**

UNIT 2 Introduction to automatic controls. Modeling of general second order system(mechanical systems [spring, mass, damper], flow, heat transfer and electrical, pneumatic and vibration systems). Block diagram and transfer function, Modeling of continuous system, Extraction of reduced order models. Transient and frequency response evaluation using Laplace transform, Control loop and its elements, Dynamic behaviour of first, second and higher order physical systems. Linearization of non-linear systems. Controller hardware, sensors, transmitters and control valves **[7 hrs]**

UNIT 3 Characteristics of hydraulic controller, pneumatic, electronic controller, electro hydraulic and electro-pneumatic controllers, PID control, Stability, Gain and phase margins, Control system design using root and compensation **[8 hrs]**

UNIT 4 Simulation Introduction, Advantages, Limitations, Disadvantages, Concept of System, Process, Activity, Attributes, Closed & Open System, Activities: Deterministic & Stochastic, Models: Static, Dynamic, Transient, Simulation Approaches: Event Scheduling, Process Interaction, Activity Scanning, Steps in Simulation Study **[8 hrs]**

UNIT 5 Instrumentation and Process Control-Introduction, Study of various measuring parameters of a process/system and Measuring instruments for: Temperature, pressure, level, flow, Control schemes with applications to Machine tool, Boiler, Engine Governing, Aerospace, Active vibration control, Manufacturing, Process control, etc. **[8 hrs]**

UNIT 6 Application to Control panel modeling, Virtual Instrumentations using Lab View, Auto-tuning, Sequence control, Logic diagram, Introduction to digital control, Implementation using computer language /software, Introduction to control of MIMO systems, State Space modeling **[7 hrs]**

Text Books:

1. S.R Bhonsale, K.J., "Mathematical modeling for design of machine components", Weinmann, 1999, Prentice Hall.
2. A.F. D'souza V K Gar, "Englewood Cliffs Advanced Dynamics: Modelling and Analysis," N. J., Prentice Hall, 1984
3. Averal M. Law, W. David Kelton, "Simulation, Modelling and analysis", McGraw Hill, 1992.

Reference Books:

1. Reference manuals: Matlab- Simulink/AutoLISP/ADAMS/Pro-Mechanica/VisualNastran/WorkingModel 4D/ MathCAD/Mathematica, Lab View.
2. Mathematical modeling for design of machine components, S.R Bhonsale, K.J. Weinmann, 1999, Prentice Hall.
3. Advanced Dynamics: Modelling and Analysis, A.F. D'souza V K Gar, Englewood Cliffs, N. J., Prentice Hall, 1984
4. Simulation, Modelling and analysis, Averal M. Law, W. David Kelton, McGraw Hill, 1992.
5. Jean Ulrich, Thoma, "Modelling and Simulation in Thermal and Chemical Engineering: a bond graph approach", Springer, 2000, ISBN 3540663886
6. Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice", Wiley-Interscience, 1998, ISBN: 0471134031
7. Christopher A. Chung, "Simulation Modeling Handbook: a practical approach", CRC,2003, ISBN: 0849312418
8. Averill Law, W. David Kelton, "Simulation Modeling and Analysis (Industrial Engineering and Management Science Series) ", McGraw-Hill Inc, 1999, ISBN: 0070592926
9. Philip J. Thomas, "Simulation of Industrial Processes for Control Engineers", Butter worth-Heinemann 1999,ISBN: 0750641614
10. Sheldon M. Ross, "Simulation", Academic Press, 2001, ISBN: 0125980531
11. John Montgomery, Vjekoslav Damic, "Mechatronics by Bondgraphs ", Springer, ISBN: 3540423753
12. Bernard P. Zeigler, Tag Gon Kim, Herbert Praehofer, "Theory of Modeling and Simulation"Academic Press, 2000, ISBN: 0127784551
13. Nicholas M. Karayanakis , "Advanced System Modelling and Simulation with Block Diagram Languages", CRC 1995, ISBN: 0849394791
14. Giancarlo Genta, "Motor Vehicle Dynamics: Modeling and Simulation (Series on Advances in Mathematics for Applied Sciences)",Publisher: World Scientific Publishing Company 1997, ISBN: 9810229119
15. Damian Flynn, "Thermal Power Plant Simulation and Control",Institution Electrical Engineers 2003, ISBN: 0852964196
16. Ian Cameron, K. M. Hangos, Katalin Hangos, "Process Modelling and Model Analysis (Process Systems Engineering) Elsevier Limited, 2006, ISBN: 0121569314
17. Reinhold von Schwerin , "MultiBody System SIMulation: Numerical Methods, Algorithms, and Software",Springer2005,ISBN: 1402033923

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II Semester

ME2913	Finite Element Method	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

OBJECTIVES

FEM a numerical technique will be useful subject for the students in finding approximate solutions of partial differential equations as well as of integral equations. FEM allows detailed visualization of where structures bend or twist, and indicates the distribution of stresses and displacements. FEM software provides a wide range of simulation options for controlling the complexity of both modeling and analysis of a system. Similarly, the desired level of accuracy required and associated computational time requirements can be managed simultaneously to address most engineering applications. FEM allows entire designs to be constructed, refined, and optimized before the design is manufactured.

UNIT 1 Fundamentals of stress & strain, stress & strain components, stress strain relationship, Elastic constants, plane stress, plane strain., differential equation of equilibrium, compatibility equations, boundary conditions, Saint Venant's principle, Airy's stress function. **[7Hrs]**

UNIT 2 Fundamental concepts of FEM -' Historical background, Scope of FEM in Engg.Applications, Principle of minimum potential energy. Concept of Virtual work. Variational method. FEM analysis procedure. Mathematical understanding required for FEM, Matrix algebra & operations, Eigen values & Eigen vectors. Methods for solution of simultaneous equations. like Gauss elimination. Matrix decomposition method.
Concept of discritization of body into elements. Degrees of freedom, bandwidth, and Basic types of 2-D & 3-D elements, displacement models, convergence requirements, shape function. Commercial FE Software's. **[7Hrs]**

UNIT 3 Finite element modeling & analysis using Bar & Beam element -stiffness matrix, assembly, boundary conditions, load vector, temperature effects.
Two dimensional plane 'b11ss -Local & Global coordinate system, element stiffness matrix, assembly, boundary conditions, load vector, force & stress calculations. **[8Hrs]**

UNIT 4 Two dimensional problems using CST & LST -formulation of CST & LST elements, elemental stiffness matrix, assembly, boundary conditions, load vector. Stress calculation. Temperature effect.
Axi-symmetric solids subjected to axi-symmetric loading -axi-symmetric formulation using CST ring, element, stiffness matrix, boundary conditions, load vector, calculation of stresses. **[8Hrs]**

UNIT 5 Introduction to Isopearametric & Higher order elements. Introduction to Numerical Integration. Introduction to dynamic analysis, formulation of mass matrix for one-dimensional bar element, free vibration analysis using one-dimensional bar element. Torsion of prismatic bars using triangular elements **[7Hrs]**

UNIT 6 Steady state one dimensional & two dimensional heat conduction problems using I-D and triangular element respectively. Programming aspects of FEM -Algorithms for, reading Finite Element modeling data, formation of elemental stiffness matrix, and formation of elemental load vector. assembly of individual elemental spiffiness matrix into global' stiffness' matrix, assembly of individual elemental load vector into global load vector, application of boundary .conditions, solution of equations, determination of stresses and strains. Pre & Post processing in FEA. **[8Hrs]**

Suggested books

1) Introduction to Finite Elements in Engineering -T.R. Chandrupatla & AD. Belegundu .
2) Finite Element Analysis for engineering-T.R.Chandrupatla.
3) Theory of Elasticity -S.P. Timoshenko
4) Concept and applications of Finite element Analysis -RD. Cook
5) The Finite Element Method -A basic introduction for engineers -D. W. Griffiths, D.A Nethercot – Granada Publishing
6) Finite element methods – Krishnamurthy & Desai
7) Finite element methods – Zeinkeiwiz
8) Finite element methods – J. N. Reddy
9) Finite element methods – Finite to Infinite series

Tutorials

1) C – programming for stress analysis of elements to be carried out.
2) Comparison of a)Analytical result b) C- programming result and c) result due to Ansys to be made.

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II Semester

ME2914	**LAB: Finite Element Method**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
			40	**60**	**100**	

List of Practical :
Students should use the commercial software or programmes from the text-books or self developed programs, to verify the results obtained by manual calculations. The input data and output results of the problem solved using the computer programs should be included in the Journal.

1) Any two problem using bar element
2) Any two problems using truss element
3) Any two problems using CST element
4) Any one problem using axisyrmnetric element
5) Any one problem of free vibration analysis using bar element
6) Any one problem of Torsion of Prismatic bars.
7) Any one problem on Steady State Heat conduction.

II Semester

ME2915	**Artificial Intelligence**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

To learn about the automation of machines tools making the system intelligent. Understanding the different techniques used for implementation of artificial intelligence.

Unit 1 Human and machine intelligence, Artificial Intelligence (AI), Programming in AI environment,. Natural Language processing (NLP), Need of AI. **[7hrs]**

UNIT 2 Architecture of an Expert system, Knowledge base, inference engine forward and backward chaining, use of probability and fuzzy logic. Selection of inference mechanism, (Relevant case studies) **[8 hrs]**

UNIT 3 Neural Network and application artificial neural network models, NN applications in Cellular manufacturing and other areas of mechanical Engg..(Relevant case studies) **[8 hrs]**

UNIT 4 Introduction to Rule Based System. Conflict Resolution Advantages and Drawbacks of Rule Based Systems Clausal Form Logic, Rule Base Verification, Refinement and Validation.
Creating Knowledge Base, Knowledge Engineer and Domain Expert, Phases of Knowledge Engineering, Tools for Knowledge Engineering. **[7 hrs]**

UNIT 5 Fundamentals of OOP (Object oriented programming), creating structures and objects, object operations, invoking procedures, programming applications, Object oriented expert systems.
Semantic nets, structure and objects, ruled systems for semantic nets, certainty factors, automated. **[7 hrs]**

UNIT 6 Relevant case studies. **[8 hrs]**

Books for Reference:

- Addis, T.R., "Designing Knowledge Based System", Prentice Hall, 1985.
- Rolston, D.W., "Principles of Artificial Intelligence and Expert Systems Development", McGraw Hill, 1988.
- Maus, R. and Keyes, J., "Handbook of Expert Systems in Manufacturing", McGraw Hill, 1991
- Robert Levine, "A comprehensive guide to artificial intelligence and expert systems",Elain Rich ,"Artificial Intelligence",
- Sasikumar, Ramani, et al ,"Rule based expert systems".
- Graham Winstanley, "Program Design for Knowledge Based Systems", Galgotia Publications.
- Artificial Neural Networks", Zurada
- V.B. Rao and H.V. Rao, "C++ : Neural Networks and Fuzzy Logic", BPB Publications.

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II Semester

ME2916	**PE II: Product Data Management**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES
This engineering course focuses on understanding the structure of database, design of database, different types of database and query languages and constraints and pitfalls in database design .Also provides the learning of Expert Database Architectures; Semantic Data Models,Decision-Support Systems and databases for product design and other CAD/CAM applications.

Unit 1 Purpose of Database Systems; View of Data; Data Models; Database Languages; Database Users; Overall System Structure **[7hrs]**

UNIT 2 Design Issues; Mapping Constraints; Keys; Entity-Relationship Diagram; Weak Entity Sets; Extended E-R Features; Design of an E-R Database Schema; **[8 hrs]**

UNIT 3 Structure of Relational Databases; The Relational Algebra; The Tupple Relational Calculus; The Domain Relational Calculus; Extended Relational Algebra Operations; Modifications of the Database; Views
Basic Structure; Set Operations; Aggregate Functions; Null Values; Nested Sub queries; Derived Relations; Views; Modification of the Database; Joined Relations; Data-Definition Language; Other Relational Languages - Query-by-Example; Quel; Datalog; Views **[8 hrs]**

UNIT 4 Domain Constraints; Referential Integrity; Assertions; Triggers; Functional Dependencies Views
Pitfalls in Relational-Database Design; Decomposition; Normalization Using Functional Dependencies; Views **[7 hrs]**

UNIT 5 New Database Applications; The Object-Oriented Data Model; Object-Oriented Languages; Persistent Programming Languages; Persistent C++ Systems; Object-Relational Databases Views: Indexing and Hashing Ordered Indices
Centralized Systems; Client-Server Systems; Parallel Systems; Distributed Systems; Network Types; Parallel Databases; Distributed Databases; Security and Integrity; Standardization Views **[7 hrs]**

UNIT 6 Expert Database Architectures; Semantic Data Models; Views
Decision-Support Systems; Data Analysis; Data Warehousing; Spatial and Geographic Databases; Multimedia Databases; Mobility and Personal Databases; Information-
Product Design Databases; CAD-CAM Data Management Requirements; Databases for Shop floor control and Factory information system; Enterprise Resource Planning; Database requirements of Computer Integrated Manufacturing Views:
Assignment for hands on experience on computer using any commercial database for different applications to be given. The assignment to be given in the groups. **[7 hrs]**

Books for Reference:

1. Abraham Silberschatz, Henry F. Korth, S.Sudarshan, "Database System Concepts", McGraw Hill International Editions, Third Edition
2. P. Beynon-Davies, "Expert Database Systems – A Gentle Introduction", McGraw Hill International; 1991
3. James Martin ,"Database Management Systems",
4. Mark Swank and Drew Kittel , "Worldwide Web - Database Developer's Guide"
5. Fredrick H.Jones and Lloyd Martin "The AutoCAD Database Book - Accessing and Managing CAD Drawing Information"; Galgotia Publications, Third Edition.

II Semester

ME2917	**PE II: Mechatronics**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

Develop the ability to understand the working of various electronically and computer control devices. This will help to bridge the existing gap between machines, Automation and Computer control system

Unit 1 Introduction to Mechatronics. Components of mechatronics system. Signal Conditioning Process, Operational Amplifier, Data Acquisition Systems.

[7 hrs]

Unit 2 Introduction, sensors, actuators, modeling of systems. Recent trend of designing machine units along with electronic circuits for operation and supervision of mechanisms. Actuators, Sensors and Transducers: Hydraulic, pneumatic and electrical actuators and their system modeling, performance terminology, system modeling of sensors; displacement, position and proximity sensors, velocity and acceleration sensors, flow sensors, force sensors, temperature sensors, ultrasonic and fiber-optic sensors, selection of sensor, piezo-electric sensors Techniques of interfacing mechanical devices with computer hardware

[7 hrs]

Unit 3 Basic principles ,working and specific applications of armature and field controlled D.C. Motors, Variable voltage and variable frequency control of 3 phase and single phase Induction motors, speed control of synchronous motors, Different types of stepper motors-Constriction ,working and application. Position control of stepper motors.

[8 hrs]

Unit 4 Comparison between microprocessor and microcontroller, organization of microcontroller system, architecture of controller, pin diagram of 8051, addressing modes, programming of 8051, interfacing input and output devices, interfacing D/A converters and A/D converters, Various applications for automation and control purpose.

[7 hrs]

Unit 5 Programmable Logic Controller: Review of logic gates, basic structure, features, input/output processing, programming, functional block diagram (FBD), ladder diagram, logic functions, latching, sequencing, jumps, internal relays, counters, shift registers, master and jump control, data handling, data movement, data comparison, arithmetic operations, code conversion, analog input and output, applications for automation, diagnostics and condition monitoring.

[8 hrs]

Unit 6 General philosophy of Artificial Neural Network simulations, Fuzzy logic for operation and control of mechatronic systems. Study of systems used in Ink Jet Printers, Photo copying, Washing Machines, IC Engine fuel injection system etc

[7 hrs]

Text books:

S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Introduction to Mechatronics and Measurement Systems	2007	Michael B.Histand and David G. Alciatore	Tata McGraw-Hill Education
2	Mechatronics	2007	Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ.,	Chapman and Hall, 1991
3	Microprocessor Architecture, Programming and Applications	2002	Ramesh.S, Gaonkar	Prentice Hall
4	Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics	1996	Lawrence J.Kamm	John Wiley and Sons
5	Introduction to Microprocessors for Engineers and Scientists	2004,	Ghosh, P.K. and Sridhar	PHI Learning Pvt. Ltd.

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II Semester

ME2918	**PE II: Machine Tool Design**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles. This subject deals with the basic structure of machine tools , its design and design of gear box, guides , and other machine tool elements.

Unit 1: Machine Tools **(8 Hrs.)**
Introduction, classification, general requirements, characteristics, technical and economical prerequisites for machine tool design, machine tool design process, machine tool layout, motion in machine tool, machine tool drives, hydraulic and mechanical drives, types and elements, individual and group drives, devices for intermittent motion, reversing and differential mechanism, selection of electric motor.

Unit 2: Regulation of Speed and Feed Rates: **(8 hrs.)**
Aim of speed and feed regulations, stepped regulations of speed-Various laws of step regulation, Selection of range ratio, Standard value of Geometric progression ratio and guidelines for selection proper values, Breakup of speed steps, Structure diagrams and its analysis, Classification of speed and feed boxes, design of feed box, machine tool drives using multiple speed motors, Special cases of gear box Design speed box with Overlapping speed steps, Speed box with combine structure, Speed box with Broken geometric progression, electromechanical system of regulation, Friction, Pressure and Ball Variations, Epicyclic Drive.

Unit 3: Design of machine Tool Structure: **(8 Hrs.)**
Function and requirement of machine tool structure, design criteria from strength and stiffness consideration, concept of unit rigidity, unit strength under bending for material of machine tool structures, compare steel and cast iron on the basis of material properties, manufacturing problems and economy, role of static and dynamic stiffness in design of elements of machine tools, profiles of machine tool structures, factors affecting stiffness of machine tool structures.

Unit 4: **Design of Guideway and Power Screws**: **(8 hrs.)**
Function and types of Guideways, types of slideways and antifriction ways, functional features of slides ways, its shapes and materials, methods of adjusting clearance, design criteria (wear resistance and stiffness) and calculations for slideways operating under semi liquid friction condition, stick slip phenomenon affects accuracy of setting and working motions, comparision of design and stiffness of hydrodynamic, hydrostatic and aerostatics slide ways, design of antifriction Guideways, concept of combination of Guideways, Design of sliding friction power screw for wear resistance, strength, stiffness and buckling stability, design of rolling friction power screw for strength under static loading.

Unit 5 : Design of Spindle: **(7hrs.)**
Function and requirements of spindle units, their materials, effect of machine tool compliance on machining accuracy, design of spindles for bending stiffness: deflection of spindle axis due to a) bending b) compliance of spindle supports c) compliance of tapered joints, optimum spacing between spindle supports permissible deflection and design for stiffness: additional check for strength like additional supports, location of bearings and drive elements, balancing.

Unit 6 : **Design of spindle supports:** **(7hrs.)**
Requirements of spindle supports, features of antifriction bearings, load bearing abilities of ball and roller bearing. Parameters which access the violability of combinations of roller and ball and roller bearings in spindle units. Preloading of antifriction bearing and its method design of sliding bearing: sleeve, hydrodynamic journal, hydrostatic journal, air lubricated (aerodynamic, aerostatic)

Text Books:

I) Machine Tool Design -N. K. Mehata TMH
2) Principles of Machine Tools –Gopal Chandra Sen , Amitabh Bhattacharya New central book agency
3) Machine Tool Design -Basu, Pal Oxford IBH
4) Technology of Machine Tool by Steve F. Krar Indian Edition 2013 (Mc-Graw Hill)

Reference Books:
All about Machine Tool – by Henrich Gerling (New Edge Publication)

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II Semester

ME2919	**PE II: Plant Design**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

To learn the design consideration and methodology of various equipment used in plants like pressure vessels and its foundation, storage tanks, heat exchangers etc. To learn about the components and design of piping systems.

Unit 1 Pressure Vessel Design **[7 Hrs]**

Introduction to Pressure Vessels: Fired & Un-fired vessels. Vessel Mechanics & Design considerations: Thick/Thin shells -cylindrical, spherical & different types of end-covers. Design of a typical pressure vessel using industrial Software.

UNIT 2 Shell and Mounting Design **[8 Hrs]**

Design of spherical/ cylindrical shells and heads/ closures for cylindrical shells under internal and external pressure;
Design of a self- supporting tall vertical cylindrical vessel under wind/ seismic loading; Design of RCC foundation for a tall vessel; Compensation for openings in cylindrical shells; Design of special flanges;

UNIT 3 Design of Storage Tank and Heat Exchangers **[7 Hrs]**

Design of storage tanks for liquids.
Design of heat exchanger and heat exchanger network

UNIT 4 Valves **[7 Hrs]**

Selection of valves, Pressure reducing valves and fittings; Water treatment, Storage; Steam: Steam handling ,Steam Trap, Ejectors etc.;

UNIT 5 Piping Design **[7 Hrs]**

Pipe Size and pressure drop calculation for single and two phase flow, multiple pipe line networking ..

UNIT 6 Piping Analysis **[7 Hrs]**

Introduction to Piping Engineering – their design. Method of stress analysis of piping system – Thermal & other static modes of loading. Design of a typical piping problem using industrial software

Text Books:

- Bedworth, Wolfe & Henderson -Computer Aided Design & Manufacturing - McGraw Hill

Reference Books:

- Ibrahim Zeid – CAD/CAM –Theory & Practice –TMH
- Couper, Penny, Roy-Chemical Process Equipment (Selection and Design)
- Shashi Menon- Piping Calculation

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II Semester

ME2920	**Seminar**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
					100	

Objective:

Each student of the concern project shall present and seminars using audio visuals, aids of on their project methodology. Seminar delivery will be followed by question – answer session. The student shall also require to submit minimum 3 page report about the progress. The minimum 3 member seminar committee shall be constituted for the purpose of evaluating seminar

III Semester

ME2931	**Product Design and Development**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES
To understand the Product Life Cycle. Study different design techniques, product development phases, process selection, material selection and costs associated with PDD.

Unit 1 **Introduction** **[7 hrs]**
Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods.

UNIT 2 **Material selection** **[7 hrs]**
Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart

UNIT 3 **Process selection**
Process selection – Importance types of manufacturing processes and their classification, sources of information, selection criteria, Material and Process selection Methods- Expert systems, Computer Database Approach, Performance indices, decision matrix, AHP and fuzzy approach, introduction to material and process selection software **[8 hrs]**

UNIT 4 **Benchmarking**
Benchmarking – DFM, DFA, DFX, Early supplier involvement, robust design, QFD and concurrent engineering. **[8 hrs]**

UNIT 5 **Costing & Assembly**
Mathematics of Time Value of Money, Cost Comparison, Depreciation, Taxes, Inflation, Profitability of Investment and Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates. Industrial Engineering Approach, Parametric Approach, **[8 hrs]**
Introduction to Assembly Modelling, Top-Down and Bottom-Up Approaches of AM, Mating Conditions, Representation Schemes, Generations of Assembly Sequences

UNIT 6 **Rapid Prototyping** **[7 hrs]**
Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereolithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations

Book for reference:

1. Dieter George E. "Engineering Design", McGraw Hill Pub. Company, 2000
2. Ulirich Karl T. and Eppinger Steven D., "Product Design and Development" McGraw Hill Pub. Company, 1995.
3. Bralla, James G., "Handbook of Product Design for Manufacturing" McGraw Hill Pub. Company, 1986
4. A. K. Chitale and R. C. Gupta, Product Design and Manufacturing, PHI Pvt. Ltd., 2002.
5. HARRY NYSTROM, " Creativity and innovation", John Wiley & Sons, 1979.
6. BRAIN TWISS, " Managing technological innovation", Pitman Publishing Ltd., 1992.
7. HARRY B.WATTON, " New Product Planning ", Prentice Hall Inc. 1992.
8. P.N.KHANDWALLA - " Fourth Eye (Excellence through Creativity) – Wheeler Publishing ",Allahabad, 1992.
9. I.P.R. Bulletins, TIFAC, New Delhi,

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III Semester

ME2932	**PE III: Computational Fluid Dynamics**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

The aim of this course is to provide basic knowledge on modern computational methods which are commonly used for laminar and turbulent flows. Furthermore, the intention is to provide skills in the analysis and evaluation of results from numerical flow simulations. This knowledge should be sufficient to be able to chose an appropriate solution strategy and estimate the accuracy of the results for a given flow case.Knowledge and understanding : For a passing grade the student must be able to:

- discuss the potential and limitations of computational fluid dynamics
- describe different methods for numerical solution of flow problems and their applicability for different types of flow
- describe the sources of errors in the process from mathematical description to numerical solution of a fluid mechanical problem and how these errors affect the solution

Unit 1 **Introduction** **[7 hrs]**

Introduction –Theoretical, Computational and Experimental Techniques and their comparison. Scope of CFD. Different CFD Approaches. Modeling, Discretization and Basic Solution Module. Convergence, Stability and Consistency

UNIT 2 **Modelling** **[7 hrs]**

Modeling in CFD – Navier-Stokes Equation for Laminar Flow in Cartesian Coordinate System. Potential, Boundary-Layer and Fully Viscous Modeling. Streamfunction-Vorticity Formulation

UNIT 3 Boundary Conditions in Different Formulations and Case Studies like Potential and Viscous Modeling of Flow in a Cavity, Boundary-Layer Modeling of Flow over a Flat Plate and Viscous Modeling of Flow in Entrance-Region for Flow between Parallel Plates. **[8 hrs]**

UNIT 4 **Discretization** **[8 hrs]**

Finite-Difference Discretization of CFD Model – Discretization of First and Second Derivatives by Forward, Backward and Central Differencing. Truncation and Order of Error, and Accuracy.

UNIT 5 Case Studies like Potential and Viscous Modeling of Flow in a Cavity, Boundary-Layer Modeling of Flow over a Flat Plate and Viscous Modeling of Steady Flow in Entrance-Region for Flow between Parallel Plates in Streamfunction-Vorticity Formulation along with Role of Upwinding. Unsteady Flow Modeling and Stability **[8 hrs]**

UNIT 6 Special Topics in CFD – Solution of Simultaneous Linear Algebraic Equations by TDMA and ADI Techniques. Viscous Flow Modeling in Primitive-Variable Formulation: SIMPLE Algorithm **[7 hrs]**

Book for reference:

1. Anderson John; "Computational Fluid Dynamics"
2. Chung T.J;"Computational Fluid Dynamics"
3. Thévenin Dominique, Janiga Gábor; "Optimization and Computational Fluid Dynamics"
4. Date Anil Waman; "Introduction to Computational Fluid Dynamics"

Softwares:

1. PHOENICS
2. Fluent
3. Ansys CFX - 5

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III Semester

ME2933	**PE III: Design Optimization Techniques**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

OBJECTIVES

The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course

UNIT 1 Introduction to optimization, classification of optimization problems, classical optimization techniques, Linear programming, simplex method and Duality in linear programming, sensitivity or post-optimality analysis, **[7hrs]**

UNIT 2 Non-Linear Programming: - One dimensional minimization, constrained optimization, direct and indirect methods **[8 hrs]**

UNIT 3 Geometric programming, unconstrained and constrained minimization, complimentary geometric programming, applications of geometric programming, **[8 hrs]**

UNIT 4 Dynamic programming, multistage decision process, concept of sub optimization and principle of optimality, continuous dynamic programming **[7 hrs]**

UNIT 5 Optimum design of tension bar, stepped bar, links connected to other elements by pins, beams, shafts, stepped shafts, shafts with keyways **[7 hrs]**

UNIT 6 Optimum design of members subjected to both bending and twisting, cams, spur gears, pressure vessels **[7 hrs]**

Reference Books:

1. S.S.Rao," Optimization theory and applications" Willey Eastern Ltd
2. J. S. Arora, "Introduction to Optimum Design", McGraw Hill, New York, 1989.
3. L.C.W. Dixon, "Non-Linear Optimisation - Theory and Algorithms", Birkhauser, Boston, 1980.
4. R.J. Duffin, E.L. Peterson and C.Zener "Geometric Programming-Theory and Applications", Willey, New York, 1967.
5. G.B. Dantzig "Linear Programming and Extensions Princeton University Press", Princeton, N. J., 1963.
6. R. Bellman "Dynamic Programming-Princeton" University Press, Princeton, N.J. 1957.
7. R.C. Johnson, "Optimum Design of Mechanical Elements", Willey, New York, 1980.
8. S. S. Stricker, "Optimising performance of energy systems" Battelle Press, New York, 1985.

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III Semester

ME2934	PE III: Rapid Prototyping		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT - I INTRODUCTION

CAD-CAM and its integration, Development of CAD CAM., The importance of being Rapid, The nature of RP/T, The state of RP/T industry. Rapid Prototyping Defined. Time compression Technologies, Product development and its relationship with rapid prototyping.

UNIT - II PROCESS CHAIN FOR RAPID PROTOTYPING
Data Preparation (Pre-processing), Part Building, Post Processing. CAD Model Preparation, Reverse Engineering and CAD model, Digitizing Techniques: Mechanical Contact Digitizing, Optical Non-contact Measurement, CT Scanning Method, Data Processing for Surface Reconstruction.

Data interface for Rapid Prototyping: STL interface Specification, STL data generation, STL data Manipulation, Advantages and limitations of STL file format. Open files. Repair of STL files. Alternative RP interfaces.
Part orientation and support generation: Factors affecting part orientation, various models for part orientation determination, the function of part supports, support structure design, Automatic support structure generation.

UNIT - III MODEL SLICING AND CONTOUR DATA ORGANIZATION
Model slicing and skin contour determination, Identification of external and internal contours, Contour data organization, Direct and adaptive slicing: Identification of peak features, Adaptive layer thickness determination, Skin contour computation. Tool path generation.
Part Building: Recoating, parameters affecting part building time, part quality.
Post Processing: Part removal, finishing, curing.
Other issues: Shrinkage, Swelling, Curl and distortion, Surface Deviation and accuracy, Build Style Decisions,

UNIT – IV RAPID PROTOTYPING MACHINES
Classification, Description of RP Machines: SLA, SLS, FDM, 3D Printing, LOM, SDM, Contour Crafting

UNIT – V RAPID TOOLING AND MANUFACTURING
Classification of RT Routes, RP of Patterns, Indirect RT: Indirect method for Soft and Bridge Tooling, Indirect method for Production Tooling, Direct RT: Direct RT method for Soft and Bridge Tooling, Direct method for Production Tooling, Other RT Approaches. Rapid Manufacturing: Methods, limitations.

UNIT – VI APPLICATION OF RP
Heterogeneous objects, Assemblies, MEMES and other small objects, Medicine, miscellaneous areas including art.

BOOKS RECOMMENDED
1 Bjorke, Layer Manufacturing, Tapir Publisher. 1992.
2 Jacobs, PF (Ed), Rapid Prototyping and Manufacturing, Society of Manuf. Engrs, 1992.
3 Burns, M., Automated Fabrication: Improving Productivity in Manufacturing, 1993.
4 Jacobs, P.F. (Ed.), Stereo lithography and Other RP&M Technologies: From Rapid Prototyping to Rapid Tooling, Society of Manuf. Engrs. NY, 1996.
5 Chua C. k. and L. K. Fai, Rapid Prototyping: Principles and Applications in Manufacturing.
6 Gibson, I. (Ed.), Software Solutions for Rapid Prototyping, Professional Engineering Publications, London., 2002.

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III Semester

ME2935	PE III: Design for Manufacturing and Assembly		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT- I INTRODUCTION: **[6 hrs]**

Design philosophy steps in Design process — General Design rules for manufacturability — basic principles of design Ling for economical production — creativity in design. Materials: Selection of Materials for design Developments in Material technology -- criteria for material selection — Material selection interrelationship with process selection process selection charts.

UNIT II: METAL CASTING: **[7 hrs]**

Appraisal of various casting processes, selection of casting process, - general design considerations for casting — casting tolerances — use of solidification simulation in casting design — product design rules for casting.

UNIT III: MACHINING PROCESS: **[9 hrs]**

Overview of various machining processes -- general design rules for machining - Dimensional tolerance and surface roughness — Design for machining — Ease — Redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT IV: METAL JOINING: **[8 hrs]**

Appraisal of various welding processes, Factors in design of weidments — general design guidelines — pre and post treatment of welds — effects of thermal stresses in weld joints — design of brazed joints. Forging — Design factors for Forging — Closed die forging design — parting lines of die5 drop forging die design — general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, and Deep Drawing— Keeler Goodman Forming Line Diagram — Component Design for Blanking.

UNIT-V ASSEMBLY : **[8 hrs]**

Assemble Advantages: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.

Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

UNIT-VI: DESIGN OF MANUAL ASSEMBLY **[7 hrs]**

Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

TEXTBOOK:

1. Geoffrey Boothroyd, "Assembly Automation and Product Design", Marcel Dekker Inc., NY, 1992.
2. Engineering Design – Material & Processing Approach – George E. Deiter, McGraw Hill Intl. 2nd Ed. 2000.

REFERENCE BOOKS:

1. Geoffrey Boothroyd, "Hand Book of Product Design" Marcel and Dekken, N.Y. 1990.
2. A Delbainbre "Computer Aided Assembly London, 1992.

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III Semester

ME2939	**Project Phase I**	**L=0**	**T=0**	**P=16**	**Credits=8**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
			100		**100**	

OBJECTIVES

As the project methodology for the batches is decided in the 2nd semester the student shall carry out the project work further 3rd semester. The project work consists of ;

1. A comprehend since and update survey of literature.
2. Study of processes /phenomenon related to project.
3. Design of any equipment its fabrication and testing.
4. Critical analysis of design or process for optimization
5. Verification by experimentation.
6. In case of industrial project the necessary modifications with the proper drawing / design suggested to the industry should be explained. The letter from the industry should be attached in the report related to the performance of the student.

IV Semester

ME2940	**Project Phase II**	**L=0**	**T=0**	**P=24**	**Credits=12**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
			40	**60**	**100**	

Objectives:

As per the Project Phase 1, the students should carry out and submit the project work that include the implementation of all Semesters subjects knowledge with required validation and certification.

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

SoE & Syllabus 2018-19

M. Tech. Integrated Power Systems (IPS)

28 June 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. SCHEME OF EXAMINATION 2018-19

Integrated Power Systems

SN	Sem	Sub Code	Subject	T/P	Contact Hours				Credits	% Weightage				ESE Duration Hours
					L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
			I SEMESTER											
1	1	EL2901	Advanced Power Electronics	T	3	0	0	3	3	15	15	10	60	3
8	1	EL2902	Lab: Advance Power Electronics	P	0	0	4	4	2			40	60	
2	1	EL2903	Analog & Digital Protection	T	3	0	0	3	3	15	15	10	60	3
6	1	EL2904	Lab: Analog & Digital Protection	P	0	0	4	4	2			40	60	
3	1	EL2905	Digital Control System	T	3	0	0	3	3	15	15	10	60	3
4	1	EL2906	HVDC Power Transmission	T	3	0	0	3	3	15	15	10	60	3
5	1	EL2907	Power System Modelling	T	3	0	0	3	3	15	15	10	60	3
			Total		**15**	**0**	**8**	**23**	**19**					
			II SEMESTER											
1	2	EL2911	Power System planning	T	3	0	0	3	3	15	15	10	60	3
2	2	EL2912	Application of Power Electronics to Power System	T	3	0	0	3	3	15	15	10	60	3
3	2	EL2913	Power Quality	T	3	0	0	3	3	15	15	10	60	3
4	2		**Professional Elective- I**	**T**	3	0	0	3	3	15	15	10	60	3
5	2		**Lab: Professional Elective I**	**P**	0	0	4	4	2			40	60	
6	2		**Professional Elective II**	**T**	3	0	0	3	3	15	15	10	60	3
7	2	EL2921	Power System Simulation	P	0	0	4	4	2			40	60	
			Total		**15**	**0**	**8**	**23**	**19**					

List of Professional Electives-I

2	EL2914	PE I: Electrical Drives and Controls
2	EL2915	PE I: Lab: Electrical Drives and Controls
2	EL2916	PE I: Renewable Energy System
2	EL2917	PE I: Lab: Renewable Energy System

List of Professional Electives-II

2	EL2918	PE II: Advanced Digital Signal Processing
2	EL2919	PE II: EHV Power Transmission
2	EL2920	PE II: Restructuring of Power System

			III SEMESTER											
1	3		**Professional Elective - III**	**T**	3	0	0	3	3	15	15	10	60	3
2	3		**Professional Elective - IV**	**T**	3	0	0	3	3	15	15	10	60	3
3	3	EL2938	Lab.: Power System Design	P	0	0	4	4	2			40	60	
4	3	EL2939	Project Phase -I	P	0	0	16		8			100		
			Total		**6**	**0**	**20**	**10**	**16**					

List of Professional Electives-III

3	EL2931	Power System Stability
3	EL2932	Electrical Distribution Systems
3	EL2933	Power System Operation and Control
3	EL2934	Transients in Power Systems

List of Professional Electives-IV

3	EL2935	Distribtuted Automation
3	EL2936	Power Electronics for Renewable Energy Systems
3	EL2937	Control System Design

			IV SEMESTER											
1	4	EL2940	Project Phase-II	P	0	0	20	24	12			40	60	
			Total		**0**	**0**	**20**	**24**	**12**					
			Grand Total of Credits						**66**					

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First Semester

EL2901	Advanced Power Electronics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:

1. To impart the knowledge of recent and advanced developments in the PE field.
2. To ensure the students having an in-depth understanding of the design and control of various converters.

Course Outcomes: At the end of the course student will

1. Describe the working operation of conventional and advanced semiconductor devices
2. Be able to demonstrate the skill of analyzing and design of controlled rectifiers.
3. Have the ability to analyze and design of non isolated DC-DC converters.
4. Have the ability to analyze and design of isolated DC-DC converters.
5. Have the skill of analyze and design of various two-level and multilevel converters.
6. Acquire understanding and able to analyze and design of resonant converters

UNIT-1: Semiconductor Power Devices

Conventional semiconductor power devices:-Thyristor, Gate Turn Off thyristor(GTO),Metal Oxide Field Effect Transitor(MOSFET),Insulted Gate Bipolar Transistor(IGBT). Advanced semiconductor devices: MOS Turn Of Thyristor(MTO), Emitter Turn of Thyristor(ETO), Integrated Gate Commuted Thyristor(IGCT), MOS Controlled Thyristor(MCT), Static Induction Thyristor(SITH) - symbol, structure and equivalent circuit-comparison of their features. Significance of wide band gap materials (especially SiC and GaN).

UNIT-2: AC/DC Controlled Rectifier

Single phase half controlled and full controlled converters continuous and discontinuous mode, Three phase controlled rectifier continuous mode, Single phase series converter, single and three phase dual converters, Effect of source inductance, Evaluation of input power factor and harmonic factor.

UNIT-3: Non isolated DC/DC Converters

Principle of operation and analysis of buck, boost, buck-boost, Cuk and Single Ended Primary Inductance Converter (SEPIC) regulators in discontinuous and Continuous (DCM/CCM) mode, Input and output filter design.

UNIT-4: Isolated DC/DC converters

Introduction, transformer models, principle of operation and analysis of Flyback, Forward, double ended (Two Switch) forward, Push-Pull, half-bridge and full Bridge converters. Continuous and discontinuous mode operation and design consideration.

UNIT-5 : Multilevel Inverters

Single phase half and full bridge Voltage source Inverter(VSI),Three Phase Inverter, Evaluation of performance parameters. Multilevel inverter topologies- Neutral Point clamped (NPC), Flying capacitor (FC), Symmetrical and asymmetrical Cascaded Inverters etc., Other advanced inverters such as Multi-pulse, matrix inverter, Modulation techniques: Pulse Width Modulation (PWM), SHE, SHE PWM, Hysteresis, Space Vector modulation techniques for above inverters, Introduction to Current Source Inverter (CSI)

UNIT-6 :Soft switching Converters

Resonant Converters- Classification of resonant converters, Basic resonant circuit concepts, Series parallel resonant converters, Zero voltage switching (ZVS) and Zero Current (ZCS) switching converters, steady state and dynamic analysis, modeling and control

Text books:

1	Power Electronics Circuits Devices application	2004	M.H. Rashid	PHI third edition First Indian edition
2	Power Electronics: Converters, Application and Design	1996	Ned Mohan, Undeland and Robbin	John Wiley & Sons Third edition

Reference books:

1 Pulse width modulated DC-DC power converters	1993	Marian K Kazimierczuk	John Willey & Sons
2 High power converter and ac drives	2006	Bin Wu	Wiley-IEEE Press
3 Power electronics-principles and applications	1995	Joseph Vithayathil	McGraw hill Inc, New York
4 IEEE/IET publications		Various authors	On Internet site www.ieeexplore.ieee.org

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First Semester

EL2902	Lab: Advance Power Electronics	L=0	T=0	P=4	Credits=2

Evaluation Scheme	TA	ESE	Total
	40	60	100

Objective: To study/ perform the practical based on syllabus

Advanced power electronics Laboratory
The list of practical will be according to the syllabi of Advanced power Electronics

First Semester

EL2903	Analog & Digital Protection	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To study analog protection and digital protection.

UNIT-1:EHV line Protection
Relay coordination using over current relay, Drawback of over current relay, Distance protection of three phase lines, carrier aided schemes. Stability of protection on power swing.

UNIT-2: **Transformer & Machine Protection**
Various fault occurring on transformers, alternators & large motors & complete protection against these fault.

UNIT-3: Basic elements of Digital Protection
Evolution of digital relays from electromechanical relays , Performance & operational characteristics of digital protection, Basic elements of digital protection, Signal conditioning, transducers, surge protection, analog filtering, analog multiplexer.
Conversion system- Sampling theorem, signal aliasing error, sample & hold circuit, multiplexer, analog to digital conversion, digital relay as a unit .
Digital filtering system- Low pass, High pass, FIR &IIR Filters.

UNIT-4 : Algorithms-I
Sinusoidal wave based algorithm, first & second derivative method, two sample & three sample technique.

UNIT-5: Algorithms-II
Fourier analysis &Fourier transform based algorithm.
Walsh function based algorithm, Differential equation based technique.

UNIT-6: Algorithm-III
Incident & reflected wave, coefficient of reflection, superimposed quantities & their properties & polarity versus fault location, reverse & forward faults, elliptical trajectory, Bergerons equation, discriminant function for single phase lines.
Recent advances-Synchrophasors & Wavelet analysis.

Text books:

1	Fundamentals of Power System Protection	2005	Y.G.Paithankar&S.R.Bhide	Prentice Hall of India
2	Digital Protection for power system		A.T.Johns&S.K.Salman	Peter Peregrinus Ltd.

Reference books:

1	Power System Protection	Ungradetal	Marcel Dekker Pub
2	Transmission Network Protection	Y.G.Paithankar	Marcel Dekker Pub
3	Power System Protection (Static Relays)	T.S. MadhavaRao	Tata McGraw-Hill,
4	English Electric Relay Application Guide		
5	IEEE/IEE Publications		

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First Semester

EL2904	Lab: Analog & Digital Protection	L=0	T=0	P=4	Credits=2

Evaluation Scheme	TA	ESE	Total
	40	60	100

Objective: To study/ perform the practicals based on syllabus

1. To plot the characteristic of IDMT relay ICM 21N.
2. To plot the characteristic of directional relay with calculation of maximum torque angle.
3. To plot the characteristic of reactance relay.
4. To plot the characteristic of impedance relay.
5. To plot the characteristic of fuse wire.
6. To study the differential protection of single phase transformer.
7. To study mho relay & offset mho relay.
8. To study the undercurrent & overcurrent relay.
9. To study the harmonic restraint effect on differential relay.
10. To plot the characteristic of earth fault relay.
11. To study undervoltage relay.
12. To study air circuit breaker.
13. To study MICOM P430 distance protection relay.
14. Study of relay co-ordiantion using SKM Power tools software.

Practicals based on MATLAB:-

15. To calculate peak value by full cycle window (Fourier Analysis)
16. To calculate peak value by half cycle window(Fourier Analysis)
17. Analytical Analysis by two sample method
18. Analytical Analysis by three sample method
19. Analytical Analysis by sample and derivative method
20. Analytical Analysis of first and second derivative method
21. To calculate peak values by Walsh coefficient
22. To calulate walsh function

First Semester

EL2905	Digital Control System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand the advance concepts in control system.

UNIT-1:Introduction
Revive of state variable analysis, types of sampling operations, Sample and Hold operations, Sampling theorem, Basic discrete time signals, Discretisation of continuous time system.

UNIT-2:Analysis of Digital Control Systems and Stability Methods
Z-Transforms, Properties of Z-Transform, Inverse Z-Transforms, Pulse Transfer Function, Difference equations, Z-Transform method for solving the difference equations, Block diagram and signal flow graph analysis, Time response of digital control systems. Mapping between s-plane and z-plane, stability methods: Modified Routh's Criterion, Jury's method, Lyapunov stability analysis.

UNIT-3:Models of Control Systems
Problem of pole placement, effect of addition of poles & zeros to open loop transfer function, design of Digital compensator using root locus plots.

UNIT-4:State Variable analysis of Digital Control Systems
State variable description of digital control systems, conversion of state variable models to transfer function and vice versa, solution of state difference equations, controllability and observability, design of state feedback and state estimation.

UNIT-5:PID control
Conventional tuning methods such as Ziegler Nichols methods, Refined zeigler Nichols method etc., Introduction to optimization methods for tuning of PID controller; Particle swarm optimization (PSO), Genetic Algorithms (GA) etc.

UNIT-6:Optimal and Robust control system design
Review of optimal control, Linear Quadratic Regulators (LQR), LQR tracking problem, H_2-optimal control, H_∞-optimal control, Introduction to multivariable robust controls.

Text books:

1	Digital Control and State Variable Methods	M. Gopal	Tata Mc-Graw-Hill
2	Discrete Time Control Systems	K.Ogata	Pearson Education,(Singapore) (Thomson Press India).
3	Digital Control Systems	B.C Kuo	Prentice Hall
4	Optimal control: Linear Quadratic Methods	B.D.O. Anderson	Dover publications
5	Robust control design & optimal control Approach	Senglin	John Wiley & sons

Reference books:

1	Control System Engg	I.J. Nagrath&M.Gopal	John Wiley & sons
2	Control System Analysis and Design	K.K. Aggarwal	Khanna Publishers
3	Optimal Control	BDO Andersom, Moore	Dover Publications

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First Semester

EL2906	HVDC Power Transmission	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To learn the principles of conventional High Voltage Direct Current Transmission and modern trends in it. Multiterminal HVDC systems are also studied. Also voltage source converter technology is introduced.

UNIT-1:Introduction to HVDC
Development of HVDC technology comparison between HVAC and HVDC, Applications of HVDC transmission, Type of DC transmission, Selection of converter configuration.

UNIT-2:Rectifier and inverter
Rectifier and inverter operation of Line commutated converters, Analysis of rectifier with two-valve condition, Analysis of rectifier with two-three valve conduction, Analysis of inverter with two valve conduction, Analysis of inverter with two-three valve conduction. Introduction to HVDC with Voltage Source Converters(VSC)

UNIT-3: Digital simulation
Digital simulation of converters, Generalized equation for simulation of converters, Derivation of converter equations with Two valve conduction, Three valve conduction.

UNIT-4:Control of HVDC converters and system
Requirements of control system for HVDC converter, Rectifier compounding, Inverter compounding, Converter control characteristics, Converter firing schemes: Individual phase control (IPC) , Equidistant pulse control (EPC), Draw backs of individual phase control, Draw backs of EPC, Higher level controls, power controllers, Characteristics & non characteristics harmonics, Different methods to overcome problem of non-characteristics Harmonics.,Filters.Starting and stopping of DC links.

UNIT-5 : Multiterminal HVDC system
Fault development and protection, Inter action between AC-DC power system, Over-voltage on AC/DC side Multi-terminal HVDC system, Control of MTDC system,

UNIT-6:Modeling of HVDC system
Per unit system representation for power flow solution, Representation for stability studies. Effect of HVDC Link on Stability. Faults and Protection of HVDC Systems. HVDC circuit breaker

Text books:

1	High voltage direct current transmission		J. Arrillaga	Peter Peregrinus ltd. London, U.K.
2	Direct Current Transmission (Vol.I)	1971	E. W. Kimbark	Wiley Interscience
3	HVDC power Transmission Systems	1990	K. R. Padiyar	Wiley Eastern Ltd.

First Semester

EL2907	Power System Modeling	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand the concept of modelling of Electrical equipment such as synchromous machines, transformer, transmission line etc.To understand the excitation system used for thermal power generator. Students also learn the load modelling.

UNIT-1: General Background
Evolution of electric power system, structure of power system, power system control, design and operating criteria for stability.

Power System stability Problems
Basic Concepts & definition, rotor angle stability, voltage stability & Voltage collapse, mid-term & long term stability, Classification of Stability.

UNIT-2:Synchronous Machine Modeling I
Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation.

UNIT-3 : Synchronous Machine Modeling II
Per Unit Representations: The Park's transformation, power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values.

UNIT-4 : Excitation and prime-mover controllers
Excitation system, excitation system modeling, excitation system –standard block diagram, system representation by state equations, prime mover control system, examples.

UNIT-5 : Transformer modeling & the per unit system
Introduction, single phase transformer model , three phase transformer connection , per phase analysis, p.u. normalization, p.u. three phase quantities, p.u. analysis of normal system , regulating transformer for voltage & phase angle control.

UNIT-6:Load modeling
Basic load- modeling concept, static load models, dynamic load model, modeling of I.M., acquisition of load model parameters.
Transmission line Modeling
Introduction, derivation of terminal V,I relations, waves on transmission lines, transmission matrix, lumped circuit equivalent, simplified models, complex power transmission (short line,medium & long line, Radial line).

Text books:

1	Power System Stability and Control	1993	P. Kundur	McGraw-Hill
2	Dynamic Models for Steam and Hydro Turbines in Power System Studies			IEEE Committee Report
3	Power System Control and Stability	1978	P.M Anderson and A.A Fouad	Iowa State University Press, Ames, Iowa

Second Semester

EL2911	Power System Planning	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand the load forecasting for the planning of power generation. To do the generation planning considering reliability, environmental aspects. Students also understand how to design the optimal power availability .

UNIT-1: **Introduction**
Introduction of power planning, National and Regional Planning, structure of P.S., planning tools, Electricity Regulation

UNIT-2: **Load Forecasting & Generation Planning**
Electrical Forecasting, forecasting techniques modeling. Generation planning, Integrated power generation cogeneration/captive power, Power pooling and power trading.

UNIT-3 : Transmission planning and Power System Economics
Transmission and distribution planning, Power system Economics, Power sector finance, financial planning, private participation Rural Electrification investment, concept of Rational tariffs.

UNIT-4: Reliability
Power supply Reliablity, Reliability planning, Reliability evaluation, Functional zones, Generation reliability, Generation & Transmission reliability, Quality of Supply.

UNIT-5 : System Operation & Environmental Aspects in Planning
System operation planning, load management, load prediction, reactive power balance, online power flow studies, state estimation, computerized management, power system simulator.
Computer aided planning, wheeling, Environmental effects, Greenhouse effect, Technological impacts, Insulation coordination, Reactive compensation.

UNIT-6:Power System Security :
Operation in Power System Security :- Introduction, Factors affecting power system security, Contingency analysis, ac power flow security analysis, concentric relaxation, bounding area method.
State Estimation :- Introduction, Method of least squares, Maximum likelihood weighted least square estimation, State estimation by orthogonal decomposition, Detection and identification of bad measurements, network observability and pseudo-measurements.

Text books:				
1	Electrical Power System Planning	**Edition (Year of publication)**	A.S.Pabla	Macmillan India Ltd.
2	Power Generation, Operation & Control	**2011**	Allen J. Wood, B.F. Wollenberg	Wiley India, Reprint
3	Modern Power System Analysis	**4th Edition**	D.P. Kothari, I.J. Nagrath	Tata Mcgraw Hill Education Pvt. Ltd.
4	Electrical Power Systems – Analysis, Security and Deregulation	**Third Printing**	P. Venkatesh, B. V. Manikandan, S. Charles Raja, A. Srinivasan	PHI Learning Pvt. Ltd.

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Second Semester

EL2912	Application of Power Electronics to Power System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand how the constraints of the AC power transmission can be solved and performance of AC transmission can be enhanced by different FACTS controllers. The objective is also study comprehensively different FACTS controllers like shunt, series, shunt-series and phase angle regulators.

UNIT-1:Introduction
Introduction of Semiconductor Devices , Steady state and Dynamic Problems in AC Systems, Flexible AC transmission system : Introduction , types of Facts controllers.

UNIT-2:Shunt FACT Controllers
TCR(Thyristor Controlled Reactor) , TSC(Thyristor Switched Capacitor) ,FC-TCR(Fixed Capacitor -thyristor controlled reactor),TSC-TCR(Thyristor Switched Capacitor Thyristor switched Capacitor),Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of svc for power flow and transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping – Prevention of voltage instability.

UNIT-3 : Series FACT Controller
TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping-SSR Mitigation, TSSC, GCSC.

UNIT-4: Converter based Shunt and Series controllers
STATCOM – Different modes of operation of working, different control strategies. Comparison with Static VAR Compensator (SVC). Different advantages and the constraints.
SSSC- Introduction, Inductive and the capacitive modes of operations. Different control strategies. Comarison with Thyristor based series controllers. Constraints of the SSSC

UNIT-5:Phase Shifter and Phase angle Regulator
TCPAR, TCVR, Voltage Controlled Source Based Phase Shifter and Angle Regulator, Introduction working and control strategies.

UNIT-6 :Other FACTS Controller
UnifiedPower Flow Controller(UPFC), Interline Power Flow Controller(IPFC): Introduction ,Controlled Strategies and Application

Text books:

1	Thyristor – Based Facts Controllers for Electrical Transmission Systems	R.MohanMathur, Rajiv K.Varma	IEEE press and John Wiley & Sons, Inc
2	Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems	Narain G. Hingorani	Standard Publishers Distributors, Delhi
3	FACTS Controllers in Power Transmission and Distribution	K.R.Padiyar	New Age International(P) Limited, Publishers, New Delhi

Reference books:

1	Flexible A.C. Transmission Systems	1999	A.T.John	Institution of Electrical and Electronic Engineers (IEEE)
2	HVDC and FACTS controllers – Applications of Static Converters in Power System	APRIL 2004	V.K.Sood	Kluwer Academic Publishers

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Second Semester

EL2913	Power Quality	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: The objective is to understand the different power quality problems, its causes, effects and various mitigating custom power devices. Further the subject is concentrated to analyse the different control strategies and algorithm.

UNIT-1:Introduction
Introduction – Characterisation of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

UNIT-2:Non Linear Loads
Single phase / Three phase static converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

UNIT-3: Measurement and Analysis Method
Voltage, Current, Power and Energy measurements, power factor measurements and definitions, event recorders, Measurement Error – Analysis: Analysis in the periodic steady state, Time domain methods, Frequency domain methods: Laplace's, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform.

UNIT-4:Analysis and Conventional Mitigation Methods
Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices.

UNIT-5 : Voltage Sag
Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

UNIT-6:Power Quality Improvement
Utility-Customer interface –Harmonic filters: passive,–Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC – control strategies: P-Q theory, Synchronous detection method – Custom power park – Status of application of custom power devices.

Text books:

1	Power Quality Enhancement Using Custom Power Devices	2002	ArindamGhosh	Kluwer Academic Publishers
2	Electric Power Quality	1994(2nd edition)	G.T.Heydt	Stars in a Circle Publications
3	Power Quality	Edition (Year of publication)	R.C. Duggan	Publisher

Reference books:

1	Power system harmonics	A.J. Arrillga	Publisher
2	Power electronic converter harmonics	Derek A. Paice	Publisher
3	Title of the book	Author(s)	Publisher

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Second Semester

EL2914	PE I : Electrical Drives and Controls	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:: To understand the mathematical modeling of drives and the latest technology. Stress is given on Vector control, space vector modulation control of induction motor and synchronous motor. Adaptive control and introduction to fuzzy and neural control of drives is introduced.

UNIT-1:**Analysis of DC Motor:** State variable representation of seperately excited DC motor and DC shunt motor, Converters for DC drives,Average value analysis of DC drive.Machine control with voltage controlled converter, Machine control with current controlled converter.

UNIT-2:**- Analysis of Induction Motor:**
Reference frame theory, Balanced Set,Transformation of resistance and flux linkages, Theory of symmetrical Induction motor, voltage and torque equations in machine variables and their transformation to arbitrary reference frame, state vector representation of the equations, free acceleration characteristics,

UNIT-3: **Induction motor control systems**
Voltage Source Inverter Drive with PWM,Current Source Inverter Drive, Forced commutated inverter drive control of Induction motor, Flux Vector control of Induction motors, Direct torque control.

UNIT-4:Synchronous motors Drives:
Synchronous machines equations in different reference frames,
Synchronous motor drives with sinusoidal waveforms, True Synchronous mode and Self controlled mode Load commutated inverter drives
Synchronous motor drive with trapezoidal waveforms(Brushless DC motor).,Vector Control of Synchronous motors, Switched reluctance motor and its control.

UNIT-5 : Space vectors:
Stator space current, stator voltage space vector, stator flux linkage space vector, transformation of space vector coordinates from one reference frame to another. Space vector Modulation ,Control of Induction motor by Space vector Modulation.

UNIT-6:Digital Control of Drives
Adaptive control principles,Gainscheduling,Self tuning control,Model referencing adaptive control,Sliding Mode control,Idea of Fuzzy and Neural Control.
Necessity and Application of Digital signal processors to control of AC/DC Drives.BasicArchitectoure of Texas Instruments TMS320LF2407 processor,Programming methods
Idea of Field Programmable Gate Arrays(FPGA) Technology.

Text books:

1	Analysis of Electric Machinery		Paul, C. Krause	McGraw Hill
2	Modern Power Electronics and AC Drives		B.K. Bose	Prentice Hall
3	Texas Instruments TMS320LF2407 processor Manual			
4	Variable frequency AC motor Drive system		David Finney	IEE Press
5	Control of Electrical Drives	1996	W. Leonhard	Springer Verlag
6	Electric Drive		VedamSubramanyam	Tata McGraw Hill

Reference books:

1	High-Power Converters and AC Drives	2006	Bin Wu	Wiley & IEEE Press
2	Power Electronics, Converters, Applications and Design	3rd Edition	Ned Mohan, T. M. Undeland, W. P. Robbins	Media Enhanced
3	'Power Semiconductor Controlled Drives	1989	G.K. Dubey	Prentice Hall, N. Jersey
4	Electric Drives	2002	Krishnan	Prentice Hall of India

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Second Semester

EL2915	PE I : Lab Electrical Drives and control	L=0	T=0	P=3	Credits=1.5

Evaluation Scheme	TA	ESE	Total
	40	60	100

List of Practicals

1. Study of program written in C to generate Pulse width modulated pulses with DSP
2. Closed Loop Speed control of separately excited D.C. motor
3. Closed Loop Speed control of Brushless DC motor
4. Closed Loop Speed control of Induction motor
5. Vector control of Induction motor
6. Control of Switched Reluctance motor with DSP program
7. To study the Simulation of DC Drive in MATLAB
8. To study the Simulation of Vector Control in MATLAB

Second Semester

EL2916	PE I : Renewable Energy System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To study the major renewable energy sources including solar, wind, Biomass for different applications.

UNIT-1:Introduction to Energy Sources
World Energy Futures, Conventional Energy Sources, Renewable Energy Sources, Prospects of Renewable Energy Sources. Environmental aspects of Electrical Energy Generation.

UNIT-2:Solar Energy -
a) Introduction to Solar Radiation and its measurement, Introduction to Solar Energy Collectors and Storage.
b) Applications of Solar Energy: Solar Thermal Electric Conversion, Thermal Electric Conversion Systems, Solar Electric power Generation Solar Photo- Voltaics, Solar Cell Principle, Semiconductor Junctions, Conversion efficiency and power output, Basic Photo Voltaic System for Power Generation. Solar photovoltaic modules, maximum power point tracking and algorithms

UNIT-3: **Wind Energy:**
a) Introduction to wind energy Conversion, the nature of the wind, Power in the wind.
b) Wind Energy Conversion: Wind data and energy estimation, Site Selection Considerations, Basic Components of a Wind Energy Conversion System, Classification of WEC Systems, Schemes for Electric Generation using Synchronous Generator and Induction Generator, Wind energy Storage.

UNIT-4:Direct Energy Conversion Processes (Overview) :
a) Information on Magneto Hydro Dynamic Power Generation:
b) Thermo-Electric Generation: Basic principles of thermo-electric powergeneration, Seebeck, Peltier, Thomson effects, Thermo-Electric power generator, Analysis, materials.
c) Thermionic Generation: Thermionic emission and work function, Basic thermionic generation.
d) Fuel Cells H_2O_2**C**ell, Classification of fuel Cells, Types, Advantages, Electrodes, Polarization.
e) Thermo Nuclear Fusion Energy: The basic Nuclear Function and Reactions Plasma Confinement, Thermo Nuclear function Reactions.

UNIT-5 : Energy from Biomass:
a) Introduction: Biomass conversion technologies, photosynthesis, Bio-gas generation, types of bio-gas plants.
b) Biomass as a Source of Energy: Method for obtaining energy from Bio-mass, Biological Conversion of Solar Energy.

UNIT-6:
Applications of Renewable energy
Wind Farms: Grid interfacing of wind farm, methods of grid connection, grid system and properties. Small hydro power, Hybrid systems: Wind- solar, wind photovoltaic etc,

Text books:

1	Non-Conventional Sources of Energy	4th Edition, 2010	G.D. Rai	Khanna Publishers
2	Non Conventional Energy Sources	2nd Edition.2009	B. H. Khan	The McGraw Hill Companies
3	Renewable energy sources and conversion technology	1990	N.K. Bansal, M. Kleemann, M. Heliss	Tata McGraw Hill

Reference books:

1	Direct Energy Conversion		R. A. Coombie	Pitman
2	Renewable energy sources and emerging technologies	1st Edition,2008	D. P. Kothari	PHI
3	Related IEEE/IEE Publications			

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Second Semester

EL2917	PE I : Lab : Renewable Energy System	L=0	T=0	P=3	Credits=1.5

Evaluation Scheme	TA	ESE	Total
	40	60	100

List of Practical's

Second Semester

EL2918	PE II : Advanced Digital Signal Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives:

UNIT-1:Introduction
Mathematical description of change of sampling rate – Interpolation and Decimation, Filter implementation for sampling rate conversion – direct form FIR structures, DTFT, FFT, Wavelet transform and filter bank implementation of wavelet expansion of signals

UNIT-2:Estimation Techniques
Discrete Random Processes – Ensemble averages, Stationary processes, Autocorrelation and Auto covariance matrices, Parseval's Theorem, Wiener-Khintchine Relation – Power Spectral Density**,** AR, MA, ARMA model based spectral estimation, Parameter Estimation,

UNIT-3: **Prediction Techniques**
Linear prediction – Forward and backward predictions, Least mean squared error criterion – Wiener filter for filtering and prediction, Discrete Kalman filter.

UNIT-4:Digital Signal Processor
Basic Architecture – Computational building blocks, MAC, Bus Architecture and memory, Data Addressing, Parallelism and pipelining, Parallel I/O interface, Memory Interface, Interrupt, DMA.

UNIT-5 : APPLICATION OF DSP
Design of Decimation and Interpolation Filter, FFT Algorithm, PID Controller, Application for Serial Interfacing, DSP based Power Meter, Position control.

UNIT-6:VLSI IMPLEMENTATION
Basics on DSP sytem architecture design using VHDL programming, Mapping of DSP algorithm onto hardware, Realisation of MAC & Filter structure.

Text books:

1	Adaptive Signal Processing	Third edition, 2004	Bernard Widrow, Samuel D. Stearns	Pearson Education
2	Statistical & Adaptive signal processing, spectral estimation, signal modeling, Adaptive filtering & Array processing	2000	**Author(s)**	McGraw-Hill International
3	Statistical Digital Signal Processing and Modelling	**Edition (Year of publication)**	Monson H. Hayes	John Wiley and Sons, Inc

Reference books:

1	Digital Signal Processing	2002	John G. Proaks, Dimitris G. Manolakis	Pearson Education
2	Digital Signal Processing		S. Salivahanan, A. Vallavaraj and C. Gnanapriya	TMH
3	Digital Signal Processing- Implementation using DSP Microprocessors with Examples from TMS320C54xx	**2004**	Avatar Sing, S. Srinivasan	Thomson India
4	DSP Integrated Circuits	1999	Lars Wanhammer	Academic press, New York
5	Digital Signal Processing: A Modern Introduction	2007	Ashok Ambardar	Thomson India edition, 2007.

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Second Semester

EL2919	PE II : EHV Power Transmission	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: Mention the objectives of the course here. Not more than 5 lines

UNIT-1:Introduction
Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance.

UNIT-2:Calculation of Line Parameters
Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return, numerical example involving a typical 400/220kV line using line constant program.

UNIT-3: **Voltage Gradients Of Conductors**
Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

UNIT-4:Corona Effects-I :
Power losses and audible losses: I^2R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference.

UNIT-5 : Corona Effects – II :-
Corona pulses (their generation and properties),Frequency spectrum,Properties of pulse trains and filter response ,Limits for radio interference fields ,the CIGRE formula,The RI excitation functionProcedure for obtaining excitation fudnction from CIGRE Formula,Design of filter, television Interference.

UNIT-6:Electrostatic Field Of EHV Lines
Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines- effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in unenergised circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference.

Text books:

1	Extra High Voltage AC Transmission Engineering	Second Edition, 1990	Rakosh Das Begamudre	New Age International Pvt. Ltd
2	Power Engineer's Handbook	6th Edition, Oct. 2002		TNEB Engineers' Association
3	Microtran Reference Manual www.microtran.com		Microtran Power System Analysis Corporation	

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Second Semester

EL2920	PE II : Restructuring of Power System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1:Deregulation of Electricity Market

Introduction to Power System Deregulation, Reform Motivations, Traditional Model, Separation of Ownership, Competition and Direct Access in the Electricity Market, Role of ISO, Retail Market, International Experiences

UNIT-2:Electricity Market Characteristics

Direct Access and Power Wheeling, Pool & Bilateral trading, Bidding and Auction Mechanisms, Market Timing, Sequential and Simultaneous Markets, Scheduling, Gaming, Congestion Management

UNIT-3: Transmission Open Access

Transmission Open Access, Transmission Pricing, Impact of Congestion and Management, ATC and Factors affecting ATC, Determination of ATC, Ancillary Services and their management, Electricity Bill 2003 and its impact.

UNIT-4 Optimal Power Flow

OPF and its Formulation, Constraints, Different solution Techniques, Non Linear Programming (NLP) and Genetic Algorithm.

UNIT-5: SCADA and Distribution Automation

SCADA & Distribution Automation, Energy management system

UNIT-6: Power System Communication

Analog and Digital Communication, communication architecture, Power system communication, PLCC, Optical Fibre etc

Text books:

1	Power System restructuring and deregulation	2001	Loi Lei Lai	John Wiley and Sons, UK.
2	Operation of Restructured Power Systems	2001	K. Bhattacharya, MHT Bollen and J.C Doolder	Kluwer Academic Publishers, USA
3	Power System Operation and Control		A.J Wood and B.F Wollenberg	John Wiley and Sons

Reference books:

1	Computational Methods for large Sparse Power System Analysis: An Object Oriented Approach	**Edition (Year of publication)**	S.A Soman, S.A Khafasok, ShubhaPandit	Kluwer Academic Publishers

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Third Semester

EL2931	PE III : **Power System Stability**	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand various types of stabilities in power system, their analysis and means to overcome the instability.

UNIT-1: Introduction

Power System Operation and Control, power system stability, classification of stability, mid-term and long term stability, Impact on Power System Operation, classical representation of synchronous machine in a single machine infinite bus system (SMIB), limitations of classical model

Unit 2: Excitation and Prime Mover

Characteristics and types of excitation systems, IEEE type-I excitation system, Prime mover and energy supply systems, mathematical modeling of simple excitation system, power system stabilizers

UNIT-3: Steady state and transient characteristics of system

Phasor diagrams in terms of voltages Eq, Eq', and Vg for salient and non salient pole machines, Derivation of power expressions, saliency, Characteristics of system with generator operating at synchronous speed

UNIT4: Steady state stability

Steady state stability, characteristics, effect of damping, positive, negative resistance and turbine regulation, effect of induced currents in field winding, stability analysis with excitation

Unit 5: Transient stability

Transient stability, swing equation, equal area criterion, solution of swing equation, Numerical methods- Modified Euler's method, Runge-Kutta method, Multimachine stability, Extended equal area criterion

Unit 6: Voltage stability

Classification of voltage stability, voltage stability analysis: static and dynamic, comparison with angle stability,
Voltage collapse, prevention of voltage collapse

Text books:

1	Power System Stability and control	Prabha Kundur	Mc Graw Hill Inc
2	Power System Stability Vol. III	Edward Kimbark	IEEE Press, Wiley Inter science John Wiley & Sons Publication
3	Power System Dynamics : Stability and Control	K.R. Padiyar	2nd edition BS Publications
4	Computational Techniques for voltage stability assessment and control	Aijarapu V	. Springer

Reference books:

1	Power System Dynamics : Stability Control	Jan Machowski	John Wiley & Sons (2nd Edition)
2	Power System Analysis	Grainger, Stevenson	McGraw-Hill series in Electrical & Computer Engineering

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Third Semester

EL2932	PE III : Electrical Distribution Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To understand the various aspects of distribution including type of distribution system, voltage level, equipment's used, protection etc.

UNIT-1:Introduction to Distribution systems, Regulations, Electricity Act 2003, Energy conservation act-2001, electricity rules-2005, electricity authority regulations, distribution code, consumer values, consumer satisfaction, measurement standards of consumer satisfaction, Model distribution system.
Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor-Relationship between the load factor and loss factor - Classification of loads. Load, Management Strategies : Differential tariff, load staggering, interruptible load, supplies, maintenance of essential services, integrated system operation, use of captive generation & cogeneration in distribution network, distribution system measures, conservation.

UNIT-2:Feeders : Radial and loop types, Engineering considerations for voltage levels and loading, causes of unbalance and unequal drops. System analysis : Voltage drop and power loss calculations, manual methods of solution of radial networks, three-phase & non-three-phase primary lines load flow and symmetrical component applications.

UNIT-3: Voltage control : Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop calculations and compensations, Reactive power requirements, economic consideration & best location.

UNIT-4: Distribution System Reliability : Basic defination, Appropriate levels of distribution reliability, Series & Parallel System, Markov Processes, Distribution reliability Indices, System and customer based indices, load and energy based indices, usage of reliability indices.

UNIT-5 : Introduction to Distribution Automation, Data acquisition system and decentralized control, data acquisition and protection considerations of control panel. Circuit breaker, reclosers, sectionalizers, location of sectionalizers, fuses, low voltage and current limiting fuses, expulsion fuses, fuses applications considerations, lightning protection, disconnect switches, non load break disconnect switches, break disconnect switches., relays.
Earthing System: Earth and safety, nature of an earth electrode, earth conductor sized, design of earthing electrode, electrode earth resistance, temporary earthing, system earthing, line and substation earthing, substation earthing mat, consumer installation earthing.

UNIT-6: Substation :-Substation layout, selection criteria, voltage and spacing load, space and location, distribution substation protection needs, distribution substation construction methods, trends in distribution substation, insulation coordination, voltage regulation, distribution substation layout, one feeder substation, single bus substation, two transformer distribution substation, automatic switching, double bus substation, bus arrangements, fault, distribution substation protection, zones of protection, transformer and bus protection, feeder overcurrent protection, substation grounding.

Text books:

1	Electric Power Distribution	4th edition, 1997	A.S.Pabla, , .	Tata McGraw-Hill Publishing Company
2.	Electric Power Distribution System Engineering	2nd Edition 2008	Turan Gonen	CRC Press

Reference books:

1	A Text Book of Electric Power Distribution Automation	Edition (Year of publication)	. Khedkar and Dr. G. M. Dhole,.	Laxmi Publications

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Third Semester

EL2933	PE III : Power System Operation and Control	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: Mention the objectives of the course here. Not more than 5 lines

UNIT-1:Load Forecasting
Introduction – Estimation of Average and trend terms – Estimation of periodic components – Estimation of Stochastic components : Time series approach – Auto- Regressive Model, Auto-Regressive Moving – Average Models – Kalman Filtering Approach – On-line techniques for non stationary load prediction.

UNIT-2:Unit Commitment
Constraints in unit commitment – Spinning reserve **–** Thermal unit constraints **–** Other constraints – Solution using Priority List method, Dynamic programming method - Forward DP approach Lagrangian relaxation method – adjusting .

UNIT-3: **Generation Scheduling**
The Economic dispatch problem – Thermal system dispatching with network losses considered – The Lambda – iteration method – Gradient method of economic dispatch – Economic dispatch with Piecewise Linear cost functions – Transmission system effects **–** A two generator system **–** coordination equations **–** Incremental losses and penalty factors-Hydro Thermal Scheduling using DP.

UNIT-4:Control of Power Systems
Review of AGC and reactive power control -System operating states by security control functions – Monitoring, evaluation of system state by contingency analysis – Corrective controls (Preventive, emergency and restorative) - Energy control center – SCADA system – Functions – monitoring , Data acquisition and controls – EMS system.

UNIT-5 : State Estimation
Maximum likelihood Weighted Least Squares Estimation: - Concepts - Matrix formulation - Example for Weighted Least Squares state estimation ; State estimation of an AC network: development of method **–** Typical results of state estimation on an AC network **–** State Estimation by Orthogonal Decomposition algorithm.

UNIT-6:Advance Measurements
Introduction to Advanced topics : Detection and Identification of Bad Measurements , Estimation of Quantities Not Being Measured , Network Observability and Pseudo **–** measurements **–** Application of Power Systems State Estimation .

Text books:

1	Electric Energy System Theory - an Introduction	**2002**	O.I.Elgerd	Tata McGraw Hill, New Delhi
2	Power System Stability and Control		P.Kundur	EPRI Publications, California
3	Power System Operation and Control		A.J Wood and B.F Wollenberg	John Wiley and Sons

Reference books:

1	Computer Aided Power System Analysis and Control	**1984**	A.K.Mahalanabis, D.P.Kothari. and S.I.Ahson	Tata McGraw Hill publishing Ltd

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Third Semester

EL2934	PE III : Transients in Power Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: The insulation system be capable of withstanding such high normal system voltages, it should also be capable of withstanding transient overvoltage associated with external lighting discharges or internal switching operations without any outage.

UNIT-1:Travelling Waves On Transmission Line
Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

UNIT-2:Computation Of Power System Transients
Principle of digital computation – Matrix method of solution, Modal analysis,Z transforms, Computation using EMTP – Simulation of switches and non-linear elements.

UNIT-3 : Lightning, Switching And Temporary Overvoltages
Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Factors contributing to line design – Switching: Short line or kilometric fault – Energizing transients - closing and re-closing of lines - line dropping, load rejection - Voltage induced by fault – Very Fast Transient Overvoltage (VFTO)

UNIT-4:Behaviour Of Winding Under Transient Condition
Initial and Final voltage distribution - Winding oscillation - traveling wave solution -

UNIT-5 : Transformer under Surge Condition
Behaviour of the transformer core under surge condition – Rotating machine – Surge in generator and motor

UNIT-6:
Insulation Co-Ordination
Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), insulation level, statistical approach, co-ordination between insulation and protection level –overvoltage protective devices – lightning arresters, substation earthing.

Text books:

1	Electromagnetic transients in Power System	1996.	PritindraChowdhari	John Wiley and Sons Inc
2	Electrical Transients in Power System	1991	Allan Greenwood	Wiley & Sons Inc. New York
3	Surges in High Voltage Networks	1980	Klaus Ragaller	Plenum Press, New York

Reference books:

1	Extra High Voltage AC Transmission Engineering	Second edition,1980	Rakosh Das Begamudre	Newage International (P) Ltd., New Delhi
2	High Voltage Engineering	2004.	Naidu M S and Kamaraju V	Tata McGraw-Hill Publishing Company Ltd., New Delhi
3	IEEE Guide for safety in AC substation grounding IEEE Standard 80-2000			
	Very fast transient phenomena associated with Gas Insulated System'		CIGRE, Working Group 33/13-09 (1988)	

Third Semester

EL2935	PE IV : Distribution Automation	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: Mention the objectives of the course here. Not more than 5 lines

UNIT-1:Distribution Automation and the utility system
Introduction to Distribution Automation (DA), control system interfaces, control and data requirements, centralized (Vs) decentralized control, DA System (DAS), DA Hardware, DAS software.

UNIT-2:Distribution Automation Functions
DA capabilities, Automation system computer facilities, management processes, Information management, system reliability management, system efficiency management, voltage management, Load management.

UNIT-3:Communication Systems for DA
DA communication requirements, Communication reliability, Cost effectiveness, Data rate requirements, Two way capability, Ability to communicate during outages and faults, Ease of operation and maintenance, Conforming to the architecture of data flow.

UNIT-4:Communication systems used in DA
Distribution line carrier (Power line carrier), Ripple control, Zero crossing technique, telephone, cable TV, Radio, AM broadcast, FM SCA, VHF Radio, UHF Radio, Microwave satellite, fiber optics, Hybrid Communication systems, Communication systems used in field tests.

UNIT-5 : Technical Benefits
DA benefit categories, Capital deferred savings, Operation and Maintenance savings, Interruption related savings, Customer related savings, Operational savings, Improved operation, Function benefits, Potential benefits for functions, function shared benefits, Guide lines for formulation of estimating equations, Parameters required, economic impact areas, Resources for determining benefits impact on distribution system, integration of benefits into economic evaluation.

UNIT-6:Economic Evaluation Methods
Development and evaluation of alternate plans, Select study area, Select study period, Project load growth, Develop Alternatives, Calculate operating and maintenance costs, Evaluate alternatives, Economic comparison of alternate plans, Classification of expenses and capital expenditures, Comparision of revenue requirements of alternative plans, Book Life and Continuing plant analysis, Year by year revenue requirement analysis, short term analysis, end of study adjustment, Break even analysis, Sensitivity analysis computational aids.

Text books:

1	A Text Book of Electric Power Distribution Automation	. Khedkar and Dr. G. M. Dhole,.	Laxmi Publications
2	Electric Power Distribution	A. S. Pabla	Tata McGraw Hill Publication, New Delhi
3	Distribution Automation	IEEE Tutorial Course	

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Third Semester

EL2936	PE IV : **Power Electronics for Renewable Energy Systems**	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objectives: To overview the different renewable energy system and generator usedand to understand their different configurations and topology. The objective is to study the various Grid interactive power converter topologies used in Wind and solar energy conversion system and their hybrid combination and the related power quality issues.

UNIT-1:introduction
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT-2: Solar Thermal and Photovoltaic System
Solar Thermal: Different Solar Concentrators and solar thermal applications
Solar Photovoltaic: PV cell equivalent and V-I, P-V characteristics, DC-DC Converters and its role in Maximum Power Point Tracking (MPPT), MPPT techniques (Direct and Indirect)

UNIT-3: Solar PV converters and Configurations
PV inverters: PV inverter Configurations, PV based transformerless inverter topologies.
Configuration: Standalone, Grid interactive, Bi-Modal systems, Grid synchronization (time and frequency Domain), Islanding and detection methods, Generic control for PV inverters.

UNIT-4: Wind Energy Conversion System (WECS)
WECS: Introduction to WECS, Wind turbine technologies, WECS configurations and fundamentals of WECS controls, wind MPPT control, operation and analysis of wind generators (IG, PMSG, SCIG, DFIG)

UNIT-5 : Power Converters, Configurations and Controls for Wind Energy Systems

Power Converters: AC Voltage Controllers, PWM inverters, Grid interactive inverters
Configurations and Controls: Fixed speed WECS, Variable speed WECS (converter configurations for IG, PMSG based WECS and their controls)

UNIT-6 : Hybrid Renewable Energy System and Power Quality (PQ)

Need for Hybrid Systems and type of Hybrid systems, PQ issues in grid interconnections, measurement of voltage flicker, voltage dip, voltage swell, harmonics in grid integration and remedial measures.

Text books:

1	Power Electronics Hand book	2001.	Rashid .M. H	Academic press,
2.	Power Electronics for Modern Wind Turbines	2006	F. Blaabjerg and Z. Chen	Morgan & Claypool Publishers, 2006
3	Non-conventional Energy Sources	2006	B. H. Khan	Tata McGraw Hill,
4	Modern Power Electronics and AC Drives	2001	B. K. Bose	Prentice Hall PTR

Reference books:

1	Wind energy system		Gray, L. Johnson	prentice hall inc
2	Power Conversion and Control of Wind Energy System	2011	Bin Wu, Yongqiang Lang, Navid Zargari, Samir Kouro	John Willey & Sons Inc., Publications , IEEE Press.2011
3.	Grid Converters for Photovoltaic and Wind Power Systems	2011	Remus Teodorescu. Marco Liserre, Pedro Rodriguez	John Willey & Sons Inc., Publications , IEEE Press.2011
4.	Analysis of Electric Machinery and Drive Systems		P. C. Krause, O. Wasynzuk, and S. D. Sudhoff	John Willey & Sons Inc., Publications , IEEE Press.
5.	Wind Power in Power System	2005	T. Ackermann	John Willey & Sons Inc., Publications , IEEE Press.2005

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Third Semester

EL2937	PE IV : Control System Design	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course objectives
The theory of design of control system is particularly useful for various analytical design approaches in various power system problems. Students will study the time domain and frequency domain approach for linear time invariant systems. They shall be explored to design of discrete state variable and state estimation using observers and the optimal control methods are covered for specific systems.

Course Outcomes
Upon successful completion of this course you should be able to:
1) Design PID controller and compensators for practical systems 2) Understand time domain and frequency
3) domain interpretations of various controller 4) Apply the controller design methods for discrete systems
5) Design discrete state variable systems 6) Formulate the observer design procedures
7) Understand and solve the formulation of optimal control problems

UNIT-1: CONVENTIONAL DESIGN METHODS IN TIME DOMAIN
Design specifications, Fixed configuration design, Time domain interpretations of PI, PD and PID controllers and lead, lag and lag-lead compensators- Root locus based design, Design examples.

UNIT-2: CONVENTIONAL DESIGN METHODS IN FREQUENCY DOMAIN
Frequency domain specifications, Correlation between time and frequency domain, Frequency domain interpretations of PI, PD and PID controllers and lead, lag and lag-lead compensators, Design examples

UNIT-3 : DESIGN IN DISCRETE TIME DOMAIN
Design of Discrete-time control system by conventional methods: Introduction, Digital implementation of analog controller (PID and lead-lag controllers) : Digital controllers, Realization of pulse transfer function by direct, Cascade and parallel programming. Design based on root locus method. Dead beat controller.

UNIT-4 : DISCRETE DESIGN IN FREQUENCY DOMAIN
Mapping between S plane and Z plane, Bilinear transformation, Design based on frequency domain for PID and lag lead compensators. . Design examples

UNIT-5: DISCRETE STATE VARIABLE DESIGN
Discrete pole placement- state and output feedback-estimated state feedback, state feedback with integral control, State Estimation Problem -State estimation- Luenberger's observer and reduced order observer. Concept of Sliding Mode controller.

UNIT-6: OPTIMAL CONTROL
Formation of optimal control problems-Results of Calculus of variations- Hamiltonian formulation-solution of optimal control problems- Evaluation of Riccati's equation. State and output Regulator problems-- dynamic programming-Design examples.

Text books:

1	Modern control system Theory	2005	M. Gopal	New Age International
2	Digital control systems	2004	Benjamin C. Kuo	Oxford University Press
3	Discrete time control systems	2002	Katsuhiko Ogata	Pearson Education Asia
4	Control systems principals and design	2003	M. Gopal	TMH

Reference books:

1	Control system Design	2003	Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado	PHI (Pearson), 2003
2	Digital Control of Dynamic Systems	2002.	G. F. Franklin, J. D. Powell and M Workman	PHI (Pearson),

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Third Semester

EL2938	**Lab.: Power System Design**	L=0	T=0	P=3	Credits=3

Evaluation Scheme	TA	ESE	Total
	40	60	100

Practices may be carried out on the following topics but are not limited.

- HVDC Transmission
- HVAC transmission.
- Steady state and transient stability.
- Voltage stability.
- Different fault analysis.
- Sub synchronous resonance.
- Reactive power compensation (shunt, series etc.).

Groups can be formed for some of the practical's consisting of four or five students for the following reasons to get every student involved in the practical

(a) Different voltages and different power ratings in some of the practical may be assigned to them.
(b) Various reactive power compensators etc.

Third Semester

EL2939	Project Phase-I	L=0	T=0	P=16	Credits=8

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	100	0	100	

Fourth Semester

EL2940	Project Phase-II	L=0	T=0	P=24	Credits=12

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	0	0	40	60	100	

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

SoE & Syllabus 2018-19

M. Tech. Electronics Engineering

28 June 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. SCHEME OF EXAMINATION 2018-19

Electronics Engineering

SN	Sem	Sub Code	Subject	T/P	Contact				Credits	% Weightage				ESE Duration
					L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
I SEMESTER														
1	1	EE2901	Advanced Digital Signal Processing	T	3	0	0	3	3	15	15	10	60	3
6	1	EE2902	Lab: Advanced Digital Signal Processing	P	0	0	2	2	1			40	60	
2	1	EE2903	Digital IC Design	T	3	0	0	3	3	15	15	10	60	3
7	1	EE2904	Lab: Digital IC Design	P	0	0	2	2	1			40	60	
3	1	EE2905	RISC & DSP Processor Architecture	T	3	0	0	3	3	15	15	10	60	3
4	1	EE2906	Advanced Digital System Design	T	3	0	0	3	3	15	15	10	60	3
8	1	EE2907	Lab: Advanced Digital System Design	P	0	0	2	2	1			40	60	
5	1	EE2908	Advanced Communication Systems	T	3	0	0	3	3	15	15	10	60	3
Total					**15**	**0**	**6**	**21**	**18**					
II SEMESTER														
1	2	EE2911	RF Circuit Design	T	3	0	0	3	3	15	15	10	60	3
2	2	EE2912	Lab: RF Circuit Design	P	0	0	2	2	1			40	60	
3	2	EE2913	Soft Computing Techniques	T	3	0	0	3	3	15	15	10	60	3
4	2	EE2914	Digital Image Processing	T	3	0	0	3	3	15	15	10	60	3
5	2	EE2915	Lab : Digital Image Processing	P	0	0	2	2	1			40	60	
6	2	**Professional Elective- I**		**T**	3	0	0	3	3	15	15	10	60	3
7	2	**Professional Elective- II**		**T**	3	0	0	3	3	15	15	10	60	3
8	2	EE2922	Seminar	P	0	0	2	2	1			100		
Total					**15**	**0**	**6**	**21**	**18**					

List of Professional Electives-I

2	EE2916	PE I: Analog IC Design
2	EE2917	PE I: Multirate signal Processing
2	EE2918	PE I: Low Power CMOS VLSI Design

List of Professional Electives-II

2	EE2919	PE II: Wireless Communication
2	EE2920	PE II: VLSI Signal Processing
2	EE2921	PE II: Verification & testing of VLSI Circuit

III SEMESTER														
1	3	**Professional Elective- III**		T	3	0	0	3	3	15	15	10	60	3
2	3	**Professional Elective- IV**		T	3	0	0	3	3	15	15	10	60	3
3	3	EE2939	Project Phase - I	P	0	0	16	16	8			100		
Total					**6**	**0**	**16**	**22**	**14**					

List of Professional Electives-III

3	EE2931	PE III :Wireless Sensor
3	EE2932	PE III :Biomedical Instrumentation
3	EE2933	PE III :Mixed signal VLSI Design
3	EE2934	PE III :Cryptography & Network Security

List of Professional Electives-IV

3	EE2935	PE IV :Adaptive Signal Processing
3	EE2936	PE IV :Embedded System & RTOS
3	EE2937	PE IV :Advanced Computer Architecture
3	EE2938	PE IV :Pattern recognition

IV SEMESTER														
1		EE2940	Project Phase - II	P	0	0	24	24	12			40	60	
Total					**0**	**0**	**24**	**24**	**12**					
Grand Total of Credits									**62**					

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I Semester

EE2901	Advanced Digital Signal Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
To acquaint students with advanced methods of digital signal processing and their application in practice. Design and testing of systems for advanced signal processing, aiming at optimum and adaptive noise reduction, identification and modeling of systems, reconstruction and restoration, analysis and classification of signals and images	1. Graduates will be able classify the transfer functions based on systems. 2. Graduates will understand and able to design and realize FIR and IIR filters using different methodologies. 3. Graduates will able to implement the DSP algorithms. 4. Graduates will understand and analyse multirate signal processing concepts.
Mapped Program Outcomes: a, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will be able classify the transfer functions based on systems.				S			
2	Graduates will understand and able to design and realize FIR and IIR filters using different methodologies.	S			L			
3	Graduates will able to implement the DSP algorithms.	S			S			
4	Graduates will understand and analyze multirate signal processing concepts.	S			M			

Unit I: LTI Discrete Time Systems in the Transform Domain

Transfer function classification based on Magnitude characteristics, Transfer function classification based on phase characteristics, Types of linear phase transfer functions, Simple Digital Filters, Complementary Transfer Functions, Inverse Systems, System Identification, Digital Two pairs, Algebraic Stability Test.

UNIT II: Digital Filter Structures

Block Diagram representation, Equivalent Structures, Basic FIR Digital filter structures, Basic FIR Digital filter structures, All pass Filters, Tunable IIR filters, IIR Tapped Cascaded Lattice Structures , IIR Tapped Cascaded Lattice Structures, Parallel All pass Realization Of IIR Transfer Functions, Digital Sine-Cosine Generator, Computational Complexity of Digital Filter Structures.

UNIT III: IIR Digital Filter Design and FIR Digital Filter Design

Preliminary Considerations, Bilinear Transformation Method of IIR Filter Design, Design of Lowpass IIR Digital Filters, Design of High pass, Band pass, and Band stop IIR Digital Filters, Preliminary Considerations, FIR Filter Design Based on Windowed Fourier Series, Design of linear phase, minimum phase FIR filters, Design of Computationally efficient FIR Digital filters.

UNIT IV: DSP Algorithm Implementation

Computation of Discrete Fourier Transform, Fast DFT Algorithms Based on index mapping, DFT and IDFT Computation, Sliding Discrete Fourier Transform, DFT Computation over a Narrow Frequency Band, Number representation, Arithmetic Operations, Handling of Overflow, Tunable Digital Filters.

UNIT V: Analysis of Finite Word length effect

The Quantization Process and Errors, Quantization of Fixed point Numbers, Quantization of floating point Numbers, Analysis of Coefficient Quantisation Effects, A/D conversion Noise Analysis, Analysis Of Arithmetic Round off Errors, Dynamic Range Scaling, Signal To noise ratio in low order IIR Filters, Low Sensitivity Digital Filters, Reduction of product round off errors using Error Feedback, Limit Cycles in IIR Digital Filters, Round Off Errors in FFT Algorithm.

UNIT VI: Multirate DSP

Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion, Polyphase filter structure.

Resources:

1. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata Mc Graw-Hill, 2008,3rd edition.
2. Digital Signal Processing. Principles, algorithms, and applications by John G. Proakis and Dimitris G.Manolakis, PHI, 1997.3rd edition
3. Oppenheim and Schafer, Discrete Time signal Processing, Prentice Hall, 2nd edition.
4. Theory and applications of digital signal processing by Lawrence R. Rabiner and Bernard Gold, PHI,1st edition

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I Semester

EE2903	Digital IC Design	L= 3	T = 0	P = 0	Credits =3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The aim of this course is to give knowledge and skills in the area of CAD design of digital circuits, units and systems on currently usable VLSI chips.	1. Graduates will able to demonstrate issues related to the development of digital integrated circuits including fabrication, circuit design, implementation methodologies 2. Graduates will able to Solve complex circuit problems and optimization techniques 3. Graduates will able to design CMOS combinational, sequential logic design
Mapped Program Outcomes: a, d	

Sr.	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will able to demonstrate issues related to the development of digital integrated circuits including fabrication, circuit design, implementation methodologies	H						
2	Graduates will able to Solve complex circuit problems and optimization techniques				M			
3	Graduates will able to design CMOS combinational, sequential logic design				M			

Unit I: CMOS processing technology:

MOS transistors, CMOS logic, NAND gate, combinational logic, NOR gate, Compound gates, Pass transistor and transmission gates, tristates, multiplexers, latches and flip flops, inverter cross section, fabrication process, Layout design rules, CMOS processing technology, CMOS Process enhancements, stick diagram, VLSI design flow ,Euler path in a CMOS gate.

Unit II: MOS transistor theory:

MOS transistor theory, Working of nMOS enhancement transistor & PMOS enhancement transistor, Ideal Current voltage characteristics, threshold voltage , nonideal current voltage effects, velocity saturation, mobility degradation, channel length modulation, Body effect, sub-threshold conduction, Junction leakage, Tunnelling, Temperature dependence, Geometry dependence, Small signal AC characteristics, CMOS inverter DC transfer characteristics, Beta ratio effects, noise margin, Ratioed inverter transfer function, switch level RC delay models

Unit III: Circuit characterization and performance estimation:

Delay estimation, RC delay models, linear delay model, logical effort, parasitic delay, Delay in a logic gate, delay in a multistage logic networks, power dissipation, interconnect, design margin, Reliability, Scaling

Unit IV: Combinational circuit design:

Circuit families, static CMOS, Ratioed circuits, Cascode voltage switch logic, dynamic circuits, pass transistor circuits, differential circuits, sense amplifier circuits, BiCMOS circuits

Unit V: Sequential Circuit design:

Sequencing static circuits, Sequencing methods, Max-delay constraints, Min-delay constraints, Time borrowing, clock skew, circuit design of latches and Flip flops, static sequencing element methodology, Two phase timing types, characterizing sequencing element delays, sequencing dynamic circuits, Synchronizers.

Unit VI: Array subsystems:

Static Random access memory, Dynamic random access memory, serial access memories,Content addressable memory Programmable logic arrays.

Resources:

1. "CMOS VLSI design: A Circuits and Systems Perspective", Neil H. E. Weste, David F. Harris, A.Banerjee, 3rd Edition, Addison Wesley Publication, 2008
2. "CMOS Digital Integrated Circuits: Analysis and Design", Sung-Mo Kang, Yusuf Lebeleci, 3rd Edition, McGraw-Hill Publications, 2002

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I Semester

EE2905	**RISC & DSP Processor Architecture**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The aim of this course is to give knowledge and skills in the area of embedded system particularly RISC architecture & develop a system around processor core particularly ARM core. • Also this subject will provide knowledge about DSP Processors and associated hardware experimentation.	1. Graduates will understand architectural details of ARM7, DSP processor & Embedded System. 2. Graduates will be able to demonstrate the Embedded based system design 3. Graduates will be able to interface various peripheral devices with processor to solve engineering problems.
Mapped Program Outcomes: a, b, d	

S	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will understand architectural details of ARM7, DSP processor & Embedded System.	H	L		L			
2	Graduates will be able to demonstrate the Embedded based system design		H		M			
3	Graduates will be able to interface various peripheral devices with processor to solve engineering problems.		H		M			

Unit – I: Introduction to Embedded Systems, RISC architecture, CISC architecture, Introduction to VLIW architecture, Von Neuman & Harward architecture, pipelining, MEMORY organization.

Unit– II: Architectural Features of ARM: Processor modes, Register organization, ARM exceptions, ARM and THUMB instruction sets, Programming, ARM development tools.

Unit–III : Pipeline ARM organisation, ARM instruction execution, Timing diagrams for data path, Co-processor interface, Hardware and software breakpoints, Exceptions and its handling, Memory faults.

Unit–IV : ARM architectural support for high level language programming, floating point data types, functions and procedures, Thumb instruction set, The ARM memory interface, the advanced buses: AMBA, ASB, APB, ARM Debugger.

Unit–V : Peripherals: Arm ADC, Real Time Clock, UARTs, SPI, Communication Protocols: I2C Bus, Control Area Network, Bluetooth

Unit–VI : DSP Architecture: MAC, Modified bus structures and Memory access schemes, multiple access Memory, Multi-ported memory, Pipelining, Special addressing modes, 32 bit floating point DSP Processor: architecture, block diagram, functional units, on chip memory, on chip peripherals.

Resources:

1. "ARM System-on-Chip Architecture", Steve Furber ,2nd Edition, Pearson Education,2002
2. "Digital signal processors",B. Venkataramani, M Bhaskar, 1st Edition, Tata McGraw Hill , 2002
3. "Embedded System Design", Frank Vahid and Tony Givargis, 1st Edition, Wiely Publication, 2002
4. Technical reference manuals from TI
5. "ARM System Developer's Guide: Designing and Optimizing", Sloss Andrew N, Symes Dominic, Wright Chris, Morgan Kaufman Publication.2004
6. Embedded Linux, Hardware, Software and interfacing 2002. Craig Hallabaugh Addison-Wesley Professional
7. "Embedded Systems: Architecture, Programming and Design" Raj Kamal 2nd Edition Tata McGraw-Hill Edication

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I Semester

EE2906	**Advanced Digital System Design**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design.	1. Graduates will be able to design and analyse combinational and sequential logic circuits. 2. Graduates will understand hardware description language and able to design and simulate digital systems using different abstraction levels. 3. Graduates will be able to understand and apply timing issues in multiple contexts and design the circuit. 4. Graduates will understand programmable devices and able to design digital systems using modern design tools.
Mapped Program Outcomes: a, c, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will be able to design and analyse combinational and sequential logic circuits.	H			H			
2	Graduates will understand hardware description language and able to design and simulate digital systems using different abstraction levels.	H			H			
3	Graduates will be able to understand and apply timing issues in multiple contexts and design the circuit.	L			M			
4	Graduates will understand programmable devices and able to design digital systems using modern design tools.	L		L				

Unit - I

Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs

Unit - II

HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module

Unit – III

Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog & Testbench, Compilation and synthesis, Timing analysis

Unit – IV

Data Flow Modelling, Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modelling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives

Unit - V

Behavioural Modelling, Initial, Always, Procedural Assignment, Blocking and Non- Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign De-assign, Force Release, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines

Unit - VI

Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Stacks and Queues, Multi bit Adders & Multiplier, Huffman Coding, Processor and Memory Model, CPU, System Tasks and Functions, Design Verification

Resources:

1. "Verilog Digital System Design" - Zainalabedin Navabi , Second Edition, Tata McGraw Hill , 2009
2. "Verilog HDL : A Guide to Digital Design and Synthesis" ,Samir Palnitkar, 2nd Edition , Prentice Hall India, 2003
3. "A Verilog HDL Primer", J. Bhaskar, 2nd Edition, Star Galaxy Press, 1997

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I Semester

EE2908	**Advanced Communication System**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To acquaint students to the advanced communication systems and methodology and various Issues related with Communication.	1. Graduates will be able to understand basic theory of digital communications and the most common digital communications techniques. 2. Graduates will be able to apply and analyze mathematical modeling to the problems in digital communications. 3. Graduates will be able to demonstrate the concept of modulation technique used in digital communication 4. Graduates will be able to understand error control coding and optimum receivers in communication systems.
Mapped Program Outcomes: a, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will be able to understand basic theory of digital communications and the most common digital communications techniques.	M			H			
2	Graduates will be able to apply and analyze mathematical modeling to the problems in digital communications.	H			M			
3	Graduates will be able to demonstrate the concept of modulation technique used in digital communication	L			M			
4.	Graduates will be able to understand error control coding and optimum receivers in communication systems.	L			H			

Unit I

Random Process: Mathematical Definition of a Random Process, Stationary Processes, Mean, Correlation and Covariance functions ,Transmission of a Random Process Through a linear Time Invariant Filter, Power Spectral Density, Gaussian Process, Noise, Narrowband Noise, Representation of Narrowband Nose in terms of In Phase and Quadrature components, Representation of Narrowband Noise in terms of Envelope and Phase components. .[CO1-M,CO2-H]

Unit II

Characterization of Communication Signals and Systems- Signal space representation- Vector space concept, signal space concept, orthogonal expansions of signals, representation of digitally modulated signals-memory less modulation methods, [CO1-M,Co2-H]

Unit III

Pulse Modulation techniques
Minimum Shift Keying (MSK) Modulation, GMSK, Continuous Phase Modulation (CPM) Schemes Channel Characterization and Modeling, Orthogonal Frequency Division Multiplexing (OFDM), Carrier Synchronization, Timing synchronization. [CO1-L,CO2-M,CO3-H]

Unit IV

Optimum receiver for signals corrupted by AWGN, performance of the Optimum receiver for memory less modulation, Optimum receiver for CPM signals Optimum receiver for signal with random phase in AWGN channel. The optimum filter, Schwarz's inequality, transfer function of optimum filter, matched filter, properties of Matched filter, correlation receiver. [CO2-M,CO3-S]

Unit V

Channel Capacity and Convolution Coding::Channel models, Channel Capacity, Transfer convolution Codes, Optimum decoding of convolution codes-Viterbi algorithm, Fano algorithm, Punctured convolution codes. [CO1-L,CO3-H]
.

Unit VI

Spread spectrum signals for digital communications: Introduction to Spread Spectrum Modulation, DSSS, FHSS, and CDMA signals, Code Acquisition and Tracking, Spread Spectrum as a Multiple Access Technique. [CO1-M,CO3-H]

Resources:

1. "Communication Systems", Simon Haykins, 4th edition,John Wiley and sons,INC
2. "Digital Communication", J.G. Proakis, 4th edition, McGraw Hill, 1995.
3. "Digital Communication", Edward. A. Lee and David. G. Messerschmitt, 2nd Edition, Allied Publishers, 2003

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I Semester

EE2902	**Lab.: Advanced Digital Signal Processing**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
To acquaint students with advanced methods of digital signal processing and their application in practice. Design and testing of systems for advanced signal processing.	1. Graduates will able to design and realize FIR and IIR filters using different methodologies using software 2. Graduates will be able to do statically and parametric analysis of the signals using software.
Mapped Program Outcomes: a, c, e, f	

Sr. No.	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will able to design and realize FIR and IIR filters using different methodologies using software	S		M		L	L	
2	Graduates will be able to do statically and parametric analysis of the signals using software.	S		M		L	L	

S.N.	Name of the experiment
1	Write a MATLAB program and function to generate different time signals. [CO2(M)]
2	To perform a signal manipulation (sine, cosine, ramp, exponential etc.). [CO2(M)]
3	To perform convolution and correlation generating function. [CO2(M)]
4	To find z-transform and plot pole zero plot. [CO2(M)]
5	To find DFT and IDFT of sequence in MATLAB. [CO1(S),CO2(M)]
6	To determine the circular convolution using MATLAB. [CO1(S),CO2(M)]
7	Design of IIR filter using windowing technique. [CO1(S),CO2(M)]
8	Design of IIR filter using Bilinear transformation. [CO1(S),CO2(M)]
9	Design of IIR/FIR filter using FDA tool. [CO1(S),CO2(M)]
10	To study and design LPF/HPF/BPF/BRF by simulink. [CO1(S),CO2(M)]

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I Semester

EE2904	**Lab: Digital IC Design**	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
To design & analyze the performance of MOS circuits	1. Graduates will able to design layout of basic gates, combinational & sequential logic circuits for the given technology using EDA tools 2. Graduates will able to optimize complex circuits 3. Graduate will be able to apply lambda/micron rules for designing layout
Mapped Program Outcomes: c, d, e, f	

Sr. No.	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will able to design layout of basic gates, combinational & sequential logic circuits for the given technology using EDA tools			H	H	H	H	
2	Graduates will able to optimize complex circuits			H	H	H	H	
3	Graduate will be able to apply lambda/micron rules for designing layout			H	H	H	H	

Sr. No	Name of Experiment	Mapping with CO
1.	a) Plot current voltage characteristics of nmos transistor using 0.5 micron technology b) Plot current voltage characteristics of PMOS transistor using 0.5 micron technology	CO1,CO3
2.	To design and simulate CMOS inverter using 0.5 micron technology	CO1,CO3
3.	Plot transfer characteristics of pseudo-nmos inverter with w/l for pmos is equal to twice w/l of nmos.	CO1,CO2,CO3
4.	Design and simulate two input CMOS NAND gate	CO1,CO2,CO3
5.	Design two input CMOS NOR gate.	CO1,CO2,CO3
6.	Design CMOS transmission gate.	CO1,CO2,CO3
7.	Design and simulate D-Latch using transmission gate	CO1,CO2,CO3
8.	Design 2:1 MUX using transmission gate	CO1,CO2,CO3
9.	Design two input CMOS XOR gate	CO1,CO2,CO3
10.	Design function f=not(A+B+C+D) using Euler path approach	CO1,CO2,CO3

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I Semester

EE2907	Lab: Advanced Digital System Design	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
To learn front end Digital System design flow.	1. Graduates will be able to design, simulate and synthesize digital systems using Modern digital system design tools. 2. Graduates will be able to apply timing issues in multiple contexts.
Mapped Program Outcomes: c, d, e, f	

Sr. No.	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1.	Graduates will be able to design, simulate and synthesize digital systems using Modern digital system design tools.			H		H	H	
2.	Graduates will be able to apply timing issues in multiple contexts.				H	M	H	

Sr. No	Name of Experiment
1	Verilog Code using Bitwise Operator .Test it with test stimuli generated by test bench.[CO1(H),CO2(H)]
2	Using GATE level primitive write verilog code and test it with test stimuli generated by test bench. [CO1(H),CO2(H)]
3	Verilog code using DATA flow modeling style. Test it with test stimuli generated by test bench. [CO1(H),CO2(H)]
4	Write verilog code using conditional assignment statement. Test it with test stimuli generated by test bench. [CO1(H),CO2(H)]
5	Write verilog code using Structural Modeling style. Test it with test stimuli generated by test bench. [CO1(H),CO2(H)]
6	Verilog code using Behavioral modeling style. Test it with test stimuli generated by test bench. [CO1(H),CO2(H)]
7	Write UDP for A. Combinational Circuit B.Sequential circuit [CO1(H),CO2(H)]
8	Write verilog code using switch level modeling for a. NAND gate b. Full adder using transmission gate [CO1(H),CO2(H)]
9	Write verilog code using while loop. [CO1(H),CO2(H)]
10	Write Verilog code for Mealy and Moore sequence detector.(using overlapping allowed and not allowed). [CO1(H),CO2(H)]
11	Mini Project[CO1(H),CO2(H)]

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II Semester

EE2911	RF Circuit Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To study RF component such as resonator, filter, transmission lines, etc • To learn design of RF amplifiers using transistors	1. Graduates will have an ability to demonstrate in- depth knowledge of general RF circuits, components and systems and an understanding of resonant circuits 2. Graduates will be able to understand and use Smith Chart for developing circuits in RF applications. 3. Graduates will be able to design impedance matching networks, passive RF filters and RF power amplifiers.
Mapped Program Outcomes: a, d	

Sr. No.	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will have an ability to demonstrate in- depth knowledge of general RF circuits, components and systems and an understanding of resonant circuits	H			L			
2	Graduates will be able to understand and use Smith Chart for developing circuits in RF applications.	M			H			
3	Graduates will be able to design impedance matching networks, passive RF filters and RF power amplifiers.				H			

Unit – I

Introduction, Importance of Radio frequency Design, RF Behaviour of Passive Components, Chip Components, Transmission Line Analysis, Equivalent Circuit Representation, Circuit Parameters for a Parallel Plate Transmission Line, Microstrip Transmission Line, Terminated Lossless Transmission Line, Special Termination Conditions, Sourced and Loaded Transmission Line.

Unit – II

The Smith Chart, From Reflection Coefficient to Load Impedance, Impedance Transformation, Admittance, Transformation, Parallel and Series Connections, Single- and Multiport Networks, Interconnecting Networks, Network Properties and Applications, Scattering Parameters.

Unit – III

An Overview of RF Filter Design, Basic Resonator and Filter Configurations, Special Filter Realizations, Filter Implementation, Coupled Filter.

Unit – IV

Matching and Biasing Networks: Impedance Matching Using Discrete Components, Microstrip Line Matching Networks, Amplifier Classes of Operation and Biasing Networks.

Unit – V

RF Transistor Amplifier Designs: Characteristics of Amplifiers, Amplifier Power Relations, Stability Considerations, Constant Gain, Noise Figure Circles, Constant VSWR Circles, Broadband, High-Power, and Multistage Amplifiers

Unit – VI

Oscillators, Basic Oscillator Model, High-Frequency Oscillator Configuration, Oscillators describing functions, Colpitt's oscillators Resonators, Tuned Oscillators, Negative resistance oscillators, Phase noise Basic Characteristics of Mixers. Non-linear based mixers, Quadratic mixers, Multiplier based mixers, Single balanced and doubles balanced mixers, sub sampling mixers.

Resources:

1. "RF Circuit Design – Theory and Applications", Reinhold Luduig and Pavel Bretchko, 2nd Edition, Pearson Education, 2000.
2. T.Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004.
3. B.Razavi, "RF Microelectronics", Pearson Education, 1997.
4. B.Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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II Semester

EE2913	**Soft Computing Techniques**	L= 3	T =0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience & neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems. • To provide the mathematical background for carrying out the optimization associated with neural network learning • To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations	1. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems 2. Graduates will have an ability to identify and describe the control operation by applying a soft computing methodology for a particular problem 3. Apply neural networks to pattern classification and regression problems 4. Apply genetic algorithms to optimization problems and evaluate and compare solutions by various soft computing approaches for a given problem
Mapped Program Outcomes: a, b	

Sr. No.	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems	H						
2	Graduates will have an ability to identify and describe the control operation by applying a soft computing methodology for a particular problem	L	H					
3	Apply neural networks to pattern classification and regression problems	M	H					
4	Apply genetic algorithms to optimization problems and evaluate and compare solutions by various soft computing approaches for a given problem		H					

Unit I : Fuzzy sets- Basic concepts, representation of fuzzy sets, extension principle for fuzzy sets.

Unit II : Fuzzy arithmetic, Arithmetic operations on intervals and fuzzy numbers, fuzzy equations, Fuzzy relations, Fuzzy expert systems, fuzzy controllers

Unit III : Introduction to neural networks, Neural Network architectures and learning processes, Single and Multi-layer perceptions.

Unit IV : Feed-forward nets- Back propagation network, Radial Basis Function networks, Self organizing maps- Kohonen SOM, Learning vector quantization, MAX net, Maxican Hat, Hamming net

Unit V : Basic concepts of Genetic Algorithms, working principle, methods of encoding, fitness function and reproduction

Unit VI : Introduction to Neuro - fuzzy Systems, Fuzzy-Neural and Neuro-Fuzzy, Neuro-fuzzy-GA Hybrid models

Resources:

1. "Fuzzy sets and Fuzzy logic – Theory and Applications", George J. Klir , Bo Yuan ,2nd Edition, Prentice Hall,1995
2. "Neural Networks – A Comprehensive Foundation", Simon Haykin,2nd Edition, PearsonEducation, 1998
3. "Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications",S.Rajasekaran, G.A. Vijayalakshmi Pai, 6th Edition , Prentice Hall of India, 2004
4. "Fuzzy Logic – Intelligence, control and Information", John Yen, Reza Langari, 1st Edition, Pearson Education, 1999
5. "Neural Network Design", Martin Hagan, Howard Demuth, Mark Beale,1st Edition, Thomson Learning, 1996
6. "Introduction of Artificial Neural Networks", Jacek Zurada, 2nd Edition, Jaico Publishing House, 2005
7. "Multi-objective Optimization and Genetic Algorithm", Kalyanmay Deb, Wiley Publications, 2001

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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II Semester

EE2914	Digital Image Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• Provide deeper knowledge of theoretically demanding methods of image data processing and of their applications.	Upon successfully completing the course, the student should: 1. Demonstrate the understanding of fundamentals of Digital image processing wrt to enhancement, filtering, segmentation, restoration & representation 2. Able to understand the mathematical implementation & interpretation of image transforms 3. be able to formulate solutions to general image processing problems 4. develop skill base necessary to further explore advanced topics of Digital Image Processing for research
Mapped Program Outcomes: a, c, d	

Sr. No.	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Demonstrate the understanding of fundamentals of Digital image processing wrt to enhancement, filtering, segmentation, restoration & representation	H		M	M			
2	Able to understand the mathematical implementation & interpretation of image transforms	H		M	M			
3	be able to formulate solutions to general image processing problems	H		M	M			
4	develop skill base necessary to further explore advanced topics of Digital Image Processing for research	M		M	M			

Unit I

An image model – sampling & quantization – basic relation between pixels: imaging geometry, Properties of 2-D Fourier transforms, FFT algorithm and other separable image transforms, Walsh transforms, Hadamard, Cosine, Haar, Slant Transforms, KL Transforms and their properties, Wavelets.

Unit II

Spatial domain methods, Frequency domain methods, Histogram Modification technique, Neighbourhood averaging, Median filtering, Low pass filtering, Averaging of Multiple Images, Image sharpening by differentiation, High pass Filtering,

Unit III

Degradation model for Continuous functions, Discrete Formulation, Diagonalization of Circulant and Block –Circulant Matrices, Effects of Diagonalization, Constrained and unconstrained Restorations Inverse filtering, Wiener Filter, Constrained least Square Restoration.

Unit IV

Fundamentals, Image compression models, error free compression, lossy compression, image compression standards Objective an subjective Fidelity Criteria, the encoding process, the Mapping, the Quantizer and the Coder, Contour Encoding, Run length Encoding, Image Encoding relative to a Fidelity Criterion, Differential Pulse Code Modulation, Transform Encoding.

Unit V

The detection of Discontinuities, Point Line and Edge Detections, Gradient Operators, Combined Detection, Image segmentation Thresholding. Region oriented segmentation Representation Schemes, Chain Codes, Polygon Approximation, Boundary Descriptors, Simple Descriptors, Shape Numbers, Fourier Descriptors Dilation and erosion, opening and closing hit-or-miss transformation, morphological algorithms, extension to gray scale images.

Unit VI

Color Image Processing: Color Fundamentals, color models, Pseudocolor image processing, Basics of full color image processing, Color transformations, Smoothing and sharpening, Color segmentation, Noise in color images,

Resources:

1. "Digital Image Processing", Gonzalez RC & Woods RE, 2nd Edition ,Addison Wesley Publishing Company,2002
2. "Fundamentals of Digital Image Processing" ,3rd Edition, Jain AK, Printice Hall of India, 1989
3. "Digital Image Processing", Pratt William K., 4th Edition,John Wiley & Sons 2000.

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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II Semester

EE2916	PE I: Analog IC Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
To understand the functions of various digital and analog ICs and their applications in the design of electronic circuits.	1. Graduates will able to demonstrate behaviour of single, multiple transistor amplifiers. 2. Graduates will able to Solve complex circuit problems 3. Graduates will able to model integrated circuit devices 4. Graduates will be able to design nonlinear analog circuits.
Mapped Program Outcomes: a, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will able to demonstrate behaviour of single, multiple transistor amplifiers.	H			M			
2	Graduates will able to Solve complex circuit problems				H			
3	Graduates will able to model integrated circuit devices	H			M			
4	Graduates will be able to design nonlinear analog circuits.				L			

Unit I: Models for integrated circuit active devices:
Depletion region of a p-n junction, Small Signal & large signal behavior of MOS & BJT transistor, short channel effects in MOS transistors, weak inversion in MOS transistor, substrate current in MOS transistor

Unit II: Single transistor and multiple transistor amplifiers:
Basic Single transistor Amplifiers stages: Common Emitter, Common base, Common Collector, Common Drain, Common Gate & Common Source Amplifiers, Multiple Transistor Amplifier stages: CC-CE, CC-CC, & Darlington configuration, Cascode configuration, Active Cascode, Super source follower, Differential pairs, DC transfer characteristics.

Unit III: Current Mirrors, Active Loads & References:
Current Mirrors: Simple current mirror, Cascode current mirrors, Widlar current mirror, Wilson Current mirror, Active loads, Voltage & current references, supply and temperature independent biasing techniques

Unit IV: Operational Amplifier with single ended outputs:
Deviations from ideality in real operational amplifiers, Basic two stage op amp, two stage MOS Operational Amplifier with cascodes, MOS telescopic-cascode operational amplifiers, MOS Folded-cascode operational amplifiers, MOS active cascade operational amplifiers, Bipolar operational amplifiers

Unit V: Frequency response of integrated circuits:
Single stage amplifiers & miller effect, MOS differential amplifier differential mode gain, frequency response of the common mode gain for a differential amplifier, frequency response of voltage buffers, frequency response of current buffers, Multistage amplifier frequency response, frequency response of a current mirror loading a differential pair.

Unit VI: Nonlinear Analog Circuits:
Analysis of four quadrants, Gilbert cell as an analog multiplier, Phase Locked Loops, Integrated circuit phase locked loops, Voltage controlled oscillators, Switched Capacitor Circuits and Switched Capacitor Filters.

Resources:
1) "Analysis and Design of Analog Integrated Circuits", Paul B Gray ,hurst ,Lewis, Meyer ,fifth edition, John Wiley & sons, reprint 2010.
2) "CMOS Analog Circuit Design"P.E.Allen,D.R.Holdberg,second edition,Oxford univ. press.2010
3) "CMOS circuit design, Layout, and simulation" R.Jacob Baker, second edition, Wiley student edition, reprint 2009

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II Semester

EEE2917	**PE I: Multirate Signal Processing**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To acquaint the students with Multirate systems, Multirate Filter Banks and wavelet transform and application in signal processing	1. Graduates will understand and demonstrate multirate filter bank theory in signal processing area. 2. Graduates will able to understand and identify perfect reconstruction process. 3. Graduates will able to understand and identify difference between Fourier Transform, short time Fourier Transform and wavelet Transform 4. Graduates will understand knowledge of wavelet Transform and its applications.
Mapped Program Outcomes: a, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will understand and demonstrate multirate filter bank theory in signal processing area.	M			H			
2	Graduates will able to understand and identify perfect reconstruction process.	L			M			
3	Graduates will able to understand and identify difference between Fourier Transform, short time Fourier Transform and wavelet Transform	M			M			
4	Graduates will understand knowledge of wavelet Transform and its applications.	H						

Unit I

Basic multi-rate operations, interconnection of building blocks, poly-phase representation, multistage implementation, applications of multi-rate systems, special filters and filter banks.

Unit II

Maximally decimated filter banks: Errors created in the QMF bank, alias free QMF system, power symmetric QMF banks, M-channel filter banks, poly-phase representation, perfect reconstruction systems, alias-free filter banks.

Unit III

Para-unitary Perfect Reconstruction Filter Banks: Lossless transfer matrices, filter bank properties induced by paraunitariness, two channel Paraunitary lattices, M-channel FIR Para-unitary QMF banks, transform coding. Short-time Fourier transform: trades of between traditional Fourier transform and STFT,STFT as a bank of filter , window selection, STFT verses Wavelet transform, STFT to wavelet conversion .

Unit IV

Continuous Time Wavelets, Definition of CWT, CWT as a correlation, Constant Q factor Filtering Interpretation and Time Frequency Resolution.CWT as an operator. Inverse CWT. Introduction to the discrete Wavelet transform and orthogonal wavelet decomposition.

Unit V

MRA, Orthogonal Wavelets, and their relationship to Filter Banks: Introduction, Formal Definition of an MRN, Construction of a General orthonormal MRN, Wavelet basis For the MRN. Digital Filtering Interpretation, Examples of orthonomal basis generating Wavelets, Interpreting orthonormal MRNs for discrete tine signals, DTWT for Image Compression, Audio Compression

Unit VI

Biomedical signal processing applications; Geophysical signal analysis applications, Efficient signal design and realization: wavelet based modulation and demodulation, Applications in mathematical approximation, Applications to the solution of some differential equations, Applications in computer graphics and computer vision.

Resources:

1. P.P. Vaidyanathan, "Multirate Systems and Filter Banks," Pearson Education.
2. Raghuveer M.Rao ,Ajit Bopardikar, Wavelet Transform; Introduction to theory and application, Pearson Education,2006
3. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata Mc Graw-Hill,1998,3rd edition.

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II Semester

EE2918	**PE I: Low Power CMOS VLSI Design**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To acquaint students with principles of design , analysis , modelling and optimization of low power VLSI , as well as to promote an interest in VLSI design	1. Graduates will understand the concepts of sources of power dissipation and basics of CMOS Physics. 2. Graduates will understand the concepts of levels of abstraction and its power dissipation. 3. Graduates will understand the Power Optimization methods at Behavior, Logic and Circuit Level design. 4. Graduates will understand the challenges in deep submicron technology. 5. Graduates will understand the principles for low power designs, and have the capabilities to analyze power consumption and develop low power strategies for a given system.
Mapped Program Outcomes: a, b, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will understand the concepts of sources of power dissipation and basics of CMOS Physics.	M	L					
2	Graduates will understand the concepts of levels of abstraction and its power dissipation.	M	M					
3	Graduates will understand the Power Optimization methods at Behavior, Logic and Circuit Level design.	M	L		H			
4	Graduates will understand the challenges in deep submicron technology.	M	M		H			
5	Graduates will understand the principles for low power designs, and have the capabilities to analyze power consumption and develop low power strategies for a given system.	M	M		H			

Unit - I

Need for low power VLSI chips, Sources of power dissipation: Short circuit dissipation, dynamic dissipation, designing Techniques for low power. Physics of power dissipation in MOSFET devices, MOS Capacitance analysis, low power figure of merits, brief overview of low power VLSI design limits.

Unit - II

Probabilistic power analysis: random logic signals, probability and frequency, probabilistic power analysis techniques, signal entropy, Low power circuits: transistor and gate sizing, equivalent pin ordering, network reconstruction and reorganization, Glitching Power, special latches and flip-flops.

Unit - III

Behavioural, Logic and circuit level approaches. Algorithm level transforms. Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre-computation, Logic: gate reorganization, signal gating, logic encoding, state machine encoding.

Unit - IV

Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect. Low voltage design techniques using reverse Vgs. Steep sub threshold swing and multiple threshold voltages. Multiple threshold CMOS based on path critically, multiple supply voltages.

Unit - V

Low energy computing, Energy dissipation in transistor channel. Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and IO Buffer, supply clock generation.

Unit - VI

Introduction, sources of software power dissipation, power estimation and optimization. Co-design for low power**.**

Resources:

1. "Solid State Electronic Devices", 6th Edition, Ben Streetman, Sanjay Benerjee.
2. "Low-Power CMOS VLSI Circuit Design", Kaushik Roy, Sharat C. Prasad, 1st Edition, Wiley India, 2009
3. "Practical Low Power Digital VLSI Design", Gary K. Yeap, Kluwer Academic Publisher, 2002
4. "Low-Power CMOS Circuits-Technology, Logic Design and CAD Tools" Christian Piguet, 2006 by Taylor & Francis Group, LLC
5. "Energy Efficient Microprocessor Design", T. D. Burd and R. A. Brodersen, Boston: Springer, 2002.
6. "Low-Power Digital CMOS Design", A. Chandrakasan and R. Brodersen, Boston: Springer, 1995.
7. "Digital Integrated Circuits: A Design Perspective", 2nd ed., J. Rabaey, A. Chandrakasan, B. Nikolic.

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II Semester

EE2919	**PE II: Wireless Communication**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The course aims to give basic knowledge of different mobile / wireless communication systems	1. Will be able to study different standard & generation in mobile communication system 2. Will be able to understand the need and different methods for enhancing the quality of communication. 3. Will be able to gain technical knowledge of current practice in wireless systems. 4. Will be able to analyse & solve the problem to improve quality of communication.
Mapped Program Outcomes: a, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Will be able to study different standard & generation in mobile communication system	M						
2	Will be able to understand the need and different methods for enhancing the quality of communication.	M			M			
3	Will be able to gain technical knowledge of current practice in wireless systems.	H						
4	Will be able to analyze & solve the problem to improve quality of communication.				M			

Unit - I

Mobile Radio Propagation: Large& Small Scale Path Loss & Fading: Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling. Small Scale Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh & Rician Distribution

Unit - II

Equalization&Diversity: Fundamentals of equalization, classification of equalizer: linear & non-linear equalizer, Diversity Technique: Derivation of selection diversity improvement, Derivation of maximal ratio combining improvement, Space diversity, Polarization Diversity, time diversity & frequency diversity RAKE receivers

Unit - III

Multiplexing & multiple access techniques for wireless communication: FDMA, TDMA, FHMA, CDMA, SDMA, Orthogonal Frequency Division Multiplexing (OFDM)**,** Packet radio protocol: Pure & Slotted ALOHA, CSMA, PRMA, capacity of cellular system

Unit - IV

Wireless Systems and Standards: GSM-GSM services and features, Architecture, Radio Subsystem, GSM channel types, Frame structure and signal processing in GSM, CDMA-Forward CDMA channel, Reverse CDMA channel

Unit – V

Modern Wireless Communication System: 2G, 3G wireless network, Wireless local loop, & LMDS, Wireless Local Area networks (WLANs), Bluetooth & Personal Area Networks (PANs)

Unit – VI

Advanced wireless communication: 4G features and challenges,QoS-enabled MAC Protocol, Class-based QoS over Air Interface in 4G,Wi-Fi,Wi-Max,wirelessRouter,features of wireless routers, Difference between wireless & Wi-Fi,Zigbee

Resources:

1. "Advanced Wireless Communication"-- Savo G. GlisicJohn Wiley & Sons, 13-Dec-2005
2. "Wireless Communication- Principle and Practices" – Rapaport, 2nd Edition,Pearson Education , 2001
3. "Mobile Communications – Design fundamentals" ,William C. Y. Lee,2nd Edition, John Wiley Publication, 1993
4. "Mobile Cellular Communication", W .C .Y. Lee ,2nd Edition, McGraw Hill, 2006
5. "The Mobile Radio Propagation channel", J.D. Parson ,2nd edition, John Willey,2010

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II Semester

EE2920	**PE II: VLSI Signal Processing**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The students shall gain proficiency in subjects like the basic design of theory involved in VLSI for signal processing and communication systems , various software tools related to VLSI, Signal Processing and Communication Systems.	1. Graduates will understand and able to design architectures for DSP algorithms. 2. Graduates will understand and able to apply the optimisation concept in terms of area, speed and power on DSP systems. 3. Graduates will understand and able to optimize DSP arithmetic.
Mapped Program Outcomes: a, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will understand and able to design architectures for DSP algorithms.	H			M			
2	Graduates will understand and able to apply the optimisation concept in terms of area, speed and power on DSP systems.	M			M			
3	Graduates will understand and able to optimize DSP arithmetic.	M			H			

UNIT I:

Introduction to DSP systems, Data flow and Dependence graphs - critical path, Loop bound, iteration bound, longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, parallel processing, Pipelining and parallel processing for low power.

UNIT II:

Retiming – definitions and properties, solving systems of inequalities, Retiming techniques, Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application

UNIT III:

Folding: folding transformation, Register Minimization Techniques, Register minimization in folded architectures folding of multirate systems. Systolic Architecture Design: Introduction, Systolic Array Design Methodology, FIR systolic Arrays, Selection of scheduling vector, Matrix Multiplication and 2D systolic array Design, Systolic design for space representations containing Delays.

UNIT IV:

Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm, Winograd algorithm, iterated and cyclic convolution, Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, rank-order filters, Odd-Even merge-sort architecture, parallel rank order filters.

UNIT V:

Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement, Distributed Arithmetic.

Unit VI:

Redundant number representation, carry free radix-2 addition and subtraction, hybrid radix 4 addition,radix2 hybrid redundant multiplication architectures, data format conversion, redundant to non redundant converter, Numerical strength reduction – sub-expression elimination, multiple constant multiplication, iterative matching.

Resources:

1. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007.
2. U. Meyer – Baese, " Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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II Semester

EE2921	**PE II: Verification & Testing of VLSI Circuits**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To gain a knowledge from the area of applying diagnostic principles in the design of modern Electronic systems.	1. Students develop an understanding of VLSI design verification and testing issues. 2. Students learn how to generate test patterns for faults in a system and how to design a system for testability. 3. Ability to model different faults and carry out fault simulation in digital circuits. 4. Ability to know about importance of testing and its types in VLSI circuits.
Mapped Program Outcomes: a, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Students develop an understanding of VLSI design verification and testing issues.	M						
2	Students learn how to generate test patterns for faults in a system and how to design a system for testability.	M			H			
3	Ability to model different faults and carry out fault simulation in digital circuits.				H			
4	Ability to know about importance of testing and its types in VLSI circuits.				M			

Unit I : Overview Of Testing**:** Design Process, Verification, Faults & Their Detection, Test Pattern Generation, Fault Coverage, Types Of Tests, Test Application, Testing Economics. Defects, Failures, and Faults: Physical Defects, Failures Modes, Faults, Fault Equivalence and Dominance, Fault Collapsing

Unit II : Design Representation: Graphical representation, Graphs, Binary Decision diagrams, Netlists, VLSI Design Flow: CAD tools, Design Methodologies, Semicustom Design

Unit III : Simulation: Logic Simulation, Approaches to Simulation, Fault Simulation & Their Results. Automatic Test Pattern Generation: D-Algorithm, Critical Path Extensions to D-Algorithm PODEM, FAN

Unit IV : Ad Hoc Techniques, Scan–Path Design, Test pattern generation, Test Pattern Application, Scan architectures, multiple scan chains, Partial Scan Testing

Unit V : Boundary-Scan Testing: Boundary Scans Architecture, Test Access Port, Registers, Tap Controller, Modes of Operation. Built In Self Test: Pseudorandom Test Pattern Generation, Response Compaction, BIST Architectures

Unit VI : Memory Testing: Types of Memory Testing, Functional Testing Schemes, Testing FPGAs and Microprocessors: Testability Of FPGAs, Testing RAM- Based FPGAs, Testing Microprocessors, Synthesis For Testability.

Resources:

1. "Principles of Testing Electronic Systems", 2nd edition Samiha Mourad, Yervant Zorian
2. "Essentials of Electronic Testing for Digital, Memory, and Mixed-Signal VLSI Circuits",Michael L. Bushnell and Vishwani D. Agrawal, B.S.Publications, 2000
3. "Digital Systems Testing and Testable Design" ,Miron Abramovici, Melvin Breuer and Arthur Friedman, IEEE press,
4. "A Guide to VHDL" by Stanley Mazor,2nd Edition, Kluwer Academic Press, 2007
5. "HDL Chip Design" by Douglas Smith, 3rd Edition, Doone Publications, 2008
6. "Rapid Prototyping of Digital Systems", by J. O. Hamblen and M. Furman, Kluwer Academic Publishers.2001

II Semester

EE2915	Lab: Digital Image Processing	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
Provide deeper knowledge of theoretically demanding methods of image data processing and of their applications.	1. Graduates will Understand digital image processing fundamentals: digitization, enhancement and restoration, encoding, segmentation 2. Graduates will be able to apply image processing techniques in both the spatial and frequency (Fourier) domain.
Mapped Program Outcomes: a, c, d, e, f	

SN.	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will Understand digital image processing fundamentals: digitization, enhancement and restoration, encoding, segmentation			M	M	H	H	
2	Graduates will be able to apply image processing techniques in both the spatial and frequency (Fourier) domain.	H			H	H	H	

Expt. No.	Name of Experiments
1.	Write a Matlab Code for Bit Plane Slicing of a given image.[CO-1(S)]
2.	To perform point processing of the given image.[CO-1(S),CO-2(M)]
3.	To perform histogram equalization on a gray scale image.[CO-1(S)]
4.	Perform spatial filtering using Median filter.[CO-1(S),CO-2(M)]
5.	To perform Fourier transform on an image.[CO-2,(S)]
6.	To perform edge detection using sobel and prewitt operation on an image.[CO-1(S),CO-2(W)]
7.	To perform morphological operations such as dilation and erosion.[CO-1(S),CO-2(W)]
8.	To perform Wavelet transform on a gray scale image.[CO-1(M)]
9.	To perform low pass and high pass filtering in frequency domain on a gray scale image.[CO-1(W),CO-2(S)]
10.	To perform gray level morphological operations on an image.[CO-1(S),CO-2(M)]

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

II Semester

EE2912	Lab : RF Circuit Design	L= 0	T = 0	P = 2	Credits = 1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcomes
• To study RF component such as resonator, filter, transmission lines, etc • To learn design of RF amplifiers using transistors	1. Graduates will able to Understand and use smith chart for developing circuits in RF applications 2. Graduates will be able to design impedance matching networks, passive RF filters and RF filters and RF power amplifiers 3. Graduate will be able to use CAD tools for RF circuit design
Mapped Program Outcomes: c, d, e, f	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will able to Understand and use smith chart for developing circuits in RF applications				H	H	H	
2	Graduates will be able to design impedance matching networks, passive RF filters and RF filters and RF power amplifiers				H	H	H	
3	Graduate will be able to use CAD tools for RF circuit design			M		H	H	

Sr. No	Name of Experiment		
1	To find impedances of different resonant circuits.	CO1[M], CO2[M]	CO3[S]
2	To find input impedance of a short circuited transmission line.	CO1[M], CO2[M]	CO3[S]
3	To determine input impedance of transmission line using smith chart.	CO1[M], CO2[M]	CO3[S]
4	Design of T- matched network.	CO3[S]	CO3[S]
5	Design of π- matched network.	CO3[S]	CO3[S]
6	Design of low pass filter and high pass filter.	CO3[S]	CO3[S]
7	Design of band pass filter and band reject filter.	CO3[S]	CO3[S]
8	Design of tapped capacitor and tapped inductor network.	CO3[S]	CO3[S]
9	Design of double tapped resonator network.	CO3[S]	CO3[S]
10	Design of high power amplifier as per the specifications.	CO3[S]	CO3[S]
11	Design of Low noise amplifier as per the specifications.	CO3[S]	CO3[S]
12	Design of Dual stage transistor amplifier.	CO3[S]	CO3[S]

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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III Semester

EE2931	**PE III: Wireless Sensor**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The objective of the course is to give the student good understanding of programming embedded wireless systems where the requirements on low energy dissipation is hard and the real time requirements and the limited resources of memory and processing capability makes it necessary for optimised the implementation of the software functions.	1. Graduates will able to study basic wireless sensor technology and different types of sensor protocol. 2. Graduates will able to understand different routing challenges and design issue in wireless sensor 3. Graduates will able to understand wireless sensor network management and traffic management issues
Mapped Program Outcomes: a, d	

SN	Outcome	a	b	c	d	e	f	g
1	Graduates will able to study basic wireless sensor technology and different types of sensor protocol	M						
2	Graduates will able to understand different routing challenges and design issue in wireless sensor				H			
3	Graduates will able to understand wireless sensor network management and traffic management issues				H			

Unit I
Introduction and Overview of Wireless Sensor Networks, Commercial and Scientific Applications of Wireless Sensor Networks, Basic Wireless Sensor Technology, Sensor Taxonomy, wireless network environment, wireless network trends.

Unit II
Radio technology primer, Available wireless technologies, Wireless Sensors Networks Protocols, Physical Layer, Fundamentals of Medium Access Control Protocols for Wireless Sensor Networks, MAC protocols for WSN, Case Study, IEEE 802.15 4LR WPAN, Standard case study.

Unit III
Sensors Network Protocols, Data dissemination and gathering, Routing Challenges and design issues in wireless sensor network, Routing strategies in WSN.

Unit IV
Protocols, Transport Control Protocols for Wireless Sensors Networks, Traditional transport control protocol, and transport protocol design issues, examples of existing transport control protocol, performance of TCP.

Unit V
Middleware for Sensor Networks, WSN middleware principles, Middleware architecture, existing middleware.

Unit VI
Network Management for Wireless Sensor Networks, Requirements, Design issues, Examples of management Architecture, Performance and Traffic Management Issues.

Resources:
1. "Wireless Sensor Networks: Technology, Protocols, and Applications", Kazem Sohraby, Daniel Minoli, Taieb Znati, WIey Interscience Publication, 2007
2. "Computer Networks" ,Andrew Tanenbaum, 4th ed, Pearson Education,2007

III Semester

EE2932	PE III: Biomedical Instrumentation	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• This course is intended for exposing the students to basics of biomedical instrumentation. • It also includes sections on microprocessors and signal acquisition systems as applied to medical instrumentation.	1. Graduate will be able to develop understanding of biology and physiology 2. Graduate will be able to make measurements on and interpret data from living systems 3. Graduate will be able apply knowledge of science and engineering to solve the problems at the interface of engineering and biology 4. Graduate will be able address the problems associated with the interaction between Instruments and living systems.
Mapped Program Outcomes: a, b, d	

SN	Outcome	a	b	c	d	e	f	g
1	Graduate will be able to develop understanding of biology and physiology				H			
2	Graduate will be able to make measurements on and interpret data from living systems		M					
3	Graduate will be able apply knowledge of science and engineering to solve the problems at the interface of engineering and biology	H	H					
4	Graduate will be able address the problems associated with the interaction between Instruments and living systems.		M		L			

UNIT I:
Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.

UNIT II:
Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers.

UNIT III:
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers.

UNIT VI:
Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG.

UNIT V:
Patient care and monitoring, the elements of intensive care monitoring , diagnosis, calibration, reparability of patient monitoring equipment, instrumentation for monitoring patient, pacemakers, defibrillators.

UNIT VI:
Interfacing the computer with medical instrumentation and other equipments, electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments, Methods of accident prevention.

Resources:
1. Biomedical Instrumentation & Measurement, By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer, 2nd Edition ,PHI
2. Handbook of Biomedical Instrumentation, R.S.Khandpur, 2nd Edition, TMH
3. Bioelectronic Measurement, Dean A Dmane, David Michaels,Jan 1983 edition, PHI
4. Medicine and Clinical Engineering, Jacobson and Webster, 2nd Edition, PHI
5. Introduction to Biomedical Equipment Design ,Carr and Brown, 4th Edition, John Wiley
6. Biomedical Digital Signal Processing, Tompkins, 1993 Edition, PHI

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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III Semester

EE2933	PE III: Mixed Signal VLSI Design	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To study different types of mixed signal VLSI design and their procedures with methods applied in different stages of design.	1. Graduates will understand the challenges in modern VLSI Design and learn the skills of overcoming these problems when two opposing signal domains are integrated onto a single chip. 2. Graduates will understand the basic building blocks of Data converter systems. 3. Graduates will understand the review of fundamentals of semiconductor components. 4. Graduates will understand the basics of different data converters that are used in different mixed signal systems. 5. Graduates will understand the physical layout representation and the alternative layout solutions of data converter systems. 6. Graduates will understand the design of various CMOS Op-Amps used in mixed signal system. 7. Graduates will understand the design of various analog filers used in data converter systems.
Mapped Program Outcomes: a, b, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will understand the challenges in modern VLSI Design and learn the skills of overcoming these problems when two opposing signal domains are integrated onto a single chip.	M	M		H			
2	Graduates will understand the basic building blocks of Data converter systems.	M	M		H			
3	Graduates will understand the review of fundamentals of semiconductor components.	H	M		M			
4	Graduates will understand the basics of different data converters that are used in different Mixed signal systems.	M	M		H			
5	Graduates will understand the physical layout representation and the alternative layout solutions of data converter systems.	L	M		M			
6	Graduates will understand the design of various CMOS Op-Amps used in Mixed signal system.	M	L		M			
7	Graduates will understand the design of various analog filers used in data converter systems.	M	M		H			

Unit - I

Introduction to Mixed Signal VLSI System, Signal and Filters, digital comb filter, the z-plane, simple digital filters, Sampling and Aliasing: Impulse Sampling, Sample and Hold. Quantization noise. Spectral density of quantization noise.

Unit - II

Data Converter SNR: Effective number of bits Clock jitter, Using averaging to improve SNR, Decimating filters for ADCs, Interpolating filters for DACs, Band pass and High pass Sync filters, Using feedback to improve SNR.

Unit - III

Sub-Micron CMOS circuit design : Process flow, capacitors and resistors, MOSFET Switch, Delay and Adder elements, Analog circuits – MOSFET Biasing, Op-Amp design, Circuit noise.

Unit - IV

Implementing Data converters: Current mode and voltage mode R-2R DAC, Using Op-Amps in data converters, Implementing ADCs, Cyclic ADC, Introduction to Sigma Delta ADC and Line Drivers.

Unit - V

Integrator Based CMOS Filters: Integrator Building Blocks, Low pass and Active R-C filters, MOSFET-C integrators,gm-C Integrators, Discrete time integrators

Unit - VI

Bilinear and Bi-quadratic transfer functions – Active R-C Transconductor-C and Switched Capacitor implementations both transfer functions, Canonic form of a digital filter.

Resources:

1. "CMOS – Mixed signal circuit design, layout and simulation",R.Jacob Baker, "2nd Edition
   a. IEEE Press and Wiley Interscience, 2002.
2. "CMOS Circuit Design, Layout, and Simulation", Third Edition, R. Jacob Baker
3. "Design of Analog CMOS Integrated circuits", B. Razavi, 1st Edition, McGraw Hill, 2001.
4. "CMOS Analog Circuit Design", P.E. Allen and D.R. Holberg, 2nd Edition, Oxford University Press, 2002.

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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III Semester

EE2934	**PE III: Cryptography & Network Security**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• This course will introduce cryptography theories, algorithms, and systems. It will also consider necessary approaches and techniques to build protection mechanisms in order to secure computer networks.	The students who succeeded in this course; 1. Learn threats to computer networks and protection mechanisms and methods need to thwart these threats. 2. Understand the theory of fundamental cryptography, encryption, and decryption algorithms, 3. Build simple cryptosystems by applying encryption algorithms, 4. Comprehend secure identity management (authentication), message authentication, and digital signature techniques.
Mapped Program Outcomes: a, b, c, d, e, f	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Learn threats to computer networks and protection mechanisms and methods need to thwart these threats.	M	M	M	S	M		
2	Understand the theory of fundamental cryptography, encryption, and decryption algorithms,		M		M	H		
3	Build simple cryptosystems by applying encryption algorithms,			M	M	M	S	
4	Comprehend secure identity management (authentication), message authentication, and digital signature techniques.					M		

UNIT I:
Security Goals, Cryptographic Attacks, Services & Mechanisms, Techniques, Mathematics of Cryptography, Traditional Symmetric Key Ciphers.

Unit II:
Mathematics of Symmetric Key Cryptography , Algebraic Structures, GF(2n) Fields, Introduction to Modern Key Ciphers , Modern Block Ciphers, Modern Stream Ciphers.

Unit III:
Data Encryption Standard (DES) , DES Structure, DES Analysis, Security of DES, Multiple DES, Examples of Block Cipers Influenced by DES, Advanced Encryption Standard, Transformation , Key Expansion , AES Ciphers, Analysis of AES.

UNIT IV:
Mathematics of Asymmetric-Key Cryptography , Primes , Primality Testing, Factorization, Chinese's Remainder Theorem, Quadratic Congruence, Exponentiation & Logarithmic.

UNIT V:
Asymmetric – Key Cryptography , RSA Cryptography , Rabin Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem

Unit VI:
Message Authentication and Hash Functions, Digital Signatures and Key Management. IP Security: Architecture, Authentication header, Encapsulating security payloads, Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET). System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

Resources:
1. Cryptography and Network Security, William Stallings. (Second Edition) Pearson Education Asia .
2. Cryptography and Network Security, Behrouz A. Forouzan (Second Edition) Mcgraw-Hill .

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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III Semester

EE2935	PE IV: Adaptive Signal Processing	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• The primary objective of this course is to develop the ideas of optimality and adaptation in signal processing, design, analysis, and implementation of digital signal processing systems	1. Graduates will understand and analyze knowledge of adaptive filters 2. Graduates will able to identify and analyze statistical analysis. 3. Graduates will understand parametric signal analysis
Mapped Program Outcomes: a, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Graduates will understand and analyze knowledge of adaptive filters	M			H			
2	Graduates will able to identify and analyze statistical analysis.	M			H			
3	Graduates will understand parametric signal analysis	M						

Unit – I

The Filtering Problem, Adaptive Filters, Linear Filter Structures, Approaches to the Development of Linear Adaptive Filtering Algorithms, Real and Complex Forms of Adaptive Filters, Nonlinear Adaptive Filters, Some Historical Notes, Partial Characterization of a Discrete-Time Stochastic Process, Mean Ergodic Theorem, Correlation Matrix, Correlation Matrix of Sine Wave Plus Noise, Stochastic Models, Wold Decomposition, Asymptotic Stationarity of an Autoregressive Process, Yule-Walker Equations, Computer Experiment: Autoregressive Process of Order2, Selecting the Model Order, Complex Gaussian Processes

Unit – II

Power Spectral Density, Properties of Power Spectral Density, Transmission of a Stationary Process Through a Linear Filter, Cramer Spectral Representation for a Stationary Process, Power Spectrum Estimation,Other Statistical Characteristics of a Stochastic Process, Polyspectra,Spectral-Correlation Density, The Eigenvalue Problem, Properties of Eigenvalues and Eigenvectors, Low-Rank Modeling, Eigenfilters, Eigenvalue Computations

Unit – II

Linear Optimum Filtering: Problem Statement, Principle of Orthogonality,Minimum Mean Squared Error, Wiener-Hopf Equations, Error-Performance Surface, Numerical Example, Channel Equalization, Linearly Constrained Minimum Variance Filter, Generalized Sidelobe Cancelers, Forward Linear Predication, Backward Linear Predication, Levinson-Durbin Algorithm, Properties of Prediction-Error Filters, Schur-Cohn Test, Autoregressive Modeling of a Stationary Stochastic Process, Cholesky Factorization, Lattice Predictors, Joint-Process Estimation, Block Estimation, Recursive Minimum Mean-Square Estimation For Scalar Random Variables, The Innovation of the State using the Innovations Process, Filtering, Initial Conditions, Summary of the Kalman Filter, The Extended Kalman Filter

Unit – IV

Overview of the structure and operation of the Least-Mean-Square Algorithm,Stability and Performance Analysis of the LMS Algorithm, Computer Experiment of Adaptive Prediction, Computer Experiment of Adaptive Equalization, Computer Experiment on Minimum-Variance Distortionless Response Beamformer, Directionality of Convergence of the LMS Algorithm for Non-White Inputs, Robustness of the LMS Algorithm, Normalized LMS Algorithm

Unit – V

Block Adaptive Filters, Fast LMS Algorithm, Unconstrained Frequency- Domain Adaptive Filtering, Self-Orthogonalizing Adaptive Filters,Computer Experiment on Adaptive Equalization, Classification of Adaptive Filtering Algorithms,

Unit – VI

Statement of the Linear Least-Squares Estimation Problem, Data Windowing, Principle of Orthogonality , Minimum Sum of Error Squares,Normal Equations and Linear Least Squares Filters, Time-Averaged Correlation Matrix, Reformulation of the Normal Equations in Terms of Data Matrices, Properties of Least- Squares Estimates, Parametric Spectrum estimation, Singular Value Decomposition, Pseudoinverse, Interpretation of Singular Values and Singular Vectors, Minimum Norm Solution to the Linear Least-Squares Problem, Normalized LMS Algorithm Viewed as the Minimum-Norm Solution to an Underdetermined Least Squares Estimation Problem,

Resources:

1. "Adaptive Filter Theory ", Simon Haykin, 4th Edition, Prentice Hall of India, 2001
2. "Theory and Design of Adaptive Filters", Michael G Larimore, C Richard Johnson,John R Treichler, Prentice Hall of India, 1987.

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III Semester

EE2936	**PE IV: Embedded System & RTOS**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• To introduce students to the embedded systems, its hardware and software, real time operating systems, inter-task communication and an exemplary case of RTOS.	1. Students will be able to understand and learn the concepts, architecture, programming, addressing modes for various embedded systems 2. Students will be acquainted with the new concepts related to design of embedded systems, introspect themselves for applying their previous knowledge for various parameters, especially, selection of operating systems, processors, controllers, memory, IO devices, etc 3. Students will be able to establish link for hardware-software interaction for embedded systems, develop build process for signal / data processing through related software and hardware set up 4. Students will be acquainted with task scheduling, interrupt mechanisms and various managements related to embedded real time operating systems, and will be able to discuss / deliver presentation on contemporary issues related to system on chip and system on slice
Mapped Program Outcomes: a, c, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Students will be able to understand and learn the concepts, architecture, programming, addressing modes for various embedded systems	H						
2	Students will be acquainted with the new concepts related to design of embedded systems, introspect themselves for applying their previous knowledge for various parameters, especially, selection of operating systems, processors, controllers, memory, IO devices, etc	H			H			
3	Students will be able to establish link for hardware-software interaction for embedded systems, develop build process for signal / data processing through related software and hardware set up	M		H	H			
4	Students will be acquainted with task scheduling, interrupt mechanisms and various managements related to embedded real time operating systems, and will be able to discuss / deliver presentation on contemporary issues related to system on chip and system on slice				M			

Unit I: Introduction to embedded systems, basic concepts, application areas and categories of embedded systems: Stand alone Embedded systems, Real Time systems, Requirements, challenges Recent trends and applications of Embedded systems.

Unit II: New trends in hardware platforms for Embedded system design, Processor selection criteria in Embedded system design, Embedded system design with microprocessors, microcontrollers, and DSP processor.

Unit III: Issues involved in choosing appropriate development platforms and tools for design of Embedded systems, development environments, operating systems, task scheduling, non real and real time operating systems

Unit IV: Need for communication Interfaces, RS 232 communication parameters, connector configurations, UART, serial communications, Ethernet, IEEE 802.11, Bluetooth system specifications

Unit V: Embedded Real Time Operating systems, concepts, architecture of Kernel, tasks, task scheduler, interrupt service routines, semaphores, Mutex, Mailboxes, Message queue management function calls, event register management function calls, signals and timer management function calls, memory management, priority inversion problems in design of Embedded Real Time Operating systems.

Unit VI: Commonalities of Embedded Real Time Operating systems, Embedded operating systems –LINUX, Real Time Operating systems – RTLINUX, Concept of system on chip and system on Slice.

Resources:

1. 'Embedded / Real Time Systems – Concepts, design and programming' Dr.K.V.K.K.Prasad, (DreamTech Press), Reprint Edition, 2006
2. 'Designing Embedded Hardware', John Catsoulis, 2nd Edition, O'reilly Publication, 2005
3. 'Programming for Embedded systems – Cracking the code' DreamTech Software Team, WileyPublishing Inc, 2006
4. "An Embedded Software Primer", David E. Simon, 1st Edition, Pearson Education,1999
5. "Embedded System Design", Frank Vahid, Tony Givargis, John Wiley & Sons, Inc,2002
6. "Building Embedded Linux Systems", Karim Yaghmour,2nd Edition, O'reilly,2008
7. "Programming Embedded Systems", Michael Barr, 2nd Edition, O'reilly,2006
8. "Real-time systems & software", Alan C. Shaw,3rd Edition, John Wiley & sons, Inc.2001
9. "Computers as Components", Wayne Wolf, 1st Edition, Harcourt India Pvt. Ltd., 2002

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III Semester

EE2937	PE IV: Advanced Computer Architecture		L=3	T = 0	P = 0	Credits =3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
• The objective of this course is to introduce the fundamental techniques on which high-performance computing is based, to develop the foundations for analyzing the benefits of design options in computer architecture, and to give some experience of the application of these techniques.	1. Understand and evaluate the hardware components of advanced architectures Understand and analyze architectures performance and select among different ones for particular use scenarios 2. Understand and analyze the most important parallel architectures in order to distinguish their main difference. 3. Understand the levels of software and hardware comprising the Instruction Set Architecture (ISA) of a computer 4. Make design decisions based on performance data
Mapped Program Outcomes: a, c, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Understand and evaluate the hardware components of advanced architectures Understand and analyze architectures performance and select among different ones for particular use scenarios	M						
2	Understand and analyze the most important parallel architectures in order to distinguish their main difference.	M			M			
3	Understand the levels of software and hardware comprising the Instruction Set Architecture (ISA) of a computer	M		M	M			
4	Make design decisions based on performance data				M			

Unit – I

The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers. Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit – II

Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Unit – III

Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors,RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Unit - IV

Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Unit – V

Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Unit – VI

Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Resources:

1. "Advanced computer architecture", Kai Hwang, Tata McGraw Hill,1993
2. "Computer organization and design" ,D. A. Patterson and J. L. Hennessey, 2nd Edition, Morgan Kaufmann,
3. "Computer Architecture and organization", J.P.Hayes, 3rd Edition, McGraw Hill,1998
4. "Memory System and Pipelined processors" Harvey G.Cragon , NarosaPublication,1998
5. "Parallel computer";V.Rajaranam & C.S.R.Murthy, Printice Hall of India,2002
6. "Foundation of Parallel Processing", K.Ghose, Rajan Moona & Phalguni Gupta, Narosa Publications,2002

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III Semester

EE2938	**PE IV: Pattern Recognition**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcomes
• Provide deeper knowledge of demanding methods of pattern recognition and of their applications.	Upon successfully completing the course, the student should: 1. Demonstrate the understanding of fundamentals of Bays Decision Theory 2. Able to understand parameter estimation and supervised learning, non-parametric techniques 3. be able to use linear discriminate functions, unsupervised learning and clustering 4. develop skill base necessary to further explore advanced topics of Pattern Recognition and their applications for research
Mapped Program Outcomes: a, b, d	

SN	Course Outcomes	Mapped PO						
		a	b	c	d	e	f	g
1	Upon successfully completing the course, the student should: Demonstrate the understanding of fundamentals of Bays Decision Theory	**H**			**M**			
2	Able to understand parameter estimation and supervised learning, non-parametric techniques		**H**		M			
3	be able to use linear discriminate functions, unsupervised learning and clustering	H						
4	develop skill base necessary to further explore advanced topics of Pattern Recognition and their applications for research		**M**		H			

Unit I

PATTERN RECOGNITION OVERVIEW: Engineering approach to PATTERN RECOGNITION, relationship of PATTERN RECOGNITION to other areas, Pattern recognition applications, pattern techniques, pattern recognition approaches (StatPR, SyntPR, NeurPR)

FEATURES AND FEATURE EXTRACTIONS TECHNIQUES: Introduction, zoned features, Graph representation techniques, sequentially detected features, feature extraction, feature vector and feature space.

Unit II

BAYS DECISION THEORY: Introduction, bays decision theory continuous case, two category classification, minimum error rate classification, classifier, discriminate functions and decision surfaces (multicategory and two category case). The normal density function (Univariate and multivariate normal density function)

Unit III

PARAMETER ESTIMATION AND SUPERVISED LEARNING: maximum likelihood estimation, Bayes classifier, general Bayesian learning, problem of dimensionally,

Unit IV

NON-PARAMATRIC TECHNIQUES, Density estimation, Parzen windows, k nearest estimation, nearest neighbor rule, k- nearest neighbor rule, approximation by Series expansion, approximation for binary case, Fisher's linear discriminant, Multiple discriminant analysis

Unit V

LINEAR DISCRIMINATE FUNCTIONS: Linear discriminate functions and decision surface, two category and multicategory case generalized linear discriminate functions, minimizing the perception criteria functions, relaxation procedure, minimum squared error procedures

Unit VI

UNSUPERVISED LEARNING AND CLUSTERING: Mixture densities and identifiability Maximum likelihood estimates, Unsupervised Bayesian learning, Data description and clustering, similarity measures, criterion functions for clustering, iterative optimization, hierarchical clustering

References:

1. Pattern classification and scene analysis, R. O. Duda and P. E. Hart, Wiley Interscience publications.
2. Pattern Recognition and Image Analysis, Earl Gose, Richard Johnsonbaugh, and Steve Jost; PHI Pvte. Ltd.,NewDelhi-1, 1999
3. Pattern Recognition, Sergios Theodoridis and Konstantinos Koutroumbas, Elsevier Academic Press, Second Edition, 2003,

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III Semester

EE2939	**Project Phase – I**	L= 0	T = 0	P = 16	Credits = 8
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	100			100	

Objective	Outcome
	1. Students will be able to identify and formulate problem effectively through literature survey and analysis. 2. Students will be able present the idea effectively with good presentation and communication skill 3. Students will be able to use related EDA tools and related software. 4. Students will be able to understand project management and the importance of social and research ethics.
Mapped PO: a, b, c, d, e, f, g	

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IV Semester

EE2940	**Project Phase – II**	L= 0	T = 0	P = 24	Credits = 12

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objective	Outcome
	1. Students will be able to identify and formulate problem effectively through literature survey and analysis. 2. Students will be able present the idea effectively with good presentation and communication skill 3. Students will be able to use related EDA tools and related software. 4. Students will be able to understand project management and the importance of social and research ethics.
Mapped PO: a ,b, c, d, e, f, g	

Dean (Acad)
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AUTONOMOUS INSTITUTION
SEAL
NAGPUR

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NAGPUR - 441110

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

SoE & Syllabus 2018-19

M. Tech. Communication Engineering

28 June 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. SCHEME OF EXAMINATION 2018-19

Communication Engineering

SN	Sem	Sub Code	Subject	T/P	Contact				Credits	% Weightage				ESE Duration
					L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
I SEMESTER														
1	1	ET2901	Mathematical Foundations for Communication Engineering	T	3	0	0	3	3	15	15	10	60	3
2	1	ET2902	Passive RF Circuits & Systems	T	3	0	0	3	3	15	15	10	60	3
3	1	ET2903	**Lab:** Passive RF Circuits & Systems	P	0	0	2	2	1			40	60	
4	1	ET2904	Advanced Digital Communication	T	3	0	0	3	3	15	15	10	60	3
5	1	ET2905	Lab: Advanced Digital Communication	P	0	0	2	2	1			40	60	
6	1	ET2906	Adaptive Signal Processing	T	3	0	0	3	3	15	15	10	60	3
7	1	ET2907	**Lab:** Adaptive Signal Processing	P	0	0	2	2	1			40	60	
8	1		**Professional Elective- I**	**T**	3	0	0	3	3	15	15	10	60	3
Total					**15**	**0**	**6**	**21**	**18**					

List of Professional Electives-I		
1	ET2908	PE I: Error Control Coding
1	ET2909	PE I: Embedded Systems & DSP Processor
1	ET2910	PE I: Pattern Recognition

II SEMESTER														
1	2	ET2911	Advanced Antenna Theory	T	3	0	0	3	3	15	15	10	60	3
2	2	ET2912	**Lab:** Advanced Antenna Theory	P	0	0	2	2	1			40	60	
3	2	ET2913	VLSI Signal Processing	T	3	0	0	3	3	15	15	10	60	3
4	2	ET2914	Digital Image processing	T	3	0	0	3	3	15	15	10	60	3
5	2	ET2915	**Lab:** Digital Image processing	P	0	0	2	2	1			40	60	
6	2	ET2916	Wireless Communications & Networks	T	3	0	0	3	3	15	15	10	60	3
7	2		**Professional Elective -II**	T	3	0	0	3	3	15	15	10	60	3
8	2	ET2921	Seminar	P	0	0	2	2	1			100		
Total					**15**	**0**	**6**	**21**	**18**					

List of Professional Electives-II		
2	ET2917	PE II: Selected Topics in Communication Systems
2	ET2918	PE II: Speech Processing
2	ET2919	PE II: Detection & Estimation Theory
2	ET2920	PE II: Real Time Operating System

III SEMESTER														
1	3		**Professional Elective- III**	T	3	0	0	3	3	15	15	10	60	3
2	3		**Professional Elective-IV**	T	3	0	0	3	3	15	15	10	60	3
3	3	ET2937	Project Phase-I	P	0	0	16	16	8			100		
Total					**6**	**0**	**16**	**22**	**14**					

List of Professional Electives-III		
3	ET2931	PE III: Multimedia Communications
3	ET2932	PE III: Active RF Devices and Circuits
3	ET2933	PE III: Soft Computing

List of Professional Electives-IV		
3	ET2934	PE IV: High Speed Networks
3	ET2935	PE IV: Wireless Sensor Networks
3	ET2936	PE IV: Micro Electro Mechanical Systems

IV SEMESTER														
1	4	ET2940	Project Phase-II	P	0	0	24	24	12			40	60	
Total					**0**	**0**	**24**	**24**	**12**					
Grand Total of Credits									62					

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I Semester

ET2901	**Mathematical Foundations for Communication Engineering**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 hrs**

OBJECTIVES:
To introduce the fundamentals of probability theory and random processes and illustrate these concepts with Communication engineering applications such as signal processing and digital communications.

UNIT-1:
Definitions, limitations of classical and relative-frequency-based definitions. Sets, fields, sample space and events; axiomatic definition of probability. Combinatory: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes' rule and applications

06Hrs

UNIT-2:
Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties. Jointly distributed random variables, conditional and joint density and distribution functions, independence; Bayes' rule for continuous and mixed random variables.

06Hrs

UNIT-3
Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution
Functions of a random variable, Functions of two random variables; Sum of two independent random variables.

06Hrs

UNIT-4:

Expectation: mean, variance and moments of a random variable. Joint moments, conditional expectation, Moment-generating and characteristic functions and their applications, Bounds and approximations:. Schwarz Inequality, Chebyshev inequality and Chernoff Bound, Central limit theorem and its significance.

06Hrs

UNIT-5
Random vector: Joint distribution and densities, multiple transformation, mean vector, covariance matrix and properties, simultaneous, characteristic functions of random vectors, parameter estimation

06Hrs

UNIT-6:
Basic definitions, important Random processes, continuous-time linear systems with random inputs white noise, classification of random processes, WSS processes and LSI systems.

06Hrs

Text books:

1	Probability and Random Processes	2002	H. Stark, J.W Woods	Pearson Education
2	Probability, Random Variables and Stochastic Processes	2002	A. Papoulis, S. U. Pillai,	McGraw Hill

Reference books:

1	Probability and Stochastic Processes	1992	R D Yates, D J Goodman	John Wiley and Sons

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I Semester

ET2902	Passive RF Circuits and Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
To understand and study the design of RF circuits in communication systems. This course will help in Resonator and RF Filter designing, Study of RF Active components.

UNIT-1: Review of Basic Transmission Line Theory, Planar Transmission Lines - Stripline, microstrip line, Suspended strip line and coplanar line; Parallel coupled lines in Stripline and microstrip – Analysis, Design and characteristics.

06 Hrs

UNIT-2:
Microwave Network Analysis - Microwave network representation, Impedance and admittance matrices, Scattering parameters, Typical two-port, three port, four port networks; Impedance Matching Techniques - Smith chart, Matching networks using lumped elements, Single- and double-stub matching, Quarter wave transformer, Baluns

06 Hrs

UNIT-3
Basic Passive Components -Lumped elements in MIC, Discontinuities and resonators in microstrip, Analysis and design of Stripline/microstrip components- Directional couplers, Power divider, Hybrid ring.

06 Hrs

UNIT-4:
Switches and Phase Shifters Basic series and shunt switches in microstrip; SPST and SPDT switches, Switched line, branch line coupled and loaded line phase shifters in microstrip, Applications in phased arrays.

06 Hrs

UNIT-5
MIC Filters - Lumped element filter design at RF. Impedance and Low pass scaling, Frequency transformation, High impedance/Low impedance low pass filter, Parallel coupled band pass filter, High pass filter, bandstop filter

06 Hrs

UNIT-6:
Basics of MIC, MMIC and MEMS technologies - Substrates used.

06 Hrs

Text books:

1 Radio Frequency and Microwave Electronics 2001 M.M. Radmanesh, Pearson Education Asia,

2 Stripline-like Transmission Line for Microwave Integrated Circuits, 1989. B. Bhat& S.K. Koul New Age Intl. (P) Ltd.,

Reference books:

1 Radio Frequency and Microwave Communication Circuits – Analysis and Design, 2001. D. K. Misra, John Wiley & Sons,

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I Semester

ET2903	**Lab: Passive RF Circuits and Systems**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

Ten Experiments based on

1. **Low Pass, Band Pass, Band Stop Filters**
2. **Couplers**
3. **Phase Shifter**
4. **Power Divider**
5. **Hybrid ring Coupler**
6. **Switches**

I Semester

ET2904	Advanced Digital Communication	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
This course discusses the principles that underline the analysis and design of digital communication systems. The focus is on the reliable transmission and reception of symbols over noisy channels. The students will explore linear and nonlinear modulation techniques, various channels like AWGN and fading, Synchronization techniques, Equalization techniques and MIMO channels

UNIT-1: Review of fundamental concepts and parameters in Digital Communications, Performance of BPSK and QPSK in AWGN channel, Performance of binary FSK and M-ary PSK in AWGN channel.

06 Hrs

UNIT-2:
Minimum Shift Keying (MSK) Modulation, GMSK, Continuous Phase Modulation (CPM) Schemes Channel Characterization and Modeling, Orthogonal Frequency Division Multiplexing (OFDM), Carrier Synchronization, Timing synchronization.

06 Hrs

UNIT-3
Representations of band pass signal and systems, signal space representation, representation of digitally modulated signals, spectral characteristics of digitally modulated signals.

06 Hrs

UNIT-4:
Baseband reception and probability of error, the ML and MAP detection strategies, ML detection with zero mean AWGN,the optimum filter, Schwarz's inequality, transfer function of optimum filter, matched filter, properties of Matched filter, correlation receiver,equalization,the zero forcing equalizer, adaptive equalizer, scrambling, the eye pattern.

06 Hrs

UNIT-5
Spread spectrum signals for digital communications: Introduction to Spread Spectrum Modulation, DSSS, FHSS, and CDMA signals, Code Acquisition and Tracking, Spread Spectrum as a Multiple Access Technique.

06 Hrs

UNIT-6:
Multichannel and Multicarrier Systems; Digital Communications through Fading Multipath channels; Multi User Communications.

06 Hrs

Text books:

1	Digital Communications	1995 4th Edition	J.G.Proakis	McGraw Hill,
2	Digital Communications	1998	Simon Haykin	John Wiley & Sons

Reference books:

1	Principles of Digital Communications and Coding	1979	J. Viterbi and J. K. Omura	McGraw Hill,
2	Spread Spectrum Communications	1995.	MarvinK.Simon,Jim K Omura, RobertA. Scholtz, Barry K.Levit	John Wiley & Sons
3	CDMA Principles of Spread Spectrum Communications	1995.	Andrew J Viterbi	Addison Wesley

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I Semester

ET2905	**Lab : Advanced Digital Communication**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

Ten Experiments based on

1. **BPSK**
2. **QPSK**
3. **MSK**
4. **MIMO**
5. **OFDM**
6. **Channel Estimation**

I Semester

ET2906	Adaptive Signal Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
Advances in Digital Signal Processing involve variable sampling rates, applications in communication systems and signal processing. Linear adaptive filters are studied. It is intended to introduce a course in multirate signal processing, filtering and spectrum estimation.

UNIT-1: Wiener filtering. Optimum linear prediction. Levinson- Durbin algorithm. Prediction error filters.
06 Hrs

UNIT-2:
Adaptive filters. FIR adaptive LMS algorithm. Convergence of adaptive algorithms. Fast algorithms. Applications; Noise canceller, echo canceller and equalizer.
06 Hrs

UNIT-3
Transform domain adaptive filters, The orthogonalization property of orthogonal transforms, The transform domain LMS algorithm.
06 Hrs

UNIT-4:
Recursive least – squares algorithms. Matrix inversion lemma. Convergence analysis of the RLS algorithm.
06 Hrs

UNIT-5
Adaptive beam forming. Kalman filtering.
06 Hrs

UNIT-6:
Fast RLS algorithm, Least square forward prediction, Least square backward prediction, least square lattice, The RLS algorithm, The FTRLS algorithm. Case studies and Industrial Applications.
06 Hrs

Text books:

1	Adaptive Filters:Theory& Applications		B.FarhangBoroujeny	wiley Publication
2	Adaptive Filter Theory	1996,(3/e),	Simon Haykin	Prentice- Hall

Reference books:

1	Statistical and Adaptive Signal Processing	2005	D.G.Manolakis	McGraw-Hill,
2	Statistical Digital Signal Processing and Modeling		M.H.Hays,	John-Wiley.

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I Semester

ET2907	Lab : Adaptive Signal Processing	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Ten Experiments based on

1. Random Number generator and finding correlation and autocorrelation
2. Wiener filter
3. LMS and NLMS
4. Adaptive equalizer
5. Linear predictor
6. RLS algorithm and fast algorithm

I Semester

ET2908	PE I: Error Control Coding	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
The purpose of the course is to present error correction/detection coding in a modern setting, covering both traditional concepts thoroughly as well as modern developments in soft-decision and iteratively decoded codes and recent decoding algorithms for algebraic codes.

UNIT-1:
Coding for reliable digital transmission and storage. Groups, Rings, Vector Spaces, Galois Fields, Polynomial rings.
06 Hrs.

UNIT-2:
Channel models, Linear Block codes, syndrome and error detection, the minimum distance of block code,standard array and syndrome decoding, Cyclic codes, polynomials , the division algorithm for polynomials,circuit implementation of cyclic codes.
06 Hrs.

UNIT-3
Convolution codes, decoding algorithms for Convolution codes, Viterbi, Stack algorithm, Fano algorithm, Application of Convolution codes.
06 Hrs.

Unit 4:
BCH codes, primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, Reed Solomon Codes, Berlekamp-Massey and Euclid decoding algorithm, Decoding beyond the minimum distance Parameter, Applications of Reed-Solomon codes.
06 Hrs.

UNIT-5
Trellis coded Modulation, Combinatorial description of Block and Convolution codes, mapping by set partitioning ,TCM design rule.
06 Hrs.

UNIT-6:
Soft decision decoding algorithms, Iterative decoding algorithms, Turbo-decoding, Two-way algorithm, LDPC codes, Use of LDPC codes in digital video broadcasting, belief propagation (BP) algorithms, Space-Time codes.
06 Hrs.

Text books:

1	Error Control Coding: Fundamentals and Applications	2003.	Shu Lin and Danicl J. Costello Jr	Prentice Hall,
2	Error Control Systems for Digital Communication and Storage	1995	S. B Wicker	Prentice- Hall

Reference books:

1	Theory and Practise of Error Control Codes	2003.	Shu Lin and Danicl J. Costello Jr	Prentice Hall,
2	Error Control Systems for Digital Communication and Storage	1983.	Blahut R. E	Addisson Wesley
3	Algebraic codes for Data transmission	2003	Blahut R.E	Cambridge University Press
4	Fundamentals of Convolutional codes	1999.	Johannesson R and Zigangirov K.S	IEEE press
5	Trellis structure of codes, Chapter 24 of Handbook of Coding Theory.		V. S Pless and W. C Huffman, A. Vardy	
6	Error Correction Coding-Mathematical methods & algorithms		Todd K Moon	Wiley

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I Semester

ET2909	PE I: Embedded Systems & DSP Processor	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
The course introduces us with the basics of embedded systems, familiarity with the Optimizing Design Metrics, processor technology, IC technology, design technology, hardware, the software, peripherals, memory and interfacing and tradeoffs.

UNIT-1:
Embedded Systems, Introduction, Design Metrics, Processor Technology, IC Technology, Design Technology, Design Productivity Gap, Custom Single purpose Processor Design, RT level design, FSMD, Data-paths, Optimization, Instruction set simulators for simple processors.
06Hrs

UNIT-2:
Architectural Features Of ARM: Processor modes, Register organization, Exceptions and its handling,Memory, Memory-mapped I/Os, ARM and THUMB instruction sets, Addressing modes, DSP extensions, ARM sample codes
06 Hrs

UNIT-3
ARM7/9 Core: H/W architecture, Timing diagrams for Memory access, Co-processor interface, Debug support, Scan chains, Embedded Real Time ICE, Hardware and software breakpoints. Buses: AMBA, ASB, APB, Development tool like Compilers, Debuggers, IDE etc.
06Hrs

UNIT-4:
DSP Architecture: MAC, Modified bus structures and Memory access schemes, Multiple access Memory , Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes, On chip peripherals.
06 Hrs

UNIT-5:
TMS320C3X -32 bit floating point DSP Processor: Introduction, features, Applications, Block diagram, Internal architecture, CPU & data paths, Functional units, Addressing modes, Memory architecture, External memory accesses, Pipeline operation, Peripherals.
06Hrs

UNIT-6:
Assembly language programming. Hardware tools: DSP and other DSP boards Software tools: Assembly language tools.
06Hrs

Text books:

1	ARM System Developer's Guide: Designing and Optimizing	2004	Sloss Andrew N, Symes Dominic, Wright Chris	Morgan Kaufman Publication
2	Digital signal processors	2002, 1st Edition	B. Venkataramani, M Bhaskar	Tata McGraw Hill

Reference books:

1	ARM System-on-Chip Architecture	2nd Edition,2002	Steve furber	Pearson Education
2	Embedded System Design	2002, 1st Edition	Frank Vahid and Tony Givargis	Wiely Publication
3	Embedded System Design	2003	Raj Kamal	Tata McGraw Hill ,

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I Semester

ET2910	PE I: Pattern Recognition	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
To equip with basic mathematical and statistical techniques commonly used in pattern recognition. To introduce to the various pattern recognition algorithms.

UNIT-1:
Introduction ,Applications of Pattern Recognition, Statistical Decision Theory,The Internet Pointers to the Literature, Problems
05Hrs

UNIT-2:
Probability, Probabilities of Events, Random Variables, Joint Distributions and Densities Moments of Random Variables ,Estimation of Parameters from Samples, Minimum Risk Estimators, Problems
06Hrs

UNIT-3
Statistical Decision Making
Introduction, Bayes' Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries ,Unequal Costs of Error ,Estimation of Error Rates ,The Leaving-One-Out Technique, Characteristic Curves, Estimating the Composition of Populations, Problems
07Hrs

UNIT-4:
Nonparametric Decision Making
Introduction , Histograms, Kernel and Window Estimators, Nearest Neighbor Classification Techniques, Adaptive Decision Boundaries, Adaptive Discriminant Functions , Minimum Squared Error Discriminant Functions, Choosing a Decision Making Technique, Problems
07Hrs

UNIT-5
Clustering
Introduction , Hierarchical Clustering, Partitional Clustering, Problems
07Hrs

UNIT-6:
Recent trends in Pattern Recognition
03 Hrs

Text books:

1	Pattern Recognition and Image Analysis	Earl Gose,Richard Johnsonbaugh		Printice Hall
2	Pattern Classification	2006	Richard O. Duda, Peter E. Hart and David G. Stork	2nd Edition, John Wiley,

Reference books:

1	Pattern Recognition and Machine Learning	2009	C. M. Bishop	Springer,
2	Pattern Recognition	2009	Theodoridis and K. Koutroumbas	4th Edition, Academic Press

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II Semester

ET2911	Advanced Antenna Theory	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
The course aims at basic principles and theory of antennas. It gives the latest developments and advances on antennas and its physical concepts are emphasized.

UNIT-1:
Fundamental Parameters of Antenna, Radiation Integrals & Auxillary Potential Function

06Hrs

UNIT-2:
Planar Antennas Microstrip rectangular and circular patch antennas. Analysis and design, Feeding Methods; Circularly polarized microstrip antennas, Broadbanding techniques. Printed slot antennas.

06Hrs

UNIT-3

Yagi array of linear elements and printed version, Log-periodic dipole array. Frequency Independent Antennas Planar spiral antenna,

06Hrs

UNIT-4:
Array Theory Linear array; Broadside and end fire arrays, Self and mutual impedance of between Linear elements, grating lobe considerations. Planar array, Array factor, beamwidth, directivity. Example of microstrip patches arrays and feed networks & analysis**.**

06Hrs

UNIT-5
Aperture Antennas- Field equivalence principle, Babinet's principle. Rectangular waveguide horn antenna, Parabolic reflector antenna. Uniqueness theorem

06Hrs

UNIT-6:
Antennas for mobile communication. Handset antennas: FIFA, Smart antennas, Switch beam system, Adaptive array system, Spatial Division Multiple Access.

06 Hrs

Text books:

1	Antenna Theory and Design	1997.	C. A. Balanis	John Wiley & Sons

Reference books:

1	CAD of Microstrip Antennas for Wireless Applications	1996.	R.A. Sainati	Artech House
2	Antenna design Handbook	1988	R. Garg, P. Bharhia, I. Bahl, and A. Ittipiboo	Artech House.
3	Microstrip Antennas: Theory & Design		J. R. James, P.S. Hall and C.Wood, , Peter Peregrinns	UK

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II Semester

ET2912	Lab : Advanced Antenna Theory	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Sr. No.	Ten Experiments Based on
1.	Microstrip patch antenna
2.	Slot Antenna
3.	Yagi Uda Antenna
4.	Log periodic Antenna
5.	Horn Antenna
6.	Antenna Arrays

II Semester

ET2913	VLSI Signal Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES

The students shall gain proficiency in subjects like the basic design of theory involved in VLSI for signal processing and communication systems , various software tools related to VLSI, Signal Processing and Communication Systems.

UNIT-1:

Introduction to DSP systems – Typical DSP algorithms, Data flow and Dependence graphs - critical path, Loop bound, iteration bound, longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power,

06Hrs

UNIT-2:

Retiming – definitions and properties. Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application.

06Hrs

UNIT-3

Folding transformation, Register minimisation techniques Systolic architecture design, FIR systolic arrays, selection of scheduling vector, 2d systolic array design, systolic design for space representations containing delays.

06Hrs

UNIT-4:

Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm

Pipelined and parallel recursive filters – Look-Ahead pipelining in first-order IIR filters, Look-Ahead pipelining with power-of-2 decomposition, Clustered look-ahead pipelining, Parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters**.**

06 Hrs

UNIT-5

Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement

06 Hrs

UNIT-6:

Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture

Numerical strength reduction- subexpression elimination, multiple constant multiplication, iterative matching, sub-expression sharing in digital filters, additive and multiplicative number splitting

06 Hrs

Text books:

1	VLSI Digital Signal Processing Systems, Design and implementation	2007 1st Edition	Keshab K. Parhi	Wiley Interscience,.

Reference books:

1	"Digital Signal Processing with Field Programmable Gate Arrays".	2nd Edition, 2004	U. Meyer- Bease,	Springer,

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II Semester

ET2914	Digital Image Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
Objectives of the course is to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field. Concepts of video and standards are introduced.

UNIT-1:
Digital image fundamentals – image acquisition, representation, visual perception, quality measures, Sampling and quantization, basic relationship between pixels, imaging geometry, color spaces, Image enhancement – point processing, spatial domain filtering.
06 Hrs

UNIT-2:
Image transforms - DFT, DCT, Haar, KL transform, Wavelets and multiresolution processing, Sub-band coding, Multiresolution expansion, One dimensional wavelet transform, Wavelet series expansion, Discrete wavelet transform, Continuous wavelet transform, fast wavelet transform, 2-D wavelet transform, Wavelet packets.
06 Hrs

UNIT-3
Frequency domain filtering, Image restoration/degradation model, Restoration-spatial domain filtering, Periodic Noise Reduction by Frequency Domain filtering, Motion debluring, Estimation the degradation function, Inverse filtering, Minimum Mean Square Error (Wiener Filtering),Constrained Least square filter**.**
06 Hrs

UNIT-4:
Image compression – Data redundancy, lossless and lossy compression techniques, standards for image compression – JPEG, JPEG2000.
06 Hrs

UNIT-5
Image Segmentation-The detection of Discontinuities: Point, Line and Edge Detections :Gradient Operators and Laplacian, Edge linking and Boundary detection : Local Processing and Global Processing Via Hough Transform, Thresholding. Region based segmentation, Clustering technique, Active Contour.
06 Hrs

UNIT-6:
Representation Schemes, Chain Codes, Polygon Approximation, signatures, Skeleton, Boundary Descriptors: Simple Descriptors, Shape Numbers, Fourier Descriptors, Region Descriptor: statistical moments, simple descriptor, Topological descriptor, Texture, Dilation and erosion, opening and closing hit-or-miss transformation, morphological algorithms.
06Hrs

Text books:

1	Digital Image Processing	2002	R. C. Gonzalez and R E Woods	Pearson Education
2	Digital Image Processing		S. Jayaraman, S. Esakkirajan, T Veerakumar	McGraw-Hill

Reference books:

1	Fundamentals of Digital Image Processing	1989	A K Jain	Pearson Education
2	Digital Image Processing	2001	W Pratt	Wiley

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II Semester

ET2915	Lab : Digital Image Processing	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Sr. No.	Ten Experiments Based on
1.	Image Enhancement & Spatial Domain Filtering
2.	Image Transforms
3.	Frequency Domain Filtering
4.	Image Compression
5.	Image Segmentation
6.	Morphological Operations

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II Semester

ET2916	Wireless Communications & Networks	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
This course provides an authoritative treatment of the fundamentals of mobile communications, one of the fastest growing areas of the modern telecommunications industry. It stresses the fundamentals of mobile communications engineering and the networks that are important for the design of any mobile system.

UNIT-1:
Radio Propagation Characteristics: Reflection, diffraction and Scattering, Models for path loss, shadowing and multipath fading (delay Spread, coherence band width, coherence time, Doppler spread), Multipath Fading Models.
06 Hrs

UNIT-2:
Diversity**:** Realization of Independent Fading Paths ,Diversity System Model , Selection Combining , Threshold Combining , Maximal Ratio Combining, Equal-Gain Combining ,Moment Generating Functions in Diversity Analysis , Diversity Analysis for MRC , Diversity Analysis for EGC and SC , Diversity Analysis for Noncoherent and Differentially Coherent Modulation , Transmitter Diversity
06 Hrs

UNIT-3
Multicarrier Modulation , Fading across Subcarriers , Frequency Equalization , Precoding , Adaptive Loading ,Coding across Sub channels RAKE receivers ,
06 Hrs

UNIT-4.:
Multiple access techniques for wireless communication: SDMA ,Packet radio protocols: Pure & Slotted ALOHA,CSMA
06 Hrs

UNIT-5:
Wireless Systems and Standards: GSM-GSM services and features, Architecture, Radio Subsystem, GSM channel types, Frame structure and signal processing in GSM, CDMA-Forward CDMA channel, Reverse CDMA channel
06 Hrs

UNIT-6:
3G Overview, 3GPP Network Architecture, 4G features and challenges, Introduction to wireless LANs - IEEE 802.11 WLANs, Blue tooth , Wi-Max, Zigbee
06 Hrs

TEXTBOOK

1	Wireless communications	2003.	Rappaport. T.S	Pearson Education
2	Wireless Communications	2007.	Andrea Goldsmith	Cambridge University Press

REFERENCES:

1.	Fixed Broadband Wireless System Design	2003.	HARRY R. ANDERSON	John Wiley –India
2.	3G Wireless Networks	2nd Edition, 2007	Clint Smith. P.E., and Daniel Collins	Tata McGraw Hill
3.	Wireless Communication and Networking	2007	Vijay. K. Garg, Morgan Kaufmann	Publishers, http://books.elsevier.com/9780123735805
4.	Principles of Wireless Networks	2006.	Kaveth Pahlavan,. K. Prashanth Krishnamuorthy	Prentice Hall of India,
5.	Wireless Communications and networks	2nd Ed., 2007.	William Stallings	Pearson / Prentice Hall of India,

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II Semester

ET2917	PE II: Selected Topics In Communication Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
This course takes a unified view of the fundamentals of wireless communication and explains the web of concepts underpinning these advances at a level accessible to an audience with a basic background in probability and digital communication. Particular emphasis is placed on the interplay between concepts and their implementation in systems.

UNIT-1:
Physical modeling for wireless channels**:** Free space, fixed transmit and receive antennas, moving antenna , Reflection from wall, Reflection from a ground plane , Power decay with distance and shadowing ,Moving antenna with multiple reflectors Input /output model of the wireless channel: linear time-varying system, Baseband equivalent model, A discrete-time baseband model, Degrees of freedom, Additive white noise Time and frequency coherence **:**Doppler spread and coherence time, Delay spread and coherence bandwidth. Statistical channel models **:**Rayleigh and Rician fading**.**

06Hrs

UNIT-2:
Detection in a Rayleigh fading channel: Non-coherent and Coherent detection Time diversity
Antenna diversity : Receive diversity, Transmit diversity, MIMO. Frequency diversity :Single-carrier with ISI equalization, Direct-sequence spread-spectrum

06 Hrs

UNIT-3
AWGN channel capacity Capacity of Flat: Fading Channels- Channel Distribution Information (CDI), Channel Side Information at Receiver, Channel Side Information at Transmitter and Receiver, Capacity with Receiver Diversity Capacity of Frequency: Selective Fading Channels- Linear time-invariant, Time-Varying Channels

06 Hrs

UNIT-4:
Multiplexing capability of deterministic MIMO channels : Capacity via singular value decomposition, Rank and condition number. Physical modeling of MIMO channels: Line-of-sight SIMO channel ,Line-of-sight MISO channel , Antenna arrays with only a line-of-sight path ,Geographically separated antennas,Line-of-sight plus one reflected path Modeling of MIMO fading channels**.**

06 Hrs

UNIT-5
The V-BLAST architecture Fast fading MIMO channel: Capacity with CSI at receiver and Full CSI. Receiver architectures: Linear decorrelator, Successive cancellation, Linear MMSE receiver D-BLAST**:** an outage-optimal architecture, Coding across transmit antennas: D-BLAST.

06 Hrs

UNIT-6:
Diversity–multiplexing tradeoff: Scalar Rayleigh channel, Parallel Rayleigh channel, MISO Rayleigh channel, 2×2 MIMO Rayleigh channel, nt ×nr MIMO i.i.d. Rayleigh channel Universal code design for optimal diversity: multiplexing tradeoff - Universal code design for scalar channels, parallel channels, MISO channels, MIMO channels Uplink with multiple receive antennas: Space-division multiple access ,SDMA capacity region MIMO uplink:SDMA with multiple transmit antennas, Downlink with multiple transmit antennas MIMO downlink.

06 Hrs

Text books:

1	Fundamentals of Wireless Communications	2005	David Tse, Pramod Viswanath	Cambridge University Press

Reference books:

1	Coding for Wireless Channels	2007	E. Biglieri,	Springer,
2	MIMO Wireless Communications	2007	E. Biglieri,	Cambridge University Press
3	WIRELESS COMMUNICATIONS	2005	Andrea Goldsmith	Cambridge University Press

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II Semester

ET2918	**PE II: Speech Processing**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 hrs**

OBJECTIVES: This course provide with an overview of speech communication in its wide ranging aspects,from a discussion of how humans produce and perceive speech to details of computer based speech processing for diverse communication applications.

UNIT-1: Speech Production
Human speech production mechanism, acoustic theory of speech production, Digital models for speech production.
06Hrs

UNIT-2: TIME DOMAIN MODELS FOR SPEECH PROCESSING
Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate ,Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.
06Hrs

UNIT-3: FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING
Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder, Channel Vocoder -Homomorphic speech analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic Vocoders.
07Hrs

UNIT-4: LINEAR PREDICTIVE CODING (LPC) ANALYSIS
Basic principles of Linear Predictive Analysis:The Autocorrelation Method, The Covariance Method,Solution of Lpc Equations: Cholesky Decomposition, Solution for Covariance Method, Durbin's Recursive Solution for the AutoCorrelation Equations, Comparision between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.
07Hrs

UNIT-5: Speaker Recognition:
Issues in speaker recognition, Speaker verification vs identification, Text-dependent vs text-independent speaker recognition, Vector quantization models applications in speaker recognition, and Gaussian mixture modeling for speaker and speech recognition
06Hrs

UNIT-6: Discrete and Continuous Hidden Markov modeling for isolated word and continuous speech recognition, DTW.
06Hrs

Text books:

1	Discrete-time speech signal processing: Principles and Practice	2002	T.F Quatieri	Pearson
2	Digital Processing of Speech Signals	1978.	L R Rabiner,	Pearson
3.	Fundamentals of Speech Recognition	1993	L. Rabiner and B. Juang	Pearson

Reference books:

1	Speech Communication – Human and Machine	2000	Douglas O'Shaugnessy	IEEE Press

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II Semester

ET2919	PE II: Detection and Estimation Theory	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
This course provides an introduction to the basic theory and techniques of signal detection and estimation. It provides essential background for engineers and scientists working in a number of fields, including communications, control, signal, and image processing, radar and sonar, radio astronomy, seismology, remote sensing, and instrumentation.

UNIT-1:
Review of Probability Theory; Stochastic Processes; Representation of Stochastic Processes;
06Hrs

UNIT-2:
Classical Detection and Estimation Theory Elementary hypothesis testing, Bayes rule, minimax rule, Neyman-Pearson rule; composite hypothesis testing.
06Hrs

UNIT-3
Detection of deterministic and random signals in Gaussian noise; Detection in non-Gaussian noise; Chernoff bound, asymptotic relative efficiency; sequential and distributed detection;
06Hrs

UNIT-4:
Estimation Theory: estimation of parameters, Random parameters: Bayes Estimates, Estimation of , Nonrandom parameters, Properties of Estimators, LMSE.
06Hrs

UNIT-5
Estimation of Waveforms: Linear MMSE Estimation of waveforms, Estimation of Stationary processes: Wiener filter, Estimation of Non-stationary processes: Kalman filter, Nonlinear estimation
06Hrs

UNIT-6:
Nonparametric detection, Locally optimal detection, Robust detection and estimation.
Applications of detection and estimation Applications in diverse fields such as communications, system identification, adaptive filtering, pattern recognition.
06Hrs

Text books:

1	Introduction to statistical Signal processing with Applications	1989.	Srinath, Rajasekaran&Viswanathan	Prentice Hall of India, New Delhi
2	An Introduction to Signal Detection and Estimation	1994	H.V. Poor	2nd edition, Springer,
3	Fundamentals of Statistical Signal Processing:Vols.1&2	1993, 1998	S.M. Kay	Prentice Hall,

Reference books:

1	Detection, Estimation and Modulation Theory	1968.	. E.L. Van Trees	Wiley, New York,
2	Detection of signals in noise and estimation	1985	Shanmugam and Breipohl	John Wiley & Sons, New York
3	Signal processing: Discrete Spectral analysis, Detection and Estimation	1975	Mischa Schwartz and Leonard Shaw	Mc-Graw Hill Book Company

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II Semester

ET2920	PE II: Real Time Operating Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Objective

The course objective is to cover the principles of real-time and embedded systems inherent in many hardware platforms and applications being developed for engineering applications. As part of this course, students will learn about real-time and quality of service system principles, understand real-time operating systems and the resource management and quality of service issues that arise, and construct sample applications on representative platforms.

UNIT-1:

Overview Of Commands, File I/O. (Open, Create, Close, Lseek, Read, Write), Process Control (Fork, Vfork, Exit, Wait, Waitpid, Exec), Signals, Inter Process Communication (Pipes, FIFOs, Message Queues, Semaphores, Shared Memory).

06 Hrs

UNIT-2:

Typical Real Time Application, Hard Vs Soft Real Time Systems, a Reference Model of Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

06 Hrs

UNIT-3

Functional Parameters, Resource Parameters of Jobs and Parameters of Resources Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs State Systems, Effective Release Times and Dead Lines, Offline Vs Online Scheduling.

06 Hrs

UNIT-4:

Overview, Time Services and Scheduling Mechanisms, other Basic Operating System Function, Processor Reserves and Resource Kernel. Capabilities of Commercial Real Time Operating Systems.

06 Hrs

UNIT-5

Introduction, Fault Causes, Types, Detection, Fault and Error Containment, Redundancy: Hardware, Software, Time. Integrated Failure Handling.

06 Hrs

UNIT-6:

Memory Managements Task State Transition Diagram, Pre-Emptive Priority, Scheduling, Context Switches – Semaphore – Binary Mutex, Counting: Watch Dogs, I/O System Process Management, Scheduling, Interrupt Management, and Synchronization.

06 Hrs

Text books:

1	Real Time Systems	1999	Jane W.S. Liu	Pearson
2	Real Time Systems		C.M.Krishna, KANG G. Shin	McGraw.Hill

Reference books:

1	Advanced Unix Programming	Richard Stevens

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II Semester

ET2921	**Seminar**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
			100		**100**	

III Semester

ET2931	PE III: Multimedia Communications			L= 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hrs

Course Objectives

1. To learn the basics of image & graphics data types
2. To understand various Fundamental concepts in video
3. To grasp basics of digital audio
4. To get acquainted with various algorithms used for multimedia data compression
5. To explore various standards used in image, video and audio compression

UNIT-1: Introduction to multimedia , concept of non-temporal and temporal media, Graphics & image data representation: graphics & image data types, computer image processing: Image synthesis, analysis and transmission, popular file formats(GIF, TIFF, JPEG, PNG**)**

06 Hrs

UNIT-2: Fundamental concepts in video Types of video signals: component, composite and s-video,
analog video :NTSC, PAL, SECAM video, digital video : chroma sub-sampling, CCIR standards for digital video, HDTV,

06 Hrs

UNIT-3: Basics of digital audio:
digitization of sound, MIDI, quantization and transmission of audio

06 Hrs

UNIT-4:
Multimedia data compression
Lossless compression algorithms: Run length coding, Huffman coding, arithmetic coding
Lossy compression algorithms - DCT, Wavelet- Based Coding
Basic image compression standard- JPEG- **main steps in JPEG Image compression, Image preparation, JPEG modes- Lossy sequential DCT based, Expanded lossy DCT based, Lossless and hierarchical mode**

06 Hrs

UNIT-5: Video compression
Introdction to video compression, video compression based on motion compensation, search for motion vectors, detail study of various video compression standards-MPEG-1, MPEG-2, MPEG-4, MPEG-7

06 Hrs

UNIT-6: Audio compression
Basic audio compression techniques, , MPEG audio compression, Applications of multimedia related to image and video processing

06 Hrs

Text books:

1	Fundamentals of Multimedia	2004	Ze-Nian Li , Mark S Drew	PHI/Pearson Education
2	Multimedia Applications	2004	Steinmetz, Nahrst	Springer

Reference books:

1	Multimedia Communications: Applications, Networks, Protocols and Standars	2001	Fred Halsall	Addison-Wesley

Course Outcome:
Students will be able to

1.Graphics/image/video/audio data representations, including color models, HDTV, MIDI, and audio coding
2.Compression formats and standards for data, images, audio, and video, including both lossless and lossy formats
3.Multimedia networks, considering QoS, VoIP, media-on-demand, and multimedia over wireless networks
4.Content-based retrieval in digital libraries

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III Semester

ET2932	PE III: Active RF Devices and Circuits	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
Analyze microwave components and circuits in terms of scattering parameters. Determine the electrical characteristics of waveguides and transmission lines through electromagnetic field analysis. Design microwave amplifiers and oscillators based on stability, bandwidth, power, gain and noise figure criteria.

Unit 1
Active RF Component & their Modeling: RF Diodes, Linear & Non linear Diode Models, small & large signal Model of BJT & FET, Active Device Measurements

06 Hrs

UNIT 2
Transistor Amplifiers - Types of amplifiers. S parameter characterization of transistors; Two Port power gain Amplifier Stability , Stability Circle , Test for Unconditional Stability, MOSFETs , Equivalent circuit model.

06 Hrs

UNIT-3:
Single stage amplifier design- unilateral and bilateral cases, Design for Maximum Gain Constant gain, design for Specified Gain , DC bias circuits for amplifiers;

06 Hrs

UNIT-4
Detectors - Point contact and Schottky barrier diodes. Characteristics and equivalent circuit, Theory of microwave detection, Detector circuit design, FM detectors. Low Noise amplifier and Power amplifier : Class A, B, AB, C, D, E, F

06 Hrs

UNIT-5:
Types of mixers. Mixer theory and characteristics. SSB versus DSB mixers. Single-ended mixer and single-balanced mixer. Double balanced and image rejection mixers;

06 Hrs

UNIT-6
Oscillators Oscillator versus amplifier design, Oscillation conditions; Gunn diode Modes of operation, Equivalent circuit. Design of Gunn diode oscillator, FET oscillators. Frequency tuning techniques. Phase Locked Loop (PLL).

06 Hrs

Text books:

1	Radio Frequency and Microwave Communication Circuits Analysis and Design	2004	D. K. Misra	John Wiley,
2	Microwave Engineering	1998	D. M. Pozar	John Wiley
3.	**RF Circuits Design**		Renhold Ludwig and Pavel Bretchko	Prentice Hall

Reference books:

1	Microwave Transistor Amplifiers Analysis and Design	1997.	G. Gonzalez	Prentice Hall
2	The Design of CMOS Radio-Frequency Integrated Circuits	Second Edition	Thomas H. Lee	CAMBRIDGE
3	Microwave and Millimeter Wave Phase Shifters, Vol.II- Semiconductor And Delay Line Phase Shifters,	1991	S.K. Koul and B. Bhat	Artech House
4	Microwave Circuit Design using Linear and Nonlinear Techniques,	1990	G.D. Vendelin, A.M. Pavio and U.L. Rhode	

III Semester

ET2933	PE III: Soft Computing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Objective The objective is to have general understanding of soft computing methodologies including artificial neural networks, genetic algorithms, fuzzy sets and fuzzy logic systems. Develop computational neural network models and fuzzy models for engineering systems.

Unit 1
Genetic algorithms: Population based search techniques, evolutionary strategies, mathematical foundations of genetic algorithms, search operators, genetic algorithms in function and combinational optimization, hybrid algorithms, application to pattern recognition
06 Hrs

Unit 2
Introduction of neural networks, NN Architecture Neural learning and laws, Applications of ANN Evaluation of network,
Supervised Learning:
Single layer network: MP neuron, Perceptron, Perceptron training algorithm, LMS algorithm, ADALINE
06 Hrs

Unit 3
Multiplayer network: Multilevel Discrimination, Backpropogation Algorithm, Setting the parameter values, Accelerating the learning Process, MADALINE, Adaptive Multilayer Networks, Recurrent Network, RBF networks,
06 Hrs

Unit 4
Unsupervised Learning: Winner Take Network, Learning Vector Quantizer, ART Networks, self-organizing feature maps, PCA, Associate Models
06 Hrs

Unit 5
Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conorms Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers
06 Hrs

Unit 6
Fuzzy equations, fuzzy relations , Fuzzy controllers, Defuzzification Methods, Fuzzy Inference Techniques, applications of fuzzy logic
06 Hrs

Text books:

1	Neural networks	2004	C. Mohan and S. Ranka	Penram publications
2	Fuzzy sets and fuzzy logic, Theory and Applications ,	2009	George J. Klir, Bo Yuan	PHI
3	Neural Networks: A comprehensive foundation	1999	S. Haykin	Pearson

Reference books:

1	Introduction to artificial neural networks	1997	J. M. Zurada	Jaico publishing
2	Artificial Neural Networks	1999	B. Yejnanarayana	PHI
3	Neural Networks, Fuzzy Logic, and Genetic algorithms, Synthesis and Applications	2006	S.Rajasekaran, G.A.Viayalakshmi Pai	Prentice Hall

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III Semester

ET2934	PE IV: High Speed Networks		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
The main purpose of this course is to introduce students the important areas of communication networks, mainly Multistage networks .This will enable the students to acquire a solid understanding of foundations of networks technologies, systems, networks issues as well as economic deployment considerations, of networks technologies, systems, networks issues as well as economic deployment considerations.

UNIT-1:
Network services, Network Elements, Basic Network Mechanism, High Performance Networks, Traffic Characterization and quality of service, Applications, Layered Architecture.
06 Hrs

UNIT-2:
OSI and IP Models, Frame Relay, Internet Protocol, TCP and UDP, Performance of TCP/IP networks, Internet Success and Limitation
06 Hrs

UNIT-3 :
Wireless Networks: Introduction, The wireless Channel, Link Level Design, Channel Access, Network Design
06 Hrs

UNIT-4:
Control of Networks: Objectives and Methods of Control, Circuit-switched Networks, Datagram Networks, Mathematical Background of Control Networks.
06 Hrs

UNIT-5:
Introduction to Adhoc Wireless Networks, Issues, Routing approaches, Table-Driven of Routing Protocols, On-Demand Routing Protocols, Hierarchical routing Protocols. Ad hoc network security- Requirements, Issues and Challenges
06 Hrs

UNIT-6:
SONET, Optical Links, WDM Systems, Optical Cross-Connects, Optical LANs, Optical Paths and Networks
06 Hrs

Text books:

1	Computer Networking	2005	J.F.Kurose & K.W. Ross	Pearson
2	High-Performance Communication Networks	2e	Jean Warland Pravin Varaiya	Elsevier

Reference books:

1	Adhoc Wireless Networks	2005	C.Siva Ram Murthy & B.S.Manoj	Pearson Education, 2005.

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III Semester

ET2935	PE IV: Wireless Sensor Network	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
To expose the students the fundamental concepts of IP based wireless communication systems/networks. To impart students with Wireless/Mobile IP Architecture and Evolution; Performance and Quality of Service; Mobility, Routing, and Signaling; Real-Time Applications.

UNIT-1:
Introduction to sensors**-** Definition of sensor & its difference from transducer, Classification of sensors, application of sensors in various fields. Architecture-single node architecture-hardware components, energy consumption of sensor nodes, operating system and execution **environments**

06Hrs

UNIT-2:
Network architecture-optimization goal and figure of merit-design principles for WSN, service interface of WSN, Gateway concept challenges of WSN, comparison with other network.

06Hrs

UNIT-3
Wireless channel and communication fundamental, physical layer and transceiver design consideration in WSN.

06Hrs

UNIT-4:
MAC Protocols-Fundamental of MAC Protocol, low duty cycle protocol and wakeup concepts, schedule based protocols , Link layer protocols, routing protocols ,

06Hrs

UNIT-5
Naming and addressing, Time synchronization, Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement.

06Hrs

UNIT-6:
Data centric routing, Data aggregation, Data centric storage, Topology control-controlling topology in a flat network, Hirarical network by dominating set, Hierarchical network by clustering, combining Hierarchical topologies and power control**.**

06Hrs

Text books:

1	Protocols and architecture for Wireless Sensor Networks	2007	Holger Karl, Andreas Willig,	Wiley
2	Handbook of Algorithms for Wireless Networking and Mobile Computing	2006	AzzedineBoukerche	Chapman & Hall/CRC, 2006

Reference books:

1	Wireless Sensor Network Designs,	2003	Anna Hac	Wiley
2	Wireless Sensor Networks : A systems perspective	2005	NirupamaBulusu and Sanjay Jha	Artech House, August 2005.
3	Wireless Sensor Networks : Architecture and Protocols	2003	Jr., Edgar H. Callaway,	Auerbach, 2003.
4	Wireless Sensor Networks	2005	C.S. Raghavendra, Krishna M. Sivalingam and TaiebZnati	Springer,

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III Semester

ET2936	PE IV: Micro Electro Mechanical Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

OBJECTIVES:
To give detail study of micro electronics circuit and various devices in the manufacturing process of MEMS.
To give brief introduction regarding various processes involved in the manufacturing of MEMS.

UNIT-1:
Intrinsic Characteristic of MEMS :- Energy Domains & Transducers. Sensors & Actuators. Introduction to Micro fabrication- silicon based MEMS processes. New Materials- Review of Electrical and Mechanical concepts in MEMS. Semiconductor devices- Stress & Strain analysis- Flexural beam bending, Torsional deflection

07Hrs

UNIT-2:
Electrostatic sensors- Parallel Plate capacitors, Applications, Interdigital Finger capacitor,Com drive devices, Thermal sensing and Actuation, Thermal Expansion, Thermal couples, Thermal resistors, Applications, Magnetic Actuators, Micro magnetic Components, Case studies of MEMS in magnetic actuators

06Hrs

UNIT-3
Piezoresistive sensors, Piezoresistive sensor materials, Stress analysis of mechanical elements, Applications to Inertia, Pressure, Acoustic, Tactile and Flow sensors, Piezoelectric sensors and actuators, Piezoelectric effects, Piezoelectric materials.

06Hrs

UNIT-4:
Silicon Anisotropic Wet Etching, Dry Etching of Silicon, Plasma Etching, Deep reaction Ion Etching (DRIE), Isotropic Wet Etching, Gas phase Etchants-Case studies, Basic surface micromachining processes, Structural and sacrificial materials, Acceleration of sacrificial Etch, Striction and Anistriction methods, Assembly of 3D MEMS,Foundry process

08Hrs

UNIT-5
Polymers in MEMS , Polimide, SU-8, Liquid Crystal Polymer(LCP), PDMS, PMMA, Parylene,Flurocarbon, Application to acceleration, Pressure, Flow and Tactile sensors

06Hrs

UNIT-6:
Optical MEMS, Lensens and Mirrors, Actuators for Active Optical MEMS.

06Hrs

Text books:

1	Foundations of MEMS	2006	Chang Liu,	Pearson Education Inc

Reference books:

1	An Introduction to Micro electro mechanical system design	2000	Nadim Maluf	Artech House
2	The MEMS Handbook	2000	Mohames Gad-el-Hak	CRDC press Baco Raton
3	MEMS & Micro systems Design and Manufacture	2002	Tai Ran Hsu,	Tata Mcgraw Hill, New Delhi.

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III Semester

ET2937	**PROJECT PHASE - I**	**L=0**	**T=0**	**P=16**	**Credits=8**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
			100		**100**	

OBJECTIVES

As the project methodology for the batches is decided in the 2nd semester the student shall carry out the project work further 3rd semester. The project work consists of ;

1. Literature survey
2. Study of processes /phenomenon related to project.
3. Design of any equipment its fabrication and testing.

IV Semester

ET2940	**PROJECT PHASE – II**	**L=0**	**T=0**	**P=24**	**Credits=12**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
			40	**60**	**100**	

1. Review of work done in project phase I and final Design of any equipment, its fabrication and testing.
2. Critical analysis of design or process for optimization
3. Verification by experimentation.
4. In case of industrial project the necessary modifications with the proper design suggested to the industry should be explained. The letter from the industry should be attached in the report related to the performance of the student.

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

SoE & Syllabus 2018-19

M. Tech. Computer Science Engineering

28 June 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. SCHEME OF EXAMINATION 2018-19

Computer Science Engineering

SN	Sem	Sub Code	Subject	T/P	Contact Hours				Credits	% Weightage				ESE Duration Hours
					L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
I SEMESTER														
1	1	CSE2901	High Performance Computer Architecture	T	3	0	0	3	3	15	15	10	60	3
2	1	CSE2902	Real Time Systems	T	3	0	0	3	3	15	15	10	60	3
3	1	CSE2903	Network Security & Cryptography	T	3	0	0	3	3	15	15	10	60	3
4	1	CSE2904	Lab: Network Security & Cryptography	P	0	0	2	2	1			40	60	
5	1	CSE2905	Algorithm Design Techniques	T	3	0	0	3	3	15	15	10	60	3
6	1	CSE2906	Lab: Algorithm Design Techniques	P	0	0	2	2	1			40	60	
7	1		**Professional Elective-I**	T	3	0	0	3	3	15	15	10	60	3
8	1	CSE2911	Software Lab 1	P	0	0	2	2	2			40	60	
Total					**15**	**0**	**6**	**21**	**19**					

List of Professional Electives-I

1	CSE2907	PE I: Advanced Digital Image Processing
1	CSE2908	PE I: Ethical Hacking
1	CSE2909	PE I: Machine Learning
1	CSE2910	PE I: Grid and Cloud Computing

II SEMESTER														
1	2	CSE2912	Data Mining	T	3	0	0	3	3	15	15	10	60	3
2	2	CSE2913	Distributed Systems	T	3	0	0	3	3	15	15	10	60	3
3	2	CSE2914	Optimizing Compilers	T	3	0	0	3	3	15	15	10	60	3
4	2	CSE2915	Lab: Optimizing Compilers	P	0	0	2	2	1			40	60	
5	2	CSE2916	Software Architecture	T	3	0	0	3	3	15	15	10	60	3
6	2	CSE2917	Lab: Software Architecture	P	0	0	2	2	1			40	60	
7	2	CSE2918	Seminar (Technical Writing and Publishing)	P	0	0	2	2	1			100		1
8	2		**Professional Elective-II**	T	3	0	0	3	3	15	15	10	60	3
9	2	CSE2923	Software Lab 2	P	0	0	2	2	2			40	60	
Total					**15**	**0**	**8**	**23**	**20**					

List of Professional Electives-II

2	CSE2919	PE II: Soft Computing Techniques
2	CSE2920	PE II: Data Warehousing
2	CSE2921	PE II: Wireless Sensor Network
2	CSE2922	PE II: Information Retrieval Systems

III SEMESTER														
1	3		**Professional Elective- III**	**T**	3	0	0	3	3	15	15	10	60	3
2	3		**Professional Elective-IV**	**T**	3	0	0	3	3	15	15	10	60	3
3	3	CSE2939	Project Phase – I	P	0	0	16	16	8	100				
Total					**6**	**0**	**16**	**22**	**14**					

List of Professional Electives-III

3	CSE2931	PE III: Computer Vision
3	CSE2932	PE III: Natural Language Processing
3	CSE2933	PE III: Optimization Techniques
3	CSE2934	PE III: Database Security

List of Professional Electives-IV

3	CSE2935	PE IV: Cyber Forensics
3	CSE2936	PE IV: Pattern Recognition
3	CSE2937	PE IV: Algorithms for Bioinformatics
3	CSE2938	PE IV: Semantic Web and Social Networks

IV SEMESTER														
1	4	CSE2940	Project Phase - II	P	0	0	24	24	12			40	60	
Total					**0**	**0**	**24**	**24**	**12**					
Grand Total of Credits									**65**					

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I SEMESTER

CSE2901	**High Performance Computer Architectures**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I : The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers.

Unit II : Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus dataflow, Dataflow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit III : Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Unit IV : Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, cache coherence protocols, memory based directory protocols, cache based directory protocols.

Unit V : Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors.

Unit VI: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency. Multicore and Many core computing, GPU programming: OpenCL , CUDA

Text Books:

1. Kai Hwang, "Advanced computer architecture", TMH publications
2. D. A. Patterson and, J. L. Hennessey, "Computer organization and design", Morgan Kaufmann

Reference Books:

1. J. P. Hayes, "Computer Architecture and organization", MGH
2. Ryojitsuchiyama, Takashi Nakamura, Takurolizuka, Akihiro Asahara, satoshi Miki "OpenCL Programming Book", Kindle Edition
3. Edward Kandrot, Jason Sanders, "CUDA by Example, An Introduction to General-Purpose GPU Programming" Prentice Hall Publications.
4. V. Rajaranam & C. S. R. Murthy, "Parallel computer", PHI
5. R. K. Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications
6. Kai Hwang and Zu, "Scalable Parallel Computers Architecture", MGH.
7. M. J. Flynn, "Computer Architecture, Pipelined and Parallel Processor Design", Narosa Publishing.
8. D. A. Patterson, J. L. Hennessy, "Computer Architecture: Aquantitative approach", Morgan Kauffmann
9. Cuda toolkit documentation from NVIDIA and developer.nvidia.com/cuda-zone

I SEMESTER

CSE2902	**Real Time Systems**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I: Introduction to real-time systems, Example real-time applications, Hard vs. soft real time, Reference model, Classic uniprocessor scheduling, Static scheduling, Dynamic scheduling, Cyclic executives

Unit II: Dynamic-priority scheduling: Optimality of EDF and LLF, Utilization-based schedulability test for EDF, Non preemptive EDF, Static-priority scheduling: Optimality of RM and DM, Utilization-based schedulability test for RM, Demand-based scheduling: conditions for static-priority systems. Dealing with complexities arising in real systems: Practical considerations, Timing analysis.

Unit III: Preemptive systems: Dynamic-priority systems, Static-priority systems, Non preemptive systems, Dynamic-priority systems, Static-priority systems

Unit IV: Independent Task Models, Resource sharing, Priority inheritance and priority ceiling protocols, stack resource protocol, Lock-free approach Global multiprocessor schedulability analysis, Hard real-time analysis for global EDF, Soft real-time analysis for global EDF.

Unit V: Synchronization in multiprocessors and distributed systems, Multiprocessor locking protocols, End-to-end scheduling. Mixing real-time and non-real-time, Deferrable servers, Sporadic servers, Constant utilization and total bandwidth servers fairness and starvation
Unit VI: A look at some real systems, Basic operating-system functions needed for real-time computing, Survey of commercial real-time and non-real-time operating systems.

Text Books:

1. Hermann Kopetz, Real-Time Systems: Design Principles for Distributed Embedded Applications, Springer
2. Jane W. S. Liu: Real-Time Systems, Prentice Hall,

Reference Books:

1. Philip A. Laplante, Seppo J. Ovaska: Real-Time Systems Design and Analysis: Tools for Practitioner
2. C.M. Krishna, Kang G. Shin, "Real Time Systems", McGraw – Hill International Edition
3. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI

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I SEMESTER-

CSE2903	**Network Security & Cryptography**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I: Introduction: Security Trends, Security Goals, Security Attacks, Security Services, Security Mechanisms, Relation between Services and Mechanisms, Network Security model, Techniques.

Unit II: Encryption Techniques: Traditional Symmetric Key Ciphers: Substitution, Transposition, Stream and Block Ciphers, Modern Symmetric Key Ciphers: Introduction, Data Encryption Standard (DES), AES. Symmetric Key Cryptography: RSA, Rabin, ElGamal Cryptosystem.

Unit III: Integrity, Authentication: Message Integrity, Message Authentication, Cryptographic Hash Functions, Digital signature, Entity Authentication.

Unit IV: Key Management: KDC, Kerberos, symmetric Key Management: Diffie–Hellman key management, Public Key Distribution: Trusted Center, Certification Authority, X.509, Public Key Infrastructure (PKI).

Unit V: Security at Application Layer: Pretty Good Privacy (PGP), S/MIME.
Security at Transport Layer: Secure Socket Layer (SSL), Transport Layer Security (TLS).
Security at Network Layer: IPsec.

Unit VI: System Security: Intruders, Intrusion detection, Password Management, Malicious Software, Viruses and related threats, Virus Counter measures, Distributed Denial of Service Attacks, Firewalls, Firewall design principles, Trusted systems.

Text Books:

1. Behrouz A. Forouzan, "Cryptography and Network Security", Tata McGraw-Hill
2. William Stalling, "Cryptography and Network Security", Fourth Ed., Prentice Hall
3. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill

I SEMESTER

CSE2904	**Lab : Network Security and Cryptography**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

List of Practical's

1. Study of various types of network security attacks, attack detection and defense mechanism.
2. Use of different network attacking, traffic monitoring, detection and defense tools in Linux/ Window
3. Report on YCCE Campus wide networking and its performance monitoring.
4. Installation and configuration of Apache Web Server on Linux/Windows Platform.
5. Installation and configuration of Apache Tomcat Application Server on Linux/Windows Platform.

I SEMESTER

CSE2905	**Algorithm Design Techniques**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I: Algorithmic analysis: Analyzing control structures, Solving recurrences, Review of data structures.
Greedy algorithms: General characteristics, Graphs algorithms, Scheduling.

Unit II: Divide and conquer algorithms: General template, Searching, Sorting, Matrix multiplication, Exponentiation and its application in cryptography. **Dynamic programming**: Principle of optimality, Shortest paths, Chained matrix multiplication, Approaches using recursion, Memory functions.

Unit III: Linear programming: Formulating problems as linear programs, The simplex algorithm, Duality.

Unit IV: Probabilistic algorithms: Introduction, Pseudorandom generation, Numerical probabilistic algorithms, Monte Carlo algorithms, Las Vegas algorithms. **Heuristic algorithms and Approximate algorithms**: Heuristic algorithms, NP-hard approximation problems

Unit V: Parallel algorithms: Basic techniques, Parallel evaluation of expressions, Parallel sorting networks, parallel sorting, Distributed computation.

Unit VI: Computational complexity: Introduction, Linear reductions, Introduction to NP-completeness.

Text Books:

1. T. H. Cormen, C. E. Leiserson, R.L. Rivest, C. Stein, "Introduction to Algorithms", PHI.

Reference Books:

1. G. Brassard, P. Bratley, "Fundamentals of Algorithmics", PHI
2. A.V. Aho, J. E. Hopcroft, J.D. Ulman, "The Design & Analysis of Computer Algorithms", Addison Wesley.
3. Horowitz E., Sahni S, Rajasekharan S., "Fundamentals of computer algorithms", University press

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I SEMESTER

CSE2906	Lab : Algorithm Design Techniques	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

List of Practical's

1. Write an algorithm and program for fractional knapsack problem using greedy strategy.
2. Implement Strassen's algorithm using divide and conquer strategy.
3. Write an algorithm and program for 0-1 knapsack problem using dynamic programming strategy
4. Write an algorithm and program to demonstrate the Simplex Method.
5. Write an algorithm and program to implement randomized quicksort algorithm.
6. Study of NESL: A Parallel Programming Language
7. Study of Heuristic algorithm for TSP
8. Study of Approximation algorithm for TSP

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I SEMESTER

CSE2907	**PE I: Advanced Digital Image Processing**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I: Overview of Digital Image Processing and Image Enhancement: A Simple Image Model, Sampling and Quantization, Basic Relationship Between Pixel, Basic gray level Transformation, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filtering, Sharpening Spatial Filters, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, Inverse Fourier Transform, Filtering in Frequency Domain**,** Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homographic Filtering.

Unit II: Image Segmentation: Fundamentals, Point, line and edge detection, thresholding, Region Oriented Segmentation, Motion Based Segmentation.

Unit III: Morphing, Representation and Description: Introduction, Basic Morphological Algorithm, Chain Code, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of a region, Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors.

Unit IV: Model of the Image Degradation/Restoration Process: Noise Models, Restoration in the presence of Noise only-Spatial Filtering, Periodic Noise reduction by frequency domain filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse Filtering, Wiener Filtering, Constrained Least Square Filtering.

Unit V: Wavelets: Image Pyramids, Haar Transform, Multiresolution Expansions, Wavelet Transforms in1D, Fast wavelet Transform, wavelet packets.

Unit VI: Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Fidelity criteria, Image compression models, compression standards, Basic compression methods, Huffman coding, colomb coding, arithmetic coding, LZW coding, runlength coding, Symbol based coding, Block transform coding, predictive coding.

Text Books:
1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", Pearson Education.
2. A. K. Jain, "Fundamental of Digital Image Processing", PHI.

Reference Books:
1. Rosefield Kak, "Digital Image Processing".
2. W. K. Pratt, "Digital Image Processing".

I SEMESTER

CSE2908	PE I: Ethical Hacking	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction to Ethical Hacking, Ethics, and Legality: Ethical Hacking Terminology, Types, Phases and Stages of Ethical Hacking: Passive and Active Reconnaissance, Scanning, Gaining Access, Maintaining Access, Covering Tracks, Hacktivism, Hacker Classes, Skills Required to Become an Ethical Hacker, Vulnerability Research, Ways to Conduct Ethical Hacking, Creating a Security Evaluation Plan, Types of Ethical Hacks, Testing Types, Ethical Hacking Report

Footprinting and Social Engineering: Footprinting, Information Gathering Methodology, Competitive Intelligence, DNS Enumeration, Who is and ARIN Lookups, Types of DNS Records, Traceroute, E-Mail Tracking , Web Spiders, Social Engineering, Types of Attacks: Insider Attacks, Identity Theft, Phishing Attacks, Online Scams, URL Obfuscation, Social-Engineering Countermeasures.

Unit II: Scanning and Enumeration: Types of Scanning , CEH Scanning Methodology ,Ping Sweep Techniques, Nmap Command Switches, SYN, Stealth, XMAS, NULL, IDLE, and FIN Scans, TCP Communication Flag Types, War-Dialing Techniques, Banner Grabbing and OS Fingerprinting Techniques, Proxy Servers, Anonymizers, HTTP Tunneling Techniques, IP Spoofing Techniques, Enumeration, Null Sessions, SNMP Enumeration & Steps Involved

Unit III: System Hacking: Password-Cracking Techniques, LAN Manager Hash Cracking Windows 2000 Passwords, Redirecting the SMB Logon to the Attacker SMB Redirection, SMB Relay MITM Attacks and Countermeasures, NetBIOS, DoS Attacks, Password-Cracking Countermeasures, Types of Passwords Passive Online Attacks, Active Online Attacks, Offline Attacks, Non electronic Attacks, Keyloggers and Spyware Technologies Escalating Privileges, Buffer Overflows, Planting Root kits on XP Machines, Rootkit Embedded TCP/IP Stack Rootkit Countermeasures, Hiding Files, NTFS File Streaming NTFS Stream Countermeasures, Steganography Technologies, How to Cover Your Tracks and Erase Evidence, Disabling Auditing, Clearing the Event Log

Unit IV: Trojans, Backdoors, Viruses, and Worms: Trojans and Backdoors, Overt and Covert Channels, Types of Trojans, Reverse-Connecting Trojans, Netcat Trojan ,Wrapping, Trojan Construction Kit and Trojan Makers , Countermeasure Techniques, Trojan-Evading Techniques, System File Verification, Viruses and Worms, Types of Viruses, Antivirus Evasion Techniques, Virus Detection Methods Sniffers: Protocols Susceptible to Sniffing, Active and Passive Sniffing, ARP Poisoning, Ethereal Capture and Display Filters, MAC Flooding, DNS Spoofing Techniques, Sniffing Countermeasures

Denial of Service and Session Hijacking: Denial of Service, Types of DoS Attacks, DDoS Attacks DoS/DDoS Countermeasures, Session Hijacking, Spoofing vs. Hijacking, Session Hijacking, Sequence Prediction, Prevention of Session Hijacking

Unit V : Hacking Web Servers, Web Application Vulnerabilities, and Web-Based Password Cracking: Web Server Vulnerabilities, Attacks against Web Servers, IIS Unicode Exploits, Patch Management Techniques, Web Server Hardening Methods, Web Application Vulnerabilities, Objectives, Anatomy of an Attack, Web Application Threats, Google Hacking, Web Application Countermeasures, Web-Based Password Cracking Techniques, Authentication Types, Password Cracker, Password Attacks, Password-Cracking Countermeasures

SQL Injection and Buffer Overflows: SQL Injection, SQL Server, Vulnerabilities, SQL Injection Countermeasures, Buffer Overflows, Types and Methods of Detection, Stack-Based Buffer Overflows, Mutation Techniques

Unit VI: Linux Hacking: Linux Basics, Compile a Linux Kernel, GCC Compilation Commands, Install Linux Kernel Modules, Linux Hardening Methods
Penetration Testing Methodologies: Security Assessments, Penetration Testing Methodologies, Penetration Testing Steps, Pen-Test Legal Framework, Automated Penetration Testing Tools, Pen-Test Deliverables

Text Books:
1. CEH Certified Ethical Hacker study Guide V6, Wiley Publication

Reference Books:
1. Rich Annings, Himanshu Dwivedi, Zane Lackey, "Hacking Exposed Web 2.0", Tata McGraw Hill
2. Michael T, "Ethical Hacking & Network Defense", Simpson
3. Joel Scambray, cissp, Stuart Mcclure, Cissp, "Hacking Exposed Windows", 3rd Edition, Tata McGraw Hill
4. Joel Scambray Stuart Mcclure, "Hacking Exposed Window server 2003", Tata McGraw Hill

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I SEMESTER

CSE2909	PE I: Machine Learning	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

Unit II: Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search indecision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks

Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms

Unit III: Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, NaïveBayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm

Unit IV: Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning

Instance-Based Learning- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning

Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

Unit V: Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution

Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

Unit VI: Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators,

Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

Text Books:

1. Tom M. Mitchell, "Machine Learning", MGH
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Taylor & Francis (CRC)

Reference Books:

1. William W Hsieh, "Machine Learning Methods in the Environmental Sciences, Neural Networks", Cambridge Univ Press.
2. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", John Wiley & Sons

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I SEMESTER

CSE2910	**PE I: Grid and Cloud Computing**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I: System models for advanced computing –clusters of cooperative computing, grid computing and cloud computing; software systems for advanced computing-service oriented software and parallel and distributed programming models with introductory details, Features of grid and cloud platform.

Unit II: Cloud Computing services models and features in Saas, Paas and Iaas. Service oriented architecture and web services; Features of cloud computing architectures and simple case studies.

Unit III: Virtualization- Characteristic features, Taxonomy Hypervisor, Virtualization and Cloud Computing, Pros and Cons of Cloud Computing, Technology Examples/Case Studies.

Unit IV: Cloud programming Environmental- Map Reduce Hadoop Library from Apache, Open Source Cloud Software Systems –Eucalyptus.

Unit V: Grid Architecture and Service modeling, Grid resource management, Grid Application trends.

Unit VI: Case Studies

Text Books:
1. Kaittwang Geoffrey C.Fox and Jack J Dongrra, "Distributed and Cloud Computing, Elsevier India
2. Raj Kumar Buyya, Christian Vecchiola and S.TanuraiSelvi, "Mastering Cloud Computing",TMH,

Reference Books:
1. John W. Ritting House and James F Ramsome, "Cloud Computing", CRC Press
2. Gautam Shroff, "Enterprise Cloud Computing", Cambridge University Press

I SEMESTER

CSE2911	**Software Lab 1**	**L=0**	**T=0**	**P=2**	**Credits=2**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

I. **Unix/Linux Lab**

a. Common Commands – ls, passwd, wc, chdir, mkdir, chmod, cd, mv, df, du, netstat, ps, more, set, env, setenv, chgrp, man, rm, rmdir, grep, vi, tar, untar, uuencode, find, cat, history, ping, ifconfig, traceroute, cksum, cmp, ln, lynx, gzip, gunzip

b. Piping and redirection
c. Editing, Scripting and Pattern Matching – vi, emacs, awk, sed, bash script – variables, conditionals, and loops
d. Parameter passing to C program from shell (argc / argv)
e. Introduction to using different tools for identification of possible errors in C program – gdb, concepts of "core dump", backtracing using "bt", using "info" to dump all registers, creating watch-list / watch variables.
f. DDD (Data Display Debugger) – introduction and usage

II. **Web Technologies and Networking Lab**

a. Creating your own homepage
b. HTML, XML, XSD
c. J2EE introduction: Using Eclipse to create webpages
d. JavaScript and JavaScript debugging
e. Networking Commands – inetd, host, ifconfig, netstat, nslookup, ping, ssh, traceroute
g. Network Monitoring tools – Nagios, Wireshark, OpenNMS

III. Programming and Data Structures Lab

a. Arrays: Searching, Sorting, 2D/3D arrays
b. Functions: Pass-by-Value, Pass-by-Reference, Recurrence Functions
c. Generating permutation/combinations, generating truth-table for a logical formula

IV. Object Oriented Lab

a. OO Concepts – Classes, Objects, Inheritance, Overloading
b. Exceptions and Error Handing
c. Threading and Synchronization in Java/C++

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II **SEMESTER**

CSE2912	Data Mining	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I:
Introduction to data mining, Process of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task primitives, Major issues in Data Mining, Applications of Data Mining

Unit II: Classification and Clustering Classification: Introduction, decision tree, building a decision tree- the tree induction algorithm, split algorithm based on information theory, gini index, over fitting and pruning, decision tree rules, naïve Bayes method.

Clustering: Types of data in cluster analysis, Categorization of major clustering methods: Partitioning methods, Hierarchical methods, Applications of clustering.

Unit III: Mining Frequent Patterns and Association Rules: Market Basket Analysis, Frequent Item sets and Association rules, A Priori Algorithm, Improving the efficiency of A priori, FP- growth Algorithm.

Unit IV: Social Media Analytics: Social network analysis, Representation of social data, Social media analysis, Tools to collect and analyze data of social media based on NODEXL.

Unit V: Visualization and Prediction Visualization: Motivation for visualization, General concepts, Techniques
Prediction: Linear regression (Least Square method), Analyzing regression error, Analyzing goodness of fit

Unit VI: Statistical Mining: Logistic Regression, Multivariate regression, ANOVA, PCA, Factor analysis, Graph Mining

Text Books:
1 Jiawei Han & Micheline Kamber, "Data Mining – Concepts and Techniques", Harcourt India.
2. Arun K Pujari, "Data Mining Techniques", University Press.
3. Pang-ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data mining"

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II SEMESTER

CSE2913	Distributed Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and The Web, Challenges, System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

Unit II: Interprocess Communication: Introduction, The API for the Internet Protocols- The Characteristics of Interprocess communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast.

Unit III: Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; RPC, Events and Notifications, Case Study: JAVA RMI

Unit IV: Operating System Support: Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

Unit V: Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

Unit VI: Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication. Transactions& Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

Text Books:

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication
2. Ajay D Kshemkalyani, Mukesh Sighal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge
3. Andrew S Tanenbaum, Maarten Van Steen: "Distributed Systems- Principles and Paradigms", Pearson Publication

II SEMESTER

CSE2914	Optimizing Compilers	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Overview Lexical analyzer, Syntax analyzer, Semantic analysis

Unit II: Intermediate code generation, Compiler Challenges for High-Performance Architectures, Dependence and its Properties, Parallelization and Vectorization

Unit III: Loop optimization, Data flow analysis, Enhancing Fine-Grained Parallelism

Unit IV: Creating Coarse-Grained Parallelism, Cache management.

Unit V: Scheduling, Register allocation & Assignment

Unit VI: Case studies of compilers.

Text Books:

1. Randy Allen and Ken Kennedy, "Optimizing compilers for modern architectures", Morgan Kaufmann Publishers
2. Steven S. Muchnick, "Advanced Compiler Design and implementation".
3. A. V. Aho, R. Sethi, & J. D. Ullman, "Compilers: Principles, Techniques &Tools", Pearson Edu.

Reference Books:

1. C. Fischer and R. LeBlanc, "Crafting a Compiler", Pearson Education.
2. A. C. Holub, "Compiler Design in C", Pearson Education.
3. Appel Modern Compiler Implementation in Java: Basic Design, Cambridge Press.
4. Fraser and Hanson, "A Retargetable C Compiler: Design and Implementation, Pearson Education.

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II **SEMESTER**

CSE2915	Lab: Optimizing Compilers	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

List of Practical's

1. Study of Fast Lexical Analyzer (FLEX).
2. Write a FLEX program to display welcome message to the user along with his name when user enters the word "Hello"
3. Write a FLEX program to recognize input as integer number, decimal number, character, word, identifier or special symbol.
4. Write a FLEX program to count number of Characters, Words and Lines in a given input text file.
5. Write a FLEX program to recognize whether the entered arithmetic expression is correct or not.
6. Write a FLEX program to solve arithmetical expression of two numbers entered by user.
7. Study of Yet Another Compiler Compiler (YACC).
8. Write a YACC program to display the message "Hello <user>" when user enters his name using standard input.
9. Write a YACC program perform arithmetic operations like +, -, /, *

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II **SEMESTER**

CSE2916	Software Architecture	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction and Overview of Software Architecture, Architectural Models: Models for characterizing and reasoning about architectures, Tools for architectural modeling

Unit II: Typical software system structures (Architectural styles), Techniques for Designing and Implementing these structures,

Unit III: Role of architecture in Software engineering; Enterprise Architectures, Zachman's Framework, Software Product Lines and its Architecture Configurable Software

Unit IV: Design Patterns,Component based development

Unit V: Architectural Description Languages

Unit VI: Self-Adaptive Software, Feature Modeling, Architecture and Model-Based Testing, Detailed Case study on contemporary Software Architecture**.**

Text Books:

1. Software Architecture: Foundations, Theory, and Practice by Eric M. Dashofy, Nenad Medvidovic, Ricard N. Taylor, John Wiley & Sons
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, MiachelStal, Douglas Schmidt, "*Pattern Oriented Software Architecture",* Volumes 1 &2, Wiley Publications.
3. Len Bass, Paul Clements, Rick Katzman, Ken Bass, "*Software Architecture in Practice",* Pearson Edu.

Reference Books:

1. Kurt Wallnau, Scott Hissam and Robert Seacord, "Building Systems from Commercial Components", Addison-Wesley
2. George T. Heineman, William T. Councill, "Component Based Software Engineering", Addison-Wesley

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II **SEMESTER**

CSE2917	Lab: Software Architecture	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

List of Practical's

1. Creation of software architecture document
2. Identify appropriate architectural style for B.E. project
3. Implementation of simple connectors or client server using middleware
4. Identify & familiarize tools and techniques for architectural modelling
5. Architectural analysis of B.E. project
6. Implementation of framework
7. Study of non-functional properties of an operating system
8. Web service implementation
9. Study typical industry cases for design pattern
10. Creation of domain model in a known domain

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II **SEMESTER**

CSE2918	**Seminar (Technical Writing and Publishing)**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**Continuous Evaluation**	**CA**	**ESE**	**Total**	**ESE Duration**
		100		**100**	

UNIT I
Identification of research domain and the broader area of work.

UNIT II
Report/Paper Writing – Introduction, Background to the Study, Literature Study, Methodology, Conclusion

UNIT III
Data Analysis: Analyzing multiple results obtained over time and reporting those using charts and graphs

UNIT IV
Document Preparation System: Latex

UNIT V
Summarizing papers/articles into a report and adapt the ethics of publication.

UNIT VI
Presentation using power point slides and publication based on the work carried out.

Text books and/or other required material:
1. Strunk and White: The Elements of Style
2. Gretchen Hargis *et., al*.: Developing Quality Technical Information: A Handbook for Writers and Editors, Second Edition, IBM, 2004.
3. Leslie Lamport: LaTex

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II **SEMESTER**

CSE2919	PE II: Soft Computing Techniques	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Unit II: Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. **Operations on Fuzzy Sets:** Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

Unit III: Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Unit IV: Introduction of Neuro Fuzzy Systems, Architecture of Neuro Fuzzy Networks.

Unit V: Application of Fuzzy Logic: Engineering, Economics, etc.

Unit VI: Computational Learning Theory: - Instance-Based Learning: k-Nearest-neighbor algorithm, Learning first-order rules etc.

Text Books:

1. R. A. Aliev, R. R. Aliev, "Soft Computing and Its Applications"
2. Bar Kosko, "Neural Networks and Fuzzy Systems", Prentice-Hall
3. Melanie Mitchell, "An Introduction to Genetic Algorithms (Complex Adaptive Systems)", MIT Press

II **SEMESTER**

CSE2920	PE II: Data Warehousing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I:
Introduction to data warehousing, real time applications, scope of mining and warehousing for various applications. Data warehousing- Various schema, three-tier architecture, design issues, multidimensional model. Data warehouse development life cycle Data Warehouse Design - Massive denormalisation, STAR schema design, Data ware house Architecture, OLAP, ROLAP and MOLAP , concepts of Fact and dimension table.

Unit II:
System Processes: Extract and Load process, Clean and transform data, Backup and Archive, Query management process. Process Architecture: Load, Warehouse, and Query Manager, Detailed and summary information, Metadata, Data marts

Unit III:
Aggregations, Data warehouse analysis and statistical queries, CUBE, ROLL UP and STAR queries.

Unit IV:
Space Management in Data warehouse - Schemas for storing data in warehouse using different storage structures, B-tree index, hash index, clusters, Bitmap index functional index, domain index, Data partitions.

Unit V:
Performance and Tuning- Query optimization, memory management, process management. I/o management for Data warehouse.

Unit VI:
Handling BIG data, NO sql database, Columnar database.

Text Books:

1. Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons
2. Sam Anahony, "Data Warehousing in the real world: A practical guide for building decision support systems", John Wiley
3. W.H. Inmon, "Building the Data Warehouse", 3rd Ed., John Wiley & Sons.
4. W.H.Inmon, C.Kelly, Developing the Data Warehouse", John Wiley & Sons.
5. Thomas Connoly, Carolyn Begg, "Database Systems-A practical approach toDesign, Implementation and management" 3rdEdition, Pearson Education

Reference Books:
1. W. H. Inmon, "Building the operational data store", 2nd Ed., John Wiley
2. Kamber and Han, "Data Mining Concepts and Techniques", Hartcourt India

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II **SEMESTER**

CSE2921	PE II: Wireless Sensor Network	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: OVERVIEW OF WIRELESS SENSOR NETWORKS
Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

Unit II: ARCHITECTURES
Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

Unit III: COMMUNICATION PROTOCOLS
Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , Contention based Protocols, Schedule based protocols

Unit IV: LINK LAYER PROTOCOLS
Fundamental, Error Control, Framing, Link Management, Naming And Addressing – Fundamentals, Assignment of MAC Address, Distributed assignment of locally unique addresses, Content based and geographic addressing

Unit V: INFRASTRUCTURE ESTABLISHMENT
Localization and Positioning, Topology Control, Clustering

Unit VI: Middleware for Wireless Sensor Network, Network Management for WSN

Text Books:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.

II **SEMESTER**

CSE2922	PE II: Information Retrieval Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Boolean Retrieval, Vocabulary and postings lists, Dictionaries and tolerant retrieval, Index construction, Index compression

Unit II: Scoring, Weighting and the vector space model, Computing scores in a complete search system, Evaluation in information retrieval, Relevance feedback and query expansion

Unit III: XML retrieval, Probabilistic information retrieval, Language models for information retrieval, Text, Classification, Vector space classification

Unit IV: Support Vector Machines and Machine Learning on documents, Flat clustering, Hierarchical clustering, Matrix decompositions and Latent Semantic Indexing.

Unit V: Web search basics, Web Crawling and Indexes, Link analysis

Unit VI: Case studies

Text Books:

1. Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press

Reference Books:

1. Kowalski, Gerald, Mark T Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", Springer.
2. Ricardo Baeza-Yates, "Modern Information Retrieval", Pearson Education
3. David A Grossman and Ophir Frieder, "Information Retrieval: Algorithms and Heuristics", 2nd Edition, Springer
4. William B Frakes, Ricardo Baeza-Yates, "Information Retrieval Data Structures and Algorithms", Pearson Education
5. Robert Korfhage, "Information Storage & Retieval", John Wiley & Sons.

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II SEMESTER

CSE2923	**Software Lab 2**	**L=0**	**T=0**	**P=2**	**Credits=2**

Evaluation Scheme	**Continuous Evaluation**	**ESE**	**Total**	**ESE Duration**
	40	**60**	**100**	

I. Unix/Linux Lab

a.Makefile – writing Makefile, compilation via make, compilation of C programs distributed in multiple files

b. Versioning system like CVS – versioning and branching

c. Linux System Administration

Installing Linux in a virtual machine

Mounting/Unmounting Disks

Setting and using Path and Environment Variables

Starting telnet, ftp, smtp services and using them

rcp, rsh, rlogin

Super user commands/priviledges – su, sudo, install/uninstall of packages, updating linux system

d. OS related exercises – Accessing iNode, Creation of threads, fork / join, creation of semaphore / mutex, assignments on synchronizing threads. Pthreads and Java threading APIs.

II. Advanced Programming and Data Structures Lab

a. Pointers: Linked List, Queue, Stack, Sparse Matrix, trees, graphs

III. Open Sources Lab

a. Using automatic testing tools – Junit/ NUnit/ TestNG

b. Installing and using Apache Web server to develop a website, Installing and using mysql to store some data

c. Java Native Interface (JNI) – Calling C / C++ code from Java and vice versa

d. Use of open source cloud platforms:

- Integration of gmail with google calendar
- Creating a website on Salesforce cloud for tracking inventory from east, west, north, south regions in India separately.
- Accessing google-map via google-map APIs

e. Downloading and Installing Hadoop on 3 to 4 machines and writing a distributed sorting program on the same.

f. Creating web-services using Axis-2 (Java) or gSoap library (C / C++)

g. Introduction to SSL. Use digital certificates to encrypt / decrypt data in transfers

h. Introduction to Android Platform and APIs / libraries provided. A sample game / application on Android.

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III **SEMESTER**

CSE2931	**PE III: Computer Vision**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESEDuration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit I: Introduction to Human and Computer Vision, Image Registration algorithm

Unit II: Pattern Recognition Techniques, Statistical, Structural, Neural and Hybrid Techniques. Feature Extraction Techniques, Training and Classification

Unit III: Sensing 3D Shapes, How the 3rd dimension changes the problem, Stereo 3D description,3D Model, Matching

Unit IV: Content based image retrieval

Unit V: Virtual reality

Unit VI: Emerging IT applications, Recognition of characters, Fingerprint, Iris and Face

Text Books:

1. Shapiro and G. Stockman, "Computer Vision", Prentice Hall
2. David A. Forsyth, Jean Ponce, "Computer Vision", Prentice Hall

Reference Books:

1. A. K. Jain, "Fundamentals of Digital Image Processing"
2. Milan Sonka,Vaclav Hlavae, "Image Processing and Machine Vision"
3. J.T. Tou and R. C. Gonzalez , "Pattern Recognition Principles"
4. King Sun Fun, "Syntactic Pattern Recognition and Applications"
5. Fairhurst, "Computer Vision", Prentice Hall

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III **SEMESTER**

CT2932	PE III: Natural Language Processing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: Introduction to NLP: Computational Models of Language, Organization of NLP Systems, Natural Language Generation.

Unit II: Syntax: Linguistic Background, Elements of Simple Sentences, Parsing Techniques, Features and Augmented Grammars, Deterministic Parsing.

Unit III: Semantic: Logical Form, Case Relations, Semantic Networks, Basic Operations for Semantic Interpretation, Strategic and Issues.

Unit IV: Context & World Knowledge: Knowledge Representation, Question, Answering Systems: Natural Language Generation, Typical NLP Systems and their Architectures, Cognitive Aspects of Natural Languages

Unit V:Indian Language Processing: Techniques of Machine Translation, Approaches to Machine Translation, Typical Case Studies in Indian Language Context

Unit VI: Introduction to Speech Processing: Word level Morphology and Computational Phonology; Basic Text to Speech; Introduction to HMMs and Speech Recognition, Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning; Semantic Analysis; Lexical Semantics; Word Sense; Disambiguation; Discourse understanding; Indian language case studies

Text Book:

1. James Allen, "Natural Language Understanding", Pearson Education.
2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Prentice-Hall

Reference Books:

1. Christopher Manning "Foundations of Statistical Natural Language Processing", MIT Press, Cambridge.
2. Akshar Bharathi, Vineet Chaitanya, Rajeev Sangal, "Natural Language Processing – A Paninian Perspective", Prentice Hall
3. Tom Mitchell, "Machine Learning", McGraw Hill
4. Ronald Hausser, "Foundations of Computational Linguistics", Springer-Verlog,
5. Winograd, "Language as a cognitive process- syntax", Addison Wesley.
6. Popov, "Talking with computer in Natural language", Springer Verlog,

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III **SEMESTER**

CSE2933	**PE III: Optimization Techniques**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3hrs**

Unit-I: Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.

Unit-II: Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn –Tucker Sufficient Conditions.

Unit-III: Optimization: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg- Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP),

Unit-IV: Non-Liner Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming,

Unit-V: Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation,

Unit-VI: Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods.

Text Books.

1. Winston W L, "Operations Research: Applications and Algorithms",
2. Rao S.S., "Optimization: Theory and Applications".
3. Walsh G R., "M methods of Optimization".
4. Williams H.P., "Model Building in Mathematics Programming".
5. Williams H.P., "Model Solving in Mathematics Programming".
6. G.L. Nemhauser and L.A. Wolsey., "Intger and Combinational Optimization".
7. R.G. Parker and R.L. Rardin., "Discrete Optimization".

III **SEMESTER**

CSE2934	PE III: Database Security	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: Introduction: Introduction to Databases Security Problems in Databases Security Controls Conclusions
Security Models -1: Introduction Access Matrix Model Take-Grant Model Acten Model PN Model Hartson and Hsiao's, Model Fernandez's Model Bussolati and Martella's Model for Distributed databases

Unit II: Security Models -2: Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu's, Model The Lattice Model for the Flow Control conclusion.

Security Mechanisms: Introduction User Identification/Authentication Memory Protection Resource Protection Control Flow, Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria

Unit III: Security Software Design: Introduction, A Methodological Approach to Security Software Design Secure Operating System, Design Secure DBMS Design Security Packages Database Security Design

Unit IV: Statistical Database Protection &Intrusion Detection Systems: Introduction Statistics Concepts and Definitions Types of Attacks Inference Controls evaluation, Criteria for Control Comparison .Introduction IDES System RETISS System ASES System Discovery

Unit V: Models for the Protection of New Generation Database Systems -I: Introduction A Model for the Protection of Frame Based Systems A Model for the Protection of Object- Oriented Systems SORION Model for the Protection of Object-Oriented Databases

Unit VI: Models for the Protection of New Generation Database Systems -II: A Model for the Protection of New Generation Database Systems: the Orion Model Jajodia and Kogan's Model, A Model for the Protection of Active Databases Conclusions

Text Books:

1. Hassan A. Afyouni, "Database Security and Auditing", India Edition, Cenage Learning
2. Castano, "Database Security", Second edition, Pearson Education.

Reference Books:

1. Alfred Basta, Melissa Zgola, "Database security", Cengage learning

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III SEMESTER

CSE2935	PE IV: Cyber Forensics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Introduction: Review of TCP/IP and TCP, IP Header analysis, Introduction to Cyber World, Cyber attacks and cyber security

Unit II: Information warfare and cyber terrorism, Types of cyber attacks, Cyber Crime and Digital Fraud, Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations).

Unit III: Live Data collection and investigating windows environment: windows Registry analysis, Gathering Tools to create a response tool kit, obtaining volatile Data, Computer forensics in windows environment, Log analysis and event viewer, File auditing, identifying rogue machines, hidden files and unauthorized access points.

Unit IV: Live Data collection and investigating Linux environment: Proc file system overview, Gathering Tools to create response toolkit.

Unit V: Handling Investigations: Log Analysis (Network, host, user logging details), Recording incident time/date stamps, Identifying rogue processes, unauthorized access points, unauthorized user/group accounts

Unit VI: Forensic tools and report generation: Recovery of Deleted files, Analyzing network traffic, sniffers, Ethical Hacking, Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), Mobile forensic tools and analysis of called data record Template for computer for ensic reports.

Text Books:

1. Mandia, K., Prosise, C., Pepe, M., "Incident Response & Computer Forensics", 2nd edition, Tata-McGraw Hill,
2. Bill Nelson, Amelia Phillips**,** Frank Enfinger, and Chris Steuart, "Guide to Computer Forensics and Investigations", 2nd Edition, Thomson Learning

Reference Books:

1. Eoghan Casey, "Digital Evidence and Computer Crime", 2nd Edition, Academic Press File System
2. Brian Carrier, "Forensic Analysis", Wesley
3. Harlan Carvey, "Windows Forensic Analysis" DVD Toolkit, Syngress Publication
4. Steve Bunting, "EnCE: The Official En Case Certified Examiner Study Guide, 2nd Edition, Sybex Publication

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III **SEMESTER**

CSE2936	PE IV: Pattern Recognition	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: Introduction and classifiers based on Bayesian Decision

Unit II: Linear classifiers and non linear classifiers

Unit III: Feature selection and feature generation

Unit IV: Template matching and context dependent classification

Unit V: Clustering algorithms: Sequential and Hierarchical Algorithms

Unit VI: Clustering algorithms based on function optimization and cluster validity

Text Books:

1. Sergios Theodoridis and Konstantinos Koutroumbas, "Pattern Recognition", 4th Edition , Academic Press.
2. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley
3. John Hertz, Andres Krogh & Richard G. Palmer, "Introduction to the theory of Neural Computation", Addison Wesley
4. Theodoridis & Koutroumbas, "Pattern Recognition", 4th Edition

III SEMESTER

CSE2937	PE IV: Algorithms for Bioinformatics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 hrs

Unit I: Introduction and Information Retrieval: Introduction, Historical overview, Bioinformatics Applications, major databases, data management, data analysis, molecular biology, Tools for Web Search, Data Retrieval tools, Data mining of biological databases.

Unit II: Molecular Biology and Bioinformatics: Introduction to Genes and Proteins Genome Sequences Genome rearrangement, bock allignmeny, global sequence alignment, ORFs, Genes, Intones, Exons, Splice Variants DNA/RNA Secondary Structure, Triplet Coding Protein Sequences, bioinformatics algorithms.

Unit III: Information molecule and information flow: Central dogma of molecular biology, Problem in molecular and bioinformatics approach, Basic component, Chemistry of DNA and RNA, Basics of DNA replication

Unit IV: Introduction to protein, Amino acid and Protein Structure: Secondary, Tertiary, Quaternary, protein Folding protein function, protein purification and characterization, Data integration and Data Analysis, Multiplicity of Data and redundancy

Unit V: Genome Analysis and Gene Mapping: Pairwise Sequence Alignment, Database Similarity Searching: BLAST, FASTA, Multiple Sequence Alignment, Profiles and Hidden Markov Models Structure prediction methods for gene, Gene expression and Microarray. Protein classification and Structure Visualization, Protein structure Prediction, Proteomics, Protein folding

Unit VI: Applications: Drug Discovery**:** Introduction, Technology, Cell Cycle, G-Protein coupled Receptor as drug target.

Text Books:

1. S. C. Rastogi, Namita Mendirata, Parag Rastogi,"Bioinformatics concepts Skills and application", CBS publisher
2. S. C. Rastogi, Namita Mendirata, Parag Rastogi,"Bioinformatics Methods and application", PHI
3. D. Baxevanis and F. Oulette, "Bioinformatics: A practical guide to the analysis of genes and proteins", Wiley
4. Arthur M. Lesk, "Introduction to Bioinformatics", Oxford University

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III SEMESTER

CSE2938	PE IV: Semantic Web and Social Networks	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3hrs

Unit I: Web Intelligence: An Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

Unit II: Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontology Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language (OWL), UML, XML/XML Schema.

Unit III: Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

Unit IV: Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

Unit V: Social Network Analysis and Semantic web: Social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

Unit VI: Case Studies

Text Books:
1. Berners Lee, Godel and Turing, "Thinking on the Web", Wiley Interscience
2. Peter Mika, "Social Networks and the Semantic Web", Springer

Reference Books:
1. J. Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies, Trends and Research in Ontology Based Systems", John Wiley & Sons.
2. Liyang Lu, Chapman and Hall, "Semantic Web and Semantic Web Services", CRC Publishers,(Taylor & Francis Group)
3. Heiner Stuckenschmidt, Frank Van Harmelen, "Information Sharing on the semantic Web", Springer Publications.
4. T. Segaran, C. Evans, J. Taylor, O. Reilly, "Programming the Semantic Web", SPD.

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III SEMESTER

CSE2939	**Project Phase –I**	**T=0**	**P=16**	**Credits=8**

Evaluation Scheme	**Continuous Evaluation**	**CA**	**ESE**	**Total**	**ESE Duration**
		100		**100**	

IV SEMESTER

CSE2940	**Project Phase –II**	**T=0**	**P=24**	**Credits=12**

Evaluation Scheme	**Continuous Evaluation**	**CA**	**ESE**	**Total**	**ESE Duration**
		40	**60**	**100**	

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

		June 2018	1.00	Applicable for Sem 1 & 2 AY 2018-19 & Sem 3 & 4 AY 2019-20 Onwards
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UG SoE & Syllabus 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

SoE & Syllabus 2018-19

First & Second Semester BE

28 June 2018

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2018-19

First Year BE

SN	Sem	Sub. Code	Type	Subject	T/P	Contact Hours				Credits	% Weightage				ESE Duration Hours
						L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
First Semester Group "A"															
1	1	GE2101	BS	Engineering Mathematics I	**T**	3	1	0	4	4	15	15	10	60	3
2	1	GE2105	BS	Engineering Physics	**T**	4	0	0	4	4	15	15	10	60	3
3	1	GE2106	BS	**Lab.:** Engineering Physics	**P**	0	0	2	2	1			40	60	
4	1	GE2107	HS	Communications Skills	**T**	3	0	0	3	3	15	15	10	60	3
5	1	CV2101	BES	Engineering Mechanics	**T**	3	1	0	4	4	15	15	10	60	3
6	1	CV2102	BES	**Lab.:** Engineering Mechanics	**P**	0	0	2	2	1			40	60	
7	1	IT2101	BES	Introduction to Computer Programing	**T**	3	1	0	4	4	15	15	10	60	3
8	1	IT2102	BES	**Lab.:** Introduction to Computer Programing	**P**	0	0	2	2	1			100		
9	1	ME2103	BES	Workshop Practice	**P**	0	0	2	2	1			40	60	
					TOTAL	**16**	**3**	**8**	**27**	**23**					
First Semester Group "B"															
1	1	GE2102	BS	Engineering Mathematics II	**T**	3	1	0	4	4	15	15	10	60	3
2	1	GE2103	BS	Engineering Chemistry	**T**	4	0	0	4	4	15	15	10	60	3
3	1	GE2104	BS	**Lab.:** Engineering Chemistry	**P**	0	0	2	2	1			40	60	
4	1	GE2108	HS	Social Sciences	**T**	3	0	0	3	3	15	15	10	60	3
5	1	EL2101	BES	Electrical Engineering	**T**	3	1	0	4	4	15	15	10	60	3
6	1	EL2102	BES	**Lab.:** Electrical Engineering	**P**	0	0	2	2	1			40	60	
7	1	ME2101	BES	Engineering Graphics	**T**	1	0	0	1	1	15	15	10	60	3
8	1	ME2102	BES	**Lab.:** Engineering Graphics	**P**	0	0	4	4	2			100		
9	1	EE2101	BES	Basic Electronics	**T**	3	1	0	4	4	15	15	10	60	3
					TOTAL	**17**	**3**	**8**	**28**	**24**					

List of Audit Courses (First Sem Group "A")											
1	**1**	**GE2122**	**HS**	**Functional English-I**	**A**	3	0	0	3	0	
				OR							
2	**1**	**GE2123**	**HS**	**Functional English-V**	**A**	3	0	0	3	0	

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B.E. SCHEME OF EXAMINATION 2018-19

First Year BE

SN	Sem	Sub. Code	Type	Subject	T/P	Contact Hours				Credits	% Weightage				ESE Duration Hours
						L	T	P	Hrs		MSE-I	MSE-II	TA	ESE	
Second Semester Group "A"															
1	2	GE2102	BS	Engineering Mathematics II	T	3	1	0	4	4	15	15	10	60	3
2	2	GE2103	BS	Engineering Chemistry	T	4	0	0	4	4	15	15	10	60	3
3	2	GE2107	BS	**Lab.:** Engineering Chemistry	P	0	0	2	2	1			40	60	
4	2	GE2108	HS	Social Sciences	T	3	0	0	3	3	15	15	10	60	3
5	2	EL2101	BES	Electrical Engineering	T	3	1	0	4	4	15	15	10	60	3
6	2	EL2102	BES	**Lab.:** Electrical Engineering	P	0	0	2	2	1			40	60	
7	2	ME2101	BES	Engineering Graphics	T	1	0	0	1	1	15	15	10	60	3
8	2	ME2102	BES	**Lab.:** Engineering Graphics	P	0	0	4	4	2			100		
9	2	EE2101	BES	Basic Electronics	T	3	1	0	4	4	15	15	10	60	3
					TOTAL	**17**	**3**	**8**	**28**	**24**					
Second Semester Group "B"															
1	2	GE2101	BS	Engineering Mathematics I	T	3	1	0	4	4	15	15	10	60	3
2	2	GE2105	BS	Engineering Physics	T	4	0	0	4	4	15	15	10	60	3
3	2	GE2106	BS	**Lab.:** Engineering Physics	P	0	0	2	2	1			40	60	
4	2	GE2107	HS	Communications Skills	T	3	0	0	3	3	15	15	10	60	3
5	2	CV2101	BES	Engineering Mechanics	T	3	1	0	4	4	15	15	10	60	3
6	2	CV2102	BES	**Lab.:** Engineering Mechanics	P	0	0	2	2	1			40	60	
7	2	IT2101	BES	Introduction to Computer Programing	T	3	1	0	4	4	15	15	10	60	3
8	2	IT2102	BES	**Lab.:** Introduction to Computer Programing	P	0	0	2	2	1			100		
9	2	ME2103	BES	Workshop Practice	P	0	0	2	2	1			40	60	
					TOTAL	**16**	**3**	**8**	**27**	**23**					
List of Audit Courses (Second Sem Group "B")															
1	**2**	**GE2122**	**HS**	**Functional English-I**	**A**	3	0	0	3	0					
				OR											
2	**2**	**GE2123**	**HS**	**Functional English-V**	**A**	3	0	0	3	0					

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GE2101	Engineering Mathematics-I				L=3	T=1	P=0	Credits=4
	M	M						
						3		

Unit I: Differential Calculus (PO-1, 2)

(6 hours)

Unit II: Partial Differentiation (PO-1, 2)

(7 hours)

Unit III: Integral Calculus (PO-1, 2)

(6 hours)

Unit IV: Multiple integrals and their Applications (PO-1,2)

(7 hours)

Unit V: Vector Calculus (PO-1,2,3)

(6 hours)

Unit VI: Vector Integration & Application (PO-1,2)

(7hours)

Text Books

Reference Books

GE2102	Engineering Mathematics-II	L=3	T=1	P=0	Credits=4

[illegible]	M[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]

[illegible]	[illegible]	[illegible]
	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Unit I: Differential Equations–I (PO-1)

[illegible]

(7 hours)

Unit II: Differential Equations–II (PO-1, 2)

[illegible]

(6 hours)

Unit III: Complex Numbers (PO-1)

[illegible]

(6 hours)

UNIT IV: Complex Variables (PO-1, 2)

[illegible]

(7 hours)

UNIT V: Matrices (PO-1)

[illegible]

(7 hours)

Unit VI: Statistics (PO-1, 2)

[illegible]

(6 hours)

Text Books

[illegible]

Reference Books

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GE2103	Engineering Chemistry	L=4	T=0	P=0	CREDITS = 4

EVALUATION SCHEME					
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION
15	15	10	60	100	3 Hours

Course objectives:

3.

Unit I: Water Conditioning **(10 hrs) PO1, PO2**

Industrial

Domestic

Unit-II: Battery Technology **(8 hrs.) PO1, PO3**

Thermodynamic functions:

Electrochemistry

Battery Technology:

Unit III: Corrosion **(8 hrs) PO1**

Unit IV: Lubricants **(8 hrs.) PO1**

Unit V: Fuels **(10 hrs) PO1, PO2**

Unit VI: Cement and Advanced Materials **(8 hrs) PO1**

Cement

Advanced materials:

Nanomaterials

Shape memory alloys

Advanced Polymeric materials:

GE2103	Engineering Chemistry			L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 Hours	

Outcome:

Books recommended

Text Books

1. [illegible]
2. [illegible]

Practical book

1. [illegible]

Reference Books

- [illegible]

GE2104	Lab.: Engineering Chemistry	L=0	T=0	P=2	Credits=1

Total 10 experiments are to be performed

Course objectives:

- [illegible]
- [illegible]

List of Experiments-Phase I

[illegible]

List of Experiments-Phase II

[illegible]

Demonstration:

[illegible]

Outcome:

[illegible]

GE2105	Engineering Physics	L=4	T=0	P=0	CREDITS = 4

	M	M				
						3

Objectives	Outcomes
2.	3.

Unit-I : Wave optics (09) [CO1, (PO1, PO2)]

Unit-II : Quantum Physics (09) [CO2, (PO1, PO2)]

Unit-III : Semiconductor Physics (09) [CO3, (PO1, PO2)]

Unit-IV: Electron Ballistics (08) [CO4, (PO1, PO2)]

Unit-V: Electron Optic Devices (08) [CO5, (PO1, PO2)]

Unit-VI : Laser (09) [CO6, (PO1, PO2)]

Text books and Reference Books Recommended :

3

7. **Solid state Physics by S.O.Pillai , New Edge International Publishers**
8. **Solid State Physics by Palanswamy , SciTech publishers**

GE2106	Lab.: Engineering Physics	L=0	T=0	P=2	Credits=1

[illegible]	M[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Objectives	Outcomes
[illegible]	[illegible]

Minimum Eight experiments are to be performed from the list as given below and One or Two demonstration experiments .

[illegible]

List of demonstration experiment:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

GE2107	Communication Skills	3			3

						3

3		

GE2108	Social Science	[illegible]3	[illegible]	[illegible]	[illegible]3
[illegible]	M[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]

[illegible]	[illegible]
[illegible]	[illegible]

Unit I: Social Sciences & Its Utility **(PO-3, 4, 6) (7 Hours)**

- M[illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

Unit II: Human Civilization **(PO- 3, 6, 8)**[illegible]

- [illegible]
- [illegible]

[illegible]

Unit III: Industrialization & Society **(PO-5, 6)**[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

Unit IV: Fundamental Concept in Social Science **(PO-3, 6, 8)** [illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

Unit V: Industrial Organization **(PO-5, 7)** [illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

Unit VI: Industrial Management **(PO-4, 5, 6)**[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

Text Books:-

[illegible]

Reference Book:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

CV2101	Engineering Mechanics			L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION		
					3		

COURSE OBJECTIVE	COURSE OUTCOMES
1	1
2	2
3	3
4	4
Mapped POs :- 1, 2, 11	

Unit I: Resultant of Plane Force System **(9 Hrs.)**

Unit II: Equilibrium of Plane Force System **(9 Hrs.)**

Unit III: Friction and Trusses **(8 Hrs.)**

Unit IV: Properties of Surfaces **(9 Hrs.)**

Unit V: Virtual Work Method and Kinetics of Particle **(8 Hrs.)**

Unit VI: Work Energy and Impulse Momentum Method **(9 Hrs.)**

Text Books:-

Reference Books:-

CV2102	Lab.: Engineering Mechanics	L=0	T=0	P=2	CREDITS = 1

COURSE OBJECTIVES	COURSE OUTCOMES

Mapped POs:- 1, 2, 4, 11

SN	Minimum Ten Practical's to be performed from the list as below

Reference Books:-

EE2101	Basic Electronics	L= 3	T = 1	P = 0	Credits = 4

[illegible]	M[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]

Objectives	Outcomes
[illegible]	[illegible] [illegible] 3[illegible] [illegible] [illegible] 6. [illegible]

Unit I: Number Systems and Codes

[illegible]

(7 Hours)

Unit II: Digital Principles and Logic Design

[illegible]

(8 Hours)

Unit III: Electronic Devices and its Applications

[illegible]

(7 Hours)

Unit IV : OPAMP and its application

[illegible]

(8 Hours)

Unit V: Measurement and Instruments

[illegible]

(7 Hours)

Unit VI: Sensors and Transducer

[illegible]

(8 Hours)

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

EL2101	Electrical Engineering		L= 3	T = 1	P = 0	Credits = 4
	M	M				
						3

Course Objectives	Course Outcomes

UNIT-1: D. C. Circuits :

UNIT – 2: A. C. Fundamentals :

Single Phase Series A. C. Circuits :

UNIT – 3: Single Phase Parallel & Series – Parallel A. C. Circuits :

UNIT-4: Three Phase a.c. Circuits :

UNIT V : Single Phase Transformer:

UNIT VI : Three Phase Induction Motor:

Single Phase Induction Motor:

EL2102	Lab. : Electrical Engineering	L=0	T=0	P=2	CREDITS = 1

Course Objectives	Course Outcomes
	1) 2) 3) 5)

3	

Reference Book:

IT2101	Introduction to Computer Programming	L=3	T=1	P=0	CREDITS = 4

[illegible]	M[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3 [illegible]

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		[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

IT2101	Introduction to Computer Programming	L=3	T=1	P=0	CREDITS = 4

	M	M				
						3

IT2102	Lab. : Introduction to Computer Programming	L=0	T=0	P=2	Credits=1

Course Learning Objective:	Course Outcomes
The Students will :-	

Sr.	Problem Statements

IT2102	Lab. : Introduction to Computer Programming	L=0	T=0	P=2	Credits=1

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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[illegible]	[illegible]
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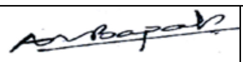
[illegible] 3	[illegible]

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

		[illegible]	[illegible]	[illegible]
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ME2101	Engineering Graphics	L=1	T=0	P=0	CREDITS=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
						3

Objective	Outcome	

Unit I : Theory of Orthographic Projections:

Unit II : Theory of Isometric Projections:

Unit III: Lines:

Unit IV: Planes and Solids:

Unit V: Section of Solids and Development of Surfaces:

Unit VI: Intersection of Surfaces of solids:

Text Books:

Reference Books:

ME2102	Lab.: Engineering Graphics	L=0	T=0	P=4	Credits=2

Sr. No.	List Of Practical's	No. of Practical's
		3
3		3
		3
		3
		3
		3
	Drawing Sheet 1:	
	Drawing Sheet 2:	
Total No. of Practical's to be conducted		**28**

Text Books:

Reference Books:

Course Outcome and Statement of Course Outcome

Course Outcome	Statement of Course Outcome
CO1	
CO2	
CO3	

Mapping of Course Outcomes with Program Outcomes: CO-PO Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		X			X					X		
CO 2			X		X				X			
CO 3			X		X				X			

ME2103	Workshop Practice	L=0	T=0	P=2	Credits=1

	M	M				

Objectives:

This course is an entry level course for all B.E. students. The course will provide an overview of the techniques and applications of basic manufacturing processes required to produce a finished product from raw materials.

Carpentry:

Smithy:

3 **Fitting:**

Welding:

Hand Tools:

Text Books Recommended

1.

Reference Books

1.
2.

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING
AUTONOMOUS INSTITUTION
SEAL
NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
3rd to 8th Semester
Civil Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. CV-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	30	40	3
2	3	PC	CV2201	Strength of Materials	T	3	0	0	3	3	30	30	40	3
3	3	PC	CV2202	**Lab:-** Strength of Materials	P	0	0	2	2	1		60	40	
4	3	PC	CV2203	Geotechnical Engineering	T	3	0	0	3	3	30	30	40	3
5	3	PC	CV2204	**Lab:-** Geotechnical Engineering	P	0	0	2	2	1		60	40	
6	3	PC	CV2205	Fluid Mechanics	T	3	0	0	3	3	30	30	40	3
7	3	PC	CV2206	**Lab:-** Fluid Mechanics	P	0	0	2	2	1		60	40	
8	3	PC	CV2207	Water Supply Engineering	T	3	0	0	3	3	30	30	40	3
9	3	PC	CV2208	**Lab:-**Water Supply Engineering	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**0**	**8**	**23**	**19**				
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	30	40	3
2	4	PC	CV2251	Concrete Technology	T	3	0	0	3	3	30	30	40	3
3	4	PC	CV2252	**Lab:-** Concrete Technology	P	0	0	2	2	1		60	40	
4	4	PC	CV2253	Surveying	T	3	0	0	3	3	30	30	40	3
5	4	PC	CV2254	**Lab:-** Surveying	P	0	0	2	2	1		60	40	
6	4	PC	CV2255	Structural Analysis	T	4	0	0	4	4	30	30	40	3
7	4	PC	CV2256	**Lab:-** Structural Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CV2257	Transportation Engineering	T	3	0	0	3	3	30	30	40	3
9	4	PC	CV2258	**Lab:-** Transportation Engineering	P	0	0	2	2	1		60	40	
					TOTAL	**16**	**0**	**8**	**24**	**20**				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	30	40	3
2	5	PC	CV2301	Reinforced Concrete Structures	**T**	3	0	0	3	3	30	30	40	4
3	5	PC	CV2302	Advanced Structural Analysis	**T**	3	0	0	3	3	30	30	40	3
4	5	PC	CV2303	**Lab:-** Analysis and Design Studio	**P**	0	0	2	2	1		60	40	
5	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	30	40	3
6	5	PE		**Lab:-** Professional Elective -I	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	30	40	3
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	30	40	3
					TOTAL	**18**	**0**	**4**	**22**	**20**				

Professional Elective - I

1	5	PE-I	CV2311	PE-I : Advanced Surveying
	5	PE-I	CV2312	**PE-I Lab :** Advanced Surveying
2	5	PE-I	CV2313	PE-I : Computer Applications in Civil Engineering
	5	PE-I	CV2314	**PE-I Lab :** Computer Applications in Civil Engineering
3	5	PE-I	CV2315	PE-I : Building Construction and Materials
	5	PE-I	CV2316	**PE-I Lab :** Building Construction and Materials
4	5	PE-I	CV2317	PE-I : Matrix Analysis of Structures
	5	PE-I	CV2318	**PE-I Lab :** Matrix Analysis of Structures
5	5	PE-I	CV2319	PE-I : Advanced Concrete Technology
	5	PE-I	CV2320	**PE-I Lab :** Advanced Concrete Technology
6	5	PE-I	CV2321	PE-I : Water Treatment
	5	PE-I	CV2322	**PE-I Lab :** Water Treatment
7	5	PE-I	CV2323	PE-I : Environmental Management
	5	PE-I	CV2324	**PE-I Lab :** Environmental Management
8	5	PE-I	CV2325	PE-I : Soil Characterization & Identification
	5	PE-I	CV2326	**PE-I Lab :** Soil Characterization & Identification
9	5	PE-I	CV2327	PE-I : Geographical Information Systems
	5	PE-I	CV2328	**PE-I Lab :** Geographical Information Systems

Open Electives -I

1	5	OE-I	CV2331	OE-I : Building Services Engineering
2	5	OE-I	CV2332	OE-I : Construction Techniques
3	5	OE-I	CV2333	OE-I : Introduction to Environmental Management
4	5	OE-I	CV2334	OE-I : Basics of Transportation Engineering
5	5	OE-I	CV2335	OE-I : Basics of Water Resource Engineering
6	5	OE-I	CV2336	OE-I : Elements of Water Power Engineering

Open Electives -II

1	5	OE-II	CV2341	OE II : Elements of Earthquake Engineering
2	5	OE-II	CV2342	OE II : Introduction to Finite Element Method
3	5	OE-II	CV2343	OE II : Air Pollution and Solid Waste Management
4	5	OE-II	CV2344	OE-II : Environmental & Social Impact Assessment
5	5	OE-II	CV2345	OE II : Disaster Management

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TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.02**	**Applicable for AY 2020-21 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

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SoE No. CV-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	30	40	**3**
2	6	PC	CV2351	Steel Structures	**T**	3	0	0	3	3	30	30	40	4
3	6	PC	CV2352	**Lab:-** Building Design Drawing	**P**	0	0	2	2	1		60	40	
4	6	PC	CV2353	Hydraulic Engineering	**T**	3	0	0	3	3	30	30	40	3
5	6	PC	CV2354	**Lab:-** Hydraulic Engineering	**P**	0	0	2	2	1		60	40	
6	6	PC	CV2355	Foundation Engineering	**T**	3	0	0	3	3	30	30	40	3
7	6	PE-II		Professional Elective -II	**T**	3	0	0	3	3	30	30	40	3
8	6	OE-II		Open Elective - III **	**T**	3	0	0	3	3	30	30	40	3
9	6	OE-IV		Open Elective - IV **	**T**	3	0	0	3	3	30	30	40	3
10	6	STR	CV2360	Industry Visit and its report	**P**	0	0	0	0	1		100		
					TOTAL	**21**	**0**	**4**	**25**	**24**				

Audit Courses														
1	6	IT	IT1121	Industrial Programmin Language	**A**	3	0	0	3	0				

Professional Elective - II

1	6	PE-II	CV2361	PE-II : Building Services
2	6	PE-II	CV2362	PE-II : New Engineering Materials
3	6	PE-II	CV2363	PE-II : Construction Management And Machinery
4	6	PE-II	CV2364	PE-II : Earthquake Engineering
5	6	PE-II	CV2365	PE-II : Optimization Techniques
6	6	PE-II	CV2366	PE-II : Introduction to Remote Sensing
7	6	PE-II	CV2367	PE-II : Environmental Geotechniques
8	6	PE-II	CV2368	PE-II : Traffic Engineering
9	6	PE-II	CV2369	PE-II : Water Transmission and Distribution Systems

Open Electives -III

1	VI	OE-III	CV2371	OE-III : Building Services Engineering
2	VI	OE-III	CV2372	OE-III : Construction Techniques
3	VI	OE-III	CV2373	OE-III : Introduction to Environmental Management
4	VI	OE-III	CV2374	OE-III : Basics of Transportation Engineering
5	VI	OE-III	CV2375	OE-III : Basics of Water Resource Engineering
6	VI	OE-III	CV2376	OE-III : Elements of Water Power Engineering

Open Electives -IV

1	VI	OE-IV	CV2381	OE-IV : Elements of Earthquake Engineering
2	VI	OE-IV	CV2382	OE-IV : Introduction to Finite Element Method
3	VI	OE-IV	CV2383	OE-IV : Air Pollution and Solid Waste Management
4	VI	OE-IV	CV2384	OE-IV : Environmental & Social Impact Assessment
5	VI	OE-IV	CV2385	OE-IV : Disaster Management

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TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Seventh Semester

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(Revised Scheme of Examination w.e.f. 2020-21 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Chairperson				Dean (Acad. Matters)	Date of Release					Version	AY 2020-21 Onwards			
Seventh Semester														
1	7	PC	CV2401	Estimating & Costing	**T**	3	0	0	3	3	30	30	40	3
2	7	PC	CV2402	**Lab:-** Estimating &Costing	**P**	0	0	2	2	1		60	40	
3	7	PC	CV2403	Wastewater Engineering	**T**	3	0	0	3	3	30	30	40	3
4	7	PC	CV2404	Hydrology and Water Resources Engineering	**T**	3	0	0	3	3	30	30	40	3
5	7	PE-III		Professional Elective -III	**T**	3	0	0	3	3	30	30	40	3
6	7	PE-IV		Professional Elective -IV	**T**	3	0	0	3	3	30	30	40	3
7	7	PE-V		Professional Elective -V	**T**	3	0	0	3	3	30	30	40	3
8	7	STR	CV2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	CV2410	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**18**	**0**	**6**	**24**	**23**				

Professional Elective - III

1	7	PE-III	CV2411	PE-III : Prestressed Concrete
2	7	PE-III	CV2412	PE-III : Advanced RCC
3	7	PE-III	CV2413	PE-III : Numerical Methods and Computational Techniques
4	7	PE-III	CV2414	PE-III : Environmental Impact Assessment
5	7	PE-III	CV2415	PE-III : Energy Conversion and Management
6	7	PE-III	CV2416	PE-III : Geotechnical Investigation & Ground Improvement Techniques
7	7	PE-III	CV2417	PE-III : Earth and Earth Retaining Structures
8	7	PE-III	CV2418	PE-III : Urban Transportation Planning
9	7	PE-III	CV2419	PE-III : Advanced Hydraulics

Professional Elective - IV

1	7	PE-IV	CV2421	PE-IV : Natural Resources Management
2	7	PE-IV	CV2422	PE-IV : Finite Element Method
3	7	PE-IV	CV2423	PE-IV : Introduction to Structural Dynamics
4	7	PE-IV	CV2424	PE-IV : Wastewater Treatment
5	7	PE-IV	CV2425	PE-IV : Environmental Legislation and Management System
6	7	PE-IV	CV2426	PE-IV : Advanced Foundation Engineering
7	7	PE-IV	CV2427	PE-IV : Geosynthetics
8	7	PE-IV	CV2428	PE-IV : Advanced Transportation Engineering
9	7	PE-IV	CV2429	PE-IV : Watershed Management

Professional Elective - V

1	7	PE-V	CV2431	PE-V : Maintenance and Rehabilitation Engineering
2	7	PE-V	CV2432	PE-V : Project Planning and Management
3	7	PE-V	CV2433	PE-V : Modern Surveying Technique
4	7	PE-V	CV2434	PE-V : Advanced Steel Design
5	7	PE-V	CV2435	PE-V : Design of Bridge Structures
6	7	PE-V	CV2436	PE-V : Industrial Waste Water Treatment and Reuse
7	7	PE-V	CV2437	PE-V : Finite Element methods in Geotechnical Engineering
8	7	PE-V	CV2438	PE-V : Pavement Design
9	7	PE-V	CV2439	PE-V : Water Power Engineering
10	7	PE-V	CV2440	PE-V : Structural Engineering Practices

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TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.02**	**Applicable for AY 2021-22 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

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SoE No. CV-201

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CV2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	CV2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				

GRAND TOTAL	**88**	**0**	**42**	**130**	**163**

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

III Semester
GE2201 - ENGINEERING MATHEMATICS-III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform, Z transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	Upon successful completion of the course, the student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.
Mapped Program Outcomes : 1,2,3,	

Unit I: Finite Differences
Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients. **(6 hours)**

Unit II: Laplace Transform
Laplace Transforms: Laplace transforms and their simple properties,Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations .**(7 hours)**

Unit III: Z-transform
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient. **(6 hours)**

Unit IV: Fourier Series
Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions **(7 hours)**

Unit V: Partial Differential Equation
Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(7 hours)**

Unit VI : Fourier Transform : Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem**.** **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan

III Semester
CV2201 - STRENGTH OF MATERIALS

COURSE OBJECTIVES	COURSE OUTCOMES
1. To analyze the structural elements and find stresses. 2. To compute quantities of S.F. and B.M. and principle stresses. 3. To determine the deflections in beams by various methods which is an important criteria in design 4. To investigate state of stress in three dimensions and various theories of failure in designing the structural members 5. To interpret failure pattern of metal under different action	1. An ability to understand basic concepts and mechanical properties of materials. 2. An ability to analyze behavior of material under various types of loading pattern. 3. An ability to draw diagram showing variation of shear force, bending moment and stresses. 4. An ability to check feasibility of different sections subjected to different loading patterns.
Mapped Program Outcomes : 1,2,10	

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UNIT – I **[7 Hrs.]**

Mechanical properties and uniaxial problems: Types of force distribution, concept of stress, strain and their relationship, stress strain behavior of ductile and brittle material in uniaxial state of stress, elastic constants, relation between elastic constants Uniaxial loading and deformation of simple cases of statically indeterminate problems under axial loading. Stress due to variation of temperature.

UNIT - II **[6 Hrs.]**

Shear force and bending moment diagram: Axial force, shear force and bending moment diagram. Determination of axial force, shear force and bending moment at a section. Axial force, shear force and bending moment diagram in beams, relation between bending moment, shear force and loading.

UNIT- III **[7 Hrs.]**

Stresses in beam: Theory of simple bending, Bending stresses in simple beam. Shear stresses in simple beams and shear stress distribution. Direct and bending stresses.

UNIT – IV **[6 Hrs.]**

Torsion of Shaft: Torsion of circular sections, assumptions and derivation of relation between torsional moment, shear stress and angle of twist. Torsional stress in solid and hollow circular sections.

UNIT – V **[7 Hrs.]**

Deflection of Beams: Derivation of differential equation of elastic curve, Differential Equation relating deflection moment, shear and load. Deflection of simple beams by double integration method.

UNIT – VI **[6 Hrs.]**

Compound stresses: State of stress in two dimensions, principal stresses, combined effect of Bending and Shear. Thin walled cylindrical and spherical pressure vessel subjected to internal pressure.

Text Books:

1. Bhavikatti S. S., Strength of Materials, 3rd Edition, Vikas Publication House Pvt. Ltd., Noida, UP, 2008.
2. Popov E.P., Engineering Mechanics of Solids, 4th Edition, Printice Hall, 2002.

Reference Books:

1. Chakraborti, M., Strength of Materials, S. K. Kataria& Sons.
2. Pytel A., Kivsalaas J. Mechenics of Material, CENGAGE LEARNING, (INDIAN EDITION),2010.
3. Shah V.L., Ogale R.A., Strength of Materials and Machine Element, 2nd Edition, Jain Book Agency, New Delhi.

III Semester
CV2202 - LAB : STRENGTH OF MATERIALS

Objective	Course Outcome
1. To study suitability of various materials for civil engineering construction. 2. To study the resistance offered by various materials against the external forces	1. An ability to understand basic concepts & mechanical properties of material. 2. An Ability to understand behavior of various materials such as Steel, Aluminum, Wood etc. when subjected to various types of loading.
Mapped Program Outcomes : 1, 2	

PRACTICAL:
Minimum **Ten** practical to be performed from the list as below:-

S No	Name of practical
1.	To study the universal testing machine.
2.	To study the extensometer.
3.	To perform tension test on metal.
4.	To determine flexural strength of timber beam.
5.	To determine modulus of rigidity of M.S. bar by torsion test.
6.	To determine impact value of metal by Charpy Impact Test and Izod Impact Test.
7.	To determine Rockwell hardness number for M.S. and Aluminium bar.
8.	To determine Brinell hardness number for M.S. and Aluminium bar.
9.	To determine the stiffness of spring and modulus of rigidity.
10.	To perform shear test on metals.
11.	To determine the compressive strength of specimen.
12.	To determine water absorption of roofing tiles, flooring tiles and bricks.

III Semester
CV2203 - GEOTECHNICAL ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide students with basic understanding of index properties of soil and their correlation with soil characterization and classification. 2. Tofamiliarize the students an understanding of permeability and seepage of soils. 3. To develop an understanding of the principles of effective stress in soils, and its application to one dimensional consolidation and compaction. 4. To provide students with analysis of stresses in soils under different loading conditions.	1. An ability to characterize and classify soils. 2. An ability to determine index and engineering properties of soil. 3. An ability to understand surface stresses and their distribution within a soil mass. 4. An ability to understand the principles of compaction and consolidation. 5. An ability to determine shear strength of soil.
Mapped Program Outcomes : 1,2,3,4,11 **PSO** : ii	

UNIT – I **[6 Hrs.]**
Introduction: Formation of soil, residual & transported soil, Role of Geotechnical engineer in construction industry.
Phases of Soil: Soil as three-phase system. Various soil weight & volume inter–relationship.

UNIT - II **[7 Hrs.]**
Index Properties & Their Determination: Water content, specific gravity, sieve analysis, particle size distribution curve, Density, Consistency of soil
Classification of Soil: Unified & I.S. classification system.

UNIT – III **[7 Hrs.]**
Permeability: Darcy's law & its validity, Discharge & seepage velocity, factors affecting Permeability, Determination of coefficient of permeability by Laboratory, permeability of stratified soil.
Seepage: Seepage pressure, quick sand condition, flow nets, flow nets, uplift pressure, piping. Principle of effective stress.

UNIT – IV **[6 Hrs.]**
Stress Distribution: Stress distribution in soil mass, Boussinesq's point load theory, uniformly loaded circular areas, Equivalent point load method, Newmark's charts.

UNIT - V **[7 Hrs.]**
Compaction: Mechanics of compaction, factors affecting compaction, Standard & Modified Proctor Tests, Optimum Moisture Content, field compaction methods, Quality control.
Consolidation: Terzaghi's 1–D consolidation theory, various terms associated with consolidation, settlement rate, time rate of consolidation.

UNIT – VI **[6 Hrs.]**
Shear Strength: Introduction, Mohr's diagram, Mohr-Coulomb's failure theory, Measurement of Shear strength by Direct shear test, Triaxial test, Unconfined compression test, Vane shear test, Shear test under different drainage conditions. Shear characteristics of sands and clays, stress paths, effective and total shear strength parameters

III Semester
CV2203 - GEOTECHNICAL ENGINEERING

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Soil Mechanics & Foundations	Punmia B. C., Jain A.K., Jain A.K.,	16th edition	Laxmi Publications, New Delhi, 2005.
2	Geotechnical Engineering – Principles and Practices of Soil Mechanics and Foundation Engineering	Murthy V.N.S.,		CRC Press, 2003
3	Basic and Applied Soil Mechanics	Gopal R., Rao A.S.R.,	2nd edition,	New Age International Publishers, New Delhi

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Soil Mechanics and Foundation Engineering	Purushothama Raj P.,	1st edition	Pearson Education India, 2008
2	Geotechnical Engineering	Datta M, Gulhati S. K.,	5th edition	Tata McGraw Hills Publications, New Delhi, 2005
3	Problems in Soil Engineering,	Shamsher Prakash, Gopal Ranjan,		Sarita Prakashan Publishers, Meerut, U.P., 1976
4	Physical and Geotechnical Properties of Soils	Joseph E. Bowles	2nd Revised edition (March 1984)	McGraw-Hill College

III Semester
CV2204 - LAB : GEOTECHNICAL ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various Index properties of soil 2. To perform various test to determine engineering properties of soil	1. An ability to determine the Index properties of soil. 2. An ability to determine the Engineering properties of soil.
Mapped Program Outcomes : 1,2,3,4,9,11 **PSO** : ii	

S No	List of Practicals
1.	To determine Moisture content of given soil sample.
2.	To determine Specific gravity of soil.
3.	To perform Grain Size Analysis – (Dry Sieve Analysis)
4.	To determine Atterberg's Limits.
5.	To determine coefficient of Permeability by (i) Constant head, and (ii) Falling head.
6.	To perform Standard Proctor Compaction Test and to determine OMC.
7.	Field Density determination by sand replacement method.
8.	Field Density determination by core cutter method.
9.	To perform Unconfined compression test.
10.	To perform Direct shear Test.
11.	To perform Triaxial Compression test (Demonstration)
12.	To find F.S.W. and D.F.S. of soil. Identification of swelling Soil.
13.	To study the Consolidation characteristics of soil

Text Books:

S.N	Title	Authors	Edition	Publisher
1	Soil Testing for Engineers	Mittal S., Shukla J.P.		Khanna Publishers, New Delhi, 2006
2	Manual of Soil Laboratory Testing	Head K. H.,	3rd edition	Whittles Publishing, 2008

III Semester
CV2205 - FLUID MECHANICS

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The fundamentals of fluid properties, Fluid static, pressure measuring devices, various energy equation. 2. Motion of fluid with and without reference of force 3. Flow measuring devices and various hydraulic coefficient.	Students will be able to 1. Examine the fundamental principles of fluid mechanic s and related applications and estimate Fluid pressure, forces on various surface. 2. Analyze the motion of fluid, various flow pattern produced without reference of force 3. Understand the kinetics of flow and computation of flow using various devices.
Mapped Program Outcomes:- 1,2,3	

UNIT – I **[7 Hrs.]**

Fluids and Their Properties: Definition of fluid, Differences between solids, liquids and gases , fluid properties, mass density, specific weight and specific gravity, viscosity, Newton's equation, coefficients of dynamic and kinematic viscosity, Rheological Diagram, Ideal and real fluids. Compressibility and bulk modulus.Surface tension, capillarity, pressure inside a bubble and cylindrical jet, vapor pressure and cavitation.Effect of pressure and temperature on fluid properties**.**

UNIT – II **[6 Hrs.]**

Fluids Pressure and its Measurement: Fluid pressure, law of fluid pressure, variation of fluid pressure with depth, pressure and head, Atmospheric pressure and vacuum. Gauge and absolute pressures.Pressure measurement by manometers.

UNIT – III **[6 Hrs.]**

Hydrostatics: Total pressure & center of pressure, Forces on a Horizontal, Vertical, Inclined, Curved, submerged surfaces**.**

Kinematics of Flow-I: Lagrangian and Eularian approaches in fluid flow description. Steady, unsteady, uniform, Non–uniform flow. One, two and three dimensional flow, Rotational &Irrotational flow. Streamline, path line, streak line.

UNIT – IV **[7 Hrs.]**

Kinematics of Flow-II: Velocity and its variation with space and time. Acceleration of fluid particles, Normal and tangential acceleration. Equation of continuity in Cartesian co-ordinates, stream unctions, velocity potential function. Relationship between stream function and velocity potential, flow net.

UNIT – V **[6 Hrs.]**

Kinetics of Flow: Forces influencing motion, Euler's equations of motion for one dimensional flow, Bernoulli's equation for ideal fluids, Assumptions, derivation, limitation and application, Kinetic energy correction factor. Momentum equation, forces on pipe bends and closed conduits, Momentum correction factor. Discharge measurement by venturimeter, orifice meter.

UNIT – VI **[7 Hrs.]**

Flow through Orifices and mouthpieces: Definition, types, hydraulic coefficients, factors affecting them and their experimental determination, time for emptying tank by orifices. Discharge through large and submerged orifices, external and internal mouth pieces, running free and running full, pressure at vena contracta, Discharge through a convergent- divergent mouthpiece**.**

III Semester
CV2205 - FLUID MECHANICS

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Fluid Flow in Pipes and Channels	Asawa, G.L.,	1st edition	CBS Publishers and Distributers, 2009
2	Fluid Mechanics and Its Applications,	Gupta V., Gupta S.K.		John Wiley & Sons, 1984
3	Hydraulics and Fluid Mechanics Including Hydraulics Machines	Modi P.N., Seth S.M.	14th edition	Standard Book House Publishers, New Delhi, 2009

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Fluid Mechanics	White F.M	6th Edition	McGraw-Hill, 2007
2	Introduction to Fluid Mechanics	Fox R.W., McDonald A.T	6th edition	John Wiley & Sons, 2003

III Semester
CV2206 - LAB : FLUID MECHANICS

COURSE OBJECTIVE	COURSE OUTCOME
1. To understand concept of equilibrium of floating bodies. 2. To understand various forms of energy of flowing fluid through pipe 3. To understand variousflow measuring devices in pipe, tank and channel. 4. To understand various concept of flow in open channel. 5. To understand the types of flow in pipe.	1. An ability to determine floating conditions of ship model. 2. An ability to verify Bernoulli's theorem. 3. An ability to measure velocity, discharge in pipe, tank, channel andto determine hydraulic coefficients of devices. 4. An ability to determine types of flow in pipes.
Mapped Program Outcomes : 1,2,3	

PRACTICAL

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	Determination of metacentric height of a given ship models.
2.	Verification of Bernoulli's theorem
3.	Velocity measurement by Pitot tube.
4.	Discharge measurement by Venturimeter- determination of coefficient discharge.
5.	Discharge measurement by pipe orifice, determination of Cd
6.	Determination of hydraulic coefficient of a sharp edged circular orifice.
7.	Determination of Cd of an external cylindrical mouth piece
8.	Determination of Cd of a rectangular notch:
9.	Determination of Cd of a triangular notch.
10.	Determination of types of flow in pipe using Reynold's apparatus.
11.	Study of micrometer contraction gauge

Reference Books:

S.N.	Title	Authors	Edition	Publisher
1	Laboratory work in Hydraulic Engineering	Asawa, G.L		New Age International Publishers

III Semester
CV2207 - WATER SUPPLY ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various components of public water supply scheme. 2. To study water quality and objectives of water treatment. 3. To study working of various water treatment units and distribution system. 4. To introduce the concept of solid waste management.	1. An ability to understand significance of community water supply scheme. 2. An ability to design water conveyance system. 3. An ability to understand importance of water quality and its treatment aspects. 4. An ability to understand different patterns of distribution of water. 5. An ability to understand the significance and concept of solid waste management.
Mapped Program Outcomes : 1,2,3,4,6,7	

UNIT – I **[7 Hrs.]**
Introduction, Importance and necessity of water supply scheme, Water demand: Types of demand, factors affecting per Capita demand, variation in demand, design period and methods of population forecasting.

UNIT – II **[6 Hrs.]**
Conveyance of water: Types of pipes, joints in pipes, valves and fittings, Intake structures: Location types – river, lake, canal reservoir, Hydraulic design of rising mains. Pump: Classification, working, merits, demerits & selection of pumps.

UNIT – III **[7 Hrs.]**
Water quality: General idea of water borne diseases, Physical, Chemical, and bacteriological characteristics and analysis of water, Standards of drinking water. Water treatment: Objective of treatment, unit operations and processes, Flow sheet of conventional water treatment plant. Aeration: Purpose, types of aerators. Coagulation and Flocculation: Definition, Principles, types of coagulants and reactions, coagulant doses, types of mixing and flocculation devices.

UNIT – IV **[6 Hrs.]**
Sedimentation: Principles, types of settling basins, inlet and outlet arrangements. Clariflocculators. Filtration: Mechanism of filtration, types of filters, working, operational problems in filters.

UNIT – V **[7 Hrs.]**
Disinfection: Purpose, Mechanism, criteria for good disinfectant,types of disinfectants, chlorination. Distribution systems: Requirements for a good distribution system, methods of distribution, systems and their layouts, Leakage and leak-detector. Storage reservoirs for treated water: Types, capacity of reservoir, mass curve.

UNIT – VI **[6 Hrs.]**
Introduction to Municipal solid waste management: Generation sources, composition, Quality, Methods of Collection, transportation, treatment and disposal, 3 R's of solid waste management.

III Semester
CV2207 - WATER SUPPLY ENGINEERING

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Water Supply Engineering (Vol.–I & II)	Modi P.N.	2nd Edition	Standard Book House / Rajsons Publication, New Delhi.
2	Water Engineering	Punmia B. C.	2nd Edition	Laxmi Publication, New Delhi
3	Water Supply and Sanitary Engineering	Birdie G.S., Birdie J.S.	4th Edition	DhanpatRai Publication, New Delhi.
4	Water Supply Engineering	S. K. Garg		Khanna Publications
5	Solid Waste Management for Developing country	A.D. Bhide & Sunderson		Indian National Scientific Documentation Centre, New Delhi

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Water supply and Sewarage	E.W.Steel,T.J.McGhee	6 edition (31 January 1991)	McGraw-Hill Education
2	Water and wastewater Engineering	Fair, Geyer and Okun		John Wiley & Sons Ltd

III Semester
CV2208 – LAB : WATER SUPPLY ENGINEERING

COURSE OBJECTIVE	COURSE OUTCOME
1. To study the water quality criteria & permissible standards. 2. To study the characteristics of water 3. To study the analysis of various parameters related to water quality.	1. To understand importance of water quality standards. 2. An ability to perform various physical and chemical tests on water sample. 3. An ability to understand various biological tests performed on water sample and to perform a few biological tests on water.
Mapped Program Outcomes : 1,2,4,	

PRACTICAL

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	Determination of pH.
2.	Determination of turbidity.
3.	To perform Jar test.
4.	Determination of available chlorine.
5.	Determination of residual chlorine.
6.	Determination of dissolved oxygen.
7.	Determination of Hardness.
8.	Determination of acidity
9.	Determination of alkalinity
10.	M.P.N. Test.
11.	Plate count test.
12.	B.O.D. test
13.	C.O.D. test

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
4th Semester
Civil Engineering

IV Semester
GE2204 – ADVANCED MATHEMATICAL TECHNIQUES

COURSE OBJECTIVE	COURSE OUTCOME
1. The objective of this paper is to study numerical methods and their methods of solution and statistics and probability with simple applications and to introduced fuzzy sets and logics	1. Students are able to solve algebraic and transcendental equations and compute n variables in simultaneous equations. 2. This topic covers the alternative techniques to solve various types of differential equations. 3. Students are proficient to design linear programming problems; methods to get optimum solution of it related to multiple variables and simplify it using graphical solution. 4. The facts of probability are used to understand the most probable behavior of various systems. 5. The unit is used to determine mathematical expectation for the random variables define in real life problems and make available analytical techniques for getting standard deviation, dispersion etc. 6. This unit gives an overview of fuzzy set theory to deal and design problems related to fuzzy chips and fully automatic control system.
Mapped Program Outcomes : 1,2,3,	

UNIT-1: (a,e) **[9 hrs]**
NUMERICAL METHODS FOR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Errors in numerical calculation, Errors in series approximation. Rounding of error solutions of algebraic and transcendental equations. Iteration method, Bisection method, False position method, Newton Rapphson method and their convergence
NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss -Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2:(a,e) **[8 hrs]**
NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor"s series method, Picard's method, Runge"s second and third order method, Runge-Kutta 4th order method, Euler"s method, Euler"s modified method, Milne"s Predictor and Corrector method. Numerical methods of solving 1st order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques (a,h) **[6 hrs]**
Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 (a,h,k) **[7 hrs]**
Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

UNIT-5:(a,h,k) **[8 hrs]**
Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 (a,h,k) **[6 hrs]**
FUZZY SETS AND FUZZY LOGIC ; Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

IV Semester
GE2204 – ADVANCED MATHEMATICAL TECHNIQUES

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition (2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers

IV Semester
CV2251 – CONCRETE TECHNOLOGY

COURSE OBJECTIVE	COURSE OUTCOME
1. To develop systematic knowledge of concrete constituents 2. To familiarize with the fundamentals of concrete 3. Principles involved for high performance concrete 4. To understand the basic concepts of special concretes 5. To introduce fundamentals of concreting methods	1. An ability to understand the properties of the constituent materials of concrete. 2. An ability to understand the properties of fresh and hardened concrete and tests to determine these properties. 3. An ability to design concrete mixes and apply statistical quality control techniques 4. An ability to understand admixtures and their role in concrete properties 5. An ability to understand the durability of concrete. 6. An ability to understand importance of Non-destructive testing and various equipment used.
Mapped Program Outcomes : 1,3,7,11,12	

UNIT – I **[7 Hrs.]**

Introduction to related Indian standard of cement and aggregates.
Constituents of cements, Hydration of cement.Water requirement, Physical properties and testing of cement. Effect of fineness, Initial, final and false setting of cement, Soundness test. Hardening and compressive strength, Grades and different types of cement,
Aggregates: Coarse and fine aggregate, normal, light and heavy weight aggregates. aggregate characteristics and their significance in properties of concrete. Sampling, Particle shape and texture, Bond of aggregate, size & grading of aggregate, strength of aggregate. Mechanical properties and tests as per IS, bulking of sand. Crushed sand.Alkali aggregate reaction.

UNIT – II **[6 Hrs.]**

Fresh Concrete: Batching, Mechanical mixers, automatic batching and mixing plants. Efficiency of mixing, Workability and its Measurement, Factor affecting workability, setting time, Significance of w/c ratio, cohesiveness of concrete, Segregation, bleeding, voids, permeability. Hot weather concreting, Conveyance of concrete, placing of concrete, compaction, vibrators, curing of concrete, significance and methods, temperature effects on curing and strength gain, IS provisions, Maturity of concrete, Formwork for concrete- IS provisions. Introduction to Ready mix, pumped and self-compacting concrete. Introduction to relevant Indian standards.

UNIT – III **[7 Hrs.]**

Strength of concrete: Strength gain, factors affecting compressive strength, Tensile and flexural strengths, relation between compressive and tensile strength. Failure modes in concrete,cracking in compression.Impact strength, fatigue strength, shear, elasticity, Poisson's ratio. Introduction to relevant Indian standards.
Testing of hardened concrete: Compression test, cube strength and cylinder strength and their relation, effect of aspect ratio on strength. Flexural strength of concrete, determination of tensile strength, indirect tension test, splitting test, abrasion resistance, accelerated curing test. Introduction to relevant Indian standards.
Non Destructive test: Significance, rebound hammer, ultra-sonic pulse velocity test, Advanced concrete testing equipment. Introduction to relevant Indian standards.

UNIT – IV **[6 Hrs.]**

Mix Design: Process, statistical relation between main and characteristic strength, variance, standard deviation, factors affecting mix properties, grading of aggregates, aggregate/cement ratio etc. Degree of quality control, design of mix by IS method, introduction to road Note No. 4 (BS) and ACI method.

IV Semester
CV2251 – CONCRETE TECHNOLOGY

UNIT – V **[7 Hrs.]**

Additives and admixtures: Types of admixtures, natural products, diatomaceous earth, calcined clays of shales, volcanic glasses, byproducts–pozzolana, fly ash, silica fume, rice husk ash, metakaolin, G.G. blast furnace slag, admixtures- air entraining, water reducing, accelerators, retarders, plasticizers and superplasticizers, permeability reducing, grouting agents, surface hardeners.

Shrinkage: Early volume changes, drying shrinkage, mechanism and factors affecting shrinkage, influence of curing conditions, differential shrinkage, carbonation, creep- factors influencing, relation between creep and time, nature of creep, effect of creep.

UNIT – VI **[6 Hrs.]**

Durability of concrete: Significance, water as an agent of deterioration, permeability of concrete, sulphate attack and its control, sea water attack, acid attack, efflorescence, resistance to corrosion, abrasion and cavitation, process of rusting of steel.

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Concrete Technology	M.S. Shetty	6th edition,	S. Chand & Company, Limited, 2008
2	"Concrete Technology	Gambhir M.L.		2013
3	Properties of concrete	AM Neville		ELBS, London, 2006

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Concrete Microstrucutres: Properties and materials	PK Mehta and PJ Monterio		
2	Concrete Technology	DF Orchard		Applied Sciences Publications

IV Semester
CV2252 – LAB : CONCRETE TECHNOLOGY

COURSE OBJECTIVE	COURSE OUTCOME
1. To understand the properties of various grades cement. 2. To study the behavior of concrete at its fresh and hardened state 3. To study about the concrete design mix 4. To know about the procedures in concreting 5. To understand special concrete and their use	1. An ability to conduct different tests on cement. 2. An ability to assess the different properties of coarse and fine aggregate. 3. An ability to conduct different workability tests on fresh concrete and various tests on hardened concrete. 4. An ability to understand working of various Non-destructive testing equipment.
Mapped Program Outcomes : 1,4,5,8,11	

PRACTICALS

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	To determine the normal consistency and initial setting time and final setting time by Vicat's apparatus.
2.	To determine the fineness of cement.
3.	To perform soundness test of cement.
4.	To determine fineness modulus for coarse and fine aggregates.
5.	To determine the bulking of sand & plotting bulking curve.
6.	To determine the compressive strength of cement.
7.	To design the concrete mix of required characteristic strength according to I.S .method.
8.	To determine the workability of concrete by slump cone, Vee bee apparatus, compaction factor and flow test.
9.	To prepare and test the concrete cubes for compressive strength by Indian standard method.
10.	Study of various Non-Destructive testing methods (NDT) in concrete Technology
11.	To determine workability of cement mortar.
12.	To determine the permeable voids of concrete.
13.	To determine the permeability of mortar.

IV Semester
CV2253 – SURVEYING

COURSE OBJECTIVE	COURSE OUTCOME
1. To know the importance, application, classification & principle of survey in Engineering field. 2. To know the different land Surveying Equipment's Such as Chain, Compass, Theodolite, Plane table, Level etc. 3. To know and understand location map, contour map etc.	1. An ability to understand the basic concepts of surveying and use of conventional surveying equipment. 2. An ability to understand the basic principles, operation, handling & uses of various advanced surveying equipment. 3. An ability to draw the location map, contour map using various surveying equipment.
Mapped Program Outcomes : 1,2,5,9,10	

UNIT – I **[7 Hrs.]**
Introduction, Chain and Compass Traversing
Introduction: - Classification, division of survey, Principle of survey,
Chain Surveying : - Basics, direct ranging and cross staff survey.
Compass Surveying: Prismatic Compass, true and magnetic bearing, local attraction, Compass traversing.

UNIT – II **[6 Hrs.]**
Direct Leveling
Leveling: Definitions, Study of Dumpy Level, temporary adjustments, principles of leveling, reduction of levels, classification of leveling, Curvature & Refraction corrections ,Reciprocal leveling**,**

UNIT – III **[6 Hrs.]**
Contouring and Trignometrical Leveling
Contouring: Definitions, Characteristics, uses, and methods of locating contours, interpolation of contours
Trignometrical Leveling: Indirect leveling, elevation of a point with base of an object accessible and inaccessible (with instrument station in/not in the same vertical plane as the elevated object)

UNIT – IV **[7 Hrs.]**
Theodolite Surveying
Theodolite: Introduction, Type of theodolite, temporary adjustment, Principle Axes and relationship, measurement of horizontal and vertical angles,
Traverse Computation: Consecutive and independent co-ordinates, adjustment of closed traverse, Area calculation by co-ordinate.

UNIT – V **[6 Hrs.]**
Plane Table Surveying & Computation of Area & Volume
Plane Table Survey: Equipment's, advantages and disadvantages, orientation, methods of plane tabling, two point and three point problems in plane tabling.
Computation of Area and Volume: Trapezoidal and Simpsons Rule,

UNIT – VI **[6 Hrs.]**
Tacheometric Survey.
Tachometric Surveying :Classification, Principle of stadia method, Distance and elevation Calculation by Stadia method,

Text Books:

S.N	Title	Authors	Edition	Publisher
1	Surveying and Leveling (Vol-I&II)	Kanitkar T.P., Kulkarni S.V.		Pune Vidyarthi Griha Prakashan, Pune
2	Surveying and Leveling (Vol–I & II)	Punmia B.C., Jain A.K., Jain A.K.	15th Edition	Laxmi Publication (P) Ltd. New Delhi, 2005

Reference Books:

S.N	Title	Authors	Edition	Publisher
1	Surveying and Leveling	Basak N. N.	1st Edition	Tata McGraw–Hill Publishing company Ltd. New Delhi

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
CV2254 – LAB : SURVEYING

COURSE OBJECTIVE	COURSE OUTCOME
1. To understand the operation, principle, handling and uses of surveying equipment such as chain, compass, theodolite, level. 2. To recognize the role of the professional surveyor, and modern developments in surveying. 3. To study map interpretation and public land systems.	1. An ability to work in a team to carry out a survey of a small area using appropriate methods. 2. An ability to describe the observation, computation and adjustment of a Traverse to carry out basic survey computation and adjustment. 3. An ability to understand the angle and distance measurement; and differential, profile, cross-section, and topographic leveling procedures and apply them to field conditions.
Mapped Program Outcomes : 1,2,5,9,10	

PRACTICALS

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	Measurement of bearing of sides of traverse with prismatic compass and computation of correct included angles.
2.	Locating given building by chain and compass traversing (1 full size drawing sheet)
3.	Determination of elevation of various points with dumpy level by collimation plane method and rise and fall method.
4.	Fixing the bench mark with respect to temporary bench mark with dumpy level by fly leveling and check leveling.
5.	Measurement of horizontal angle with theodolite by method of repetition.
6.	Measurement of vertical angle with theodolite.
7.	Determination of horizontal distance between two inaccessible point with theodolite.
8.	Locating given building by theodolite traversing. (One full size drawing sheet)
9.	Determination of elevation of point by trigonometric leveling.
10.	Determination of constants of Tacheometer.
11.	Determination of elevation of points by Tacheometric surveying.
12.	Determination of elevation of points and horizontal distance between them by Tacheometrical survey.
13.	Determination of gradient of given length of road by Tacheometric survey.

IV Semester
CV2255 – STRUCTURAL ANALYSIS

COURSE OBJECTIVE	COURSE OUTCOME
1. To provide the knowledge of analysis using three moment theorem to the students. 2. To provide the knowledge of moment distribution method. 3. To provide the knowledge about influence line diagrams for beam 4. To provide the knowledge about slope deflection method. 5. To provide the knowledge about buckling of columns and analysis of arches. 6. To provide the knowledge about strain energy methods.	1. An ability to understand basic concepts of structural analysis. 2. An ability to apply various methods of structural analysis to analyze different types of structures. 3. An ability to express results of forces generated in structure with diagrams.
Mapped Program Outcomes : 1,2,4 **PSO** : i,	

UNIT – I **[8 Hrs.]**
Analysis of fixed and continuous beams by theorem of three moments including effect of sinking of support.

UNIT – II **[9 Hrs.]**
Analysis of continuous beams and simple portals (Non sway) by using Moment Distribution method, effect of sinking of support for beam.

UNIT – III **[9 Hrs.]**
Influence lines for reactions, bending moments and shear forces in simply supported beams, cantilevers, beams with overhangs subjected to different types of loadings.

UNIT – IV **[8 Hrs.]**
Slope deflection method as applied to indeterminate beams & continuous beams, portal frames.

UNIT – V **[8 Hrs.]**
Buckling of Columns, Euler's and Rankine's formula. Analysis of Two and Three Hinged parabolic arches, shear force and normal thrust.

UNIT – VI **[9 Hrs.]**
Strain energy method as applied to the analysis of simple and redundant frames, redundant trusses up to two degrees. Determination of deflection of trusses, Castigliano's theorems, Maxwell's reciprocal theorem, Betti's theorem, Muller Breslauw Principle

Text Books:

S.N	Title	Authors	Edition	Publisher
1	Structural Analysis	Pandit G.S and Gupta S.P.		Tata McGraw-Hill Publishing company LTD, New Delhi, 1997
2	Theory of Structure	Timoshenko S.P. and D.H. Young		Tata McGraw Hill Publication, Delhi

Reference Books:

S.N	Title	Authors	Edition	Publisher
1	Theory of structures	Ramamruthum S.S. and Narayan R.		DhanpatRai and Sons New Delhi 2010
2	Analysis of structures	Vazirani V.N and Ratwani M.M		Khanna Publishers New Delhi 1994
3	Structural Analysis (volume II)	Bhavikatti S.S		Vikas publishing House LTD Delhi 2011
4	Intermediate structural analysis	Kinney J.S		Oxford and IBH Publishing o.PVT.LTD New Delhi.

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
CV2256 – LAB : STRUCTURAL ANALYSIS

COURSE OBJECTIVE	COURSE OUTCOME
1. To study the basic concept of strain measurements. 2. To study the various methods for finding deflection in truss analytically and graphically. 3. To study the analysis of the aches 4. To study various properties of beam like flexural rigidity, slope, deflection, bending moment etc. 5. To study the behavior of column curved member and portal frame.	1. An ability to understand various types of strain gauges and to measure the strain in beam. 2. An ability to find the defections in truss analytically and graphically. 3. An ability to determine the horizontal thrust of different types of arches. 4. An ability to understand the various properties of beam. 5. An ability to understand the behavior of the column, curved member and portal frame.
Mapped Program Outcomes : 1,2,4 **PSO :** i,	

Any TEN experiments from the following are required to be conducted:

S No	List of Practical
1.	To study various types of electrical resistance strain gauges.
2.	To measure the strain in the cantilever beam subjected to point load at tip and to check this value with theoretical value.
3.	To determine slope and deflection at center of each span for a two span continuous beam subjected to point load W at center of each span and to check these values with theoretical values.
4.	To verify Maxwell's Reciprocal Theorem for simply supported beam.
5.	To determine the value of flexural rigidity of given beam and to compare it with theoretical value.
6.	To determine the elastic displacements of the curved members experimentally and to check these values with theoretical values.
7.	To study the behavior of different types of struts and to calculate the Euler's buckling load for each case.
8.	To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of two hinged parabolic arch.
9.	To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of three hinged parabolic arch.
10.	To determine deflection of cantilever end of cantilever truss by Willot Mohr's diagram and to check this value with theoretical value.
11.	To study the behavior of a portal frame under different end conditions.
12.	To find the deflection of a pin-connected truss experimentally and to verify the result theoretically.
13.	To obtain the influence line for bending moment of prismatic fixed beam for cases (a) one end hinged (b) both ends fixed.
14.	To determine experimentally and analytically the reactions in the three suspension rods supporting an elastic beam with a concentrated load hung midway between two of the suspension rods when the suspension rods are attached at their upper end to rigid support.
15.	To verify Castigliano's Theorem for simply supported beam

IV Semester
CV2257 – TRANSPORTATION ENGINEERING

COURSE OBJECTIVE	COURSE OUTCOME
1. To know about importance of transportation in Indian context and study the basic of traffic Engineering. 2. To know about the geometric design of roads. 3. To know about the highway materials. 4. To know about the construction and maintenance of Highway. 5. To know about bridge engineering, its various components, estimation of flood discharge and also the various forces acting on bridge. 6. To know about various concepts of railway transportation in India.	1. An ability to understand basic concepts of transportation and traffic engineering. 2. An ability to understand concepts of geometric design, construction and maintenance of road pavements. 3. An ability to understand importance of various tests conducted on highway materials. 4. An ability to understand basics of bridge and railway engineering.
Mapped Program Outcomes : 1,2,11	

UNIT – I **[6 Hrs.]**
Introduction and importance of transportation, Road transport characteristics, Classification of roads, network patterns, Principles of alignment.
Traffic Engineering: 3E's of traffic engineering, Various Traffic Surveys, Intersection-types, parking.

UNIT – II **[7 Hrs.]**
Geometric Design: Road user & road vehicle characteristics, Factors affecting design standards. Cross Section elements, Stopping & overtaking sight distance overtaking zones. Horizontal alignment, Curves, design of super elevation, extra widening, transition curves, vertical alignments, I.R.C. Standards for geometric Design.

UNIT – III **[7 Hrs.]**
Introduction to pavement materials
Aggregates: Physical & Mechanical properties, tests on aggregates, Bituminous materials; classification, sources,
properties and tests. Cutback bitumen& Emulsions, IRC/IS standards.

UNIT – IV **[6 Hrs.]**
Construction & Maintenance: IRC, MOST specifications for quality & quantity of materials, techniques, tools and plant for the Earthwork, sub base, base and wearing/ surface course of flexible pavements with gravel, WBM, stabilized Bitumen & Concrete as Construction materials, Drainage, shoulders, maintenance & repairs.

UNIT – V **[6 Hrs.]**
Bridges: Introduction, Components, classification and identification, Data Collection, site selection, Economic Span, Estimation of flood discharge, waterway, scours depth, depth of foundation, Afflux, clearance and free board, Loads, Forces and Stresses for Bridges

UNIT – VI **[7 Hrs.]**
Railways: Classification, lines and their track standards, gauges, track section, railway terminology, permanent way.
Sleepers: Function, types, merits and demerits, sleeper density, ballast cushion, ballast section.

IV Semester
CV2257 – TRANSPORTATION ENGINEERING

Text Books:

S.N	Title	Authors	Edition	Publisher
1	Highway engineering	Khanna& Justo,		Nem Chand & Bros
2	Highway Engineering	K. L.Bhanot		S. Chand &Company (P) Ltd. New Delhi
3	Highway Engineering	T. D.Ahuja		Standard Book House Delhi
4	Bridge Engineering	S.P.Bindra		DhanpatRai Publication
5	Traffic and Highway Engineering	J. Garber and L. A. Hoel	2002	Thomson Learning, Inc
6	A Text Book of Railway Engineering	S. C. Saxena and S. P. Arora	2005	DhanpatRai Sons New Delhi

Reference Books:

1	Indian Road Congress, IRC handbooks ,International Code Council International Code Council
2	Ministry of surface/road transportation, MOST.
3	Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi

IV Semester
CV2258 – LAB : TRANSPORTATION ENGINEERING

COURSE OBJECTIVE	COURSE OUTCOMES
1. To determine various properties of aggregates. 2. To determine various properties of bitumen. 3. To perform the CBR test on soil. 4. To determine the Marshall stability of bituminous mixture. 5. To conduct traffic volume survey. 6. To know about bridges and its various components.	1. An ability to conduct various tests on aggregates and soil. 2. An ability to conduct various tests on aggregates, bitumen and bitumen mix.
Mapped Program Outcomes : 1,2,3,4,11	

Any TEN experiments from the following are required to be conducted:

S No	List of Practical
1.	To determine specific gravity of aggregates.
2.	To determine impact value of given aggregate sample.
3.	To determine crushing value of given aggregate sample.
4.	To determine flakiness index of given aggregate sample.
5.	To determine abrasion value by Los Angeles test.
6.	To perform water absorption test on given aggregate sample.
7.	To find softening point of given bitumen sample.
8.	To perform penetration test for given bitumen sample.
9.	To perform flash and fire point for given bitumen sample.
10.	To perform ductility test on given bitumen sample.
11.	To perform viscosity test on bitumen.
12.	To perform CBR test on given soil sample.
13.	To perform Marshall Stability Test on bituminous concrete.
14.	Bridge site visit.

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

5th Semester

Civil Engineering

28 June 2020

V Semester
GE2311 - Fundamentals of Management

Objective	Outcomes
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Unit – 1 - Principle of Management

[illegible]

UNIT-2: Legal Aspects of Management

[illegible]

UNIT-3: Human Resource Management

[illegible]

UNIT-4: Project Management

[illegible]

UNIT-5: Marketing Management

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
GE2311 - FUNDAMENTALS OF MANAGEMENT

UNIT-6: Financial Management

[illegible]

Text book and Reference

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2301 - REINFORCED CONCRETE STRUCTURES

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]

FMapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CV2301 - REINFORCED CONCRETE STRUCTURES

Text Books :

[illegible]

Reference Books :

[illegible]

V Semester
CV2302 - ADVANCED STRUCTURAL ANALYSIS

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO** [illegible]	

UNIT–1 : [illegible] M [illegible] **TWO** [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible] M [illegible] **THREE** [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible] **THREE** [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : M [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible] **THREE** [illegible] **THREE** [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CV2303 – LAB : ANALYSIS AND DESIGN STUDIO

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO** [illegible]	

Minimum Ten Practical to be performed

1. [illegible] ***continuous beam with and without sinking of support*** [illegible] **two degree of static indeterminacy** [illegible] **Flexibility Matrix Method.** [illegible]
2. [illegible] ***plane truss*** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible] **tiffness Matrix method** [illegible]
3. [illegible] ***continuous beam*** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible] **Stiffness Matrix Method.** [illegible]
4. [illegible] ***non-prismatic fixed beam (beam splits into three parts)*** [illegible] **Column Analogy Method** [illegible]
5. [illegible] ***rigid sway frame one bay one story*** [illegible] **Moment Distribution Method.** [illegible]
6. [illegible] ***multi storied frame structure*** [illegible] **vertical forces** [illegible] **Substitute Frame Method.** [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2303 – LAB : ANALYSIS AND DESIGN STUDIO

7. [illegible] ***multi storied frame structure*** [illegible] d [illegible] **horizontal forces** [illegible] r [illegible] **Cantilever Method or Portal Frame Method.** [illegible] d [illegible] r [illegible]
8. [illegible] r [illegible] d [illegible] r [illegible] d [illegible] d [illegible] r [illegible]
9. [illegible] r [illegible] r [illegible] d [illegible] d [illegible] r [illegible]
10. [illegible] r [illegible] r [illegible] d [illegible] d [illegible] r [illegible]
11. [illegible] d [illegible] r [illegible] r [illegible] d [illegible] d [illegible] r [illegible]
12. [illegible] d [illegible] r [illegible] d [illegible] r [illegible]

Text Books :

[illegible] d [illegible] d [illegible] r [illegible] r [illegible] M [illegible] r [illegible] M [illegible] r [illegible]

[illegible] M [illegible] r [illegible] M [illegible] r M [illegible] d [illegible] r [illegible] r [illegible] r [illegible] d [illegible] 3 [illegible]

3 [illegible] r [illegible] d [illegible] r M [illegible] r M [illegible] d [illegible] r [illegible] r [illegible]

[illegible] r [illegible] r [illegible] d [illegible] r [illegible] r [illegible] d [illegible]

[illegible] d [illegible] r [illegible] r [illegible] d [illegible] r [illegible] r [illegible] r [illegible] r [illegible] r [illegible] d [illegible]

[illegible] r [illegible] d [illegible] r [illegible] M [illegible] r [illegible] d [illegible]

Reference Books :

[illegible] r [illegible] r [illegible] d [illegible]

[illegible] r [illegible] r [illegible] r [illegible] r [illegible] d [illegible] r [illegible] d [illegible] r [illegible] d [illegible] 3 [illegible] r [illegible] d [illegible] d [illegible] r [illegible] d [illegible] rd [illegible] r [illegible] r [illegible] d [illegible]

3 [illegible] r [illegible] d [illegible] d [illegible] r [illegible] r [illegible] r [illegible]

[illegible] r [illegible] d [illegible] r [illegible] r [illegible] d [illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible] r [illegible] rd [illegible]
[illegible] r [illegible]	[illegible] d M [illegible] r [illegible]	[illegible]	[illegible] r [illegible]	

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SoE No. CV-201

CIVIL ENGINEERING

V Semester

CV2311 - PE-I : ADVANCE SURVEYING

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes: [illegible]

UNIT–1 : **Simple and Compound Curves** [illegible] **Simple Curves** [illegible] [illegible] **Compound Curves** [illegible]	**[06 Hrs.]**
UNIT–2 : **Transition and vertical curve** [illegible]	**[07 Hrs.]**
UNIT–3 **Geodetic Surveying and Triangulation Adjustment (a,b,d)** [illegible]	**[07 Hrs.]**
UNIT–4 : **ELECTRONIC SURVEYING** [illegible]	**[06 Hrs.]**
UNIT–5 : **TOTAL STATION SURVEYING** [illegible]	**[06 Hrs.]**
UNIT–6 : **Advanced surveying techniques** **Photographic Surveying:** [illegible]	**[07 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CV2312 – PE-I : LAB - ADVANCE SURVEYING

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

PRACTICALS

Any <u>Eight</u> Experiments out of the following.

[illegible]

Text Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2313 - PE-I : COMPUTER APPLICATION IN CIVIL ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Reference Books :

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2314 – PE-I : LAB - COMPUTER APPLICATION IN CIVIL ENGINEERING

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

[illegible] one [illegible] two [illegible]

Programming Language [illegible]

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Text Books:

[illegible]

[illegible]

3 [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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CIVIL ENGINEERING

V Semester

CV2315 - PE-I : BUILDING CONSTRUCTION MATERIALS

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible] **Foundations :** [illegible]	**[06 Hrs.]** [illegible]
UNIT–2 : **Brickwork :** [illegible]	**[07 Hrs.]** [illegible]
UNIT–3 : **Stone Work :** [illegible] **Arches and Lintels :** [illegible] **Damp Proofing :** [illegible]	**[07 Hrs.]** [illegible]
UNIT–4 : **Floors And Roofs :** [illegible] **Roofs :** [illegible]	**[06 Hrs.]** [illegible]
UNIT–5 : **Stairs** [illegible] **Doors and Windows :** [illegible]	**[07 Hrs.]** [illegible]
UNIT–6 : **Plastering and Pointing :** [illegible] **Temporary Timbering :** [illegible] **Painting :** [illegible]	**[06 Hrs.]** [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2315 - PE-I : BUILDING CONSTRUCTION MATERIALS

Text Books :

[illegible]

[illegible]

3 [illegible]

Reference Books :

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2316 – PE-I : LAB - BUILDING CONSTRUCTION MATERIALS

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

PRACTICALS

[illegible]

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2317 - PE-I : LAB - MATRIX ANALYSIS OF STRUCTURES

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO** [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : **Analysis of Beam (without axial deformation):** [illegible]	**[07 Hrs.]**
UNIT–3 : **Analysis of Plane Truss:** [illegible]	**[07 Hrs.]**
UNIT–4 : **Analysis of Plane Frame (Without axial deformation):** [illegible]	**[06 Hrs.]**
UNIT–5 : **Analysis of Plane frame (With axial deformation):** [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2317 - PE-I : MATRIX ANALYSIS OF STRUCTURES

Text Books :

[illegible]

Reference Books :

[illegible]

V Semester

CV2318 – PE-I : LAB - MATRIX ANALYSIS OF STRUCTURES

COURSE OBJECTIVE	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] **PSO** [illegible]

Analysis of Structures Using Standard Software Packages.

[illegible] **continuous beam** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible] **stiffness matrix method** [illegible]

[illegible] **continuous beam with sinking of support** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible] **stiffness matrix method** [illegible]

3 [illegible] **plane truss** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible] **stiffness matrix method** [illegible]

[illegible] **plane truss subjected to inclined roller support** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible] **stiffness matrix method** [illegible]

[illegible] **plane truss subjected to temperature effect** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible] **stiffness matrix method** [illegible]

[illegible] **plane truss subjected to lack of fit** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible] **stiffness matrix method** [illegible]

[illegible] **plane frame neglecting axial deformation** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible]

[illegible] **plane frame considering axial deformation** [illegible] **THREE degree of Kinematic Indeterminacy** [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2318 – PE-I : LAB - MATRIX ANALYSIS OF STRUCTURES

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2319 – PE-I : ADVANCED CONCRETE TECHNOLOGY

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CV2319 – PE-I : ADVANCED CONCRETE TECHNOLOGY

Text Books :

[illegible]

Reference Books:

[illegible]

V Semester

CV2320 – PE-I : LAB - ADVANCED CONCRETE TECHNOLOGY

COURSE OBJECTIVE	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

Any Five practical from the following are required to be conducted:

[illegible]

V Semester
CV2321 – PE-I : WATER TREATMENT

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Introduction:** [illegible] **Aeration:** [illegible]	**[06 Hrs.]**
UNIT–2 : **Coagulation:** [illegible] **Flocculation:** [illegible]	**[07 Hrs.]**
UNIT–3 : **Sedimentation:** [illegible]	**[07 Hrs.]**
UNIT–4 : **Filtration:** [illegible]	**[06 Hrs.]**
UNIT–5 : **Disinfection:** [illegible]	**[07 Hrs.]**
UNIT–6 : **Other Processes:** [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CV2322– PE-I : LAB - WATER TREATMENT

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

A. Any SIX experiments of the following will be performed.

[illegible]

B. To Design various Water Treatments Units (Any Three)

[illegible]

V Semester

CV2323– PE-I : ENVIRONMENTAL MANAGEMENT

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible] **Overview of impacts** [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CV2323– PE-I : ENVIRONMENTAL MANAGEMENT

Text Books :

[illegible]

References Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2324– PE-I : LAB - ENVIRONMENTAL MANAGEMENT

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

PRACTICALS

[illegible]

V Semester

CV2325– PE-I : SOIL CHARACTERIZATION & IDENTIFICATION

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2326– PE-I : LAB - SOIL CHARACTERIZATION & IDENTIFICATION

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible] [illegible] 3 [illegible]	[illegible] [illegible] [illegible] 3 [illegible]
Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]	

Following Practical's will be conducted:

[illegible]

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. CV-201

CIVIL ENGINEERING

V Semester

CV2327– PE-I : GEOGRAPHICAL INFORMATION SYSTEMS

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2328 – PE-I : LAB - GEOGRAPHIC INFORMATION SYSTEMS

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

[illegible]

Minimum 4 Practicals out of following will be performed

[illegible]

Reference Books : [illegible]

V Semester

CV2331 – OE-I : BUILDING SERVICES ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible] **Lighting** [illegible] **Ventilation:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Acoustics, Sound Insulation and Noise Control:** [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible] **Electrical Installations:** [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible] **Air Conditioning** [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible] **Mechanical Equipment & Installation** [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible] **Fire protection :** [illegible]	**[06 Hrs.]**

Text Books : [illegible]

[illegible]

Reference Books : [illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2332 – OE-I : CONSTRUCTION TECHNIQUES

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible] **Introduction to Cement and Concrete :** [illegible]	**[07 Hrs.]**
UNIT–2 : **Introduction to :** [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible] **Type of structure :** [illegible] **Sub Structure Construction:** [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible] **Super structure construction** [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible] **New Construction Techniques :** [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible] **Safety in Construction Operations :** [illegible]	**[06 Hrs.]**

Text Books : [illegible]

Reference Books : [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2333 – OE-I : INTRODUCTION TO ENVIRONMENTAL MANAGEMENT

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

References Books :

[illegible]

V Semester

CV2334 - OE-I : BASICS OF TRANSPORTATION ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2335 - OE-I : BASICS OF WATER RESOURCE ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Introduction:** [illegible] **Precipitation:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Infiltration:** [illegible] **Evaporation:** [illegible]	**[06 Hrs.]**
UNIT–3 : **Runoff:** [illegible]	**[06 Hrs.]**
UNIT–4 : **Hydrograph :** [illegible]	**[06 Hrs.]**
UNIT–5 : **Geo-hydrology:** [illegible]	**[07 Hrs.]**
UNIT–6 : **Ground Water Recharge** [illegible]	**[07 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

[illegible]

V Semester

CV2336 - OE-I : ELEMENTS OF WATER POWER ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2341 - OE-II : ELEMENTS OF EARTHQUAKE

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books:

[illegible]

V Semester

CV2342 - OE-II : INTRODUCTION TO FINITE ELEMENT METHO

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

V Semester

CV2343 - OE-II : AIR POLLUTION AND SOLID WASTE MANAGEMENT

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

V Semester

CV2343 - OE-II : AIR POLLUTION AND SOLID WASTE MANAGEMENT

Text Books :

[illegible]

Reference Books :

[illegible]

V Semester

CV2344 - OE-II : ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : **Evolution of EIA:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Methods for impact assessment:** [illegible]	**[06 Hrs.]**
UNIT–3 : **Assessment of impact for air and noise environment:** [illegible]	**[07 Hrs.]**
UNIT–4 : **Assessment of impact for water and soil environment:** [illegible]	**[06 Hrs.]**
UNIT–5 : **Assessment of impact on cultural and socioeconomic environment:** [illegible]	**[07 Hrs.]**
UNIT–6 : **EIA notification by Ministry of Environment and Forest (Govt. of India):** [illegible]	**[06 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CV2344 - OE-II : ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

Text Book :

[illegible]

[illegible]

3 [illegible]

Reference Books:

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CV2345 - OE-II : DISASTER MANAGEMENT

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Understanding Natural Disasters** [illegible]	**[08 Hrs.]**
UNIT–2 : **Man-Made Disasters:** [illegible]	**[05 Hrs.]**
UNIT–3 : **Risk & Cost Assessment:** [illegible]	**[06 Hrs.]**
UNIT–4 : **Disaster Preparedness:** [illegible]	**[07 Hrs.]**
UNIT–5 : **Disaster Response:** [illegible]	**[06 Hrs.]**
UNIT–6 : **Reconstruction and Rehabilitation :** [illegible]	**[07 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CV2345 - OE-II : DISASTER MANAGEMENT

Text Books:

[illegible]

Reference Books:

[illegible]

Nagar Yuwak Shikshan Sanstha's

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
6th Semester
Civil Engineering

Nagar Yuwak Shikshan Sanstha's

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SoE No. CV-201

CIVIL ENGINEERING

VI Semester

GE2312 - FUNDAMENTAL OF ECONOMICS

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Introduction to Economics and Consumers' Behaviors :** [illegible]	**[08 Hrs.]**
UNIT–2 : **Production and Costs** [illegible]	**[06 Hrs.]**
UNIT–3 : **Market structures - equilibrium output and price** [illegible]	**[07 Hrs.]**
UNIT–4 : **National income accounting:** [illegible]	**[06 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
GE2312 - FUNDAMENTAL OF ECONOMICS

UNIT–5 : **Money, Banking and Public Finance** M[illegible]	**[07 Hrs.]**
UNIT–6 : **International Trade and Institutions** [illegible]	**[05 Hrs.]**

Text Books:

[illegible] M[illegible]3[illegible]

[illegible] M[illegible]3rd[illegible]

Reference Books:

[illegible]

[illegible]

3[illegible] M[illegible]

[illegible]

[illegible] M[illegible]

[illegible] M[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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SoE No. CV-201

CIVIL ENGINEERING

VI Semester
CV2351 - Steel Structures

Objective	Outcomes
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

UNIT–1 : **Steel as a Structural Material:** [illegible]	**[06 Hrs.]**
UNIT–2 : **Connection:** [illegible]	**[07 Hrs.]**
UNIT–3 : **Tension Member:** [illegible] **Compression Member:** [illegible]	**[06 Hrs.]**
UNIT–4 : **Column:** [illegible]	**[07 Hrs.]**
UNIT–5 : **Design of Beam:** [illegible]	**[06 Hrs.]**
UNIT–6 : **Column Bases** [illegible] **Introduction to pre Engineered Building (PEB).**	**[07 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2352 - Lab - Building Design and Drawing

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO :** [illegible]	

Following Practicals will be conducted:

[illegible] **(01 Assignments)**

[illegible] **(01 Assignments)**

3 [illegible] **(01 Assignment)**

[illegible] **(01 Assignment)**

[illegible] **(01 Assignment)**

[illegible] 3 [illegible] **A3 size sketchbook**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2353 - Hydraulic Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Book :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
CV2354 - Lab - Hydraulic Engineering

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

Practicals:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2355 - Foundation Engineering

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes: [illegible] 3 [illegible] **PSO** [illegible]

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2355 - Foundation Engineering

Text Books :

[illegible]

Reference Books :

[illegible]

VI Semester
CV2360 – Industry Visit and its report

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]
[illegible]	M[illegible]
	3[illegible]
Mapped Program Outcomes : [illegible]	

[illegible]

[illegible]

[illegible]

VI Semester
CV2361 - PE-II : Building Services

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible] **Plumbing Services:** [illegible]	**[07 Hrs.]** [illegible]
UNIT–2 : **Fire Protection:** [illegible]	**[06 Hrs.]** [illegible]
UNIT–3 : [illegible] **Electrical Installations:** [illegible] **Air Conditioning:** [illegible]	**[07 Hrs.]** [illegible]
UNIT–4 : [illegible] **Lighting** [illegible] **Ventilation :** [illegible] **Acoustics, Sound Insulation and Noise Control :** [illegible]	**[07 Hrs.]** [illegible]
UNIT–5 : [illegible] **Mechanical Equipment & Installation:** [illegible]	**[07 Hrs.]** [illegible]
UNIT–6 : [illegible] **Water Services :** [illegible]	**[06 Hrs.]** [illegible]

Text Books :

[illegible]

Reference Books : [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. CV-201

CIVIL ENGINEERING

VI Semester

CV2362- PE-II : New Engineering Materials

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2363- PE-II : Construction Management And Machinery

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible] **Construction Industry** [illegible] **Construction Management** [illegible] **Construction manager** [illegible] **Legal Aspect and Laws Applicable to Construction Industry** [illegible]	**[06 Hrs.]** [illegible]
UNIT–2 : Project management: [illegible] **Job Planning** [illegible]	**[07 Hrs.]** [illegible]
UNIT–3 : **Material management** [illegible] **Equipment managemen** [illegible] **Safety Management** [illegible]	**[06 Hrs.]** [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2363- PE-II : Construction Management And Machinery

UNIT–4 : **Construction Equipment:** [illegible] **Money & Banking** [illegible] **Financial Management:** [illegible]	**[07 Hrs.]**
UNIT–5 : **Equipments for major projects** [illegible] **Concrete equipments** [illegible]	**[07 Hrs.]**
UNIT–6 : **Economics** [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2364 - PE-II : Earthquake Engineering

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible] 3rd [illegible]

[illegible]

3 [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2364 - PE-II : Earthquake Engineering

References Books :

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2365 – PE-II : Optimization Techniques

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	3[illegible]
Mapped Program Outcomes : [illegible]3[illegible]**PSO**[illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2366 – PE-II : Introduction to Remote Sensing

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2367 – PE-II : Environmental Geotechniques

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]	

UNIT–1 : [illegible] **Fundamentals of Geoenviromental Engineering:** [illegible]	**[07 Hrs.]** [illegible]
UNIT–2 : [illegible] **Soil mineralogy characterization and its significance in determining soil behavior –** [illegible]	**[06 Hrs.]** [illegible]
UNIT–3 : [illegible] **Soil-water-contaminant interactions and its implications –** [illegible]	**[06 Hrs.]** [illegible]
UNIT–4 : [illegible] **Waste Containment System** [illegible]	**[07 Hrs.]** [illegible]
UNIT–5 : [illegible] **Contaminant Site Remediation** [illegible]	**[07 Hrs.]** [illegible]
UNIT–6 : [illegible] **Advanced Soil Characterization** [illegible]	**[06 Hrs.]** [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2367 – PE-II : Environmental Geotechniques

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2368 – PE-II : Traffic Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

VI Semester
CV2369 – PE-II : Water Transmission & Distribution System

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
CV2371 – OE-III : Building Services Engineering

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible] **Lighting** [illegible] **Ventilation:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Acoustics, Sound Insulation and Noise Control:** [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible] **Electrical Installations:** [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible] **Air Conditioning** [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible] **Mechanical Equipment & Installation** [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible] **Fire protection :** [illegible]	**[06 Hrs.]**

Text Books : [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2371 – OE-III : Building Services Engineering

Reference Books :

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. CV-201

CIVIL ENGINEERING

VI Semester

CV2372 – OE-III : Construction Techniques

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible] **Introduction to Cement and Concrete :** [illegible]	**[07 Hrs.]**
UNIT–2 : **Introduction to :** [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible] **Type of structure :** [illegible] **Sub Structure Construction:** [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible] **Super structure construction** [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible] **New Construction Techniques :** [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible] **Safety in Construction Operations :** [illegible]	**[06 Hrs.]**

Text Books : [illegible]

Reference Books : [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2373 – OE-III : Introduction to Environmental Management

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

References Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2374 – OE-III : Basics of Transportation Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2375 – OE-III : Basics of Water Resource Engineering

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Introduction:** [illegible] **Precipitation:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Infiltration:** [illegible] **Evaporation:** [illegible]	**[06 Hrs.]**
UNIT–3 : **Runoff:** [illegible]	**[06 Hrs.]**
UNIT–4 : **Hydrograph :** [illegible]	**[06 Hrs.]**
UNIT–5 : **Geo-hydrology:** [illegible]	**[07 Hrs.]**
UNIT–6 : **Ground Water Recharge** [illegible]	**[07 Hrs.]**

Text Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2375 – OE-III : Basics of Water Resource Engineering

Reference Books:

[illegible]

[illegible]

3 [illegible]

[illegible]

VI Semester

CV2376 – OE-III : Elements of Water Power Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2381 – OE-IV : Elements of Earthquake Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2381 – OE-IV : Elements of Earthquake Engineering

Reference Books:

[illegible]

[illegible]

3 [illegible]

VI Semester

CV2382 – OE-IV : Introduction to Finite Element Method

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2383 – OE-IV : Air Pollution and Solid Waste Management

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

VI Semester

CV2383 – OE-IV : Air Pollution and Solid Waste Management

Reference Books :

[illegible]

[illegible]

3 [illegible]

VI Semester

CV2384 – OE-IV : Environmental & Social Impact Assessment

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : **Evolution of EIA:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Methods for impact assessment:** [illegible]	**[06 Hrs.]**
UNIT–3 : **Assessment of impact for air and noise environment:** [illegible]	**[07 Hrs.]**
UNIT–4 : **Assessment of impact for water and soil environment:** [illegible]	**[06 Hrs.]**
UNIT–5 : **Assessment of impact on cultural and socioeconomic environment:** [illegible]	**[07 Hrs.]**
UNIT–6 : **EIA notification by Ministry of Environment and Forest (Govt. of India):** [illegible]	**[06 Hrs.]**

Text Book :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

CV2384 – OE-IV : Environmental & Social Impact Assessment

Reference Books:

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

VI Semester
CV2385 – OE-IV : Disaster Management

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Understanding Natural Disasters** [illegible]	**[08 Hrs.]**
UNIT–2 : **Man-Made Disasters:** [illegible]	**[05 Hrs.]**
UNIT–3 : **Risk & Cost Assessment:** [illegible]	**[06 Hrs.]**
UNIT–4 : **Disaster Preparedness:** [illegible]	**[07 Hrs.]**
UNIT–5 : **Disaster Response:** [illegible]	**[06 Hrs.]**
UNIT–6 : **Reconstruction and Rehabilitation:** [illegible]	**[07 Hrs.]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
CV2385 – OE-IV : Disaster Management

Text Books:

[illegible]

Reference Books:

[illegible]

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
Draft SoE & Syllabus 2018
7th & 8th Semester
Civil Engineering

VII Semester
CV2401 - Estimating and Costing

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO** [illegible]	

UNIT–1 : [illegible] **General** [illegible] **Proposal and Development of Project:** [illegible] M [illegible] [illegible]	**[06 Hrs.]** [illegible]
UNIT–2 : **Specifications:** [illegible] **Cost Build up:** [illegible] [illegible]	**[06 Hrs.]** [illegible]
UNIT–3 : **Valuation:** [illegible] [illegible]	**[07 Hrs.]** [illegible]
UNIT–4 : **Earthwork of Roads, Hill Roads & canals:** [illegible] M [illegible] [illegible]	**[07 Hrs.]** [illegible]
UNIT–5 : **Quantity and cost estimates:** M [illegible] [illegible]	**[07 Hrs.]** [illegible]
UNIT–6 : **Arranging Works:** [illegible] [illegible]	**[06 Hrs.]** [illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M [illegible]	[illegible]	[illegible]	

VII Semester
CV2401 - Estimating and Costing

Text books:

[illegible]

Reference books:

[illegible]

[illegible]

3 [illegible]

VII Semester
CV2402 - LAB : Estimating and Costing

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	[illegible]
[illegible]	3 [illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO** [illegible]	

PRACTICALS (Any 8 of the following practicals will be perform)

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Reference Books :

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
CV2403 - Wastewater Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2404 - Hydrology & Water Resources Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Introduction :** [illegible] **Runoff :** [illegible] **Hydrograph :** [illegible]	**[07 Hrs.]**
UNIT–2 : **General :** [illegible] **Water requirement for crops :** [illegible]	**[06 Hrs.]**
UNIT–3 : **Reservoir Planning :** [illegible] **Statistical Methods:** [illegible] **Floods:** [illegible]	**[07 Hrs.]**
UNIT–4 : **Water Logging :** [illegible] **Canal Irrigation :** [illegible] **Canals In Alluvial Soils :** [illegible] **Lined Canals :** [illegible]	**[06 Hrs.]**
UNIT–5 : **Introduction to Dams :** [illegible] **Diversion Head Works :** [illegible] **Earthen Dams :** [illegible]	**[06 Hrs.]**
UNIT–6 : **Gravity Dam :** [illegible]	**[07 Hrs.]**

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
CV2404 - Hydrology & Water Resources Engineering

Text Books :

[illegible]

Reference Books:

[illegible]

VII Semester
CV2411 - PE-III : Prestressed Concrete

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5: [illegible]	**[07 Hrs.]**
UNIT–6: [illegible]	**[06 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2412 - PE-III : Advanced R.C.C.

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT-1 : [illegible]	**[07 Hrs.]**
Unit-2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT-5 : [illegible]	**[07 Hrs.]**
UNIT – 6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

CV2413- PE-III: NUMERICAL METHODS AND COMPUTATIONAL TECHNIQUES

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT-1 : **Solution of algebraic and transcendental equation:** [illegible]	**[06 Hrs.]**
Unit-2 : **Solution of linear algebraic equations:** [illegible]	**[07 Hrs.]**
UNIT–3 : **Eigen values problems** [illegible]	**[07 Hrs.]**
UNIT–4 : **Initial & two point boundary value problem** [illegible]	**[07 Hrs.]**
UNIT-5 : **Numerical Integration:** [illegible]	**[06 Hrs.]**
UNIT – 6 : **Direct Integration Methods:** [illegible] θ method.	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

CV2414 - PE-III : Environmental Impact Assessment

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Evolution of EIA:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Methods for impact assessment:** [illegible]	**[06 Hrs.]**
UNIT–3 : **Prediction and assessment of impact for air and noise environment:** [illegible]	**[07 Hrs.]**
UNIT–4 : **Prediction and assessment of impact for water and soil environment:** [illegible]	**[06 Hrs.]**
UNIT–5 : **Prediction and assessment of impact on cultural and socioeconomic environment:** [illegible]	**[07 Hrs.]**
UNIT–6 : **EIA notification by Ministry of Environment and Forest (Govt. of India):** [illegible]	**[06 Hrs.]**

VII Semester
CV2414 - PE-III : Environmental Impact Assessment

Text Books :

[illegible]

[illegible]

3 [illegible]

Reference Books :

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
CV2415 - PE-III : Energy Conversion & Management

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2416 - PE-III : Geotechnical Investigation & Ground Improvement Techniques

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO** [illegible]	

UNIT–1 : [illegible] **Importance and objectives of Geotechnical exploration** [illegible]	**[07 Hrs.]** [illegible]
UNIT–2 : [illegible] **Field investigations:** [illegible]	**[06 Hrs.]** [illegible]
UNIT–3 : [illegible] **Introduction to ground improvement techniques** [illegible]	**[06 Hrs.]** [illegible]
UNIT–4 : [illegible] **Reinforced soil and Geo-synthetics:** [illegible]	**[07 Hrs.]** [illegible]
UNIT–5 : [illegible] **Ground Anchor and Soil Nailing:** [illegible]	**[07 Hrs.]** [illegible]
UNIT–6 : [illegible] **Diaphragm wall:** [illegible]	**[06 Hrs.]** [illegible]

Text Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

CV2416 - PE-III : Geotechnical Investigation & Ground Improvement Techniques

Reference Books :

[illegible]

[illegible]

3[illegible]

[illegible]

VII Semester

CV2417 - PE-III : Earth Pressure & Earth Retaining Structures

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
CV2418 - PE-III : Urban Transportation Planning

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Importance of urban transport planning** **Transport Planning Process:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Traffic forecasting:** [illegible] **Traffic and environment:** [illegible]	**[06 Hrs.]**
UNIT–3 : **Trip Generation:** [illegible] **Trip Distribution** [illegible]	**[06 Hrs.]**
UNIT–4 : **Model Split:** [illegible]	**[07 Hrs.]**
UNIT–5 : **Regulation of traffic:** [illegible]	**[06 Hrs.]**
UNIT–6 : **Nature of traffic problems in cities:** [illegible] **Urban Street Light systems:** [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2419 - PE-III : Advanced Hydraulics

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]
PO MAPPED: 1,5,7,9,10,12	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**

VII Semester
CV2419 - PE-III : Advanced Hydraulics

UNIT – 5 : [illegible] M[illegible] M[illegible]	**[07 Hrs.]**
UNIT – 6 [illegible] M[illegible] [illegible]	**[07 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

VII Semester

CV2421 - PE-IV : Natural Resources Management

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Introduction to Natural Resource Bases:** [illegible]	**[07 Hrs.]**
UNIT–2 : **Overview of policies & Governance of Natural Resources:** [illegible]	**[06 Hrs.]**
UNIT–3 : **Renewable and Non Renewable Energy** [illegible]	**[07 Hrs.]**
UNIT–4 : **Programs for NRM** [illegible]	**[06 Hrs.]**
UNIT–5 : **Sustainable Natural Resources Management and Development:** [illegible]	**[07 Hrs.]**
UNIT–6 : **Environmental issues in urbanizing world:** [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2422 - PE-IV : Finite Element Method

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

CV2423 - PE-IV : Introduction To Structural Dynamics

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
CV2424 - PE-IV : Wastewater Treatment

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]3	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

CV2425 - PE-IV : Environmental Legislation & Management System

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

CV2426 - PE-IV : Advanced Foundation Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]	

UNIT–1 : [illegible] **Bearing Capacity of Foundations** [illegible]	**[07 Hrs.]** [illegible]
UNIT–2 : [illegible] **Foundation Settlements** [illegible]	**[06 Hrs.]** [illegible]
UNIT–3 : [illegible] **Combined Footing:** [illegible]	**[07 Hrs.]** [illegible]
UNIT–4 : [illegible] **Vertically Loaded Pile** [illegible]	**[06 Hrs.]** [illegible]
UNIT–5 : [illegible] **Introduction to Machine Foundation:** [illegible]	**[07 Hrs.]** [illegible]
UNIT–6 : [illegible] **Introduction to Well foundation:** [illegible]	**[06 Hrs.]** [illegible]

Text Books:

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2427 - PE-IV : Geosynthetics

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO** [illegible]	

UNIT–1 : [illegible] **Introduction** [illegible]	**[07 Hrs.]** [illegible]
UNIT–2 : [illegible] **Geotextile** [illegible]	**[06 Hrs.]** [illegible]
UNIT–3 : [illegible] **Geogrid,** [illegible]	**[07 Hrs.]** [illegible]
UNIT–4 : [illegible] **Geomembrane,** [illegible]	**[06 Hrs.]** [illegible]
UNIT–5 : [illegible] **Geonet :** [illegible]	**[07 Hrs.]** [illegible]
UNIT–6 : [illegible]	**[06 Hrs.]** [illegible]

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

CV2428 - PE-IV : Advanced Transportation Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : **Geometric design of railway track** [illegible] **Points and crossing :** [illegible]	**[06 Hrs.]**
UNIT–3 : **Station and Yards** [illegible] **Railway Signaling and interlocking:** [illegible]	**[07 Hrs.]**
UNIT–4 : **History of Air Transportation in India :** [illegible] **Airport obstructions :** [illegible] **Runway And taxiway design :** [illegible]	**[06 Hrs.]**
UNIT–5 : **Airport layout and classification** [illegible] **Visual Aids :** [illegible] **Air traffic control :** [illegible]	**[07 Hrs.]**
UNIT–6 : **Tunnels :** [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2429 - PE-IV : Watershed Management

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : 1,5,7,9,10,12	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**

VII Semester
CV2429 - PE-IV : Watershed Management

UNIT–6 : [illegible] [illegible]	**[06 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

VII Semester

CV2431 - PE-V : Maintenance & Rehabilitation Engineering

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2432 - PE-V : Project Planning & Management

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Introduction to Construction Planning and Management** [illegible]	**[06 Hrs.]**
UNIT–2 : **Introduction to Contracts Specification & Scheduling** [illegible] **Network Analysis :** [illegible]	**[07 Hrs.]**
UNIT–3 : **Manpower, Material And Machinery** **Manpower –** [illegible] **Material –** [illegible] **Machinery –** [illegible]	**[07 Hrs.]**
UNIT–4 : **Quality And Safety Management** [illegible]	**[06 Hrs.]**
UNIT–5 : **Legal Aspects In Construction Projects** [illegible]	**[06 Hrs.]**
UNIT–6 : **Different Laws in project management** [illegible]	**[07 Hrs.]**

				[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
CV2432 - PE-V : Project Planning & Management

Text Books :

[illegible]

Reference Books :

[illegible]

VII Semester
CV2433 - PE-V : Modern Surveying Technique

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible] **GPS SURVEYING** [illegible]	**[06 Hrs.]** [illegible]
UNIT–2 : [illegible]	**[07 Hrs.]** [illegible]
UNIT–3 **PHYSICS OF REMOTE SENSING** [illegible]	**[07 Hrs.]** [illegible]
UNIT–4 : **MICROWAVE REMOTE SENSING** [illegible]	**[06 Hrs.]** [illegible]
UNIT–5 : **Hydrography Introduction** [illegible] **Underground surveying :** [illegible]	**[07 Hrs.]** [illegible]
UNIT–6 : **Astronomy :** [illegible]	**[06 Hrs.]** [illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
CV2433 - PE-V : Modern Surveying Technique

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
CV2434 - PE-V : Advanced Steel Design

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible] **PSO** [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : M [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2435 - PE-V : Design Of Bridge Structures

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : **Introduction** [illegible] **Classification of Road Bridges** [illegible]	**[06 Hrs.]**
UNIT–2 : **Standard Loading for Road Bridge Design as per codes** [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : **Substructure:** [illegible] **Bridge Foundations:** [illegible]	**[07 Hrs.]**
UNIT–5 : **Bearings and Deck Joints** [illegible]	**[07 Hrs.]**
UNIT–6 : **Suspension bridges** [illegible] **Cable Stayed Bridge** [illegible]	**[06 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

CV2436 - PE-V : Industrial Wastewater Treatment And Reuse

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

CV2437 - PE-V : Finite Element Methods In Geotechnical Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[07 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text Books :

[illegible]

Reference Books :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2438 - PE-V : Pavement Design

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[06 Hrs.]**
UNIT–2 : [illegible]	**[07 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[07 Hrs.]**
UNIT–5 : [illegible]	**[06 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

VII Semester
CV2438 - PE-V : Pavement Design

Text Books :

[illegible]

References Books :

[illegible]

VII Semester

CV2439 - PE-V : Water Power Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[06 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[07 Hrs.]**

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

CV2440 - PE-V : Structural Engineering Practices

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

UNIT–1 : [illegible]	**[07 Hrs.]**
UNIT–2 : [illegible]	**[06 Hrs.]**
UNIT–3 : [illegible]	**[06 Hrs.]**
UNIT–4 : [illegible]	**[7 Hrs.]**
UNIT–5 : [illegible]	**[07 Hrs.]**
UNIT–6 : [illegible]	**[06 Hrs.]**

Text books:

[illegible]

Reference books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
CV2409 - Mini Project

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	**PSO :** [illegible]

[illegible]

VII Semester
CV2410 - Campus Recruitment Training (CRT)

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	3 [illegible]
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

[illegible]

VIII Semester
CV2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] **PSO** [illegible]

[illegible]

VIII Semester
CV2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
[illegible]	
[illegible]	
[illegible]	
[illegible]	
Mapped Program Outcomes : [illegible]	

[illegible]

VIII Semester
CV2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	On successful completion of the course students will be able to: 1. Demonstrate a sound technical knowledge of their selected project topic. 2. Undertake problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Communicate effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii,iii	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII Semester
CV2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develop creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 5,6,7,9,10,11	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

VIII Semester
CV2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] **PSO** [illegible]

[illegible]

VIII Semester
CV2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

[illegible]

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C.COLLEGE OF ENGINEERING
AUTONOMOUS INSTITUTION
SEAL
NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
3rd to 8th Semester
Mechanical Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ME-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	30	40	3
2	3	PC	ME2201	Material Science & Metallurgy	T	3	0	0	3	3	30	30	40	3
3	3	PC	ME2202	**Lab:-** Material Science & Metallurgy	P	0	0	2	2	1	0	60	40	
4	3	PC	ME2203	Manufacturing Process -I	T	3	0	0	3	3	30	30	40	3
5	3	PC	ME2204	**Lab:-** Manufacturing Process -I	P	0	0	2	2	1	0	60	40	
6	3	PC	ME2205	Mechanics of Material	T	4	0	0	4	4	30	30	40	3
7	3	PC	ME2206	**Lab:-** Mechanics of Material	P	0	0	2	2	1	0	60	40	
8	3	PC	ME2207	Kinematics of Machines	T	3	0	0	3	3	30	30	40	3
9	3	PC	ME2208	Fluid Mechanics	T	4	0	0	4	4	30	30	40	3
10	3	PC	ME2209	**Lab:-** Fluid Mechanics	P	0	0	2	2	1	0	60	40	
					TOTAL	**20**	**0**	**8**	**28**	**24**				
				Fourth Semster										
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	30	40	3
2	4	PC	ME2251	Design of Machine Elements	T	3	0	0	3	3	30	30	40	3
3	4	PC	ME2252	Engineering Thermodynamics	T	3	0	0	3	3	30	30	40	3
4	4	PC	ME2253	**Lab:-** Machine Drawing	P	0	0	2	2	1		60	40	
5	4	PC	ME2254	Manufacturing Process-II	T	3	0	0	3	3	30	30	40	3
6	4	PC	ME2255	**Lab:-** Manufacturing Process-II	P	0	0	2	2	1		60	40	
7	4	PC	ME2256	Mechanical measurement & Metrology	T	4	0	0	4	4	30	10	60	3
8	4	PC	ME2257	**Lab:-** Mechanical measurement & Metr	P	0	0	2	2	1		60	40	
					TOTAL	**16**	**0**	**6**	**22**	**19**				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ME-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	30	40	3
2	5	PC	ME2301	Heat Transfer	**T**	3	0	0	3	3	30	30	40	3
3	5	PC	ME2302	**Lab:-** Heat Transfer	**P**	0	0	2	2	1		60	40	
4	5	PC	ME2303	Dynamics of Machines	**T**	3	0	0	4	3	30	30	40	3
5	5	PC	ME2304	**Lab:-** Dynamics of Machines	**P**	0	0	2	2	1		60	40	
6	5	PC	ME2305	Production Management	**T**	3	0	0	3	3	30	30	40	3
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	30	40	3
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	30	40	3
9	5	STR	ME2310	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
					TOTAL	**18**	**0**	**4**	**23**	**21**				

Open Electives -I

1	5	OE	ME2331	OE I : Operations Research Techniques
2	5	OE	ME2332	OE I : Automobile Engineering
3	5	OE	ME2333	OE I : Control System Engineering
4	5	OE	ME2334	OEI: Robotics and Subtractive Manufacturing

Open Electives -II

4	5	OE	ME2341	OE II : Total Quality Management
5	5	OE	ME2342	OE II : Reliability Engineering
6	5	OE	ME2343	OE II : Power Generation Engineering
7	5	OE	ME2344	OE II : Project Evaluation & Management

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ME-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	30	40	3
2	6	PC	ME2351	Fluid Machines	**T**	3	0	0	3	3	30	30	40	3
3	6	PC	ME2352	**Lab:-** Fluid Machines	**P**	0	0	2	2	1		60	40	
4	6	PC	ME2353	Computer Aided Design (CAD LAB)	**P**	0	0	2	2	1		60	40	
5	6	PC	ME2354	Design of Mechanical Drives	**T**	3	0	0	3	3	30	30	40	3
6	6	PE-I		Professional Elective I	**T**	3	0	0	3	3	30	30	40	3
7	6	PE-I		**Lab:- Professional Elective I**	**P**	0	0	2	2	1		60	40	
8	6	OE-III		Open Elective - III **	**T**	3	0	0	3	3	30	30	40	3
9	6	OE-IV		Open Elective - IV **	**T**	3	0	0	3	3	30	30	40	3
					TOTAL	**18**	**0**	**6**	**24**	**21**				

Audit Courses														
1	6	IT	IT1121	Industrial Programmin Language	**A**	3	0	0	3	0				

Professional Electives -I

1	6	PE-I	ME2361	PE I : Finite Element Methods
	6	PE-I	ME2362	PE I : Lab:- Finite Element Methods
2	6	PE-I	ME2363	PE I : Computer Graphics
	6	PE-I	ME2364	PE I : Lab:- Computer Graphics
3	6	PE-I	ME2365	PE I : I.C. Engines
	6	PE-I	ME2366	PE I : Lab:- I.C. Engines
4	6	PE-I	ME2367	PE I : Refrigeration & Cryogenics
	6	PE-I	ME2368	PE I : Lab:- Refrigeration & Cryogenics
5	6	PE-I	ME2369	PE I : Computer Integrated Manufacturing
	6	PE-I	ME2370	PE I : Lab:- Computer Integrated Manufacturing
6	6	PE-I	ME2371	PE I : Mechatronics
	6	PE-I	ME2372	PE I : Lab:- Mechatronics
7	6	PE-I	ME2373	PE I : Data Structures & Algorithms
	6	PE-I	ME2374	PE I : Lab:- Data Structures & Algorithms
8	6	PE-I	ME2375	PE I : Management Information System
	6	PE-I	ME2376	PE I : Lab:- Management Information System

Open Electives -III

1	6	OE-III	ME2381	OE III : Operations Research Techniques
2	6	OE-III	ME2382	OE III : Automobile Engineering
3	6	OE-III	ME2383	OE III : Control System Engineering
4	6	OE-III	ME2384	OE III : Robotics and Subtractive Manufacturing

Open Electives -IV

1	6	OE-IV	ME2391	OE IV : Total Quality Management
2	6	OE-IV	ME2392	OE IV : Reliability Engineering
3	6	OE-IV	ME2393	OE IV : Power Generation Engineering
4	6	OE-IV	ME2394	OE IV : Project Evaluation & Management

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Yeshwantrao Chavan College of Engineering

B.E. SCHEME OF EXAMINATION 2018-19

SoE No.
ME-201

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
			M		**T**	3			3	3	3	3		3
			M	**Lab:-**	**P**									
3					**T**	3			3	3	3	3		3
					T	3			3	3	3	3		3
				Lab:-	**P**									
					T	3			3	3	3	3		3
					T	3			3	3	3	3		3
			M		**P**									
			M		**P**									
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -II

			M	
			M	
3			M 3	
			M	
			M	
			M	
			M	
			M	

Professional Electives -III

			M	
			M	
			M 3	
			M	
3			M	
			M	
			M	
			M	
			M	
			M 3	
			M 33	
			M 3	
			M 3	
			M 3	

Professional Electives -IV

3			M	
			M	
			M 3	
			M	
			M	
			M	
			M	
3			M	
3			M	

Professional Electives -V

3			M	
33			M	
3			M 3	
3			M	
3			M	
3			M	
3			M	
3			M	
			M	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2021	1.03	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Yeshwantrao Chavan College of Engineering

B.E. SCHEME OF EXAMINATION 2018-19

Mechanical Engineering

SoE No.
ME-201

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
					P									
					P									
				TOTAL		0	0	12	12	10				

GRAND TOTAL	87	0	44	132	163	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA** = for Practical : MSPA will be 15 marks each

		June 2020	1.02	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
[illegible]	[illegible]

Unit I: Finite Differences

[illegible] **(6 hours)**

Unit II: Laplace Transform

Laplace Transforms: [illegible] **(7 hours)**

Unit III: Z-transform

[illegible] **(6 hours)**

Unit IV: Fourier Series

[illegible] **(7 hours)**

Unit V: Partial Differential Equation

[illegible] **(7 hours)**

Unit VI : Fourier Transform : [illegible] **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3rd SEMESTER

ME2201	Material Science and Metallurgy	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
[illegible]	[illegible]

UNIT-1 [5 hrs]

[illegible] **[CO1]**

UNIT-2 [8 hrs]

[illegible] **[CO 1,2]**

UNIT-3 [8 hrs]

[illegible] **[CO 1,2,3]**

UNIT-4 [8 hrs]

[illegible] **[CO 1,2,3]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3rd SEMESTER

ME2201	Material Science and Metallurgy		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT-5 [8 hrs]

[illegible] **CO 1,2,3]**

UNIT-6 [8 hrs]

[illegible] **[CO 1,2]**

Reference books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3rd SEMESTER

ME2202	Lab :Material Science and Metallurgy		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
[illegible]	[illegible]

List of Practical

[illegible]

[illegible] **[CO 1,2]**

[illegible] **[CO 1,2]**

3[illegible] **[CO 1,2]**

[illegible] **[CO 1,2]**

[illegible] **[CO 1,2]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible] **[CO 1,2,3]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

MECHANICAL EGNINEERING

3rd SEMESTER

ME2203	Machining Processes	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible]

Unit I

[illegible]

Unit II

[illegible]

Unit III

[illegible]

Unit IV

[illegible]

Unit V

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3rd SEMESTER

ME2203	Machining Processes	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit VI

[illegible]

Text Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3 SEMESTER

ME2204	Lab :Machining Processes		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
[illegible]	[illegible]

LIST OF PRACTICALS:

S No	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3 SEMESTER

ME2205	Mechanics of Material	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible]

Unit 1 **[8 hrs]**

Concept of simple stresses and strains: [illegible] **[CO-1]**

Unit 2 **[8 hrs]**

Shear force and bending moments in Beam: [illegible] **[CO-2]**

Unit 3 **[6 hrs]**

Stresses in beams: [illegible]

Shear stresses in beams [illegible] **[CO-2]**

Unit 4 **[7 hrs]**

Strain energy and impact: [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3 SEMESTER

ME2205	Mechanics of Material	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Column & Struts: [illegible] **[CO-3]**

Unit 5 **[8 hrs]**

Torsion of circular shafts: [illegible]

Deflection of beams: [illegible] **[CO-4]**

Unit 6 **[8 hrs]**

Combined Stresses: [illegible] **[CO-1]**

Text Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3 SEMESTER

ME2206	Lab : Mechanics of Material		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
• [illegible] • [illegible] • [illegible] • [illegible] • [illegible] • [illegible]	[illegible] [illegible] 3 [illegible]

List of Practical

[illegible]

[illegible] **[CO-1]**

[illegible] **[CO-1]**

3 [illegible] **[CO-1]**

[illegible] **[CO-1,2]**

[illegible] **[CO-3]**

[illegible] **[CO-4]**

[illegible] **[CO-3]**

[illegible] **[CO-1]**

[illegible] **[CO-2]**

[illegible] **[CO-4]**

[illegible] **[CO-4]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

MECHANICAL EGNINEERING

3 SEMESTER

ME2207	Kinematics of Machinery	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
• [illegible] • [illegible]	[illegible] [illegible] 3 [illegible]

Unit 1 **[8 hrs]**

[illegible]

[CO 1]

Unit 2 **[7 hrs]**

[illegible] **[CO 2]**

Unit 3 **[8 hrs]**

[illegible] **[CO 3]**

Unit 4 **[7 hrs]**

[illegible] **[CO 4]**

Unit 5 **[8 hrs]**

[illegible] **[CO 4]**

Unit 6 **[7 hrs]**

[illegible] **[CO 2]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3 SEMESTER

ME2207	Kinematics of Machinery		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Nagar Yuwak Shikshan Sanstha's

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BE SoE and Syllabus 2018

MECHANICAL EGNINEERING

3 SEMESTER

ME2208	Fluid Mechanics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible] **PO: 1,3,5,12,13** [illegible] **PO: 1,3,5,12,13** [illegible] **PO: 1,3,5,12,13** [illegible] **PO: 1,3,5,12,13**

Unit1 **[8 hrs]**

[illegible] **[CO:1]**

Unit2 **[7 hrs]**

[illegible] **[CO:2]**

Unit3 **[8 hrs]**

[illegible] **[CO:3]**

Unit4 **[7 hrs]**

[illegible] **[CO:3]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3 SEMESTER

ME2208	Fluid Mechanics		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit5 **[8 hrs]**

[illegible]

[CO:3]

Unit 6 **[7 hrs]**

[illegible]

[CO:4]

Reference Books:

S. No.	Title	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

3 SEMESTER

ME2209	Lab : Fluid Mechanics		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
[illegible]	[illegible] PO: 1,3,5,12,13 [illegible] PO: 1,3,5,12,13 3 [illegible] PO: 1,3,5,12,13 [illegible] PO: 1,3,5,12,13

[illegible]

[illegible] [CO:1]

[illegible] [CO:1]

3 [illegible] [CO:1]

[illegible] [CO:3]

[illegible] [CO:3]

[illegible] [CO:3]

[illegible] [CO:3]

[illegible] [CO:3]

[illegible] [CO:3]

[illegible] [CO:4]

[illegible] [CO:4]

[illegible] [CO:4]

3 [illegible] [CO:4]

[illegible] [CO:3]

[illegible] [CO:3]

[illegible] [CO:1,3,4]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
4th Semester
Mechanical Engineering

28 June 2019

IV Semester

GE2204 - Advanced Mathematical Techniques

Objective	Outcomes
• [illegible] • [illegible] • [illegible] • [illegible]	• [illegible] • [illegible] • [illegible] • [illegible]

Unit I:

Numerical Methods for Algebraic And Transcendental Equations: [illegible]

Numerical Methods System of Algebraic Equations [illegible] **(7 hours)**

Unit II:

Numerical Methods for Differential Equations [illegible] **(6 hours)**

Unit III:

Random Variables and Probability Distribution [illegible] **(6 hours)**

UNIT IV:

Mathematical Expectation [illegible] **(7 hours)**

UNIT V:

Fuzzy Sets And Fuzzy Logic [illegible] **(7 hours)**

Unit VI:

OPTIMIZATION TECHNIQUES: [illegible] **(6 hours)**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV Semester

GE2204 - Advanced Mathematical Techniques

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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BE SoE and Syllabus 2018

MECHANICAL EGNINEERING

4th SEMESTER

ME2251	Design of Machine Elements	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible]

Unit1 **[8 hrs]**

[illegible]

[CO – 1]

Unit2 **[7 hrs]**

Design of Joints:

[illegible] **[CO – 2]**

Unit3 **[7 hrs]**

Power screw and Leaf spring: [illegible] **[CO – 3]**

Unit4 **[7 hrs]**

[illegible] **[CO – 3]**

Unit5 **[7 hrs]**

[illegible] **[CO – 4]**

Unit 6 **[8 hrs]**

[illegible] **[CO – 4]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

4th SEMESTER

ME2251	Design of Machine Elements	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	3rd [illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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BE SoE and Syllabus 2018

MECHANICAL EGNINEERING

4th SEMESTER

ME2252	Engineering Thermodynamics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	***On completion of this course, the student will be able to:*** [illegible] **Apply** [illegible] **analysis** [illegible] **evaluate** [illegible] 3 [illegible] 3 [illegible] [illegible] **Evaluate** [illegible] **applying** [illegible] 3 [illegible] 3 [illegible] 3 [illegible] **Evaluate** [illegible] *processes with phase change* **using** [illegible] **applying** [illegible] 3 [illegible] 3 [illegible] [illegible] **Analyze** [illegible] **applying** [illegible] **evaluation** [illegible] 3 [illegible] 3 [illegible]

UNIT I:

Introduction To Thermodynamics:

[illegible]

UNIT II

First Law of Thermodynamicsapplied to t [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

4th SEMESTER

ME2252	Engineering Thermodynamics	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

UNIT III

Second Law of Thermodynamics :

[illegible]

UNIT IV

Entropy:

[illegible]

UNIT V

Properties of Pure Substances (Steam) :

[illegible]

UNIT VI:

Thermodynamic Cycles

Vapor Power Cycles [illegible]

Air-standard cycles: [illegible]

Refrigeration Cycle: [illegible]

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
Reference books				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

4th SEMESTER

ME2253	Lab : Machine Drawing		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
[illegible]	[illegible]

Unit1 **[8 hrs]**

[illegible]

Unit2 **[6 hrs]**

[illegible]

Unit3 **[6 hrs]**

[illegible]

Unit4 **[8 hrs]**

[illegible]

Unit5 **[9 hrs]**

[illegible]

Unit 6 **[8 hrs]**

[illegible]

4th SEMESTER

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

ME2253	Lab : Machine Drawing		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

LIST OF PRACTICALS

[illegible]

Text Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

4th SEMESTER

ME2254	Manufacturing Processes-II	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible]

Unit 1 **[8 hrs]**

[illegible] **[CO-1]**

Unit 2 **[5 hrs]**

[illegible] **[CO-1]**

Unit 3 **[5 hrs]**

[illegible] **[CO-2]**

Unit 4 **[7 hrs]**

[illegible] **[CO-2]**

Unit 5 **[9 hrs]**

[illegible] **[CO-3]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

4th SEMESTER

ME2254	Manufacturing Processes-II	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit 6 [7 hrs]

[illegible] **[CO-4]** [illegible]

Text Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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BE SoE and Syllabus 2018

MECHANICAL EGNINEERING

4th SEMESTER

ME2255	Lab: Manufacturing Processes-II		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Objective	Course Outcome
[illegible]	(1) [illegible] (2) [illegible] (3) [illegible] (4) [illegible]

List of Practical:-

[illegible]

- [illegible]
- [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible] M [illegible] 3 [illegible]
- [illegible]
- [illegible]

[illegible]

A Visit: [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M [illegible]	[illegible]	[illegible]	

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BE SoE and Syllabus 2018

MECHANICAL EGNINEERING

4th SEMESTER

ME2256	Mechanical Measurement and Metrology	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible]

UNIT 1

[illegible]

UNIT 2

[illegible]

UNIT 3

[illegible]

UNIT 4

[illegible]

UNIT 5

[illegible]

UNIT 6

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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BE SoE and Syllabus 2018

MECHANICAL EGNINEERING

4th SEMESTER

ME2256	Mechanical Measurement and Metrology	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text Books:

S. No.	Title	Authors	Edition	Publisher
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Authors	Edition	Publisher
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	3rd [illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

4th SEMESTER

ME2257	Lab: Mechanical Measurement and Metrology	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	---

Objective	Course Outcome
[illegible]	[illegible]

List of Practical:-

[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
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4th SEMESTER

ME2257	Lab: Mechanical Measurement and Metrology	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	---

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
5th Semester
Mechanical Engineering

28 June 2020

V Semester
GE2311 - FUNDAMENTALS OF MANAGEMENT

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management

Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management

Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure .

UNIT-4: Project Management

Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.

UNIT-5: Marketing Management

Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

V Semester
GE2311 - FUNDAMENTALS OF MANAGEMENT

UNIT-6: Financial Management

Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

V Semester

ME2301 - HEAT TRANSFER

Objective	Course Outcome
The student should be able to 1) The contents of syllabus intend to understand basic principles and physical phenomenon of Thermal Energy transfer and to understand heat transfer applications and formulate the problem. 2) To apply experimental tools for analysis of heat transfer applications in engineering. 3) To receive results from experimental and the mathematical tools and interpret the results to provide solutions for improvement. 4) In all to generate interest in learning to develop intuitive understanding in Heat Transfer.**[a,e,k,l,m]**	**On completion of this course, the student will be able to** 1) Analyze and solve the problems of unidirectional steady state heat conduction systems. 2) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient. 3) Design & analyze the heat exchangers with LMTD & ϵ-NTU methods 4) Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Analyze and solve the problems of unidirectional steady state heat conduction and lumped heat capacitance systems.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO2	Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO3	Design & analyze the heat exchangers with LMTD & ϵ-NTU methods.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO4	Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.	3	3	3	2	3	1	2	1	1	1	2	2	3	3

V Semester

ME2301 - HEAT TRANSFER

Unit No.	Contents	Max. Hrs.
1	**Introduction:** Modes of Heat Transfer, Basic Laws of Heat Transfer and Conservation of Energy requirement. Derivation of **general Heat conduction equation** in Cartesian, Cylindrical and Spherical Co-ordinates, Thermal conductivity and Thermal diffusivity. **One dimensional steady state conduction equation** for the plane wall, Cylinder and Sphere, Thermal resistance of composite structures, Contact resistance, and overall heat transfer coefficient.	6
2	**Conduction with uniform internal heat generation**: within plane wall, solid Cylinder and solid sphere, **Extended Surfaces** with uniform cross section area, temperature distribution and their heat transfer rate, Fin efficiency and effectiveness,	5
3	**Forced Convection:** Physical signification of related non-dimensional parameters, Newton's law of cooling, Concept of velocity and thermal boundary layer, Local and average heat transfer coefficient, **Using Empirical co-relation** (from heat transfer data book) for heat transfer during external and internal flow in laminar and turbulent regime for UHF and UWT condition, for determination of heat transfer coefficient.	5
4	**Natural Convection:** Grashoff number, Rayleigh number, Hydrodynamic and Thermal Boundary Layer. **Using Empirical co-relation** (from heat transfer data book) for heat transfer during external flow in laminar and turbulent regime for UHF and UWT condition (over plates & cylinders in Horizonal and vertical position, and over sphere). **Heat transfer with phase change (Theory only):** Pool boiling phenomenon, curve and regimes of pool boiling, Film and drop wise condensation, Film wise condensation on vertical surface (plate & cylinder), horizontal tube & bank of tubes, effect of superheated and non-condensable gasses on condensation heat transfer.	5
5	**Heat Exchanger:** Classification of heat exchangers, overall heat transfer coefficient, fouling factor, temperature distribution **Heat Exchanger Analysis** for parallel & Counter flow heat exchangers using LMTD Approach and Effectiveness -NTU approach	6
6	**Radiation** **Basic Radiation Concepts:** Fundamentals, Basic ideas, spectrum, basic definitions, radiative properties of opaque surfaces, Spectral and directional variations, emissive power, radiosity, intensity of radiation and solid angle, Band Emission. **Black Body Radiation Laws:** Planck's law, Stefan Boltzmann law, Wien's Displacement law, Kirchhoff's law, Lambert cosine law, **Radiation Energy Exchange:** Concept of black and gray bodies, Radiation exchange between black surfaces, Radiation exchange between gray surfaces Shape Factor Concepts– Definition, relations and its properties. Radiation network for radiative exchange. Radiation between parallel plates, concentric Cylinders and concentric spheres & simple enclosures .	6

V Semester
ME2301 - HEAT TRANSFER

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1				

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to heat transfer	5th Edition(2006)	Incropera & Dewitt J. Wiley	John Wiley & Sons
2	Elements of heat transfer	Edition (2007)	M.N.Ozisik	McGraw-Hill
3	Heat transfer	4th Edition(2005)	S.P.Sukhatme	Universities press (India)
4	Heat Transfer	Edition (1998)	Yunus A Cengel	McGraw-Hill,
5	Fundamentals of Heat & Mass transfer	1st Edition (2006)	M. Thirumaleshwar	Pearson
6				

V Semester

ME2302 - LAB : HEAT TRANSFER

Objective	Course Outcome
The student should be able to 5) The contents of syllabus intend to understand basic principles and physical phenomenon of Thermal Energy transfer and to understand heat transfer applications and formulate the problem. 6) To apply experimental tools for analysis of heat transfer applications in engineering. 7) To receive results from experimental and the mathematical tools and interpret the results to provide solutions for improvement. 8) In all to generate interest in learning to develop intuitive understanding in Heat Transfer.**[a,e,k,l,m]**	**On completion of this course, the student will be able to** 5) Analyze and solve the problems of unidirectional steady state heat conduction systems. 6) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient. 7) Design & analyze the heat exchangers with LMTD & ϵ-NTU methods 8) Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.

List of Practical

A set of 9 Experiments from following list to be performed.

List of Practical: Minimum eight experiments from the following:

1D steady state Conduction:

1) Determination of **thermal conductivity of metal bar**.
2) Determination of **thermal conductivity of insulating material** in the powder form (Lagged Pipe).
3) Determination of thermal conductance of a **composite wall**.
4) Heat Transfer through **FINs**.

Steady State convection:

5) Determination of **forced convection heat transfer coefficient** for fluid flow through a closed conduit.
6) Determination of **natural convection heat transfer coefficient** for a vertical surface.

Heat Exchanger:

7) Determination of **effectiveness and overall heat transfer coefficient** for parallel flow and counter flow concentric tube heat exchangers.

Steady State Radiation

8) Determination of **emissivity** of non black surfaces.
9) Determination of **Stefan-Boltzmann constant.**

Study:

1) Study of different methods of temperature measurements with special emphasis on thermocouples.
2) Study of **heat pipes**
3) Study of **pool boiling phenomenon** (Nukiyama Curve).
4) Study of **condensation heat transfer** in film wise & drop wise modes.

V Semester

ME2303 - DYNAMICS OF MACHINERY

Objective	Course Outcome
To develop the concept of rigid body motion and impart knowledge of rigid body dynamics. To enables the students to analyze dynamic forces in mechanism. To introduce the concept of unbalanced forces need for balancing of various machines and the different ways to achieve balancing. To impart elementary knowledge of vibrations, its effect on machines .To prepares students for calculations of important parameters and vibration isolation	**On completion of this course, the student will be able to** 1) Differentiate static and dynamic forces on different machines and mechanisms. 2) Analyze the unbalanced in rotating & reciprocating machines and corrections required to balance the same. 3) Identify the vibrations in different machines. 4) Evaluate and justify vibrations

Unit No.	Contents	Max. Hrs.
1	**Introduction:** D'Alembert principle, Dynamic force analysis of simple mechanism **Gyroscope:** simple precession and gyroscopic couple, gyroscopic effect on airplane, ship, vehicles and grinding mills.	8
2	Governors **– Classification, Watt, Portal, Proell, Hartnell governors etc,** **Fly wheel:** Turning moment Vs crank angle diagram for single- cylinder and multiple-cylinder engines, punching machines etc. Flywheel selection.	7
3	**Balancing in rotating mechanism:** Static & Dynamic balancing in rotating masses, balancing of multiple masses rotating in same plane, Balancing of several masses rotating in different planes, Dynamic balancing machine.	7
4	Balancing of reciprocating masses**: Primary and secondary unbalanced forces of reciprocating masses. Partial balancing of unbalanced primary forces in a reciprocating engine.** Balancing of primary and secondary force and couples in multiple inline engine, Balancing of radial engines (Direct and reverse crank method)	8
5	**Vibration:** Derivation of equation of motion for vibratory system. Free vibration of single-degree-of-freedom system with and without damping. Logarithmic decrement and damping estimation. Forced vibration of single-degree-of-freedom and vibration isolation, whirling of shaft and critical speed of rotors.	8
6	**Torsional vibration:** Lagranges equations and introduction to multi degree freedom systems. Equation of motion for two-degree-of-freedom system. Natural frequencies and mode shapes vibration absorber. Torsional oscillation of two-disc and three disc rotors	7

V Semester
ME2303 - DYNAMICS OF MACHINERY

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Theory of Machines and Mechanism	4 Edition (2009)	Shigley	Oxford University
2	Theory of Machines and Mechanism	2 Edition (1999	Ghosh & Mallik	Affiliated East-West
3	Theory of Mechanism	2 Edition (2005)	Rattan S. S	Tata McGraw-Hill
4	Mechanism and Machine Theory	3rd edition 2004	Rao & Dukipatti	Wiley & Sons
5	Theory of Vibrations	2nd edition 1995	Thomson W T	Prentice Hall of India

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Theory of Machine	3rd Edition (2009)	Thomas Bevan	Pearson Education
2	Theory of Machines	4th Edition (2006)	Sandor & Erdman	Prentice Hall
3	Mechanical vibrations	3rd Edition (2009)	Grover M.P	prentice hall of india
4	Theory of Machine	3rd Edition (2009)	Thomas Bevan	Pearson Education
5	Theory of Vibrations	2nd edition 1995	Thomson W T	Prentice Hall of India

V Semester

ME2304 – LAB : DYNAMICS OF MACHINERY

Objective	Course Outcome
To develop the concept of rigid body motion and impart knowledge of rigid body dynamics. To enables the students to analyze dynamic forces in mechanism. To introduce the concept of unbalanced forces need for balancing of various machines and the different ways to achieve balancing. To impart elementary knowledge of vibrations, its effect on machines .To prepares students for calculations of important parameters and vibration isolation	**On completion of this course, the student will be able to** 1) Differentiate static and dynamic forces on different machines and mechanisms. 2) Analyze the unbalanced in rotating & reciprocating machines and corrections required to balance the same. 3) Identify the vibrations in different machines. 4) Evaluate and justify vibrations

List of Practical
A set of 8 Experiments from following list to be performed.

1. Study of static and dynamic force analysis
2. Determination of Gyroscopic couple through motorized Gyroscope
3. Experiments on Governors - Pronell Governor, Hartnell Governor
4. Determination of Balancing of rotating mass, statically and dynamically.
5. Determination of natural frequency of longitudinal vibration
6. Determination of natural frequency of transverse vibration of beam.
7. Determination of natural frequency of simply supported beam using dunkerlays method.
8. Determination of natural frequency of torsional vibration of single rotor.
9. Determination of natural frequency of torsional vibration of double rotor.
10. Determination of whirling speed of shaft.

V Semester

ME2305 - PRODUCTION MANAGEMENT

Objective	Course Outcome
The course aims to develop an insight into working of production systems, their evaluation analysis and control. The overall objective is to learn to plan, design, execute or operate, control and measure the efficiency/ effectiveness of production systems.	Students will have i) Ability to estimate and evaluate manage production system using work study. ii) Ability to design and evaluate plant layouts. iii) Ability to predict and evaluate future demand using forecasting. iv) Ability to estimate production costing and apply by judging production planning and control.

Unit No.	Contents	Max. Hrs.
1	Work Study: Productivity, factors affecting productivity. Measurement of productivity. Work study and methods study: Definitions, objectives, steps in method study, Process charts, string diagram, motion study, micro motion study, SIMO Chart	7
2	Work measurement: Objectives, definition, stop watch study, work sampling, PMTs, MTM & Work factor method Value analysis and value Engineering:, Introduction, steps involved in value analysis. Applications in Manufacturing.	8
3	Plant Layout: Types of Plant Layout, Layout Functions and problems, Organization, Automated material handling, Concepts of AGVs, AS/RS and other automated devices. Design of integrated plant layout for product handling system.	8
4	Forecasting: Need for forecasting, classification of forecasting methods, like judgmental technique, time series analysis, least square method, moving average method, exponential smoothing method.	7
5	Production planning and control: Definition, objectives of PPC, functions of PPC, types of production, Inventory control, EOQ, Techniques in inventory control and associated problems.	7
6	**Process analysis and Cost Estimation:** Steps involved in manual production planning, Selection of process, analysis. Aims of Cost Estimation, Difference between cost and Estimation, Elements of cost: material, Product cost, Analysis of overhead expenses, Product cost estimation.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Work study	4th Edition (1992)	George Kanawaty	ILO
2	Motion and Time study	1st Edition (1980)	Barnes	Wiley
3	Ergonomics	1st Edition (1985)	Murell	Chapman & Hall
4	Production Planning and Control	2nd Edition (2006)	Jain & Agrawal	McGraw-Hill
5	Industrial Engg. And Project management	2nd Edition (2006)	Mart and Telsang	S. Chand
6	Plant layout and Material Handling	1st Edition (1977)	James Apple	Wiley, Technology & Engineering

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chaiperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

ME2331 - OPERATION RESEARCH TECHNIQUES

Objective	Course Outcome
The course aims to develop the engineering - analysis capability for engineering-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.	**On completion of this course, the student will be able to** 1) Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method 2) .To Solve Transportation and Assignment Models and analyze the concept of dynamic programming to Solve problems of discreet and continuous variables. 3) Analyze projects for minimum total cost and smooth level of resources. 4) Evaluation of different replacement policies and its application in operation research and analysis of the application of simulation, inventory control model and waiting line model

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.	3				3	2			1				3	
CO	To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.	3				2	3			3				3	
CO	Analyze projects for minimum total cost and smooth level of resources.	3			2	2	2				2	3		3	
CO	Evaluation of different replacement policies and its application in operation research and analyse of the application of simulation, inventory control model and waiting line mode.	3				2	2	1	1			2	3	3	

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chaiperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

ME2331 - OPERATION RESEARCH TECHNIQUES

Unit No.	Contents	Max. Hrs.
1	Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR. Linear programming solutions (LPP) by graphical methods and simplex method. Sensitivity analysis. **(CO-1)**	7
2	Assignment Model and Transportation Model. **(C0- 2)**	7
3	Dynamic programming - characteristics, approach and its formulations. Application of Dynamic programming in Employment smoothening problem, Resource allocation, Inventory control & Linear programming. (CO- 2)	6
4	Project Management: Network Scheduling by CPM & PERT, Cost considerations in PERT and CPM. (CO- 3)	7
5	Replacement Models: Replacement of Models that deteriorate with time,Concept of equivalence , Interest Rate and Present worth. Replacement of items that fails suddenly considering Individual and Group replacement policy. (CO- 4)	4
6	Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), Simulations, Monte- Carlo Simulation. Inventory Control with Deterministic models. (CO- 4)	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Operation Research: Computer Oriented Algorithmic approach	2007	Billy E.Gillet	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2	Operations Research	3rd edition 2008	Prem Kumar Gupta & D.S. Hira	S. Chand& Co.
3	Operations Research: Theory and Applications	2nd edition 2002	J.K. Sharma	Mac Millan
4	Introductory Operations Research	2006	S.C. Sharma	Discovery Publishing House
5	Optimization Theory and Application	2nd edition 2010	S.S. Rao	Halsted Press
6	Operations Research - An Introduction	9th Edition 2010	Hamdy A. Taha	Prentice Hall of India Pvt. Ltd., New Delhi.

V Semester

ME2332 - AUTOMOBILE ENGINEERING

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	1) Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle. 2) Student will be able to describe various power transmission systems from clutch to wheel in vehicle. 3) Student will be able to evaluate and describe control systems like steering and brakes in vehicle. 4) Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.	3	2												3
CO2	Student will be able to describe_various power transmission systems from clutch to wheel in vehicle.	3	2												3
CO3	Student will be able to evaluate and describe control systems like steering and brakes in vehicle.	3	2												3
CO4	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.	3			2					2					3

V Semester

ME2332 - AUTOMOBILE ENGINEERING

Unit No.	Contents	Max. Hrs.
1	• Introduction, Automobile history and development and classification. Vehicles layout. • Engine Classification, construction and working 2 stroke and 4-stroke cycle. • Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic) • Engine cooling and lubrication systems. [CO-1]	7
2	Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch. Gear box: Necessity of gear box with gear theory, working principle, Classification: Sliding mesh, constant mesh, synchromesh, and Transfer case gear box, Gear Selector mechanism, Defects and remedies in Gear box. Working of CVT (Continuous variable transmission) [CO-2]	6
3	• Transmission system: Propeller shaft, Universal joint, Hotchkiss drive, torque tube drive. • Differential - Need and working principle and Differential lock. • Rear Axles and Front Axles • Wheel and Tyres: Classification, various constituents of tyres with cross section, specification, factors affecting tyre performance [CO-2]	7
4	• Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types. • Brakes - Need, types: Mechanical, hydraulic (Master and wheel cylinder), Air brakes. Drum and Disc brakes, Comparison • Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber. [CO-3]	6
5	• Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries. • Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator , wiper.(only basic) • Automobile air-conditioning, • Panel board instruments. [CO-4]	6
6	• Resistance to vehicle motion: Air, Road and gradient resistance and power calculation. • Advances in automobiles such as ABS, Power Steering. • Safety aspect in Automobile. • Overall Vehicle specifications • Servicing, Overhauling and Engine tune up. [CO-4]	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Automotive Technology		H.M.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automotive Mechanics		Joseph Heitner	
4	Motor Vehicle Technology		J.A. Dolan	
5	Automotive Engines		W.H. Crouse	

V Semester

ME2333- PLASTIC ENGINEERING

Objective	Course Outcome
To Familiarize students with : 1) Various Plastic materials, their properties and Applications. 2) The various processing techniques of material, testing and applications of fibre reinforced plastics. 3) Learn the basic of machining and joining of plastics by various adhesions and welding techniques.	**Students will be able to :** 1) Students will be able to identify the plastic materials for some specified applications based 'on its property. 2) Students will be able to investigate suitable plastic Processing technique. 3) Students will be able to evaluate the suitable machining and joining **of plastic materials.**

Unit No.	Contents	Max. Hrs.
1	Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages.	7
2	Extrusion - Blow Molding – Thermo Forming – Rotomolding	8
3	Compression and Transfer Molding - study of compression molds	7
4	Injection Molding- study of injection molding machines and molds.	7
5	General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics -Mechanical Fasteners - Thermal bonding - Press Fitting. Testing of plastic	8
6	Fibers - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics. Open Mould Processes, Bag Molding, Compression Molding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Molding - Application of PMC's.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Plastic Engineering		Patten	
2	Plastic Processing		R. J. Crawfortd	
3	Plastics Extrusion technology	1988	F.Hensen,	
4	Injection Moulding Machines	1983	F.ohannaber	Hanser Publishers,
5	Polymer extrusion	1990	C.Rauwendaal,	Hanser Publishers,
6	Blow Moulding Handbook	1989	D.V.Rosatao,	Hanser Publishers,
7	Modern Plastics Moulding		E.B Seamour,	John Wiley.
8	Manufacturing Engineering & Technology	6th Edition (2013)	S Kalpakjian & SR Schmid	Pearson Education Canada
9	Machining of Plastics	1981	Akira Kobyashi,	Mc-Graw Hill.

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chaiperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

OE-I : ME2334- CONTROL SYSTEMS ENGINEERING

Objective	Course Outcome
• To develop an ability to define transfer function. • To analyze the performance of control system in time domain and frequency domain	**Students will be able to :** 1) Describe the mathematical representation of various control system components and determine the transfer function of mechanical, electrical, thermal and fluid system. 2) Analyse the construction and working of various control system components and electrical motors. 3) Evaluate the performance of control system using time response analysis and stability analysis. 4) Analyze the performance of control system on the basis of frequency response and design suitable compensation for the control system

Unit No.	Contents	Max. Hrs.
1	Introduction, System concept Open and Closed loop control systems. Transfer function, Mathematical Modeling of Physical System and system representation through Block Diagram. Transfer function through Block Diagram Simplification. Signal Flow Graph, Masons Gain Formula Block diagrams of various control systems.	7
2	**Representation of Control components:** Mechanical and Electrical components; Analogous systems; Thermal and Fluid systems.	7
3	**Electrical systems: -** ac/dc servomotors; field controlled and armature controlled servomotors; positional servomechanisms; stepper motors. **Hydraulic systems: -** Hydraulic pumps (gear; vane; and reciprocating piston) Cylinders, Direction control valves (2, 3, 4 way) Flow control valve; Relief valve Hydraulic servomotor.	8
4	Transient and steady state response of first and second order systems Concept of stability; relative stability; Routh stability criteria.	8
5	Frequency response and its characteristics; Bode plots; Nyquist plots. Gain margin and phase margin. Identification of system transfer function.	8
6	Basic control actions; Proportional Integral and Derivative control actions and their effect on system performance. Root locus technique. Introduction to control system design log load compensation Feed Back Compensation and Pole -Zero placements.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Modern Control Engineering	3rd Edition (2009	Ogata	Prentice Hall
2	Control system Engineering	4th Edition (2007)	Nise	John Wiley & Sons
3	Control system	4th Edition (2009)	Nagrath & Gopal	New Age International
4	Modern Control System	12th Edition (2009)	Dorf	Pearson

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chaiperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

OE-II : ME2341- TOTAL QUALITY MANAGEMENT

Objective	Course Outcome
• The course aims to build an overall capability to understand Quality and its relevance in today's dynamic market. • Various Quality Improvement tools and technique shall be introduced and practiced so as to develop skills and knowledge to function as a good quality professional in the Engineering Profession.	**Students will be able to :** 1) Develop an understanding on quality management philosophies and frameworks. 2) Develop in-depth knowledge on various tools and techniques of quality management. 3) To Evaluate the applications of quality tools and techniques in both manufacturing and service industry 4) Ability to use quality management methods analyzing and solving problems of organization.

Unit No.	Contents	Max. Hrs.
1	Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering	7
2	Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards.	7
3	Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA - YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design	8
4	Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes	8
5	Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling,]	8
6	Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Total Quality Management for Engineers	1991	Mohamed Zairi	Woodhead Publishing Limited 1991
2	Production and Operations mangament - Total Quality and Responsiveness	1995	Harvid Noori and Russel	McGraw-Hill Inc, 1995
3	Managing for Total Quality	1998	N.Logothetis	Prentice Hall of India Pvt .Ltd,1998
4	The Essence of Total Quality Management	1995	John Bank	Prentice Hall of India Pvt.Ltd., 1995.
5	Introduction to Statistical Quality Control	1991	Douglus C. Montgomery	2nd Edition, John Wiley and Sons, 1991.
6	Statistical Quality Control	1984	Grant E.L and Leavensworth	McGraw-Hill, 1984.

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chaiperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

OE-II : ME2342- RELIABILITY ENGINEERING

Objective	Course Outcome
1) To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution. 2) Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.	1) Student will be able to use reliability modeling as a tool for evaluating system performance. 2) Student will be able to analyze the failure of a machine, determine the failure rate of systems or components. 3) Student will able to understand importance of the maintenance of engineering systems and factors affecting maintainability. 4) Student will be able to prepare the production & maintenance schedule of particular engineering system.

Unit No.	Contents	Max. Hrs.
1	**Fundamental concepts:-** Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability,	7
2	**Probability theory:-** Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications.	7
3	**System reliability and modeling:** Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation.	8
4	Maintainability and Availability: Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation.	8
5	System reliability Analysis: Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing.	8
6	Strength based reliability: Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads.	7

V Semester

OE-II : ME2342- RELIABILITY ENGINEERING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Concepts of Reliability Engg	1985	L.S. Srinath	Affiliated East-Wast Press (P) Ltd
2	Reliability Engineering	1983	A.K. Govil	Tata McGraw-Hill Publishing Co. Ltd
3	Reliability Engineering	1984	E. Balagurusmy	Tata McGraw-Hill Publishing Co. Ltd
4	Engineering Reliability	1980	B.S. Dhillion, C. Singh	John Wiley & Sons
5	Probabilistic, Reliability	1968	M.L. Shooman	McGraw-Hill Book Co.,
6	Practical Reliability Engg	1985	Patric D.T.O'connor	Heyden and sons ltd.
7	Reliability in Engineering Design	1977	K.C. Kapur, L.R. Lamberson	John-Wiley and sons.
8	Reliability Engineering, Theory and Practice	3rd Edition, 1999	A.Birolini	Springer,

V Semester

OE-II : ME2343- POWER GENERATION ENGINEERING

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	1) Student will be able to describe basics of power generations systems. 2) Student will be able to analyze various conventional & non-conventional power plants. 3) Student will be able to analyze and examine combined operations of different power plants. 4) Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Student will be able to describe basics of power generations systems.	3	2												3
CO2	Student will be able to analyze various conventional & non-conventional power plants.	3	2												3
CO3	Student will be able to analyze and examine combined operations of different power plants.	3	2												3
CO4	Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant	3			2					2					3

Unit No.	Contents	Max. Hrs.
1	**THERMAL POWER PLANT- I** Introduction to thermal power plants and power plant layouts. Site selection. Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling. • Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers **[CO-1]**	7
2	**THERMAL POWER PLANT- II** Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout. Comparison with other power plant. (visit to nearby power plant shall be arrange for the students) **[CO-2]**	8

3	**HYDROELECTRIC POWER PLANT.** Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve. Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection.Governing. • Comparison with other power plant. [CO-2]	7
4	**POWER PLANT ECONOMICS** Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load. • Economic Analysis: - Cost of electric energy [CO-3]	8
5	**NUCLEAR POWER PLANT** Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India. Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor. Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal. • Comparison with other power plant. [CO-4]	8
6	**COMBINED OPERATION OF DIFFERENT POWER PLANTS** Combined operation: - Need division, combination of different plant & their coordination, advantages. **NON CONVENTIONAL POWER GENERATION SYSTEMS** Introduction to Non Conventional power Generation Systems • Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant. [CO-4]	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Power Plant Engineering	2002	Domkundwar.	Dhanpat Rai & Co.
2	Power Plant Engineering	2007	Vopal & Slortzki	
3	Power Plant Engineering	2010	P K Nag	

V Semester

OE-II : ME2344- PROJECT EVALUATION & MANAGEMENT

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	**The students will be able** 1) To apply the concepts of monitoring and evaluation, appraise 2) To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 3) To perform problem analysis, determine relevant indicators and data necessary for evaluation, 4) Implement a monitoring and evaluation process, establish baselines and targets..

Unit No.	Contents	Max. Hrs.
1	**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty	7
2	**Technical feasibility**: Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation:	7
3	**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.	9
4	**Project Planning and Control:** Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating	7
5	**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital	7
6	Initial review, performance analysis, ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Projects	7th Edition 2007	Prasanna chandra	Tata mc graw Hill publishing company Ltd.
2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	5th edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	6th Edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	4th Edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	8th Edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

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V Semester

OE-II : ME2343- POWER GENERATION ENGINEERING

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	**The students will be able** 5) To apply the concepts of monitoring and evaluation, appraise 6) To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 7) To perform problem analysis, determine relevant indicators and data necessary for evaluation, 8) Implement a monitoring and evaluation process, establish baselines and targets..

Unit No.	Contents	Max. Hrs.
1	**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty	7
2	**Technical feasibility**: Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation:	7
3	**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.	9
4	**Project Planning and Control:** Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating	7
5	**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital	7
6	Initial review, performance analysis, ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects.	8

Text Books

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2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	5th edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	6th Edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	4th Edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	8th Edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

6th Semester

Mechanical Engineering

28 June 2019

VI Semester

GE2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

UNIT-1: Introduction to Economics and Consumers' Behaviors:

[illegible] **(8 Hours)**

UNIT-2: Production and Costs

[illegible] **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price

[illegible] **(7 Hours)**

UNIT-4: National income accounting:

[illegible] **(5 Hours)**

UNIT-5: Money, Banking and Public Finance

[illegible] **(7 Hours)**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
GE2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

(5 Hours)

Text Books:

Reference Books:

VI Semester
ME2351 - Fluid Machines

Objective	Course Outcome
[illegible] **[a,e,k]**	**CO:1** [illegible]
	CO:2 [illegible]
	CO:3 [illegible]
	CO:4 [illegible]

Unit No.	Contents	Max. Hrs.
Unit 1	[illegible] **[CO:1]**	**[8 hrs]**
Unit 2	[illegible] **CO:1]** [illegible]	**[7 hrs]**
Unit 3	[illegible] **CO:1]**	**[8 hrs]**
Unit 4	[illegible] **CO:2]** [illegible]	**[7 hrs]**
Unit 5	[illegible] **CO:3]**	**[7 hrs]**
Unit 6	[illegible] **CO:4]**	**[8 hrs]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ME2351 - Fluid Machines

Reference books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	3rd [illegible]	[illegible]	M[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible] M[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible] M[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

VI Semester
ME2352 - Fluid Machines Lab

List of Practical

[illegible]

[illegible]

[illegible] **Trial on Reciprocating Pump**

3[illegible] **Trial on Centrifugal Pump**

[illegible] **[CO:1]**

5) [illegible] **[CO:1]**

6) Trial on Pelton wheel [CO:2]

7) Trial on Francis Turbine

8) Trial on Kaplan Turbine

9) [illegible] **[CO:2]**

[illegible] **[CO:2]**

11) [illegible] **[CO:2]**

12) [illegible] **[CO:3]**

[illegible] **[CO:4]**

1. Mapping:

M[illegible] **COURSE OUTCOMES** [illegible] **CO's** [illegible] M[illegible] **PROGRAM OUTCOMES (PO's)**

	PO's												
CO's	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***
i	*3*		*3*		*3*							*3*	*3*
ii	*3*		*3*		*3*							*3*	*3*
iii	*3*		*3*		*3*							*3*	*3*
iv	*3*		*3*		*3*							*3*	*3*
Avg.	**3**		**3**		**3**							**3**	**3**

Correlation levels 1,2 or 3 as defined below:

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
ME2353 –Computer Aided Design LAB

Objectives:	Course outcomes:
[illegible]	[illegible]

List of Practical

[illegible]

[illegible]

VI Semester

ME2354 – Design of Mechanical Drives

Objectives	Course Outcome:
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
Unit 1	**Flat belt drive:** [illegible] **V belt drive:** [illegible]	[8 hrs]
Unit 2	**Chain Drive:** [illegible] **Rope drive:** [illegible]	[7 hrs]
Unit 3	**Gear drive:** [illegible]	[8 hrs]
Unit 4	**Worm gear drive:** [illegible] **Bevel gear drive:** [illegible]	[8 hrs]
Unit 5	**Coupling: Types of shaft coupling, design of flange coupling, flexible bush coupling.** [illegible]	[7 hrs]
Unit 6	**Bearing:** [illegible]	[7 hrs]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
ME2354 –Design of Mechanical Drives

Text books:				
	M		M	
	M	3rd		M
3	M			M
	M	d	d	
	M			

Reference books:				
	M	3rd	M	M
	M	d		
3	M		M	

VI Semester

ME2361 – PE-I : Finite Element Method

Objective	Course Outcome
[illegible]	[illegible]
	[illegible]
	[illegible]
	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
ME2361 – PE-I : Finite Element Method

Text books:

S.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CO	Statement	Mapped PO												[illegible]	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	[illegible]	3	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]
CO2	[illegible]	3	3	3	[illegible]	3	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	3
CO3	[illegible]	3	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	3
CO4	[illegible]	3	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ME2362 – PE-I : Lab: Finite Element Method

Objectives:	Course outcomes:
• [illegible] • [illegible] [illegible] 3 [illegible]	*After completion of the course students would be able to* 1. [illegible] 2. [illegible] 3. [illegible]

List of Practical:-

1. [illegible] **[PO-1,3,5,6,7,8,9,10,11,PSO-1,2]**
2. [illegible] **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
3. [illegible] **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
4. [illegible] **[PO-1,2,3,5,6,7,8,9,10,11,PSO-1,2]**
5. [illegible] **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
6. [illegible] **[PO-1,3,5,6,7,8,9,10,11,PSO-1,2]**
7. [illegible] **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
8. [illegible] **[PO-1,2,3,5,6,7,8,9,10,11,2,PSO-1,2]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
ME2363 – PE-I : Industrial Fluid Power

•	**investigate** **apply** **analysis**
•	**identify** **analyze** **justify**
	3 **design** **examine** **compose** **interpret** **using**
	examine

Unit No.	Contents	Max. Hrs.
	Fluid power systems: **Transmission of power at static & dynamic states** **Types of Hydraulic fluid,** **Filters** **Hydraulic Reservoirs and Power Pack**	
	Pumps: **Accumulators & Intensifiers**	

VI Semester
ME2363 – PE-I: Industrial Fluid Power

[illegible]	**Contents**	M[illegible]
3	**Unit 3** **[5 hrs]** **Control Of Fluid Power:** [illegible] **methods of actuation of valves.** **Pressure Control Valves** [illegible] **Flow Control Valves:** [illegible] **Direction Control Valves:** [illegible]	[illegible]
[illegible]	**Actuators:** [illegible] **Hydraulic motors:** [illegible] [illegible] **Hydraulic Cylinders:** [illegible]	[illegible]
[illegible]	**Design and analysis of Hydraulic Circuit such as:** [illegible] [illegible] 3 [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] 3 [illegible] [illegible] **Safety precautions, maintenance and trouble shooting of Hydraulic Circuits.**	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ME2363 – PE-I: Industrial Fluid Power

[illegible]	Contents	M[illegible]
[illegible]	**Pneumatics:** [illegible] **Introduction** [illegible] **Air preparation units** [illegible] **Actuators** [illegible] **Pressure Regulating Valves, Directional Control Valves, Flow Control Valves** [illegible] **Signal Processing Elements:** [illegible] **Pneumatic circuits** [illegible]	[illegible]

Books recommended :

[illegible] **Ilango** [illegible]

[illegible] **Esposito** [illegible]

3 [illegible] **Majumdar** [illegible]

[illegible] **Fitch** [illegible]

[illegible] **Majumdar** [illegible]

[illegible] **Srinivasan** [illegible]

[illegible] **Jagadeesha** [illegible]

Reference Books:

[illegible] **Pippenger** [illegible]

3 [illegible]

[illegible] **Anderson** [illegible]

[illegible] **Donaldson** [illegible]

[illegible] **Shanmuga** [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
ME2363 – PE-I: Industrial Fluid Power

CO-PO Weightage details 2020 **Industrial Fluid Power (Lab)** **CODE:6ME03**

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO1	[illegible]	3	3	2	1	3	1	2	1	1	1	2	2	3	3
CO2	[illegible]	3	3	3	1	3	1	1	1	1	1	2	2	3	3
CO3	[illegible]	3	3	3	1	2	1	1	1	1	1	2	2	3	3
CO4	[illegible]	3	2	3	1	3	1	2	1	1	1	2	2	3	3

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ME2364 – PE-I : Lab: Industrial Fluid Power

• [illegible] • [illegible]	[illegible] **investigate** [illegible] **apply** [illegible] **analysis** [illegible] [illegible] **identify** [illegible] **analyze** [illegible] **justify** [illegible] 3 [illegible] **design** [illegible] **examine** [illegible] **compose** [illegible] **interpret** [illegible] **using** [illegible] [illegible] **examine** [illegible]

List of Experiments: M[illegible]

A. Experiments on Hydraulics Circuits:

[illegible]

3 [illegible]

B. Experiments on Pneumatic Circuits:

[illegible] 3 [illegible]

Other practical work:

3 [illegible] **report** [illegible] **manufacturer's catalogue** [illegible]

[illegible] **Industrial visit** [illegible]

[illegible] **compressed air generation and distribution** [illegible]

[illegible] **simple hydraulic systems** [illegible]

[illegible] **Other circuits possible on the trainer kit, relevant to the syllabus** [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
ME2364 – PE-I : Lab: Industrial Fluid Power

C. [illegible]

Major Equipment:

[illegible]

[illegible]

3 [illegible]

List of Open Source Software/learning website:

[illegible]

ACTIVE LEARNING ASSIGNMENTS:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ME2365 – PE-I : I.C. Engines

Objectives:	Course Outcome
[illegible]	*On completion of this course, the student will be able :* [illegible] [illegible] 3 [illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3 [illegible]	[illegible]	[illegible]
[illegible]	[illegible] θ diagram. Factors affecting various [illegible]	[illegible]
[illegible]	[illegible] θ diagram, Factors affecting [illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
ME2365 – PE-I : I.C.Engines

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
ME2366 – PE-I : I.C. Engines LAB

List of Practical

[illegible]

VI Semester
ME2367 – PE-I: Refrigeration & Cryogenic

Objectives	Course Outcome
• [illegible] • [illegible] • [illegible] • [illegible]	[illegible]
	[illegible]
	3 [illegible]
	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**Air refrigeration systems** [illegible] **[CO3]**	[illegible]
[illegible]	**Vapor Compression Refrigeration system** [illegible] **[CO:1]**	[illegible]
3	**Multistage Refrigeration systems** [illegible] **[CO:I]**	[illegible]
[illegible]	**Components of Vapour compression system** [illegible] **Refrigerants** [illegible] **[CO:1]**	[illegible]
[illegible]	**Other refrigeration systems** [illegible] 3 [illegible] **[CO:2]**	[illegible]
[illegible]	**Cryogenics** [illegible] **[CO:4]**	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ME2367 – PE-I: Refrigeration & Cryogenic

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	[illegible]	3		3		3							3	3	3
CO2	[illegible]	3		3		3							3	3	3
CO3	[illegible]	3		3		3							3	3	3
CO4	[illegible]	3		3		3							3	3	3

Recommended Books

[illegible]

VI Semester

ME2368 – PE-I: Refrigeration & Cryogenic Lab

Objectives	Course outcome
[illegible]	[illegible]

List of experiment

[illegible]

VI Semester

ME2368 – PE-I: Refrigeration & Cryogenic Lab

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	[illegible]	3		3		3			3				3	3	3
CO2	[illegible]	3		3		3			3				3	3	3
CO3	[illegible]	3		3		3			3				3	3	3
CO4	[illegible]	3		3		3			3				3	3	3

VI Semester

ME2369 – PE-I: Computer Integrated Manufacturing

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

VI Semester
ME2369 – PE-I: Computer Integrated Manufacturing

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ME2370 – PE-I: Computer Integrated Manufacturing Laboratory

Objective	Course Outcome
[illegible]	[illegible]

List of Practical

[illegible]

VI Semester
ME2371 – PE-I: Mechatronics

Objective	Course Outcome
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
ME2371 – PE-I: Mechatronics

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ME2372 – PE-I: Mechatronics Laboratory

Objective	Course Outcome
[illegible]	[illegible]

List of Practical (Minimum 10 Experiments)

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ME2373 – PE-I : Thermal Engineering Systems

Objective	Course Outcome
	CO:1 [illegible] **PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO-1,2** **CO:2** [illegible] **PO: 1,2,3,4,5,7,8,9,10,11,12 PSO-1,2** **CO:3** [illegible] **PO: 1,2,3,4,5,7,8,9,10,11,12 PSO-1,2** **CO:4** [illegible] **PO: 1,2,3,4,5,7,8,9,10,11,12 PSO-1,2**

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3[illegible]	***Wind Energy*: -** [illegible] ***Biogas: -*** [illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ME2373 – PE-I : Thermal Engineering Systems

	[illegible]	
	[illegible] **CO:4]**	

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3	2	3	3	2	2	3	3	3	3	3	3	3
CO2		3	3	1	2	3	1	1	2	2	2	1	2	3	3
CO3		3	3	1	2	3	1	1	2	2	2	1	2	3	3
CO4		3	3	1	2	3	1	1	2	2	2	1	2	3	3

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]

REFERENCE BOOKS:

	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]

				[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ME2374 – PE-I : Thermal Engineering Systems Laboratory

List of Practical

[illegible]

[illegible] **[CO:1]**
[illegible] **[CO:1]**
3[illegible] **[CO:1]**
[illegible] **[CO:1]**
[illegible] **[CO:1]**
[illegible] **[CO:1]**
[illegible] **[CO:1]**
[illegible] **[CO:1]**
[illegible] **[CO:1]**
[illegible] **[CO:2]**
[illegible] **[CO:2]**
[illegible] **[CO:2]**
[illegible] **[CO:2]**
3[illegible] **[CO:3]**
[illegible] **[CO:4]**
[illegible] **[CO:3]**
[illegible] **[CO:4]**

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3	2	3	3	2	2	3	3	3	3	3	3	3
CO2		3	3	1	2	3	1	1	2	2	2	1	2	3	3
CO3		3	3	1	2	3	1	1	2	2	2	1	2	3	3
CO4		3	3	1	2	3	1	1	2	2	2	1	2	3	3

VI Semester

OE-III : ME2381 – Operation Research Techniques

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible] **(CO-1)**	[illegible]
[illegible]	[illegible] **(CO-2)**	[illegible]
3[illegible]	[illegible]	[illegible]
[illegible]	[illegible] **(CO- 3)**	[illegible]
[illegible]	[illegible] **(CO- 4)**	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

OE-III : ME2381 – Operation Research Techniques

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	[illegible]	3				3	2			1				3	
CO	[illegible]	3				2	3			3				3	
CO	[illegible]	3			2	2	2				2	3		3	
CO	[illegible]	3				2	2	1	1			2	3	3	

Text books:

Sr. No	Title of the book	Edition(Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

OE-III : ME2382 – Automobile Engineering

Objective	Course Outcome
[illegible]	[illegible]
	[illegible]
	3 [illegible]
	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	• [illegible] • [illegible] • [illegible] • [illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3	• [illegible] • [illegible] • [illegible] • [illegible]	[illegible]
[illegible]	• [illegible] • [illegible] • [illegible]	[illegible]
[illegible]	• [illegible] • [illegible] • [illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

OE-III : ME2382 – Automobile Engineering

Unit No.	Contents	Max. Hrs.
[illegible]	• [illegible] • [illegible] • [illegible] • [illegible] • [illegible]	[illegible]

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	[illegible]	3	2												3
CO	[illegible]	3	2												3
CO	[illegible]	3	2												3
CO	[illegible]	3			2					2					3

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1	Automotive Technology		H.M.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automotive Mechanics		Joseph Heitner	
4	Motor Vehicle Technology		J.A. Dolan	
5	Automotive Engines		W.H. Crouse	

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

OE-III : ME2383 – Control Systems Engineering

Course Objectives	Course Outcome
• [illegible] • [illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Text books:

[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

OE-III : ME2384 – Robotics and Subtractive Manufacturing

VI Semester
OE-IV : ME2391 – Total Quality Management

COURSE OBJECTIVES	COURSE OUTCOMES
• [illegible] • [illegible]	[illegible] [illegible] 3 [illegible] [illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3 [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

VI Semester
OE-IV : ME2391 – Total Quality Management

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

OE-IV : ME2392 – Reliability Engineering

Objective	Course Outcome
[illegible]	[illegible]
	[illegible]
	[illegible]
	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
OE-IV : ME2392 – Reliability Engineering

Reference books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

OE-IV : ME2393 – Power Generation Engineering

Objective	Course Outcome
[illegible]	[illegible]
	[illegible]
	3 [illegible]
	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**THERMAL POWER PLANT- I** [illegible] • [illegible] **[CO-1]**	[illegible]
[illegible]	**THERMAL POWER PLANT- II** [illegible] [illegible] **[CO-2]**	[illegible]
3 [illegible]	**HYDROELECTRIC POWER PLANT.** [illegible] • [illegible] **[CO-2]**	[illegible]
[illegible]	**POWER PLANT ECONOMICS** [illegible] • [illegible] **[CO-3]**	[illegible]
[illegible]	**NUCLEAR POWER PLANT** [illegible] • [illegible] **[CO-4]**	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

OE-IV : ME2393 – Power Generation Engineering

	Contents	M
	COMBINED OPERATION OF DIFFERENT POWER PLANTS **NON CONVENTIONAL POWER GENERATION SYSTEMS** • **CO-4]**	

CO	Statement	Mapped PO												PS	PS
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1		
CO		3	2												3
CO		3	2												3
CO		3	2												3
CO		3			2					2					3

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1		2002		
2		2007		
3		2010		

VI Semester

OE-IV : ME2394 – Project Evaluation & Management

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**Project Identification** [illegible]	[illegible]
[illegible]	**Technical feasibility** [illegible]	[illegible]
3[illegible]	**Economic feasibility:** [illegible]	[illegible]
[illegible]	**Project Planning and Control:** [illegible]	[illegible]
[illegible]	**Project report:** [illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

OE-IV : ME2394 – Project Evaluation & Management

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
3		3		M

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO		3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO		3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO		3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO		3	3	3	2	3	1	2	1	1	1	2	2	3	3

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

7th & 8th Semester

Mechanical Engineering

28 June 2019

VII Semester

ME2401 - Automation in Production systems

Objective	Course Outcome
[illegible]	[illegible]

Unit-1 **[7 hrs]**

Automation [illegible]

Unit-2 **[8 hrs]**

Numerical Control Production Systems [illegible]

Unit-3 **[8 hrs]**

Industrial Robotics [illegible]

Unit-4 **[7 hrs]**

Automated material handling & storage-Conveyor systems [illegible]

Automated Storage & Retrieval System [illegible]

Unit-5 **[7 hrs]**

Automated inspection & Group technology [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2401 - Automation in Production systems

Unit 6 **[7 hrs]**

Computer aided manufacturing

Computer aided process planning

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
					3		3			3								
							3			3								
							3			3								
							3			3								

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
Reference Books:				
		3		

VII Semester

ME2402 – Lab: Automation in Production systems

Objective	Course Outcome
[illegible]	[illegible]

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	3	[illegible]	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	3	[illegible]	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	3	[illegible]	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Practicals:

[illegible]

[illegible]

3[illegible]

VII Semester

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

ME2402 – Lab: Automation in Production systems

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

11) [illegible]

12) [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2411– PE-II : Tool Design

COURSE OBJECTIVES	Course Outcome
[illegible]	[illegible]

Unit1 **[8 Hrs]**

[illegible] **1,3, 5,6,9,11,12**

Unit2 **[8hrs]**

[illegible] **[1,3,5,6,9,11,12]**

Unit3 **[10hrs]**

[illegible] **[1,3, 5,6,9,11,12]**

Unit4 **[10hrs]**

[illegible] **1,3 5,6,9,11,12**

Unit5 **[7 Hrs]**

[illegible] **1,3 5,6,9,11,12**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Unit6 **[10 Hrs]**

[illegible]

1,3 5,6,9,11,12

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	3	[illegible]	3	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	3	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	3	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	3	[illegible]
			[illegible]	[illegible]	3	[illegible]	3	[illegible]	3	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	3	[illegible]
			[illegible]	[illegible]	3	[illegible]	3	[illegible]	3	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2412– PE-II : Additive manufacturing

[illegible]

UNIT	Hrs.
Unit 1 Introduction to Additive Manufacturing (AM) [illegible]	**[7Hrs]**
Unit 2 Materials science for AM [illegible]	**[7Hrs]**
Unit 3 AM technologies [illegible]	**[12Hrs]**
Unit4 Mathematical Model for AM [illegible]	**[13Hrs]**
Unit5 Process selection, planning, control for AM [illegible]	**[7Hrs]**
UNIT-6 [illegible]	**[8 hrs]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2413– PE-II : Fuel Cell Technology

OBJECTIVES	OUTCOMES
• [illegible] • [illegible] • [illegible]	[illegible] [illegible] [illegible] 3 [illegible] [illegible]

Unit I: Introduction to Fuel Cells

[illegible]

Unit II: Fuel Cell Thermodynamics

[illegible]

Unit III: Fuel Cell Electrochemistry

[illegible]

Unit IV: Fuel Cell Charge Transport and Mass Transport

[illegible]

Unit V: Fuel Cell Characterization

[illegible]

Unit VI: Polymer Electrolyte Membrane Fuel Cell (PEMFC)

[illegible]

Textbooks/Reference Books

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

ME2414– PE-II : Refrigeration and Air Conditioning

Course Objectives	Course Outcome
OBJECTIVES [illegible]	[illegible] 3 [illegible] [illegible]

Unit 1 **[7 Hrs]**

PSYCHROMETRY: [illegible]

HUMAN COMFORT: ***Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.*** *[CO-1]*

Unit 2 **[8 Hrs]**

ADVANCED PSYCHROMETRY: [illegible]

HEAT LOAD CALCULATIONS: ***Data collection for load calculation. Various components of heat load estimate. Methods of cooling load calculation. Demonstration of air conditioning systems to students.*** *[CO-1]*

Unit 3 **[7 Hrs]**

AIR TRANSMISSION & DISTRIBUTION:

[illegible]

Unit 4 **[8 Hrs.]**

REFRIGERATION: [illegible] **[CO-4]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Unit 5 **[8 Hrs]**

MULTISTAGE VAPOUR COMPRESSION REFRIGERATION SYSTEMS:

[illegible]

REFEGERANTS:

[illegible] **[CO-4]**

Unit 6. **[7 Hrs]**

STUDY OF VAPOUR ABSORPTION REFRIGERATION SYSTEM:

[illegible]

OTHER REFRIGERATION TECHNIQUES:

[illegible]

[CO-4]

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REFERENCE BOOKS:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2415– PE-II : Material Handling System

Objective	Course Outcome
[illegible]	[illegible]

Unit1 **[8 Hrs]**

[illegible]

Unit2 **[8 Hrs]**

[illegible]

Unit3 **[7 Hrs]**

[illegible]

Unit 4 **[8 Hrs]**

[illegible]

Unit5 **[8 Hrs]**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Unit6	**[7 Hrs]**
[illegible]	

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2416– PE-II : Reliability Engineering

Objective	Course Outcome
[illegible]	[illegible]

Unit	Contents	Max. Hrs.
[illegible]	[illegible]	7
[illegible]	[illegible]	8
3[illegible]	[illegible]	7
[illegible]	[illegible]	8
[illegible]	[illegible]	7
[illegible]	[illegible]	8

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Reference books:				
S.N.	**Title of the book**		**Author(s)**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
ME2417– PE-II : Advanced Manufacturing Techniques

Objective	Course Outcome
[illegible] **(a,c,k)**	[illegible]

Unit 1 **[8hrs]**

Mechanical Processes [illegible]

Unit 2 **[6 hrs]**

Chemical Processes & Electro-chemical Processes [illegible]

Unit 3 **[9 hrs]**

Thermo-electric Processes [illegible]

Unit 4 **[6hrs]**

High energy rate forming processes [illegible]

Unit 5 **[8 hrs]**

Unconventional welding techniques [illegible]

Unit 6 **[7 hrs]**

Additive Manufacturing [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Reference Books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
3				
4				

VII Semester
ME2418– PE-II : Optimization Techniques

Objective	Course Outcome
[illegible]	[illegible] **I.** [illegible] **II.** [illegible] **III.** [illegible] **IV.** [illegible]

Unit 1:	**[7 hrs]**
[illegible]	
Unit 2:	**[7 hrs]**
[illegible]	
Unit 3: [illegible]	**[7 hrs]**
Unit 4:	**[7 hrs]**
[illegible]	

Unit 6 **[7 hrs]**

Global Optimization

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
	M	Optimization for Decision Making			3				3									
										3			3					
															3			
																3		

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
3				M M

VII Semester
ME2421– PE-III : Vibration

Objective	Course Outcome
[illegible]	[illegible]

Unit 1 **[7 hrs]**

[illegible]

Unit2 **7 hrs]**

[illegible]

Unit3 **[8 hrs]**

[illegible] **degree** [illegible] Holzer"s method for [illegible]

Unit4 **[8 hrs]**

[illegible]

Unit5 **[8 hrs]**

[illegible]

Unit6 **[7 hrs]**

[illegible]

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2422– PE-III : Lab: Vibration

Objective	Course Outcome
[illegible]	[illegible]

List of Practical

[illegible]

VII Semester
ME2423– PE-III : Computer Aided Design & Manufacturing

Objectives:	**Course outcomes:**
[illegible]	*After completion of the course students would be able to* [illegible]

Unit 1 CAD TOOLS **[6 hrs]**

[illegible]

Unit2 Two/Three Dimensional Transformations **[8hrs]**

[illegible]

Unit 3 Wire Frame Modeling **[7 hrs]**

[illegible]

Unit4 Surface Modeling **[8 hrs]**

[illegible]

Unit 5 Solid Modeling & Data Exchange **[8 hrs]**

[illegible] **methods, Evaluation** [illegible]

Unit 6 Manufacturing **[8 hrs]**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Sem	Course code	Course title	C	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
V	ME	COMPUTER AIDED DESIGN	1	Distinguish the various CAD CAM tools and also evaluate criteria for CAD CAM systems	3				3	3	2		2	2	1		1	2
			2	Design 2D and 3D Transformation matrices	3		3		3	3	2		2	1			3	2
			3	Calculate and analyse the parametric equations for wire frame. surface and solid modeling entities	3				3	3	2		1	1			2	1
			4	Evaluate data exchange format, also develop part programme for Lathe & Milling Machine	3		3		3	3	2	1	2	2	1		3	1

Textbooks:

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

VII Semester

ME2424– PE-III : Lab : Computer Aided Design & Manufacturing

Objectives:	Course outcomes:
• [illegible] • [illegible]	*After completion of the course students would be able to* 1. **Study, design and develop the model for mechanical engineering parts.** 2. **Conceptualize & model any machine component** 3. **Build the CAD Model and CAM Model for simple machine elements**

List of Practical:-

1.	[illegible]
2.	[illegible]
3.	[illegible]
4.	[illegible]
5.	3 [illegible]
6.	[illegible]
7.	[illegible]
8.	[illegible]
9.	[illegible]
10.	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2425– PE-III : Vehicle Engineering

Objective		Course Outcome	Unit
[illegible]	(1)	**Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle. (PO-1,PO-2,PO-13)**	**1**
	(2)	**Student will be able to describe_various power transmission systems from clutch to wheel in vehicle. (PO-1,PO-2,PO-13)**	**2,3**
	(3)	**Student will be able to evaluate and describe_control systems like steering and brakes in vehicle. (PO-1,PO-2,PO-13)**	**4**
	(4)	**Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle. (PO-1,PO-2,PO-4,PO-13)**	**5,6**

UNIT-1 **[8 hrs]**

- [illegible]
- [illegible]
- [illegible]
- [illegible]

UNIT-2 **[8 hrs]**

- [illegible]
- [illegible]
- [illegible]

UNIT-3 **[8 hrs]**

- [illegible]
- [illegible]
- [illegible]
- [illegible]

UNIT-4 **[8 hrs]**

- [illegible]
- [illegible]
- [illegible]

UNIT-5 **[8 hrs]**

- [illegible]
- [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

UNIT-6 **[8 hrs]**

- [illegible]
- [illegible]
- [illegible]
- [illegible]

Reference books:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
ME2426– PE-III : Lab. Vehicle Engineering

Objective	Course Outcome	Unit
[illegible]	[illegible]	1
	[illegible]	2,3
	[illegible]	4
	[illegible]	5,6

List of Practical [illegible]

[illegible]

VII Semester

ME2427– PE-III : Solar Energy & Utilization

Objective	Course Outcome

Unit1 Basics of solar energy **[7hrs]**

Unit2 Solar radiation, measurement and estimation **[8hrs]**

Unit3 Concentration of solar energy **[7hrs]**

Unit4 Solar Thermal systems: **[7hrs]**

Unit5 Solar cells: **[8Hrs]**

Unit6 Storage of solar energy: **[8Hrs]**

[illegible]

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2428– PE-III : Lab. : Solar Energy & Utilization

List of Experiments

1. [illegible]
2. **Flat Plate Solar Water Heater**
3. **Flat Plate Solar Air Heater**
4. **Flat Plate Collector with Reflector**
5. [illegible]
6. [illegible]
7. **Solar Cookers**
8. [illegible]
9. **Study on Solar Cell Characteristics**
10. **Testing of SPV Standalone Systems**
11. **Testing of SPV system with tracking unit**
12. **Performance Evaluation of SPV**

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2429– PE-III : CNC and Robotics

Objective	Course Outcome
[illegible]	[illegible]

Unit 1 **[7 hrs]** [illegible]
Unit 2 **[8 hrs]** [illegible]
Unit 3 **[8 hrs]** [illegible]
Unit 4 **[7 hrs]** [illegible] *Controls, Control system concepts, Analysis, control of joints, Adaptive and optimal control* [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Unit 5	**[8 hrs]**
End effectors, Classification, Mechanical, Magnetic, Vacuum, and Adhesive, Drive systems, Force analysis and Gripper design.	
[k,m]	
Unit 6	**[7 hrs]**
[k,m]	

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher

Reference :

3				
	Robotics Technology and Flexible Automation		*Deb S.R*	

VII Semester
ME2430– PE-III : Lab. : CNC and Robotics

Objective	Course Outcome
[illegible]	[illegible]

List of Practical

[illegible]

VII Semester
ME2433– PE-III : Piping Design and Engineering

Objective	Course Outcome
• [illegible] • [illegible] • [illegible] • [illegible] • [illegible] • [illegible]	[illegible] 1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible]

Unit 1 **[8 hrs]**

Fundamentals of Piping Design and Engineering

[illegible] **[CO-1]**

Unit 2 **[8 hrs]**

Basic Piping components

[illegible] **[CO-2]**

Unit 3 **[6 hrs]**

Piping Equipment

[illegible] **[CO-2]**

Unit 4 **[7 hrs]**

Piping Engineering flow diagram and process system

[illegible] **[CO-3]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Unit 5 **[8 hrs]**

Designing & engineering of Piping Diagram

[illegible] **[CO-3]**

Unit 6 **[8 hrs]**

ASME Engineering and pressure design

[illegible] **[CO-4]**

Se	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]
			[illegible]	[illegible]	3	[illegible]	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]
			3[illegible]	[illegible]	3	[illegible]	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]

Reference books:

[illegible]	[illegible]	[illegible]	M[illegible]	M[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3				

VII Semester
ME2434– PE-III : Lab. : Piping Design and Engineering

Objective	Course Outcome
• [illegible] • [illegible] • [illegible] • [illegible] • [illegible]	[illegible] 1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible]

List of Practical

[illegible]

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO12	PSO-1	PSO-2
	M				3		3			3							3	
					3		3			3							3	
			3		3		3			3							3	
							3			3							3	

Reference books:

			M	M
			M	
3				

YCCE-CE-40

VII Semester

ME2435– PE-III : Earthmoving Equipments

Objective	Course Outcome
[illegible]	[illegible]

Unit 1 : Introduction **[8 hrs]**

Earthmoving equipments: [illegible]

Hydraulic systems: [illegible]

Seals [illegible]

Filters [illegible]

Hoses & Pipes [illegible]

Types of Hydraulic fluid [illegible]

Unit 2 : Mechanical Systems: **[7 hrs]**

Super Structure : [illegible]

Under Carriage : [illegible]

Attachments : [illegible]

Unit 3 : Hydraulic Systems: **[7 hrs]**

Pumps: [illegible]

Accumulators & Intensifiers [illegible]

Unit 4 : Hydraulic Systems : **[8 hrs]**

Valves: [illegible]

Actuators: [illegible]

Hydraulic motors: [illegible]

Hydraulic Cylinders: [illegible]

Hydraulic Circuits [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Unit 5 : Electrical and Electronics System:	**[7 hrs]**
Electronics Circuits:	
Unit 6 : Maintenance of Earthmoving Equipments:	**[8 hrs]**

Text books:			
Title of the book	**Edition (Year of publication)**	**Author(s)**	**Publisher**
Introduction to Fluid Power			**Delmar Thomson Learning**
	3rd		
Reference Books:			
	3rd		
	3rd		

VII Semester
ME2436– PE-III : Lab. : Earthmoving Equipments

Objective	Course Outcome
[illegible]	[illegible]

Practical

[illegible]

[illegible]

3 [illegible]

[illegible]

VII Semester
ME2441– PE IV : Sysnthesis of Mechanism

Objective	Course Outcome
[illegible]	[illegible]

Unit 1	[7 hrs]
[illegible]	

Unit 2	[8 hrs]
[illegible]	

Unit 3	[7 hrs]
[illegible]	

Unit 4	[8 hrs]
[illegible]	

Unit 5	[7 hrs]
[illegible]	

Unit 6	[8 hrs]
[illegible]	

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Reference books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

ME2442– PE IV : Design for Manufacturing & Assembly

VII Semester
ME2443– PE IV : Renewable Energy System

Objective	Course Outcome
[illegible]	**CO-I** [illegible] **CO-II** [illegible] **CO-III** [illegible] **CO-IV** [illegible]

Unit 1 **[8 hrs]**

Solar Energy [illegible] **[CO - I]**

Unit 2 **[8 hrs]**

Solar Collectors [illegible] **[CO - I]**

Unit 3 **[8 hrs]**

Solar energy storage [illegible]

Applications of Solar Energy: [illegible]

Biogas and Biomass: - [illegible] **[CO – II]**

Unit 4 **[7 hrs]**

Wind energy: - [illegible]

OTEC & Tidal energy [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

[CO – III]

Unit 5 **[7 hrs]**

Geothermal power generation: Geothermal energy: [illegible] **[CO - IV]**

UNIT 6 [illegible] **[7 hrs]**

Magneto Hydro Dynamic power generation: [illegible]

Fuel cells: [illegible] **[CO - IV]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference book

[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2444– PE IV : Engineering of Plastics

Objective	Course Outcome
[illegible]	[illegible]

Unit 1	[7 Hrs]
[illegible]	
Unit 2	**[7 Hrs]**
[illegible]	
Unit 3	**[8 Hrs]**
[illegible]	
Unit 4	**[8 Hrs]**
[illegible]	
Unit 5	**[8 Hrs]**
[illegible]	
Unit 6	**[7 Hrs]**
[illegible]	

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	1991	[illegible]	[illegible]
3	[illegible]	1988	[illegible]	

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Reference books:				
4	[illegible]	**1983**	[illegible]	[illegible]
5	[illegible]	**1990**	[illegible]	[illegible]
6	[illegible]	**1989**	[illegible]	[illegible]
7	[illegible]		[illegible]	[illegible]
8	[illegible]	**1952**	[illegible]	[illegible]
9	[illegible]	**1981**	[illegible]	[illegible]
10	[illegible]	**1998**	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2445– PE IV : Finance & Cost Management

Objective	Course Outcome
• [illegible] • [illegible]	[illegible]

Unit 1 **Business Finance:** [illegible]	**[7 Hrs]**
Unit 2 **Concept of Cost:** [illegible]	**[7 Hrs]**
Unit 3 **Cost ascertainment and cost reduction:** [illegible]	**[7 Hrs]**
Unit 4 **Costing System:** [illegible]	**[8 Hrs]**
Unit 5 **Cost Planning and Control:** [illegible]	**[8 Hrs]**
Unit 6 **Decision Making:**	**[8 Hrs]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

[illegible]

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	
3	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2446– PE IV : Artificial Intelligence

Objective	Course Outcome
• [illegible] • [illegible]	[illegible]

Unit 1	[7 hrs]
[illegible]	
Unit 2	**[7 hrs]**
[illegible]	
Unit 3	**[9 hrs]**
[illegible]	
Unit 4	**[7 hrs]**
[illegible]	
Unit 5	**[7 hrs]**
[illegible]	
Unit 6	**[8 hrs]**
[illegible]	

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
ME2447– PE IV : Maintenance Management

Objective	Course Outcome
To Study [illegible] [illegible] 3 [illegible] [illegible] [illegible] [illegible] (7) [illegible]	[illegible] [illegible] [illegible] [illegible] [illegible]

Unit I **[8 Hrs]**

[illegible]

Unit II **[7 Hrs]**

[illegible]

Unit III **[7 Hrs]**

[illegible]

Unit IV **[8 Hrs]**

[illegible]

Unit V **[8 Hrs]**

[illegible]

Unit VI **[7 Hrs]**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
3				

VII Semester
ME2448– PE IV : Total Quality Management

COURSE OBJECTIVES	COURSE OUTCOMES
• [illegible] • [illegible]	[illegible] [illegible] 3 [illegible] [illegible]

Unit 1 [illegible]	**[7 hrs]**
Unit 2 [illegible]	**[7 hrs]**
Unit3 [illegible]	**[8 hrs]**
Unit4 [illegible]	**[8 hrs]**
Unit5 [illegible]	**[8 hrs]**
Unit6 [illegible]	**[7 hrs]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

ME2449– PE IV : Project Evaluation & Management

Objective	Course Outcome
[illegible]	[illegible]

Unit1 **[7 hrs]**

Project Identification [illegible]

Unit2 **[7 hrs]**

Technical feasibility [illegible]

Unit3 **[9 hrs]**

Economic feasibility: [illegible]

Unit 4 **[7 hrs]**

Project Planning and Control: [illegible]

Unit 5 **[7 hrs]**

Project report: [illegible]

Unit6 **[8 hrs]** [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

[illegible].

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
ME2461– PE V : Stress Analysis

Objective	Course Outcome
[illegible]	[illegible]

Unit 1 **[7 hrs]**

[illegible]

Unit 2 **[7 hrs]**

[illegible]

Unit 3 **[7 hrs]**

[illegible]

Unit 4 **[8 hrs]**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Unit 5	**[8 hrs]**
[illegible]	
Unit 6	**[7 hrs]**
[illegible]	

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	3rd [illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2462– PE V : Product Design and Development

Objective	Course Outcome
[illegible]	[illegible]

UNIT 1	**Introduction** [illegible]	**[7 hrs]**
UNIT 2	**Material and Process selection** [illegible]	**[7 hrs]**
UNIT 4	**Benchmarking** [illegible]	**[8 hrs]**
UNIT 5	**Product Costing** [illegible]	**[8 hrs]**
UNIT 6	**Rapid Prototyping** [illegible]	**[7 hrs]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Book for reference:

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

VII Semester
ME2463– PE V : Power Plant Engineering

Objective	Course Outcome
[illegible]	[illegible]

Unit1 **[7 Hrs]**

THERMAL POWER PLANT- I

[illegible]

Unit2 **[8 Hrs]**

THERMAL POWER PLANT- II

[illegible]

Unit 3 **[7 Hrs]**

HYDROELECTRIC POWER PLANT.

[illegible]

Unit 4 **[8 Hrs]**

POWER PLANT ECONOMICS

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Unit 5 **[8 Hrs]**

NUCLEAR POWER PLANT

[illegible]

Unit 6 **[7 Hrs]**

COMBINED OPERATION OF DIFFERENT POWER PLANTS

[illegible]

NON CONVENTIONAL POWER GENERATION SYSTEMS

[illegible]

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	[illegible]	2002	[illegible]	[illegible]

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	[illegible]	2007	[illegible]	
2	[illegible]	1984	[illegible]	[illegible]
3	[illegible]	2008	[illegible]	[illegible]
4	[illegible]	2005	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2464– PE V : Value Engineering

Objective	Course Outcome
[illegible]	[illegible]

Unit 1 **[7 hrs]**

[illegible]

Unit 2 **[7 hrs]**

[illegible]

Unit 3 **[8 hrs]**

[illegible]

Unit 4 **[8 hrs]**

[illegible]

Unit 5 **[8 hrs]**

[illegible]

Unit 6 **[7 hrs]**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Reference Books				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	
4	[illegible]	3rd [illegible]	[illegible]	
5	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2465– PE V : Design of Experiments and Taguchi Methods

Objective	Course Outcome
[illegible]	[illegible]
	3 [illegible]

Unit 1 **[7 Hrs]**

[illegible]

Unit 2 **[8 Hrs]**

[illegible]

Unit 3 **[7 Hrs]**

[illegible]

Unit 4 **[7 Hrs]**

[illegible]

Unit 5 **[8 Hrs]**

[illegible]

Unit 6 **[8 Hrs]**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
ME2466– PE V : Industrial Safety

Objective	Course Outcome
• [illegible] • [illegible]	[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

Unit 1 **[7Hrs]**

[illegible]

[illegible]

Unit 2 **[8Hrs]**

Occupational Accidents

[illegible] 3 [illegible]

Unit 3 **[7Hrs]**

Risk Identification & Risk management

[illegible] **(HIRA)** [illegible] **(FTA)** [illegible] **(HAZOP)** [illegible] **(FMEA)** [illegible] **(FMCEA)** [illegible] **(SIL)** [illegible] **(LOPA)** [illegible]

Unit 4 **[7Hrs]**

Safety & The Law

[illegible]

Unit 5 **[8Hrs]**

Safety with Machines

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

rd r r

				r
r r	d M r		r	rd

Unit 6 **[7Hrs]**

Safety Training & Awareness

[illegible]

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
ME2467– PE V : Control System Engineering

Objective	Course Outcome :-
• [illegible] • [illegible]	[illegible]

Unit 1 **[7hrs]**

[illegible]

Unit 2 **[7 hrs]**

[illegible]

Unit3 **[8 hrs]**

[illegible]

Unit4 **[8 hrs]**

[illegible]

Unit5 **[8 hrs]**

[illegible]

Unit6 **[7 hrs]**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Text books:				
[illegible]	M[illegible]d[illegible]r[illegible] [illegible]r[illegible] [illegible]r[illegible]	3rd[illegible]d[illegible]	[illegible]	[illegible]r[illegible]
[illegible]	[illegible]r[illegible] [illegible]r[illegible]	[illegible]d[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]r[illegible] [illegible]	[illegible]d[illegible]	[illegible]r[illegible] [illegible]	[illegible] [illegible]r[illegible]
[illegible]	M[illegible]d[illegible]r[illegible] [illegible]r[illegible] [illegible]	[illegible]d[illegible]	[illegible]r[illegible]	[illegible]r[illegible]

[illegible]

[illegible]

VII Semester
ME2468– PE V : Tribology

Objective	Course Outcome
[illegible]	[illegible]

UNIT-1: Introduction [illegible]
UNIT-2: Friction [illegible]
UNIT-3: Wear [illegible]
UNIT-4: Lubrication and Lubricants [illegible]
UNIT-5: Fluid film lubrication [illegible]
UNIT-6: Application Tribology [illegible]

Reference Books:

[illegible]
[illegible]
3. [illegible]
[illegible]
[illegible]
[illegible]
[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
ME2469– PE V : Turbines

Objective	Course Outcome
[illegible]	**CO:1** [illegible] **CO:2** [illegible] **CO:3** [illegible] **CO:4** [illegible]

Unit No.	Contents	Max. Hrs.
Unit 1	[illegible] **[CO:1]**	**[6 hrs]**
Unit 2	[illegible] **[CO:2]**	**[7 hrs]**
Unit 3	[illegible] **[CO:3]**	**[7 hrs]**
Unit 4	[illegible] **[CO:3]**	**[6 hrs]**
Unit 5	[illegible] **[CO:3]**	**[6 hrs]**
Unit 6	[illegible] **CO:4]**	**[7 hrs]**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Text books:			
S.N.	**Title of the book**	**Author(s)**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

VIII Semester
ME2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VIII Semester

ME2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

[illegible]

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
3rd to 8th Semester
Electrical Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EL-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	30	40	3 Hours
2	3	PC	EL2201	Analog Electronics	T	3	0	0	3	3	30	30	40	3 Hours
3	3	PC	EL2202	Lab. : Electronics Engineering Workshop	P	0	0	2	2	1		60	40	
4	3	PC	EL2203	Electrical Machines	T	4	0	0	4	4	30	30	40	3 Hours
5	3	PC	EL2204	Lab.:Electrical Machines	P	0	0	2	2	1		60	40	
6	3	PC	EL2205	Network Analysis	T	3	0	0	3	3	30	30	40	3 Hours
7	3	PC	EL2206	Lab.:Computer Programming	P	0	0	2	2	1		60	40	
8	3	PC	EL2207	Electrical Measurement & Instrumentation	T	3	0	0	3	3	30	30	40	3 Hours
9	3	PC	EL2208	Lab.:Electrical Measurement & Instrumentation	P	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**8**	**24**	**20**				

				Fourth Semster										
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	30	40	3 Hours
2	4	PC	EL2251	Electrical Machines in Power System	T	3	0	0	3	3	30	30	40	3 Hours
3	4	PC	EL2252	Lab.:Electrical Machines in Power System	P	0	0	2	2	1		60	40	
4	4	PC	EL2253	Electrical Energy Generation System	T	3	0	0	3	3	30	30	40	3 Hours
5	4	PC	EL2254	Lab.:Renewable Energy System	P	0	0	2	2	1		60	40	
6	4	PC	EL2255	Electric & Magnetic Fields	T	3	0	0	3	3	30	30	40	3 Hours
7	4	PC	EL2256	Lab.:Electrical Engineering Workshop	P	0	0	2	2	1		60	40	
8	4	PC	EL2257	Microprocessor	T	3	0	0	3	3	30	30	40	3 Hours
9	4	PC	EL2258	Lab.:Microprocessor	P	0	0	2	2	1		60	40	
10	4	PC	EL2259	Signals & Systems	T	4	0	0	4	4	30	30	40	3 Hours
				TOTAL		**19**	**0**	**8**	**27**	**23**				

List of Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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SoE No. EL-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	30	40	3 Hours
2	5	PC	EL2301	Power Electronics	**T**	3	0	0	3	3	30	30	40	3 Hours
3	5	PC	EL2302	Lab.:Power Electronics	**P**	0	0	2	2	1		60	40	
4	5	PC	EL2303	Fundamentals of Power System	**T**	3	0	0	3	3	30	30	40	3 Hours
5	5	PC	EL2304	Electrical Drives	**T**	3	0	0	3	3	30	30	40	
6	5	PC	EL2305	Lab.:Electrical Drives	**P**	0	0	2	2	1		60	40	
7		OE		Open Elective - I *	**T**	3	0	0	3	3	30	30	40	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	30	40	3 Hours
					TOTAL	**18**	**0**	**4**	**22**	**20**				

Audit Courses														
1	5	IT	IT1121	Industrial Programmin Language	**A**	3	0	0	3	0				

Open Electives -I

1	5	OE	EL2311	OEI:Renewable Energy Generation System
2	5	OE	EL2312	OEI:Electrical Machines and their Applications
3	5	OE	EL2313	OEI:Testing and Maintenance of Electrical Machines

Open Electives -II

4	5	OE	EL2321	OEII:Electrical Energy Audit and Safety
5	5	OE	EL2322	OEII:Utilization of Electrical Energy
6	5	OE	EL2323	OEII:Power System Engineering

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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SoE No. EL-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	30	40	3 Hours
2	6	PC	EL2351	Control System	**T**	3	0	0	3	3	30	30	40	3 Hours
3	6	PC	EL2352	Lab.:Control System	**P**	0	0	2	2	1		60	40	
4	6	PC	EL2353	Power System Analysis	**T**	3	0	0	3	3	30	30	40	3 Hours
5	6	PE		**Professional Elective I**	**T**	3	0	0	3	3	30	30	40	3 Hours
6	6	PE	EL2354	**Lab.:**Simulation of Power Electronics & Power System	**P**	0	0	2	2	1		60	40	
7	6	OE		**Open Elective III ***	**T**	3	0	0	3	3	30	30	40	3 Hours
8	6	OE		**Open Elective IV ***	**T**	3	0	0	3	3	30	30	40	3 Hours
9	6	PC	EL2355	Lab.:Substation Design	**P**	0	0	2	2	1		60	40	
10	5/6	STR	EL2360	**Industry Visit and its report**	**P**	0	0	0	0	1		60	40	
					TOTAL	**18**	**0**	**6**	**24**	**22**				

Professional Electives -I

1	6	PE	EL2361	**PEI:**Advanced Power Electronics
2	6	PE	EL2362	**PEI**:Electrical Distribution in Power System
3	6	PE	EL2363	**PEI:**Illumination Engineering (MOOC)
4	6	PE	EL2364	**PEI:**Electric Vehicles
5	6	PE	EL2365	**PEI**:Electric Power Utilization

Open Electives -III

6	6	OE	EL2371	**OEIII**:Renewable Energy Generation System
7	6	OE	EL2372	**OEIII**:Electrical Machines and their Applications
8	6	OE	EL2373	**OEIII**:Testing and Maintenance of Electrical Machines

Open Electives -IV

9	6	OE	EL2381	**OEIV:**Electrical Energy Audit and Safety
10	6	OE	EL2382	**OEIV**:Utilization of Electrical Energy
11	6	OE	EL2383	**OEIV**:Power System Engineering

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Yeshwantrao Chavan College of Engineering

B.E. SCHEME OF EXAMINATION 2018-19

SoE No.
EL-201

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
					T	3			3	3	3	3		3
					P									
3			3			3			3	3	3	3		3
					P									
				Professional Elective II	**T**	3			3	3	3	3		3
				Professional Elective III	**T**	3			3	3	3	3		3
				Professional Elective IV	**T**	3			3	3	3	3		3
					P							6		
					P									
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -II

				PEII:
				PEII:
3			3	**PEII:**
				PEII:

Professional Electives -III

				PEIII
			3	**PEIII** Electrical Energy Management And Audit
				PEIII:
				PEIII:

Professional Electives -IV

			3	**PEIV:**
			3	**PEIV**
			33	**PEIV**
			3	**PEIV**

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Yeshwantrao Chavan College of Engineering

B.E. SCHEME OF EXAMINATION 2018-19

SoE No.
EL-201

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
			EL		P									
			EL		P									
					TOTAL	**0**	**0**	**12**	**12**	**10**				
					GRAND TOTAL	**86**	**0**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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ELECTRICAL ENGINEERING

III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
[illegible]	[illegible]

Unit I: Finite Differences

[illegible] **(6 hours)**

Unit II: Laplace Transform

Laplace Transforms: [illegible] **(7 hours)**

Unit III: Z-transform

[illegible] **(6 hours)**

Unit IV: Fourier Series

[illegible] **(7 hours)**

Unit V: Partial Differential Equation

[illegible] **(7 hours)**

Unit VI : Fourier Transform : [illegible] **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

III SEMESTER

EL2201	Analog Electronics		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1: Bipolar Junction Transistors (BJT)

[illegible]

UNIT-2: Small Signal Analysis

[illegible]

UNIT-3 :Power & Feedback Amplifier

[illegible]

UNIT-4:Oscillator Circuits

[illegible]

UNIT-5 : Operational Amplifier (OA)

[illegible]

UNIT-6: Applications of Operational Amplifier

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

III SEMESTER

EL2201	Analog Electronics		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Text Books:

SNo.	Title	Authors	Publisher
3			

Reference Books:

SNo.	Title	Authors	Publisher
3			

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

ELECTRICAL ENGINEERING

III SEMESTER

EL2202	Lab. : Electronics Engineering Workshop	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	---

Course Objective	Course Outcomes
[illegible]	[illegible] [illegible] 3 [illegible] [illegible] [illegible]

M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

M[illegible]

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

III SEMESTER

EL2203	Electrical Machines		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]
M[illegible]3[illegible]	[illegible]

UNIT 1: ELECTRO MAGNETISM: **(6)**

M[illegible]

UNIT-2: SINGLE PHASE TRANSFORMER **(10)**

[illegible]

UNIT-3: THREE PHASE TRANSFORMER **(08)**

[illegible]

UNIT-4 D.C. GENERATOR: **(08)**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

III SEMESTER

EL2203	Electrical Machines		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

UNIT 5: D.C. MOTOR: **(08)**

[illegible]

UNIT 6 :THREE PHASE INDUCTION MOTOR **(10)**

[illegible]

Text Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

ELECTRICAL ENGINEERING

III SEMESTER

EL2204	Lab. : Electrical Machines		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Course Objective	Course Outcomes
	[illegible]

[illegible]						
[illegible]						

Minimum Eight Practical are to be performed out of the following :-

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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BE SoE and Syllabus 2018

ELECTRICAL ENGINEERING

III SEMESTER

EL2205	Network Analysis		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

M[illegible]							

UNIT 6 :THREE PHASE INDUCTION MOTOR **(10)**

[illegible]

UNIT-1: NODAL ANALYSIS OF ELECTRIC CIRCUITS

[illegible]

UNIT-2: : MESH ANALYSIS OF ELECTRIC CIRCUITS

[illegible]

UNIT-3 :NETWORK THEOREM

Superposition Theorem, Thevenin"s Theorem, Norton"s Theorem, Maximum Power Transfer Theorem.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

III SEMESTER

EL2205	Network Analysis		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

UNIT-4: INITIAL AND FINAL CONDITIONS, IMPEDANCE FUNCTIONS AND CIRCUIT ANALYSIS WITH LAPLACE TRANSFORM

[illegible]

UNIT-5:TRANSFORMS OF OTHER SIGNAL WAVEFORMS, NETWORK FUNCTIONS, POLES AND ZEROS OF NETWORK FUNCTIONS

[illegible]

UNIT-6: TWO PORT PARAMETERS

[illegible]

Text Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	3rd [illegible]	M[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible] M[illegible]	M[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	Schaum"s 3000 Solved Problems [illegible]	[illegible]	[illegible]	M[illegible]
[illegible]	Schaum"s Outline Series: Theory [illegible]	[illegible]	[illegible]	M[illegible]
3[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	

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ELECTRICAL ENGINEERING

III SEMESTER

EL2206	Lab.: Computer Programming		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Course Objective	Course Outcomes
[illegible]	[illegible]

[illegible]							
[illegible]							

Minimum Eight Practical are to be performed from the following :-

Expt. No.	List of Experiments
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible] **source** [illegible] **scope sink** [illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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ELECTRICAL ENGINEERING

III SEMESTER

EL2207	Electrical Measurement & Instrumentation	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT - I: MEASURING INSTRUMENTS

[illegible]

UNIT – II: POTENTIOMETERS AND AC BRIDGES

[illegible]

UNIT – III: MEASUREMENT OF POWER AND ENERGY

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

III SEMESTER

EL2207	Electrical Measurement & Instrumentation	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

UNIT – IV: INSTRUMENT TRANSFORMERS

UNIT – V: DIGITAL INSTRUMENTS AND TRANSDUCERS

UNIT – VI: ANALOG TRANSDUCERS

Text Books:

SNo	Title	Edition	Authors	Publisher
3				

Reference Books:

SNo	Title	Edition	Authors	Publisher

III SEMESTER

EL2208	Lab: Electrical Measurement & Instrumentation	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	-	40	60	100	--

Course Objective	Course Outcomes
	[illegible]

M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Minimum Eight Practical are to be performed out of the following :-

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	To measure low resistance using Kelvins" double bridge.
3	To measure inductance using Maxwell"s inductance capacitance bridge.
[illegible]	To measure inductance using Anderson"s bridge.
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	Determination of self inductance using Owen"s bridge.
[illegible]	[illegible]
[illegible]	M[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	M[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

IV Semester

GE2204 - Advanced Mathematical Techniques

Objective	Outcomes
• [illegible] • [illegible] • [illegible] • [illegible]	• [illegible] • [illegible] • [illegible] • [illegible]

Unit I:

Numerical Methods for Algebraic And Transcendental Equations: [illegible]

Numerical Methods System of Algebraic Equations [illegible] **(7 hours)**

Unit II:

Numerical Methods for Differential Equations [illegible] **(6 hours)**

Unit III:

Random Variables and Probability Distribution [illegible] **(6 hours)**

UNIT IV:

Mathematical Expectation [illegible] **(7 hours)**

UNIT V:

Fuzzy Sets And Fuzzy Logic [illegible] **(7 hours)**

Unit VI:

OPTIMIZATION TECHNIQUES: [illegible] **(6 hours)**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

IV Semester

GE2204 - Advanced Mathematical Techniques

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2251	Electrical Machines in Power System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1: Three Phase Synchronous Generator **(07)**

[illegible]

UNIT-2: Steady State Operation of Three phase synchronous generators **(07)**

[illegible]

UNIT-3: Parallel Operation **(06)**

[illegible]

UNIT-4: Synchronous Motor **(06)**

[illegible]

UNIT 5: Synchronous Machine Connected to Infinite Bus **(08)**

[illegible]

UNIT-6: Transient Behaviour **(06)**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

IV SEMESTER

EL2251	Electrical Machines in Power System		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Text Books:

SN	Title	Edition	Authors	Publisher
3				

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2252	Lab: Electrical Machines in Power System	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Objective	Course Outcomes
[illegible]	[illegible]

M[illegible]			3				

Minimum Eight Practical are to be performed out of the following :-

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV SEMESTER

EL2253	Electrical Energy Generation System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes

Unit I: Introduction to generation systems **(7)**

Unit II: Solar Energy **(7)**

Unit III: Wind Energy **(7)**

Unit IV: Hydro Power Station **(6 or7)**

Unit V: Thermal Power Station **(7)**

Unit VI: Nuclear Power Plant and Biomass Energy **(7)**

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2253	Electrical Energy Generation System	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes

Text Books:

SN	Title	Edition	Authors	Publisher
3				

Text Books:

SN	Title	Edition	Authors	Publisher
3				

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2254	Lab.: Renewable Energy Sources	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Objective	Course Outcomes
[illegible]	[illegible] 3 [illegible]

Minimum Eight practical are to be performed based on the following :-

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2255	Electric and Magnetic Fields	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1 Vector Analysis

[illegible]

UNIT-2 Coulomb's Law and Electric Field Intensity: Electric Flux Density, Gauss's Law, and Divergence

Coulomb"s Law, electric field intensity, types of charge distributions, electric field due to line charge density, surface [illegible] d [illegible]"s Law, application of Gauss"s Law to symmetrical charge distributions, application of Gauss"s law to differential volume element, divergence, Maxwell"s first equation in electrostatics, the vector operator [illegible]

UNIT-3Energy and Potential: Conductors, Dielectrics, and Capacitance

[illegible]

UNIT-4:Poisson's and Laplace's Equations

Poisson"s and Laplace"s equations, Uniqueness theorem, examples of the solution of Laplace"s equation (involving [illegible]

UNIT-5 Steady Magnetic Field: Magnetic Forces, Materials, and Inductance

[illegible] Savart law, magnetic field due to infinitely long current filament, finite length current filament, Ampere"s [illegible] physical interpretation, Stoke"s theorem, magnetic flux and magnetic flux density, scalar and vector magnetic [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV SEMESTER

EL2255	Electric and Magnetic Fields	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT-6: Time-Varying Fields and Maxwell's Equations, Uniform Plane Wave

Faraday"s Law, derivation of Maxwell"s equations in point form and [illegible] interpretation, concept of retarded potentials, Maxwell"s equations in phasor form, wave equations, uniform plane [illegible]

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Schaum" [illegible]	[illegible]	[illegible]	Schaum" [illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2256	Lab.: Electrical Engineering Workshp	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Objective	Course Outcomes
[illegible]	[illegible] [illegible] [illegible] 3 [illegible]

M[illegible]	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]

Practical based on following topics :-

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2257	Microprocessors	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

M[illegible]	[illegible]	[illegible]	3	[illegible]

UNIT-1 Memory devices

Memory devices, RAM, ROM, Introduction to Intel"s 8085 Architecture, Flag register, Instruction set, Addressing [illegible]

UNIT-2: Programming Instructions

[illegible]

UNIT-3: Timing Diagrams

[illegible]

UNIT-4: Interfacing of Microprocessor

[illegible]

UNIT-5: Hardware interfacing and Handshaking

[illegible]

UNIT-6: Architecture and Interface

[illegible]

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2258	Lab.: Microprocessors	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Objective	Course Outcomes
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	3	[illegible]

Practical based on following topics :-

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV SEMESTER

EL2259	Signals & Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

M[illegible]	[illegible]	[illegible]	3[illegible]	[illegible]

UNIT-1: Signals and Systems

[illegible]

Linear Time - Invariant Systems

[illegible]

UNIT-2: Fourier Series Representation of Periodic Signals

[illegible]

UNIT-3 : The Continuous-Time Fourier Transform

[illegible]

The Discrete-Time Fourier Transform

[illegible]

UNIT-4: Time & Frequency Characterization of Signals and Systems

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

IV SEMESTER

EL2259	Signals & Systems	L=4	T=0	P=0	Credits=4

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Sampling

[illegible]

UNIT-5 : The Laplace Transform

[illegible]

UNIT-6: The Z-Transform

[illegible]

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

V Semester

GE 2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
Recognizes consumer's behavior and pricing.	Relate their buyer behaviour to particular product and the pricing in the market.
Extrapolates an operations in market with productions constrain.	Examine and classify various market structure and factors of production and its role in production process.
Describes the national income accounting and public finance.	Analyse the national income accounting and the various issues related to banking, taxation, and inflation.
Interprets international trade and institutions.	Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. **(8 Hours)**

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation. **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination. **(7 Hours)**

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation. **(5 Hours)**

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.

(7 Hours)

V Semester
GE 2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions. **(5 Hours)**

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Modern Economics	13th Edition	H. L. Ahuja	S. Chand Publisher, 2009.
2	Modern Economic Theory	3rd edition	K. K. Devett	S. Chand Publisher, 2007

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Advance Economic Theory	17th Edition	H. L. Ahuja	S. Chand Publisher, 2009
2	International Trade	12th edition	M. L. Zingan	Vindra Publication, 2007
3	Macro Economics	11th Edition	M. L. Zingan	Vindra Publication, 2007
4	Economics: Samuelson,			
5	Monitory Economics	11th Edition	M. L. Sheth	Vindra Publication, 2007
6	Economics of Development and Planning	12th Edition	S. K. Misra and V. K. Puri	Himalaya Publishing House, 2006.

V Semester

EL 2301 - Power Electronics

Objective	Course Outcome
The student should be able to) understand the basics of power electronics. 2)understand SCR"s, MOSFET, UJT, IGBT, Concept of rectification, inversion and commutation .	**On completion of this course, the student will be able to** 1) Demonstrate the learnings of various power semiconductor devices with their protection and apply them for various applications. 2) Analyse different Power Electronics Converter circuits and choose them for suitable applications. 3) Demonstrate the knowledge of chopper circuits, analyse and utilise them for different applications. 4) Analyse inverter circuits with different modulation techniques and identify their applications.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Demonstrate the learnings of various power semiconductor devices with their protection and apply them for various applications.	1											1	1	
CO2	Analyse different Power Electronics Converter circuits and choose them for suitable applications.	1	3	2									1	1	
CO3	Demonstrate the knowledge of chopper circuits, analyse and utilise them for different applications.	1	3	2									1	2	
CO4	Examine inverter circuits with different modulation techniques and identify their applications	1	3	2									1	2	
CO5	Develop practical aspects of power semiconductor devices, converters, inverters and chopper circuits.	1	1	2									1	2	

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V Semester

EL 2301 - Power Electronics

Unit No.	Contents	Max. Hrs.
1	**Power Semiconductor Devices** SCR and its characteristics, Gate characteristics, SCR turn off, ratings, Triggering circuits and opto-couplers	6
2	**Single Phase Line Commutated Converters** Series and parallel connections of SCRs, Single phase line commutated converters, single pulse converter, two pulse mid-point converter, single phase bridge converter, effect of source inductance, effect of freewheeling diode, single phase half controlled rectifier cyclo converter (single phase)	5
3	Three **Phase Line Commutated Converters** Three phase three pulse converter, three phase bridge converter, speed control of dc motors (with single phase rectifier).	5
4	**Forced Commutated Semiconductor Devices and Protection** Characteristic and working of MOSFET, Gate turn off thyristor and insulated gate bipolar transistor, protection of SCR, gate circuit protection, over voltage and over current protection, snubber circuit design.	5
5	**D.C. Choppers** Principles of step down chopper, step up chopper classification, Control strategies, time ratio control and current limit control Impulse commutated and resonant pulse choppers, Multiphase choppers, Application of choppers.	6
6	**Single Phase and Three Phase Bridge Inverters** Single phase and three phase bridge inverters, Output voltage control, Harmonics in output voltage waveforms, Harmonic attenuation by filters, Harmonic reduction by pulse width modulation techniques, analysis of single pulse width modulation, working of current source inverters, applications.	6

V Semester
EL 2301 - Power Electronics

Text books:				
S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics Circuit"s Devices and Applications	3rd Edition,2004	M.H.Rashid	Prentice Hall Limited
2	Power Electronics		D.Y.Shingare	Electrotech Publication Engineering Series

Reference books:				
S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics	1981	C.W.Lander	McGraw Hill
2	Thyristors and their Applications	2nd Edition 2002	Dr.M.Ramamoorty	East West Press
3	Thyristors and their Applications		Dr.G.K.Dubey, Doralda Sinha and Joshi	New Age International
4	Power Electronics	1989	Ned Mohan, T.M.Undeland, and W.P.Robbins	John Wiley and Sons

V Semester
EL 2302 - Power Electronics Lab

S.N	TITLE
1	To show V-I characteristics of SCR and measure holding and latching current of SCR.
2	To estimate sensitivity of four modes operation of TRIAC
3	To evaluate average dc voltage of single phase half wave rectifier with Resistive load.
4	To show transfer and output characteristics of Power MOSFET.
5	To show speed control of DC Shunt Motor with Semi Converter.
6	To demonstrate single phase step down Cycloconverter with Resistive load.
7	To demonstrate Forced Commutation methods of SCR.
8	To evaluate RMS AC Voltage of single phase MOSFET based full Bridge inverter.

V Semester

EL 2303 - Fundamentals of Power System

Objective	Course Outcome
The student should be able to Calculate the basic parameters of transmission line of power systems. To know the power flow through transmission lines under different circumstances.	**On completion of this course, the student will be able to** 1) Define and explain basic components of power system and representation of its elements in terms of per unit. 2) Analyze and evaluate the transmission line parameters which limits the transmission capacity of a line. 3) Classify, evaluate and determine the performance of distribution and transmission system. 4) Choose, Compare and select the type of insulators and underground cables and improve the performance of system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Define and explain basic components of power system and representation of its elements in terms of per unit.	2	2											1	
CO2	Analyze and evaluate the transmission line parameters which limits the transmission capacity of a line.	2	2	2										2	
CO3	Classify, evaluate and determine the performance of distribution and transmission system.	2	3	2	2								1	2	
CO4	Choose, Compare and select the type of insulators and underground cables and improve the performance of system.	2	2	2										1	

V Semester

EL 2303 - Fundamentals of Power System

Unit No.	Contents	Max. Hrs.
1	**Introduction to power system** Structure of Electrical Power System, use of high voltage, idea about substation, classification, Indoor, outdoor substation, symbols for equipment used in substation, concept of real, reactive and complex power. Per unit system: Representation of power system elements, models and parameters of generator, transformer and transmission lines, Numericals.	6
2	**Inductance of transmission line** Constants of transmission line, flux linkages, inductance of single phase two wire line, inductance of 3 phase overhead line, self GMD and mutual GMD,Numericals	5
3	**Capacitance of transmission line** Electric Potential, Capacitance of single phase 2 wire line, capacitance of 3 phase overhead line, Symmetrical and unsymmetrical spacing, Numericals.	5
4	**Distribution system and Load flow analysis** Types of distribution system, comparison, Feeders and distributors, Numericals on DC and AC distribution Y Bus formation, Illustration of active and reactive power transmission, Introduction to load flow studies in multi bus system (SLFE).	5
5	**Insulators and Cables** Types, Potential distribution over suspension insulator string, String efficiency, Numericals on string efficiency. CABLES: Construction, classification, insulation resistance, capacitance, Dielectric stress, economical size, Grading of cables, Numericals.	6
6	**Transmission Systems** Short, medium (Nominal T and Nominal Π method) and Long line, Voltage regulation & efficiency of power transmission lines using simple series equivalent representation, ABCD parameters of transmission lines.	6

V Semester

EL 2303 - Fundamentals of Power System

Text books:				
1	Power System		S.Chand	V.K.Mehta
2	Electrical Power Systems	5th edition	CBS	Ashfaq Hussain
3	Modern Power System Analysis	3rd -2008	Tata McGraw Hill	I. J. Nagrath and D.P. Kothari

Reference books:				
1	Elements of Power system analysis	4th - 1982	MGH	W. D. Stevenson
2	Electrical Power system	3rd -2005	New Age International	C.L Wadhwa

V Semester

EL 2304 - Electrical Drives

Objective	Course Outcome
The student should be able to After studying Electrical machines this subject elaborates applications of different machines in industry. Characteristics under starting, running braking and speed control of different motors are explained. Programmable logic controller, contactors, tractions is also explained.	**On completion of this course, the student will be able to** 1) Classify and compare characteristics of AC and DC motors to interpret application of motors in electrical drives. 2) Apply Selection criteria for electrical drives by adapting electrical and mechanical characteristics of motor. 3) Categorize and compare contactors and relays for application of control circuit. 4) Explain the applications of PLCs in electrical drives and compare and assess control of electrical drive. 5) Estimate and adapt different motors for traction work.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify and compare characteristics of AC and DC motors to interpret application of motors in electrical drives.	3	3												
CO2	Apply Selection criteria for electrical drives by adapting electrical and mechanical characteristics of motor	3	3												
CO3	: Categorize and compare contactors and relays for application of control circuit.	3												1	
CO4	Explain the applications of PLCs in electrical drives and compare and assess control of electrical drive.	3				3							1		1
CO5	Estimate and adapt different motors for traction work	3	3										1		

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V Semester

EL 2304 - Electrical Drives

Unit No.	Contents	Max. Hrs.
1	**Introduction to Drives and Speed Control** Definition of a Drive, Classification of Drives, Brief idea about drives commonly used in industries, Speed-torque characteristics of common drive motors (DC and AC), Characteristics of Drives under starting and running, Types of braking, Speed Control of AC and DC motors.	6
2	**Selection of motors** Selection of motors and bearings of motor: Power capacity for continuous and intermittent periodic duties, Flywheel effect, Duty cycles of motor, transmission, enclosure systems for drives.	5
3	**AC and DC contactor and relays** AC and DC contactor and relays: Limit Switches, Lock out contactor, magnetic structure, operation, arc interruption, Contactor rating, H.V. Contactor, control circuit for automatic starting and braking of DC motor and three phase induction motor, Control panel design for Motor Control Centre(MCC).	5
4	**Programmable Logic Controllers** Programmable Logic Controllers (PLC), programming methods, Ladder programming with few examples, Applications of PLC"s in electrical drives.	5
5	**Traction motors** Traction motors: Motors use in AC/DC traction and their performance and desirable characteristics, requirement and suitability of motor for traction duty, Speed time characteristics of train, Traction motor control. Series parallel control with numerical method, Starting and braking of traction motor.	6
6	**Digital speed control of Electric motors** Digital speed control of Electric motors, comparison with Analog method of speed control, Block Diagram arrangement for microprocessor based speed control of AC/DC motor, Flowcharts and algorithms for speed control and speed reversal of motor. Digital signal processors (DSP"s) for drive control.Variable frequency Drive(VFD)	6

V Semester
EL 2304 - Electrical Drives

Text Books:				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	A Course in Electrical Power	**1st-2005**	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Magnetic control of motors	Industrial New York 1947	Heumann	Chapman and Hall
3	Introduction to Programmable Logic Controllers	3rd Edition, 2008.	Gary Dunning	Cengage Learning

Reference books:				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Modern Electric Traction	**4th -2005**	H. Pratap	Dhanpat Rai and Company
2	Modern utilization of traction motor	2003	J.B. Gupta	
3	A Textbook of Electrical Technology Volume III Transmission, Distribution, Utilization		B.L.Theraja, A.K.Theraja	S.Chand

V Semester
EL 2305 - Electrical Drives Lab

S.N	TITLE
1	To evaluate and explain the control circuit of star delta starter
2	To evaluate and explain control circuit of direct online starter (DOL)
3	To explain function of side rotary limit switch.
4	To categorize different types contactors
5	To classify and explain programming logic control (PLC) M-1200, M-1400 and LOGO PLC.
6	To make use of operating limit switch to turn ON contactor (output device).
7	To design ladder programming in PLC to control lamp.
8	To design ladder programming using LOGO PLC to control lamp.
9	To explain Implementation of timer using LOGO PLC
10	To design ladder programming in PLC to Control of lamps in pre defined sequence
11	To design a program for Reversal of synchronous motor using PLC
12	To make use of limit switch, and sensors to turn ON contactor motor, lamp .

V Semester

EL 2311 - OE I : Renewable Energy Generation Systems

Objective	Course Outcome
This subject introduce the different renewable energy sources to the students. Students get knowledge of Electric Power generation by wind, solar, small hydro.	**On completion of this course, the student will be able to** 1) Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context. 2) Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator. 3) Demonstrate, Classify and utilize geothermal and biomass energy. 4) Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context.	1		1			1	1							
CO2	Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator.	1	2	1	1	1		2	1			1			
CO3	Demonstrate, Classify and utilize geothermal and biomass energy.	1		1		1	1	2	1			1			1
CO4	Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.	1		1		1		1				1		1	1

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V Semester

EL 2311 - OE I : Renewable Energy Generation Systems

Unit No.	Contents	Max. Hrs.
1	**Introduction** Fundamentals of Renewable / Non-renewable Energy Sources, Renewable Energy sources, Renewable Energy Potential in India, Renewable Energy Sources and their sustainable development. Storage methods for renewable energy sources.	6
2	Solar Energy Principles, scope and applications, solar radiation, its measurement & prediction, flat plate collectors-design & theory, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Solar cells, thermal storage, street lighting, solar power generation.	5
3	Wind Energy Introduction, Historical development, Wind energy resources, sites identification, blade element theory, aero-foil design, component of wind energy conversion system, wind turbine generator classification, and windmill and wind electrical generator, Advantages, disadvantages, economics and present status of wind energy generation systems, grid connection of wind energy.	5
4	Geothermal Energy and Biomass Energy Introduction, history of geothermal resources, basics of geological process, dry rock and hot aquifer analysis, geothermal exploration, geothermal well drilling and fluid extraction, utilization of geothermal resources, geothermal heat pump, site of geothermal energy in India. Biomass energy resources and conversion processes, urban waste to energy conversion.	5
5	Mini & Micro hydro-plants Introduction, Classification of water turbines, hydroelectric system, essential components of hydroelectric system, system efficiency, advantages and disadvantages of hydroelectric system, present Indian power scenario of mini- micro hydro.	6
6	Ocean Energy Ocean thermal energy conversion (OTEC), Open cycle and closed cycle OTEC, Ocean wave energy conversion, tidal energy conversion. Introduction of Fuel cells.	6

V Semester

EL 2311 - OE I : Renewable Energy Generation Systems

Text Books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Non Conventional Sources of Energy	**4th edition**	G.D.Rai	Khanna Publisher
2	Energy Technology:Nonconventional Renewable and Conventional	,	S. Rao and B.B Parulekar	Khanna Publisher New Delhi

Reference books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Solar Energy : Principles of Thermal collection and storage	**3rd edition,1994**	S.P.Sukhatme,J.K.Nayak	Tata McGraw Hill
2	Wind and Solar Power System		M. R. Patel	CRC Press, New York
3	Renewable Energy Sources Basic Principles and Applications		G. N. Tiwari and M. K. Ghoshal	Narosa Publishing House,New Delhi

V Semester

EL 2312 - OE I : Electrical Machines and their Applications

Objective	Course Outcome
The student should be able to This subject introduce the applications of different machines and commonly used drives	**On completion of this course, the student will be able to** 1) To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors. 2) To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes. 3) To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers. 4) To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors	3													1
CO2	To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes	3	1					1							1
CO3	To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers	2	1												2
CO4	To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor	3													1

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V Semester

EL 2312 - OE I : Electrical Machines and their Applications

Unit No.	Contents	Max. Hrs.
1	Introduction to Drives and Speed Control: Classification of Drives, brief idea about commonly used drives (AC and DC) drives in industry, speed- torque characteristics of different drive motors, their behaviour under starting and running conditions.	6
2	Need of starter, Starting methods, Braking and Speed Control of AC and DC motors.	5
3	Selection Criterion for Drive Motors: Criterion for selection of motors, Duty Cycle, Power Rating for Continuous and Intermittent Duty Cycles, Environment and Enclosures, Transmission System, Insulation Classes.	5
4	Single Phase transformer Review of Principle, constant flux machine, losses, efficiency etc., Operation on load (Phasor diagrams), Voltage regulation, effect of load power factor on regulation, Application of Single phase transformer in Electronic circuitry, autotransformer, welding transformer, furnace transformer.	5
5	Three Phase Transformer. Concept of three phase transformer, Comparison between unit and bank of single phase transformer, connections, All Day Efficiency, application in power system.	6
6	Special Machines: Brushless DC motor: - Principle, construction , operation, converter for BLDC, rotor position sensor (Hall Sensor), Stepper motor: types, slewing, torque-speed characteristics, stepper motor converter, Universal motor, applications Applications of three phase and single phase induction motors in cement industry, steel rolling mill, textile mill, etc.	6

V Semester

EL 2312 - OE I : Electrical Machines and their Applications

Text books				
S.N	**Title**	**Year/Edition**	**Author**	**Publisher**
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric Drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

Reference Books:

Sr. No.	Title	Year/Edition	Author	Publisher
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

V Semester

EL 2313 - OE I : Testing and Maintenance of Electrical Equipment's

Objective	Course Outcome
The student should be able to To adopt various testing and maintenance procedures for electrical equipments by providing effective insulation to enhance their life and working condition	**On completion of this course, the student will be able to** 1) Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock. 2) Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation. 3) Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance. 4) Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock.	1					2	1	3				3		1
CO2	Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation	1					2		1				1	2	
CO3	Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance.	1					2								
CO4	Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.	1					1		1				1	2	

V Semester

EL 2313 - OE I : Testing and Maintenance of Electrical Equipment's

Unit No.	Contents	Max. Hrs.
1	Safety & Prevention of Accidents Definition of terminology used in safety; safety, hazards, accident, major accident hazard, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don"ts for substation operators as listed in IS Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.	6
2	General Introduction Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing a) Direct, b) Indirect, c) Regenerative. Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.	5
3	Testing & maintenance of rotating machines Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992. Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968. Brake test on DC Series motor.	5
4	**Testing & maintenance of Insulation** Classification of insulating materials as per I.S. 8504(part III) 1994, factors affecting life of insulating materials, measurement of insulation resistance & interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot.	5
5	**Testing & maintenance of Transformer** Listing type test, routine test & special test as per I.S. 2026-1981. Procedure for conducting following tests: Measurement of winding resistance, no load losses, & no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028 (part-III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 & 3 phase transformer, load sharing calculations (numerical).	6
6	**Installation** Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992. Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.	6

V Semester

EL 2313 - OE I : Testing and Maintenance of Electrical Equipment‟s

Text Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol – I	Media Promotors & Publisher Ltd. Mumbai
02.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol – II	Media Promotors & Publisher Ltd. Mumbai

Reference Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	B. L. Theraja	Electrical Technology Vol I to IV	S. Chand & Co., New Delhi
02.	C. J. Hubert	Preventive Maintenance Hand Books & Journals	----------

V Semester

EL 2321 - OE II: Electrical Energy Audit and Safety

Objectives	Course Outcomes
The student should be able to Understand various operating characteristics of electrical equipments,its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving and its global impact	**On completion of this course, the student will be able to** 1) Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003. 2) Demonstrate, apply and evaluate different forms of electrical and thermal energy. 3) Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting. 4) Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003	1							1				1		
CO2	Demonstrate, apply and evaluate different forms of electrical and thermal energy.		1										1	1	
CO3	Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting.		2			1	1	2					1		1
CO4	Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures.	1									1		1		1

V Semester

EL 2321 - OE II: Electrical Energy Audit and Safety

Unit No.	Contents	Max. Hrs.
1	Energy Scenario Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.	6
2	Basics of Energy and its various forms Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.	5
3	Energy Management & Audit Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	5
4	Energy Monitoring and Targeting Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).	5
5	Global environmental concerns United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).	6
6	Electrical Safety Primary hazards associated with electricity. Control measures and safety-related work practices to minimize the risk associated with electrical hazards. Response procedures in the event of electrical shock or fire.	6

V Semester

EL 2321 - OE II: Electrical Energy Audit and Safety

Text Books:			
S. N.	**Author**	**Title**	**Publisher**
01	Archie,W Culp	Principles of Energy Conversion	McGraw Hill
02	Wayne C Turner	Energy Management Handbook Bureau	John Willey and Sons
03		Bureau of Energy Efficiency Study Material for Energy Managersand Auditors Examination	Bureau of Energy Efficiency www.beeindia.in

Reference Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	Amit Kumar Tyagi	Handbook on Energy Audit and Management	TERI

V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Objectives	Course Outcomes
The student should be able to To understand the basic principle of electrical heating, welding, illumination, refrigeration and air conditioning, fans, pumps, compressors and digi sets.	**On completion of this course, the student will be able to** 1) Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose. 2) Demonstrate and apply electric energy to different types of welding 3) Explain how refrigeration system and air condition system works. 4) Analyse, determine and estimate proper economic generation.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose	3	2	2					2	1	1				1
CO2	Demonstrate and apply electric energy to different types of welding			1		1			1						
CO3	Explain how refrigeration system and air condition system works	1		1	1				1						
CO4	Analyse,determine and estimate proper economic generation	3	2	2	1		1		2	2	3	1		3	1

V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Unit No.	Contents	Max. Hrs.
1	**Electric Heating:** i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat Types & application of electric heating equipment"s, transfer of heat. ii) Resistance Ovens: General constructions, design of heating elements, efficiency & losses, radiant heating. iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating. iv) Dielectric heating: Principle and application. v) Arc furnace: Direct & indirect arc furnace, power supply, characteristics & control.	6
2	**Electric Welding*:*** i) Importance, Advantages & Disadvantages of welding, classification of welding processes. ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding. iii) Electric arc welding: carbon arc welding, metal arc welding, submerged arc welding, Welding positions, Types of welding electrodes iv) Ultrasonic welding, electron beam welding, laser beam welding.	5
3	**Illumination*:*** Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.	5
4	**Refrigeration & Air conditioning:** Terminology, refrigeration cycle, refrigeration systems (Vapour compression, vapour absorption), domestic refrigerator, water cooler, desert cooler. Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.	5
5	**Electric Traction** Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipments (collector gear for overhead equipments, conductor-rail equipment)Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve	6
6	Economics of Power Generation, Electric Power Supply and Utilization Terms and Definitions, base load and peak load, selection of power plant equipment (boilers, prime-movers, size and number of generating units), economics in plant selection, economics of hydroelectric power plant, economics of combined hydro and steam power plant, performance and operating characteristics of power plants, power plant useful life, tariff for electrical energy, objective and requirements of tariff, general tariff forms, comparison between private generating plant and public supply.	6

V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
2	Art and Science of Utilization of Electrical Energy		H Pratap	Dhanpat Rai & Sons, Delhi
3	Utilization of Electrical Power		R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. Suryanarayana V.	Wiley Eastern Ltd, Age International New
3	Utilization of Electrical Energy		E.Openshaw Taylor	Orient Longman

V Semester

EL 2323- OE II: Power System Engineering

Objective	Course Outcome
The student should be able to :- (1) To comprehend the different issues related to overhead lines and underground cables. (2) To train the students with a solid foundation in power system concepts required to solve engineering problems. (3) To provide the knowledge about the system transients, sag and various issues related to cables and transmission lines. (4) To introduce the students to the general structure of the network for transferring power from generating stations to the consumers. (5) To expose the students to the different electrical & mechanical aspects of the power network along with its environmental and safety constraints	On completion of this course, the student will be able to (1) Articulate types of load and power system concepts required to engineering problems. (2) Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology. (3) Formulate A.C and D.C distribution networks for necessary variable calculation. (4) Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Articulate types of load and power system concepts required to engineering problems.	2				1		1			1			1	
CO2	Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology.	1	2	1				1				1	1	2	
CO3	Formulate A.C and D.C distribution networks for necessary variable calculation.	2	1					1						2	
CO4	Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.	1	1	2				1			1			1	

V Semester

EL 2323- OE II: Power System Engineering

Unit No.	Contents	Max. Hrs.
1	**Introduction to Power System** Restructuring of power sector, Constituents of present day power system, sources of electrical energy, types and characteristics of generating stations: Thermal, hydro, nuclear , solar ,wind and other renewable, salient features of electricity act 2003.	6
2	**Load on Power Stations** Load, Important terms and factors, and Units generated per annum , Load duration curve , Types of loads, Load demand and diversity factors, Load curves and selection of generating units, Base load and peak load on Power station, Method of meeting the load ,Interconnected grid system.	5
3	**Transmission System I** Electric supply system, A.C power supply scheme, D.C transmission scheme, Comparison of AC and DC transmission system, advantages of A.C. transmission system, Comparison of various transmission system (Two wire dc system, Single phase two wire A.C system, Single phase three wire system , three phase three wire system, Three phase four wire system) Elements of transmission line, Economic choice of transmission voltage, requirements of satisfactory electric supply, Concept of HVDC transmission.	5
4	**Transmission System II** Line support insulators, types of insulators (pin type, suspension type, strain type, shackle type), Commonly used conductor material, concept of corona, factor affecting corona, advantages and disadvantages of corona, methods of reducing corona effect, Sag and its effects, Constants of transmission line (R, L and C) , Resistance of transmission line, skin effect , Classification of overhead transmission line and voltage regulation .	5
5	**Distribution System** Classification of distribution system, Types of distribution AC and DC, Overhead verses underground system, Requirements of distribution system, Design consideration of distribution system, AC distribution types, Voltage drop calculations in different distribution system , importance of voltage control, location of voltage control equipment and its methods, Tap changing transformer , Concept of tariff, desirable characteristics of tariff, types of tariff.	6
6	**Introduction to Switchgear** Essential features of switchgear, switchgear equipment's, switches, fuses, circuit breakers, relays, HRC fuses, Bus Bar arrangement (single bus system, One and half feeder ,Main and transfer bus system) , MCB, MCCB, ELCB Introduction to Instrument transformer Current Transformer (CT) and Potential transformer (PT).	6

V Semester

EL 2323- OE II: Power System Engineering

Text books:				
	Title	Edition	Author	Publication
1.	Power System Analysis	1st edition 2007	T.K. Nagsarkar, M.S. Sukhija	Oxford
2.	Principles of Power System	2nd edition 2005	V.K.Mehta, Rohit Mehta	S.Chand
3.	Electrical Power System	5th edition 2007	Ashfaque Hussain	CBS

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcomes
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Unit – 1 - Principle of Management

[illegible]

UNIT-2: Legal Aspects of Management

[illegible]

UNIT-3: Human Resource Management

[illegible]

UNIT-4: Project Management

[illegible]

UNIT-5: Marketing Management

[illegible]

VI Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

[illegible]

Text book and Reference

[illegible]

VI Semester
EL2351- Control System

Course Learning Objectives	Course Outcomes
[illegible]	[illegible]

UNIT I : Introduction to Control Systems: [illegible]

Transfer Function, Block Diagram and Signal Flow Graph : [illegible] gram algebra & reduction techniques, signal flow graph, its constructions and Mason"s gain [illegible]

Mathematical Modelling of physical systems [illegible]

UNIT II: Characteristics of Feedback Control Systems : [illegible]

UNIT III:Time Domain Analysis of Control Systems [illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2351- Control System

UNIT IV Stability of Linear Control Systems : [illegible]

State Variable Analysis : [illegible]

UNIT V: Root LocusTechnique : [illegible]

UNIT VI: Frequency domain analysis of control systems: [illegible]

Stability in Frequency domain [illegible]

Text books:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2352- Lab.: Control System

[illegible]

	TITLE
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

VI Semester
EL2353- Power System Analysis

Course Objective	Course Outcomes
[illegible]	[illegible]
Mapped Program Outcomes:a,b,c,d,e,f,g,l,j	

UNIT-I: Symmetrical Fault Analysis

[illegible]

UNIT-II: Symmetrical Component:-

Introduction, [illegible]

UNIT-III: Unsymmetrical Fault Analysis

[illegible]

UNIT-IV: Power System Stability

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2353- Power System Analysis

[illegible]

UNIT-V: Economic operation of power system

[illegible]

UNIT-VI: System Neutral Grounding & Reactive Power Compensation

[illegible]

Text Books				
	TITLE	EDITION	AUTHOR	PUBLICATION
	[illegible]	5TH edition 2007	[illegible]	CBS

Reference books				
	TITLE	EDITION	AUTHOR	PUBLICATION
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

EL2354- Lab.: Simulation of Power Electronics & Power System

Course Objective	Course Outcomes
[illegible]	[illegible]

Expt.No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

VI Semester
EL2355- Lab. Substation Design

Course Objectives	Course Outcomes
[illegible]	[illegible]

Mapped Program Outcomes				4	

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2361- PE-I: Advanced Power Electronics

Course Objective	Outcomes
[illegible]	1) [illegible] 2) [illegible] 3) [illegible] 4) [illegible] 5) [illegible] 6) [illegible]
Mapped Program Outcomes: a,b,c,d,f,j	

UNIT-1 Power Semiconductor Devices

[illegible]

UNIT-2 Hard Switched and Soft Switched Converters

[illegible]

UNIT-3: Multilevel Inverters

[illegible]

UNIT-4: Modulation Techniques

[illegible]

UNIT 5: Harmonics

[illegible]

Unit 6:Harmonics Mitigation Techniques

[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2361- PE-I: Advanced Power Electronics

Text Books				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Reference Books				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

EL2362- PEI: Electrical Distribution in Power System

Course Objectives	Course Outcomes
[illegible]	[illegible]
Mapped Program Outcomes: a,b,d,f,j	[illegible]

UNIT-1: Load Forecasting

[illegible]

UNIT-2: Distribution Feeders

[illegible]

UNIT-3: Overhead lines and Cables

[illegible]

UNIT-4: Reactive power compensation and applications of capacitors

[illegible]

UNIT-5: Substation & Metering, instrumentation & Tariffs

[illegible]

VI Semester
EL2362- PEI: Electrical Distribution in Power System

UNIT-6: Distribution automation (DA) & SCADA

[illegible]

Text books				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2363- PEI: Illumination Engineering (MOOC)

Unit I:

Unit II:

Unit III:

Unit IV:

Unit V:

Unit VI:

VI Semester
EL2364- PEI: Electric Vehicles

Unit 1:- Introduction to Electric Vehicles & Vehicle mechanism

[illegible]

Unit 2:- Battery and other alternative Energy Sources

[illegible]

Unit 3:- Electric Machines

[illegible]

Unit 4:- Power Electronics and motor Drives

[illegible]

Unit 5: Drive Train

[illegible]

Unit 6: Hybrid Electric Vehicle

[illegible]

Text Book: -

[illegible] **Electric and Hybrid Vehicles: Design Fundamentals** [illegible]

[illegible] **Electric Powertrain- Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles** [illegible]

VI Semester
EL2365- PEI: Electric Power Utilization

Course Objectives	Course Outcomes
[illegible]	[illegible] [illegible] [illegible] 3 [illegible] [illegible] [illegible]

UNIT-1 Electric Heating

[illegible]

UNIT-2 Electric Welding:

[illegible]

UNIT-3: Illumination :

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2365- PEI: Electric Power Utilization

UNIT-4: Refrigeration & Air conditioning:

[illegible]

UNIT-5: Fans & Pumps:

[illegible]

UNIT-6: Compressors and DG Sets:

[illegible]

Text books:				
1	[illegible]		[illegible]	[illegible]
2	[illegible]		[illegible]	[illegible]
3	[illegible]		[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:				
	[illegible]			[illegible]
	[illegible]		[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2371- OEIII: Renewable Energy Generation System

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1: Introduction

[illegible]

UNIT-2: Solar Energy

[illegible]

UNIT-3: Wind Energy

[illegible]

VI Semester
EL2371- OEIII: Renewable Energy Generation System

UNIT-4: Geothermal Energy and Biomass Energy

[illegible]

UNIT-5: Mini & Micro hydro-plants

[illegible]

UNIT-6: Ocean Energy

[illegible]

Text Books				
S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	4th edition	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference books				
S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	3rd edition,1994	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

EL2372- OEIII: Electrical Machines and their Applications

Course Objective	Course Outcomes
[illegible]	[illegible]

Unit 1: Introduction to Drives and Speed Control:

[illegible]

Unit 2:

[illegible]

Unit 3: Selection Criterion for Drive Motors:

[illegible]

Unit 4: Single Phase transformer

[illegible]

Unit 5: Three Phase Transformer.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2372- OEIII: Electrical Machines and their Applications

Unit 6: Special Machines:

[illegible]

Text books				
S.N	**Title**	**Year/Edition**	**Author**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

Sr. No.	Title	Year/Edition	Author	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

EL2373 - OEIII: Testing and Maintenance of Electrical Machines

Course Objective	Course Outcomes
[illegible]	[illegible]
Mapped program outcomes:1,6,7,8,12	[illegible]

Unit 1: Safety & Prevention of Accidents

[illegible] ctrical installation, Dos & don"ts for substation operators as listed in IS Meaning & causes of electrical [illegible]

Unit 2: General Introduction

[illegible]

Unit 3: Testing & maintenance of rotating machines

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

EL2373 - OEIII: Testing and Maintenance of Electrical Machines

Unit 4: Testing & maintenance of Insulation

[illegible]

Unit 5: Testing & maintenance of Transformer

[illegible]

Unit 6: Installation

[illegible]

[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]			
S. N.	**Author**	**Title**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2381 - OEIV: Electrical Energy Audit and Safety

Course Objectives	Course Outcomes
[illegible]	[illegible]

UNIT-1: Energy Scenario

[illegible]

UNIT-2: Basics of Energy and its various forms

[illegible]

UNIT-3 : Energy Management & Audit

[illegible]

UNIT-4: Energy Monitoring and Targeting

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2381 - OEIV: Electrical Energy Audit and Safety

UNIT-5: Global environmental concerns

[illegible]

UNIT-6: Electrical Safety

[illegible]

Text Books:			
S. N.	**Author**	**Title**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:			
S. N.	**Author**	**Title**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EL2382 - OE IV: Utilization of Electrical Energy

Course Objectives	Course Outcomes
[illegible]	[illegible]

UNIT 1: Electric Heating:

[illegible] heat Types & application of electric heating equipment"s, transfer of [illegible]

UNIT-2: Electric Welding:

UNIT-3: Illumination:

UNIT-4: Refrigeration & Air conditioning:

VI Semester

EL2382 - OE IV: Utilization of Electrical Energy

UNIT-5: Electric Traction

[illegible]

UNIT-6: Economics of Power Generation, Electric Power Supply and Utilization

[illegible]

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

EL2383 - OEIV: Power System Engineering

Unit 1: Introduction to Power System

[illegible]

Unit 2: Load on Power Stations

[illegible]

Unit 3: Transmission System I

[illegible]

Unit 4: Transmission System II

[illegible]

Unit 5: Distribution System

[illegible]

Unit 6: Introduction to Switchgear

[illegible]

VI Semester

EL2383 - OEIV: Power System Engineering

	Title	Edition	Author	Publication
3				

VII Semester

EL- 2401 Switchgear and Protection

Unit No.	Contents	Max. Hrs.
3[illegible]	**Distance protection** [illegible]	[illegible]
[illegible]	**Circuit Breaker** **Circuit breakers**[illegible] [illegible]	[illegible]
[illegible]	**Equipment Protection** [illegible]	[illegible]
[illegible]	**Equipment Protection** **Protection of Generators** [illegible] **Protection of Induction Motors** [illegible] [illegible]	[illegible]

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]3[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1990	[illegible]	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	1992	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL 2402 - Lab: Switchgear and Protection

M[illegible]

[illegible]	TITLE
[illegible]	[illegible] *(IDMT)* [illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible] *MC61C* [illegible]
[illegible]	[illegible]
[illegible]	[illegible] *ICM21N* [illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible] M[illegible] M[illegible] 3[illegible]
[illegible]	[illegible] M[illegible]
[illegible]	[illegible]
[illegible] 3[illegible]	[illegible]
[illegible]	[illegible]

VII Semester

EL2403 - High Voltage Engineering

Objective	Course Outcome
[illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3 [illegible] [illegible] [illegible]

CO	Statement	Mapped PO												PSO	
		PO 1	PO	PO	PO	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
CO	[illegible]	[illegible]	3 [illegible]	[illegible]	[illegible]								[illegible]	[illegible]	
CO	[illegible]	[illegible]	3 [illegible]	[illegible]	[illegible]								[illegible]	[illegible]	
CO	[illegible]	[illegible]	3 [illegible]	3 [illegible]	[illegible]								[illegible]	[illegible]	
CO	[illegible]	[illegible]	3 [illegible]	3 [illegible]	[illegible]								[illegible]	[illegible]	
CO	[illegible]	[illegible]	3 [illegible]	3 [illegible]	[illegible]								[illegible]	[illegible]	

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M [illegible]	[illegible]	[illegible]	

VII Semester

EL2403 - High Voltage Engineering

Unit No.	Contents	Max. Hrs.
[illegible]	**Breakdown Mechanism in Dielectrics** Ionisation process : Townsend"s criterion for breakdown, Break[illegible]	[illegible]
[illegible]	**Lightning and switching over voltages** M[illegible]	[illegible]
3[illegible]	**Travelling Waves and Insulation Co-ordination** [illegible]	[illegible]
[illegible]	**Generation of High Voltage and Currents** [illegible]	[illegible]
[illegible]	**Measurement of High Voltage and Current** M[illegible]	[illegible]
[illegible]	**Non Destructive and High Voltage Testing of Electrical Apparatus** [illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL2401 : Switchgear and Protection

Objective	Course Outcome
The student should be able to 1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible]	[illegible] 1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5) [illegible]

CO	Statement	Mapped PO												[illegible]	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	[illegible]	[illegible]						[illegible]							
CO2	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
CO3	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
CO4	[illegible]	[illegible]		[illegible]				[illegible]					[illegible]	[illegible]	
CO5	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**Introduction** [illegible]	[illegible]
[illegible]	**Overcurrent Protection** [illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL2403 - High Voltage Engineering

Text books:				
SN	Title	Edition	Author	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	2004	[illegible]	[illegible]

VII Semester

EL2404 – Lab : High Voltage Engineering

M[illegible]

[illegible]	TITLE
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	M[illegible]
[illegible]	M[illegible]
[illegible]	M[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

VII Semester

EL2411- PEII: Fundamentals of Power Quality

Objective	Course Outcome
• [illegible] • [illegible] • [illegible]	**On completion of this course, the student will be able to** **1.** [illegible] **2.** [illegible] **3.** [illegible] **4.** [illegible]

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	[illegible]	3												1	
CO2	[illegible]	3	2											2	
CO3	[illegible]	3	2	2										2	1
CO4	[illegible]	3													1

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
EL2411- PEII: Fundamentals of Power Quality

Unit No.	Contents	Max. Hrs.
[illegible]	**Overview and definition of power quality** [illegible]	[illegible]
[illegible]	**Voltage sag analysis** [illegible]	[illegible]
3[illegible]	**Harmonics** [illegible]	[illegible]
[illegible]	**Filter Design** [illegible]	[illegible]
[illegible]	**Control of APF and configuring devices** [illegible]	[illegible]
[illegible]	**Custom power devices** [illegible]	[illegible]

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL2412- PEII: Electrical Installation Design

Objective	Course Outcome
[illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3 [illegible] [illegible]

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	[illegible]	[illegible]													[illegible]
CO2	[illegible]	[illegible]	[illegible]										[illegible]		
CO3	[illegible]	[illegible]	[illegible]	3 [illegible]		[illegible]							[illegible]	[illegible]	
CO4	[illegible]	3 [illegible]		[illegible]			[illegible]		[illegible]	[illegible]			[illegible]	[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible] [illegible] M [illegible] [illegible] 33 [illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M [illegible]	[illegible]	[illegible]	

VII Semester

EL2412:PEII: Electrical Installation Design

Unit No.	Contents	Max. Hrs.
3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Text Books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]3[illegible]	[illegible]	[illegible]

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	[illegible]	[illegible]	M[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL2413- PEII: Electrical Machine Design

Course Objective	Course Outcome
[illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3. [illegible] 4. [illegible]

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	[illegible]	3	2	1	1									1	
CO2	[illegible]	3	2	1	1									2	
CO3	[illegible]	3	2	1	1									2	
CO4	[illegible]	3	2	1	1									3	

Unit No.	Contents	Max. Hrs.
[illegible]	**Review of material used in construction of electrical machines** [illegible]	[illegible]
[illegible]	**Transformer design : Main Dimensions** [illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL2413 - PEII: Electrical Machine Design

Unit No.	Contents	Max. Hrs.
3	**Transformer design : Performance Characteristics**	
	Induction motors: Stator Design	
	Induction motor rotor design	
	Synchronous machines	

Text Books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**

Reference books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
		3rd		

VII Semester

EL2421- PEII: Power System Operation and Control

Objective	Course Outcome
[illegible]	**On completion of this course, the student will be able to** **1.** [illegible] **2.** [illegible] **3.** [illegible] **4.** [illegible]

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	[illegible]		3	3											
CO2	[illegible]		3	3											
CO3	[illegible]		3	3											
CO4	[illegible]														

VII Semester

EL2421:PEII: Power System Operation and Control

Unit No.	Contents	Max. Hrs.
[illegible]	**Economic Aspects** [illegible]	[illegible]
[illegible]	**Pre requisite of Load Dispatching** [illegible]	[illegible]
3[illegible]	**Load Frequency Control (LFC)** [illegible]	[illegible]
[illegible]	**Economic Dispatch Control** [illegible]	[illegible]
[illegible]	**Reactive Power Control** [illegible]	[illegible]
[illegible]	**Voltage Control** [illegible]	[illegible]

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] 3[illegible]	[illegible]	[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

EL2422- PEIII: FACTS Devices

Objective	Course Outcome
[illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3[illegible] [illegible]

CO	Statement	Mapped PO[illegible]												[illegible]	
		PO 1	PO 2	PO 3	PO 4	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
1	[illegible]	[illegible]												[illegible]	
2	[illegible]	[illegible]	[illegible]	[illegible]										3[illegible]	
3	[illegible]	[illegible]	[illegible]	[illegible]										3[illegible]	
4	[illegible]	[illegible]	[illegible]	[illegible]										3[illegible]	

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
EL2422- PEIII: FACTS Devices

Unit No.	Contents	Max. Hrs.
[illegible]	**Flexible AC Transmission Systems (FACTS)** [illegible]	[illegible]
[illegible]	**Static shunt compensators** [illegible]	[illegible]
3	**Static Series Compensators** [illegible]	[illegible]
[illegible]	**Static Voltage and Phase Angle Regulators** [illegible]	[illegible]
[illegible]	**Shunt-Series Compensators:UPFC** [illegible]	[illegible]
[illegible]	**Other FACTS Controllers** [illegible]	[illegible]

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]		[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL2423:PEIII: Electrical Energy Management And Audit

Objective	Course Outcome
[illegible]	[illegible]

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS 1	PS 2
1	[illegible]	1				1	1		1				2	1	1
2	[illegible]	1	1			1				1			1		1
3	[illegible]	1	1	1		1	2			1			2	1	1
4	[illegible]	1	1		3					2			2	1	2

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL2423:PEIII: Electrical Energy Management And Audit

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]
3[illegible]	[illegible]			[illegible]

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
[illegible]	[illegible]		[illegible]	

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL2424 - PEIII: ADVANCED CONTROL SYSTEM

Objective	Course Outcome
[illegible]	[illegible] 1) [illegible] 2) [illegible] 3) [illegible] 4) [illegible]

CO	Statement	Mapped PO													
		[illegible]	[illegible]	[illegible]3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]								[illegible]	[illegible]	3
2	[illegible]	3	[illegible]	[illegible]											3
3	[illegible]	3	[illegible]		[illegible]									[illegible]	3
4	[illegible]	3	[illegible]		[illegible]										3

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]d M[illegible]	[illegible]	[illegible]	

VII Semester

EL2424:PEIII: ADVANCED CONTROL SYSTEM

Unit No.	Contents	Max. Hrs.
	UNIT-1 Compensation	
	Design of PID Controller: Zeigler Nichol"s method of PID tuning.	
3	**State variable Feedback**	
	Non Linear control system (NLCS)	
	Phase -Plane Method	
	Sample Data control System (SDCS) linear transformation & Jury"s test. Discretization of continuous time state	

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
3				3

VII Semester

EL 2425 - PEIII: ARTIFICIAL INTELLIGENCE BASED SYSTEM

Objective	Course Outcome
[illegible]	[illegible] 1) [illegible] 2) [illegible] 3) [illegible] 4) [illegible]

CO	Statement	Mapped PO													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	[illegible]	3	3	2	1									3	3
2	[illegible]	3	3	2	1									3	3
3	[illegible]	3	3	2	1									3	3
4	[illegible]	3	3	2	1									3	3

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL 2425 - PEIII: ARTIFICIAL INTELLIGENCE BASED SYSTEM

Unit No.	Contents	Max. Hrs.
[illegible]	**Introduction:-** [illegible]	[illegible]
[illegible]	**Nonlinear fuzzy control** [illegible]	[illegible]
3[illegible]	**Adaptive Fuzzy control** [illegible]	[illegible]
[illegible]	**Artificial Neural Network** [illegible] **Feed forward networks:** [illegible]	[illegible]
[illegible]	**Recurrent networks** [illegible]	[illegible]
[illegible]	**Associative memories, self-organizing networks and Neural Control** [illegible]	[illegible]

Text books

S.N	Title	Year/Edition	Author	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference books

S.N	Title	Year/Edition	Author	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL 2431 - PEIV: ADVANCED ELECTRICAL DRIVES

Objective	Course Outcome
The student should be able [illegible] [illegible] 3 [illegible] [illegible]	[illegible] [illegible] [illegible] 3 [illegible] **4)** [illegible]

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	[illegible]	3	2	2	1										2
CO2	[illegible]	3	2	2	1										2
CO3	[illegible]	3	2	2	1										2
CO4	[illegible]	3	2	2	1										2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL 2431 - PE IV: ADVANCED ELECTRICAL DRIVES

Unit No.	Contents	Max. Hrs.
[illegible]	**Introduction to Electric Drives** [illegible]	[illegible]
[illegible]	**D.C. Drives** [illegible]	[illegible]
3[illegible]	**Induction Motor Drives** [illegible]	[illegible]
[illegible]	**Synchronous Motor Drives** [illegible]	[illegible]
[illegible]	**Special Motors Drives** [illegible]	[illegible]
[illegible]	**Traction Drives** [illegible]	[illegible]

Text books

S.N	Title	Year/Edition	Author	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	M[illegible]	[illegible]3[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]M[illegible]
[illegible]	[illegible]M[illegible]	[illegible]	[illegible]	[illegible]

Reference books

S.N	Title	Year/Edition	Author	Publisher
[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]M[illegible]	[illegible]	[illegible]	[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2021-22 onward)

ELECTRICAL ENGINEERING

VII Semester

EL 2432 - PE IV: FUNDAMENTALS OF SMARTGRID

Course Objectives	Course Outcomes
• [illegible] • [illegible] • [illegible] • [illegible]	**The student should be able to:** [illegible] [illegible] 3 [illegible] [illegible]

CO	Statement	Mapped PO													
		PO	PO	PO	PO	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
1	[illegible]	2	1				1							3	
2	[illegible]	2				2	3						1	2	
3	[illegible]	3	2		2	2	2						1	2	
4	[illegible]	2		3	2	2	1	3	1		1	1	1	3	

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL 2432 - PE IV: FUNDAMENTALS OF SMARTGRID

Unit No.	Contents	Max. Hrs.
	Introduction to Smart Grid & Power System Enhancement:	
	Smartgrid Communications :	
3	**Performance Analysis Tools for Smart grid Design**	
	Computational Tools for Smart grid Design	
	Pathway for designing Smart grid:	
	Renewable Energy and Storage:	

	TITLE	YEAR	AUTHOR	PUBLICATION

VII Semester

EL 2433 - PE IV: COMPUTER METHODS IN POWER SYSTEM

Course Objectives	Course Outcomes
The student should be able to [illegible]	**The student should be able to:** [illegible]

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	[illegible]	1	1	2		1				1			1		
2	[illegible]	1	1	2		1				1			1	2	1
3	[illegible]	1	1	2		1		1	1				1	2	1
4	[illegible]	1	1	1		1		1	1	1			1	2	

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester

EL 2433 - PE IV: COMPUTER METHODS IN POWER SYSTEM

Unit No.	Contents	Max. Hrs.
[illegible]	**UNIT-1 Incidence and network matrices** [illegible]	[illegible]
[illegible]	**Algorithm for single phase network** [illegible]	[illegible]
3	**Three Phase Networks** [illegible]	[illegible]
[illegible]	**Short circuit studies** [illegible]	[illegible]
[illegible]	**Transient stability studies** [illegible]	[illegible]
[illegible]	**Load Flow Studies** [illegible]	[illegible]

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:

[illegible]	TITLE	EDITION	AUTHOR	PUBLISHER
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	3rd [illegible]	[illegible]	[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester

EL 2434 - PE IV: EHVAC-HVDC TRANSMISION

Objective	Course Outcome
The student should be able	1) 2) 3) 4)

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		3	2	1									1	1	
CO2		3	2				3						1		
CO3		2	3										1		
CO4		3	2	2									1		1

VII Semester

EL 2434 - PE IV: EHVAC-HVDC TRANSMISION

Unit No.	Contents	Max. Hrs.
[illegible]	**[illegible]ower handling and voltage gradient** [illegible] [illegible] and bundled conductors. Maxwell"s potentials [illegible]	[illegible]
[illegible]	**Electrostatic and electromagnetic fields of EHV lines & corona** [illegible]3[illegible] [illegible]M[illegible]	[illegible]
3[illegible]	**HVDC Power transmission** [illegible]	[illegible]
[illegible]	**Analysis of HVDC converters** [illegible]	[illegible]
[illegible]	**Harmonic Filters & Reactive power compensation** [illegible]	[illegible]
[illegible]	**HVDC circuit breakers** [illegible]M[illegible]	[illegible]

[illegible]

[illegible]	Title	Edition	Author	Publication
[illegible]	[illegible]	3rd-2006	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	2nd - 2006	[illegible]	[illegible]

Reference books:

1	[illegible]	[illegible]	[illegible]	[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]M[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

ELECTRICAL ENGINEERING

VIII Semester

EL2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

ELECTRICAL ENGINEERING

VIII Semester

EL2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

[illegible]

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AN AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

3rd to 8th Semester

Electronics Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EE-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	30	40	3 Hours
2	3	PC	EE2201	Electronic Devices	T	3	1	0	4	4	30	30	40	3 Hours
3	3	PC	EE2202	**Lab:**Electronic Devices	P	0	0	2	2	1		60	40	
4	3	PC	EE2203	Signal and Systems	T	3	0	0	3	3	30	30	40	3 Hours
5	3	PC	EE2204	**Lab**:Programming Language	P	0	0	2	2	1		60	40	
6	3	PC	EE2205	Digital Logic Design	T	3	0	0	3	3	30	30	40	3 Hours
7	3	PC	EE2206	**Lab:** Digital Logic Design	P	0	0	2	2	1		60	40	
8	3	PC	EE2207	Network Analysis	T	3	0	0	3	3	30	30	40	3 Hours
9	3	PC	EE2208	**Lab:**Network Analysis	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**1**	**8**	**24**	**20**				
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	30	40	3 Hours
2	4	PC	EE2251	Electronic Circuits	T	3	0	0	3	3	30	30	40	3 Hours
3	4	PC	EE2252	**Lab:**Electronic Circuits	P	0	0	2	2	1		60	40	
4	4	PC	EE2253	Microcontroller and its Applications	T	3	0	0	3	3	30	30	40	3 Hours
5	4	PC	EE2254	**Lab:** Microcontroller and its Applications	P	0	0	2	2	1		60	40	
6	4	PC	EE2255	Analog Communication	T	3	0	0	3	3	30	30	40	3 Hours
7	4	PC	EE2256	**Lab**.: Analog Communication	P	0	0	2	2	1		60	40	
8	4	PC	EE2257	Electromagnetic Fields	T	3	1	0	4	4	30	30	40	3 Hours
9	4	PC	EE2258	**Lab**: Simulation Lab/Workshp Lab	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**1**	**8**	**24**	**20**				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EE-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	30	40	3 Hours
2	5	PC	EE2301	Digital Signal Processing	**T**	3	0	0	3	3	30	30	40	3 Hours
3	5	PC	EE2302	**Lab:** Digital Signal Processing	**P**	0	0	2	2	1		60	40	
4	5	PC	EE2303	Analog Integrated Circuit & its Application	**T**	3	0	0	3	3	30	30	40	3 Hours
	5	PC	EE2304	**Lab:** Analog Integrated Circuit & its Application	**P**	0	0	2	2	1		60	40	
5	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	30	40	3 Hours
6	5	PE		Lab.: Professional Elective-I	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	30	40	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	30	40	3 Hours
9	5	STR	EE2310	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
					TOTAL	**18**	**0**	**6**	**24**	**22**				

List of Audit Courses														
1	5	IT	IT1121	Industrial Programmin Language	**A**	3	0	0	3	0				

Professional Electives -I

1	5	PE-I	EE2311	PE-I:Computer Communication Network
2	5	PE-I	EE2312	**Lab:**PE-I:Computer Communication Network
3	5	PE-I	EE2313	PE-I:Embedded System
4	5	PE-I	EE2314	**Lab:**PE-I:Embedded System
5	5	PE-I	EE2315	PE-I:Algorithm & Data Structure
6	5	PE-I	EE2316	**Lab:**PE-I:Algorithm & Data Structure
7	5	PE-I	EE2317	PE-I: Applied Machine Learning
8	5	PE-I	EE2318	**Lab:**PE-I:Applied Machine Learning

Open Electives -I

1	5	OE-I	EE2331	OE I : Fuzzy Logic & Neural Network
2	5	OE-I	EE2332	OE I : Basics of Analog and Digital Communication
3	5	OE-I	EE2333	OE I : Biomedical Instrumentation

Open Electives -II

1	5	OE-II	EE2341	OE II : Data Acquisition & Signal Conditioning
2	5	OE-II	EE2342	OE II : Microprocessor Programming
3	5	OE-II	EE2343	OE II : Consumer Electronics

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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SoE No. EE-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	30	40	3 Hours
2	6	PC	EE2351	Control System Engineering	**T**	3	0	0	3	3	30	30	40	3 Hours
3	6	PC	EE2352	Transmission Lines and Waveguides	**P**	0	0	2	2	1		60	40	
4	6	PC	EE2353	Digital Communication	**T**	3	0	0	3	3	30	30	40	3 Hours
5	6	PC	EE2354	**Lab:**Digital Communication	**T**	3	0	0	3	3	30	30	40	3 Hours
7	6	PE		Professional Elective-II	**T**	3	0	0	3	3	30	30	40	3 Hours
8	6	PE		Lab.: Professional Elective-II	**P**	0	0	2	2	1		60	40	
9	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	30	40	3 Hours
10	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	30	40	3 Hours
					TOTAL	**21**	**0**	**4**	**25**	**23**				

Professional Electives -II

1	6	PE II	EE2361	PE II:Internet of Things
	6	PE II	EE2362	**Lab:** PE II:Internet of Things
2	6	PE II	EE2363	PE II:Digital CMOS Circuits
	6	PE II	EE2364	**Lab:** PE II:Digital CMOS Circuits
3	6	PE II	EE2365	PE II:Digital Image Processsing
	6	PE II	EE2366	**Lab:**PE II:Digital Image Processsing
4	6	PE II	EE2367	PE II:Object Oriented Programming
	6	PE II	EE2368	**Lab:**PE II:Object Oriented Programming

Open Electives -III

1	6	OE-III	EE2381	OE III : Fuzzy Logic & Neural Network
2	6	OE-III	EE2382	OE III : Basics of Analog and Digital Communication
3	6	OE-III	EE2383	OE III : Biomedical Instrumentation
Open Electives -IV				
4	6	OE-IV	EE2391	OE IV : Data Acquisition & Signal Conditioning
5	6	OE-IV	EE2392	OE IV : Microprocessor Programming
6	6	OE-IV	EE2393	OE IV : Consumer Electronics

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Yeshwantrao Chavan College of Engineering

SoE No.
EE-201

B.E. SCHEME OF EXAMINATION 2018-19

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
					T	3			3	3	3	3		3
				Lab.	P									
3					T	3			3	3	3	3		3
					T	3			3	3	3	3		3
					P									
					T	3			3	3	3	3		3
					T	3			3	3	3	3		3
					P							6		
					P									
					TOTAL	15	0	8	23	21				

Professional Electives -III

3			3	

Professional Electives -IV

				Lab:
			3	
				Lab:
3				
				Lab. :
				Lab:

Professional Electives -V

			3	
			3	
			33	
			3	

Professional Electives -VI

3			3	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA** = for Practical : MSPA will be 15 marks each

		June 2020	1.02	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Eigth Semester

			EE		P									

[illegible]

Yeshwantrao Chavan College of Engineering

[illegible]

B.E. SCHEME OF EXAMINATION 2018-19

[illegible]

SoE No. EE-201

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
[illegible]	[illegible]	[illegible]	EE[illegible]	[illegible]	P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		
					TOTAL	0	0	12	12	10				

	L	T	P	Hrs	Credits	
GRAND TOTAL	84	2	46	132	163	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA** = for Practical : MSPA will be 15 marks each

		June 2020	1.02	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

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BE SoE and Syllabus 2018

ELECTRONICS ENGINEERING

III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
[illegible]	[illegible]

Unit I: Finite Differences

[illegible] **(6 hours)**

Unit II: Laplace Transform

Laplace Transforms: [illegible] **(7 hours)**

Unit III: Z-transform

[illegible] **(6 hours)**

Unit IV: Fourier Series

[illegible] **(7 hours)**

Unit V: Partial Differential Equation

[illegible] **(7 hours)**

Unit VI : Fourier Transform : [illegible] **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3rd SEMESTER

EE2201	Electronic Devices	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

Unit I: Energy Bands and Charge carriers in Semiconductors

[illegible]

Unit II: Diode and its applications

[illegible]

Unit III: Device Fabrication Process

[illegible]

Unit IV: Bipolar Junction Transistor and its Configurations

[illegible]

Unit V: MOSFET and its Configurations

[illegible]

Unit VI: BJT and MOSFET Amplifier Configurations

[illegible]

Text Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	3rd [illegible]	[illegible]

Reference Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	3rd [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3rd SEMESTER

EE2202	Lab : Electronic Devices	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Course Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3rd SEMESTER

EE2203	Signals & Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

Unit I: Continuous and Discrete time signals **[6 hr]**

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Text Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] M[illegible]	3rd [illegible]	[illegible]

Reference Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	M[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible] M[illegible]	[illegible]	[illegible] 3	[illegible] M[illegible]
[illegible]	[illegible] M[illegible]	[illegible]	3rd [illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	[illegible]

3rd SEMESTER

EE2204	Lab : Programming Language	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Course Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

EE2205	Digital Logic Design		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

Unit I: **(7 Hr)**

[illegible]

Unit II: **(6 Hr)**

[illegible]

Unit III: **(7 Hr)**

[illegible]

Unit IV: **(6 hr)**

[illegible]

Unit V: **(7 Hr)**

[illegible]

Unit VI: **(7 Hr)**

[illegible]

Text Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	3rd [illegible]	[illegible]
3 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

3rd SEMESTER

EE2206	Lab : Digital Logic Design	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Course Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

EE2207	Network Analysis	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1 Nodal Analysis of Electric Circuits

[illegible]

UNIT-2 Mesh Analysis of Electric Circuits

[illegible]

UNIT-3: Network Theorem

[illegible]

UNIT-4: Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform

[illegible]

UNIT-5 : Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions

[illegible]

UNIT-6: Two Port Parameters

[illegible]

Text Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	3rd [illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3rd SEMESTER

EE2208	Lab : Network Analysis	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Course Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
4th Semester
Electronics Engineering

28 June 2019

IV Semester

GE2204 - Advanced Mathematical Techniques

Objective	Outcomes
• [illegible] • [illegible] • [illegible] • [illegible]	• [illegible] • [illegible] • [illegible] • [illegible]

Unit I:

Numerical Methods for Algebraic And Transcendental Equations: [illegible] **Numerical Methods System of Algebraic Equations** [illegible]

(7 hours)

Unit II:

Numerical Methods for Differential Equations [illegible] **(6 hours)**

Unit III:

Random Variables and Probability Distribution [illegible] **(6 hours)**

UNIT IV:

Mathematical Expectation [illegible] **(7 hours)**

UNIT V:

Fuzzy Sets And Fuzzy Logic [illegible] **(7 hours)**

Unit VI:

OPTIMIZATION TECHNIQUES: [illegible] **(6 hours)**

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV Semester
GE2204 - Advanced Mathematical Techniques

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

4th SEMESTER

EE2251	Electronic Circuits	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Objective	Outcomes
[illegible]	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible]

Unit I: BJT Amplifiers (Low frequency: (Single and Multi-stage)

[illegible]

Unit II: MOSFET Amplifiers (Low frequency: Single-Stage)

[illegible]

UNIT III: Transistor Amplifiers at High-frequency

[illegible]

UNIT III: MOSFET Amplifiers at High-frequency

[illegible]

UNIT V: Feedback Configurations

[illegible]

UNIT VI: Power Amplifiers

[illegible]

Text Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	3rd [illegible]	[illegible]

Reference Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	3rd [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

4th SEMESTER

EE2252	Lab : Electronic Circuits	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Objective	Outcomes
[illegible]	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible]

Exp No	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

4th SEMESTER

EE2253	Microcontroller & its Applications	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Objective	Outcomes
[illegible]	[illegible]

Unit I: [illegible]

[illegible]

Unit II: [illegible]

[illegible]

Unit III: [illegible]

[illegible]

Unit IV: [illegible]

[illegible]

Unit V: [illegible]

[illegible]

Unit VI: [illegible]

[illegible]

Text Books:

[illegible]

Reference Book:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

4th SEMESTER

EE2254	Lab. Microcontroller & its Applications	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Objective	Outcomes
[illegible]	[illegible]

Exp No	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

4th SEMESTER

EE2255	Analog Communication	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Objective	Outcome
[illegible]	[illegible]

UNIT-1: **(7 Hrs)**

[illegible]

UNIT-2: **(8 Hrs)**

[illegible]

UNIT-3: **(8 Hrs)**

[illegible]

UNIT-4: **(8 Hrs)**

[illegible]

UNIT-5: **(8 Hrs)**

[illegible]

UNIT-6: **(8 Hrs)**

[illegible]

Text Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

4th SEMESTER

EE2256	Lab : Analog Communication	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Objective	Outcome
[illegible]	[illegible]

Exp No	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

4th SEMESTER

EE2257	Electromagnetic Fields	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Objective	Outcome
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	3 [illegible]
[illegible]	[illegible]

Unit I: **(7 Hours)**

[illegible]

Unit II: **(7 Hours)**

[illegible]

Unit III: **(7 Hours)**

[illegible]

Unit IV: **(8 Hours)**

[illegible]

Unit IV: **(7 Hours)**

[illegible]

Unit VI: **(7 Hours)**

[illegible]

Text Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	3rd [illegible]	[illegible]

Reference Books:

SNo	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

4th SEMESTER

EE2258	Lab:Electronics Workshop	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Objective	Outcome
[illegible]	[illegible] 1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible]

Exp No	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

5th Semester

Electronics Engineering

28 June 2020

V Semester
GE2311 - Fundamentals of Management

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management
Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management
Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure .

UNIT-4: Project Management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.

UNIT-5: Marketing Management
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

V Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth Maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

V Semester

EE2301 – Digital Signal Processing

Objective	Course Outcome
1. This course will provide solid foundations of discrete time signal processing fundamental concepts, Transform domain analysis, Mathematical analysis of FIR and IIR filter design.	**On completion of this course, the student will be able to** 1. Apply DFT and Z transform for the analysis of signals and systems 2. Construct and optimize structures for the realization of discrete Time system 3. Design of Analog and Digital Filters for given specifications 4. Understand fundamentals and architecture of DSP processor. 5. Simulation and verification of various transform techniques and filter Design

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Apply DFT and Z transform for the analysis of signals and systems	3	2	1	2	2									
CO 2	Construct and optimize structures for the realization of discrete Time system	3	3	1	2	2									
CO 3	Design of Analog and Digital Filters for given specifications	3	3	3	2	2									
CO 4	Understand fundamentals and architecture of DSP processor	2	2	1	1	1									
CO 5	Simulation and verification of various transform techniques and filter Design	2	2	2	2	2								2	2

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

EE2301 – Digital Signal Processing

Unit No.	Contents	Max. Hrs.
1	Discrete Time(DT) Signals and System, Classification of DT signals, classification of DT systems, linear Convolution, Sampling and reconstruction.	7
2	Discrete Time Fourier Transform, Discrete Fourier Transform, Computation of DFT, Properties of DFT, convolution of data sequences, FFT algorithms, Decimation in time, Decimation in Frequency	7
3	Digital Filter structures: FIR digital filter structures, IIR digital filter structures, Lattice structures, Finite word length effect.	7
4	IIR Digital filter Design, Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Butterworth and Chebyshev filter.	7
5	FIR Digital Filter Design, FIR filter design using windowing techniques	7
6	Multirate Digital Signal processing fundamentals, sampling rate alteration, multirate structures, Decimator and Interpolator and Multistage design.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Discrete time signal processing	2nd edition, 1999	V. Oppenheim, R, W, Schafer	PHI
2	Digital signal processing – Principles, algorithms and applications	3rd Edition ,1996	J. G. Proakis, D. G. Manolakis	PHI

V Semester
EE2302 – Lab: Digital Signal Processing

Expt. No.	Name of Experiment
1	Sampling and reconstruction of signal using MATLAB
2	To generate and plot discrete time signals.
3	To perform operations on discrete time signals.
4	To compute convolution on discrete time signals.
5	To compute DFT and IDFT of discrete time signals.
6	To determine pole zero plot and inverse Z transform of a signal.
7	To design FIR and IIR filter using FDA Tool.
8	To illustrate signal processing application using SP Tool.
9	To perform upsampling and downsampling on discrete time signal.
10	To study of DSP Starter Kit (TMS 320C6XX DSK).

V Semester

EE2303 –Analog Integrated Circuits & Its Applications

Objective	Course Outcome
1. The objective of this course is to analyze and design a wide variety of operational amplifier / integrated circuits based applications and to have a firm grasp of basic principle of these to adapt to a changing technology as the new devices appear in the market	**On completion of this course,** 1. Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier. 2. Student will analyze and design the linear applications of the operational amplifier. 3. Students will analyze and design active Butterworth filters using operational amplifier 4. Student will analyze and design the non-linear applications of the operational amplifier.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier.	3													
CO 2	Student will analyze and design the linear applications of the operational amplifier.	2	3	3										2	
CO 3	Students will analyze and design active Butterworth filters using operational amplifier	1	3	3										2	
CO 4	Student will analyze and design the non-linear applications of the operational amplifier.	1	2	3										2	

V Semester

EE2303 –Analog Integrated Circuits & Its Applications

Unit No.	Contents	Max. Hrs.
1	Differential Amplifier, configurations, DC & AC Analysis of DIBO and DIUBO, Differential amplifier using swamping resistor, constant current bias, current mirror, cascaded differential amplifier. DC Level Shifter.	8
2	OPERATIONAL AMPLIFIER FUNDAMENTALS: Block Diagram of Op-AMP, Ideal Op-Amp, OPAMP parameters, Basic Op-Amp Configurations: Open loop, Feedback in OPAMP circuit: Inverting, Non-inverting, voltage follower. Compensation of error parameters :Input Bias and Offset Current, Input Bias and Offset voltages, frequency compensation.	7
3	LINEAR APPLICATIONS : Summing, difference amplifier, integrator, differentiator, Current-to-Voltage Converter, Voltage-to-Current Converter, Instrumentation Amplifiers, Instrumentation Applications, Transducer Bridge amplifiers.Precision Rectifiers, Log/Antilog amplifiers.	7
4	ACTIVE FILTERS: Transfer function, first order filter, Standard second order response, higher order filter, KRC Filters, Multiple feedback filters, second and higher order Butterworth filter design.	8
5	NONLINEAR CIRCUITS: Voltage Comparators, Comparator Applications, Peak Detectors, Schmitt Triggers: Inverting & Non-inverting, Sample-and-Hold Circuits, clipper, clamper, WAVEFORM GENERATORS: multivibrators, triangular wave generator, Sinusoidal Oscillators.	7
6	Phase Locked Loop IC565, Monolithic timer IC555, D-A AND A-D CONVERTERS: Performance Specifications of D-A Converters (DACs) and A-D Converters (ADCs), D-A Conversion Techniques, A-D Conversion Techniques.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Linear Integrated Circuits	3rd Edition	S. Salivahanan, V. S. Bhaaskaran	Tata McGraw Hill Publication
2	Op-amps and Linear Integrated Circuits	3rd Edition	RamakantA.Gayakwad,	Prentice Hall Publication

Reference Books

SN	Title	Edition	Authors	Publisher
1	Linear Integrated Circuits	3rd Edition	D. Roy Chaudhuri, Shail Jain	New Age International
2	Design with Operational Amplifiers and Analog Integrated Circuits	3rd Edition	Sergio Franco	McGraw-Hill

V Semester

EE2304 –Lab: Analog Integrated Circuits & Its Applications

Exp No.	Name of Experiment
1	Verify differential amplifier configurations DIBO and DIUBO using simulation.
2	Verify Gain relationship of Inverting and Non-inverting amplifier and plot frequency response of Non-Inverting amplifier and verify gain bandwidth relation. (Bread-Board and simulation)
3	Determine CMRR and Slew rate of OP-AMP and compare with theoretical values.(Bread-Board and simulation)
4	Verify gain relationship of Summer, Scalar and Subtractor circuits.(Bread-Board and simulation)
5	Determine cut-off frequencies f_a and $f_b$of Integrator using frequency response and verify input output waveforms.(Bread-Board and simulation)
6	Determine cut-off frequencies f_a and $f_b$ofDifferntiator using frequency response and verify input output waveforms.(Bread-Board and simulation)
7	Determine cut-off frequency of second order Butterworth Low pass filter using frequency response and verify order of filter from stop band of frequency response.(Bread-Board and simulation)
8	Determine cut-off frequency of second order Butterworth High pass filter using frequency response and verify order of filter from stop band of frequency response.(Bread-Board and simulation)
9	Verify Comparator operations using single supply op-amp configuration. (Bread-Board and simulation)
10	Verify VUT and VLT of Schmitt trigger using OP-AMP IC 741 and plot the hysteresis curve.(Bread-Board and simulation)
11	Determine frequency of operation and duty cycle of Astable Multivibrator using OP-AMP IC 741.(Bread-Board and simulation)
12	Determine frequency of operation and duty cycle of Astable Multivibrator using IC 555 and modify it for 50% duty cycle.(Bread-Board and simulation)
13	Design a Wein bridge oscillator and study its operation using 741 op-amp.(Bread-Board and simulation)
14	Verify the operation of Half wave and Full wave Precision Rectifier using OP AMP IC 741. (Bread-Board and simulation)

V Semester

EE2311 – PE I: Computer Communication Network

Objective	Course Outcome
1. To learn basics of data communication, wireless transmission, spread spectrum, medium access control- FDMA, TDMA & CDMA. 2. To study TCP/IP, ARP, RARP, UDP protocols & addressing. 3. To study network security & its applications.	**On completion of this course, Students will be able to** 1. Describe various protocols, models in Computer Networks 2. Compare Connectors, Network hardware, Media Types (cables, Wireless) 3. Design, implement and analyze simple computer networks. 4. Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe various protocols, models in Computer Networks	2	2												
CO 2	Compare Connectors, Network hardware, Media Types (cables, Wireless)	2	2												
CO 3	Design, implement and analyze simple computer networks	2	2												
CO 4	Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols	2	2												

V Semester
EE2311 – PE I: Computer Communication Network

Unit No.	Contents	Max. Hrs.
1	Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model.	8
2	LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN	7
3	Physical layer and data link layer: transmission media, PSTN. Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.	8
4	Network layer and transport layer: Network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways	7
5	Application layer: Network security cryptography, secrete key, public key, digital signature, domain name system, electronic mail system	8
6	Multimedia, real time transport protocol, e-mail security, web security, communication security, electronic mail, world wide web.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Networks	3rd Edition,1996	Tanenbaum	Prentice Hall
2	Data Communications and Networking	4th edition, 2007	Behrouz a Forouzan	Tata Mc. Graw Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Data and Computer Communication	8th Edition,2006	W. Stallings	Prentice Hall
2	Telecommunication switching systems and networks	2004.	T. Vishwanathan	Prentice Hall

V Semester
EE2312 – Lab: PE I: Computer Communication Network

Expt. No.	Name of Experiments
1.	To perform stuffing and de-stuffing operation on a given array.
2.	To Perform data encryption and data decryption.
3.	Perform network utility commands.
4.	How to bring two computers in a network.
5.	To study LAN structures.
6.	To configure DNS server.
7.	To configure DHCP server.
8.	Write a program for simple stop n wait protocol.
9.	Write a program for go back n protocol.
10.	Write a program for selective repeat ARQ protocol.

V Semester
EE2313 – PE I: Embedded Systems

Objective	Course Outcome
To provide the acquaintance with 1. Concept of RISC processor, coprocessor, bus structure, memory management. 2. Concept of RTOS &different communication protocols	**On completion of this course, Students will be able to** 1. Understand & Learn concept of Architecture & organization of ARM. 2. Understand & Learn concept of RTOS Architecture. 3. Apply the concept of programming language to interface I/O Devices. 4. Establish the communication between the different Devices.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand & Learn concept of Architecture & organization of ARM.	3	3	3											
CO 2	Understand & Learn concept of RTOS Architecture	2	3	3											
CO 3	Apply the concept of programming language to interface I/O Devices.	1	2	3											
CO 4	Establish the communication between the different Devices	1	2	3											

V Semester
EE2313 – PE I: Embedded Systems

Unit No.	Contents	Max. Hrs.
1	Introduction to ARM, Advantages of architectural features of ARM Processor, Processor modes, Register organization, Exceptions and its handling, 3/5- stage pipeline ARM organization.	7
2	Memory and memory-mapped I/Os, ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs.	8
3	Buses: ARM floating point architecture, Memory buses: AMBA, ASB, & APB. Architectural support for system development.	7
4	Memory management: DMA Architecture, Memory Hierarchy, memory size and speed, on-chip memory, caches, cache design, memory *management.*	7
5	OS Supports: Architectural support for operating system, RTOS issues, µCOS-II and embedded Linux features, the shared Data Problem, Software Architectures (Round Robin, Round Robin with Interrupts, Function Queue Scheduling,),Selecting a software Architecture, Introduction to RTOS :tasks and task states, tasks and data, semaphores and shared data, message queues, mailboxes and pipes, events, RT Linux	8
6	Case for Real Time Operating System, Embedded ARM applications such as USB interface, Bluetooth, Ethernet.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	ARM System–on-chip Architecture	2nd edition, 2000	Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2002.	Craig Hallabaugh	Addison-Wesley Professional
3	ARM System Developer's Guide: Designing and Optimizing	2005	Sloss Andrew N, Symes Dominic & Wright Chris	Morgan Kaufman Publication

Reference Books

SN	Title
1	Technical references on www.arm.com.
2	Web base resources for RTOS and µCOS.

V Semester
EE2314 – Lab: PE I: Embedded Systems

Expt. No.	Name of Experiment (Any Ten)
1	To swap data byte
2	To perform addition, subtraction of 16 bit number
3	To find larger of a two numbers.
4	To perform factorial of a given number
5	To perform ON/OFF LED and show status of LED on LCD
6	To display number from 0 to 9 on seven segment display.
7	To ON/OFF LED using Switch.
8	To rotate a stepper motor in clockwise & anti-clock wise direction with equal delay.
9	Perform experiment on DAC of LPC2103
10	ADC and display value on LCD.
11	To find 1's complements of a given number.
12	Study of RTOS
13	device driver for UART.
14	Modify scheduler in such a way that it will assign highest priority to keypad.
15	values from RTC and display on LCD.
16	SMS to any mobile number.
17	Interface pen drive for writing predefined file.

V Semester
EE2315 – PE I: Algorithm & Data Structure

Objective	Course Outcome
1. To Study different Programming Aspect 2. To understand performance of System as per Time and Space Trade-off 3. To learn the various data structures	**On completion of this course, Students will be able to** 1. Study the trade off method Demonstrate and analyze various techniques. 2. Demonstrate various operation on data Structure 3. Understand various types Data Structure 4. Implement various types algorithm and analyze performance of system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Study the trade off method Demonstrate and analyze various techniques.	3	3	1	1	1									
CO 2	Demonstrate various operation on data Structure	3	3	3	3	2									
CO 3	Understand various types Data Structure	3	3	3	3	3									
CO 4	Implement various types algorithm and analyze performance of system.	3	2	3											

V Semester
EE2315 – PE I: Algorithm & Data Structure

Unit No.	Contents	Max. Hrs.
1	Introduction to Algorithms, Basics of Algorithm, Sub Algorithms, Procedures and Functions, Analysis of Algorithms, Time and Space Complexity, Programming aspects with respect to structured programming, Top down and bottom Up Approach	7
2	Arrays, Operations, Types, Representation of 1D, 2D arrays in memory, Sparse Matrices, Sorting, Quick Sort, Merge Sort, Insertion, Radix, Selection and Bubble Sort, Heap Sort, Searching , Linear, Binary Search, Hashing and collision Handling mechanism.	8
3	Stack , Fundamentals, Operations, Push , Pop , Applications of Stacks, Evaluation of Expressions, Recursion, Stack Machines and Multiple Stacks, Queues , Operations, Add , Delete, Types of Queues , Priority Queues, Circular Queue, Dequeue	7
4	Fundamentals of singly, Doubly, Circular, Linked Stacks and Queues, Examples of Linked List, Circular Linked List, Doubly Linked List and Dynamic Storage Management, Garbage Collection, Compaction and Applications of Linked List, Operations of Polynomials, Generalized Linked List.	8
5	Basic Terminology , Binary Tree Traversals, Threaded Storage Representation, Binary Search Tree, Applications of Tree, Preliminary Treatment of AVL Trees, B-Trees, B+ Trees	7
6	Basic Terminology, Graph Representation, Matrix, List, Multi-List, Graph Traversals, Breath First Search, Depth First Search, Minimum Cost Spanning Trees, Shortest Path Algorithm, Topological Sort, Critical Path.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Structures and Program, Design in C	Second Edition	Kruse, Leung and Tondo	PHI
2	Fundamentals of Data Structures	Fifth Edition	Ellis Horowtiz and Sartaj Sahani	Galgotia,Publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	An Introduction to Data Structures with Applications	Second Edition	Tremblay & Sorenson	TMH
2	Data Structures, Schuam Series,	Fifth Edition	Seymour Lipschutz, G.A. V. Pai,	TMH

V Semester
EE2316 – Lab: PE I: Algorithm & Data Structure

Expt. No.	Name of Experiment (Any Ten)
1	Write a program on control Structure & Statements
2	Write a program on If –else structure
3	Write a program on Case Statement
4	Write a program on Functions
5	Write a program on Macros
6	Write a program on Pointers
7	Write a program on Structures
8	Write a program on Linked List
9	Write a program on Doubly linked list
10	Write a program on graphs
11	Write a program on Trees
12	Write a program on Search Algorithms
13	Write a program on Stacks

V Semester

EE2317 – PE I: Applied Machine Learning

Objective	Course Outcome
1. The basic concepts of machine learning and the relative strengths and weaknesses of different machine learning methods. 2. To understand the concepts of different types of machine learning algorithms and how to apply a learning algorithms to sample. 3. To understand the different methods of evaluation of machine learning algorithms 4. To understand different ensembling methods and new techniques like deep and shallow learning	**On completion of this course, Students will be able to** 1. Develop an appreciation for what is involved in learning from data, machine learning techniques that are suitable for the different applications 2. Design an appropriate learning model from set of samples to meet the desired needs 3. Compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices 4. Integrate machine learning algorithms with ensembling methods and explain modern technologies like deep and shallow learning

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Develop an appreciation for what is involved in learning from data, machine learning techniques that are suitable for the different applications	3	3	2											
CO 2	Design an appropriate learning model from set of samples to meet the desired needs	3	3	3	2	2	2	2	2				2		
CO 3	Compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices	3	3	3	2	2	2	2	2				2		

CO 4	Integrate machine learning algorithms with ensembling methods and explain modern technologies like deep and shallow learning	3	3	3	1	1							1		

V Semester
EE2317 – PE I: Applied Machine Learning

Unit No.	Contents	Max. Hrs.
1	**Introduction to machine learning:** Introduction, machine learning classes (i.e., supervised, unsupervised and reinforced), foundation of machine learning with data pre-processing methods and data cleaning methods	7
2	**Regression**: Linear regression, Non linear regression, model evaluation methods(Feature extraction methods used in machine learning, feature extraction from numerical data, feature extraction from text data, feature extraction from image data, feature extraction from video data)	8
3	**Classification:** Classification methods (supervised and un-supervised), classification system using pre-processing and feature extraction, accuracy estimation of the designed system.	7
4	**Clustering:** Basic clustering, design of a real time clustering , Design of feature selection methods, introduction to Bio-inspired Algorithms (majorly Genetic Algorithm & PSO) for improving the accuracy using feature selection	8
5	Training, testing and validation sets for classifiers, design and implementation of prediction algorithms (like regression learning, Naïve Bayes, Random Forest), introduction to perception and neural networks for classification and prediction	7
6	Introduction to Convolutional Neural Networks, different layer designs in CNNs, usage of standard CNNs like GoogLeNet, AlexNet and VGGNet, design of CNN for highly accurate classification	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Machine Learning	second edition	Ethem Alpaydin	MIT Press
2	Machine Learning	1997	Tom Mitchell	McGraw-Hill Science/Engineering /Math

Reference Books

SN	Title	Edition	Authors	Publisher
1	Pattern Recognition and Machine Learning	15 Feb 2010	Christopher M. Bishop	Springer
2	. http://research.microsoft.com/enus/um/people/cmbishop/prml/.			

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
EE2318 – Lab: PE I: Applied Machine Learning

Expt. No.	Name of Experiment
1.	Data Pre-processing and cleaning
2.	Linear Regression
3.	Non Linear Regression
4.	K-Nearest Neighbours
5.	Decision Tree
6.	Support Vector Machine
7.	K-Means Clustering
8.	Hierarchical Clustering
9.	Content based Recommendation System
10.	Collaborative filtering Recommendation System

V Semester

EE2331 – OE I: Fuzzy Logic & Neural Network

Objective	Course Outcome
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective	**On completion of this course, Students will be able to** **CO1:** Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks. **CO2:** Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches **CO3:** Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks **CO4:** Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks.	3	2	1	-	1	1	1	2	1	1	-	1	-	-
CO 2	Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches	3	3	3	2	2	1	1	2	1	1	-	1	3	-
CO 3	Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks	3	3	3	3	2	2	1	2	2	2	1	3	3	-

CO 4	Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.	3	3	3	3	2	2	1	2	2	2	2	3	3	-

V Semester
EE2331 – OE I: Fuzzy Logic & Neural Network

Unit No.	Contents	Max. Hrs.
1	Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets	8
2	Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations	7
3	Fuzzy controllers: an overview with applications, applications of fuzzy logic	7
4	Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning	8
5	Brief introduction to single layer and multilayer perceptions, ADALINE and MADALINE, feed-forward networks, back propagation networks and applications.	8
6	Radial basis function network, Self organizing feature map and applications	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI

2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Fuzzy Logic with engineering applications,	3rd Edition	Timothy Ross,	Wiley Publication
4	Principles of Soft Computing	2nd Edition	S. N. Sivanandanam and S. N. Deepa,	Wiley Publication

V Semester
EE2332 – OE I: Basics of Analog and Digital Communication Systems

Objective	Course Outcome
1. To Study different analog and digital modulation techniques. 2. To understand transmitter & receivers in communication systems	**On completion of this course, Students will be able to** 1. Understand different modulation and demodulation schemes for analog communication with the concept of noise 2. Understand different pulse analog and digital modulation techniques. 3. Understand different digital modulation schemes 4. Understand the different coding techniques for communication systems.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand different modulation and demodulation schemes for analog communication with the concept of noise	2	1												
CO 2	Understand different pulse analog and digital modulation techniques.	2	1												

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

CO 3	Understand different digital modulation schemes	2	1												
CO 4	Understand the different coding techniques for communication systems	2	1												

V Semester
EE2332 – OE I: Basics of Analog and Digital Communication Systems

Unit No.	Contents	Max. Hrs.
1	Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.	8
2	Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.	7
3	Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Basic digital Modulation System- PCM.	7
4	Channel capacity, DPCM, Delta Modulation, ADM, ADPCM, Adaptive sub-band coding, applications.	8
5	Digital Modulation techniques: ASK, FSK, PSK, BPSK, QPSK, MSK, DPSK, BFSK, M-ary PSK, FSK, and QAM.	8
6	Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication System	Fourth Edition,	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications	1999	SymonHykin	Wiley, 1988

Reference Books

SN	Title	Edition	Authors	Publisher

1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

V Semester
EE2333 – OE I: Biomedical Instrumentation

Objective	Course Outcome
1. This course is intended for introducing the students to evolution and development of biomedical instrumentation. 2. The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. 3. Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethys mograph and spirogyra 4. Understand the fundamentals of Telemedicine like Teleradiology, Telecardiology, Telepsychiatry and Medical Informatics	**On completion of this course, Students will be able to** 1. Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation	3	2	1		1									

CO 2	Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram	3	2	1		1									
CO 3	Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care.	3	2	1		1									
CO 4	Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.	3	2	1		3									

V Semester
EE2333 – OE I: Biomedical Instrumentation

Unit No.	Contents	Max. Hrs.
1	Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.	8
2	Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers	7
3	The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers	7
4	Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG	8
5	Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators, Electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments.	8
6	Computers in biomedical instrumentation, digital computer, Telemedicine concept, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Biomedical Instrumentation & Measurement	19 Jan 2010	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	Prentice Hall

2	Biomedical Instrumentation	1 Jan 2010	Mandeep Singh	Prentice Hall

Reference books:				
1	Handbook of Biomedical Instrumentation	1987	R.S.Khandpur	TMH
2	Bioelectronics Measurement	1983	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	1 August 2008	Jacobson and Webster	PHI

V Semester
EE2341 – OE II: Data Acquisition & Signal Conditioning

Objective	Course Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques	After study through lectures and assignments, Students will be able to: 1. Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning 2. Identify the various types of data acquisition hardware and the serial data communication standards. 3. Distinguish different standards for connection of different programmable instruments like GPIB and SCPI 4. Define use of Ethernet, Medium Access control and USB

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning	3	2	2											

CO 2	Identify the various types of data acquisition hardware and the serial data communication standards	2	1	1											
CO 3	Distinguish different standards for connection of different programmable instruments like GPIB and SCPI	3	2	1											
CO 4	Define use of Ethernet, Medium Access control and USB	3	2	1											

V Semester
EE2341 – OE II: Data Acquisition & Signal Conditioning

Unit No.	Contents	Max. Hrs.
1	Definition of data acquisition and control, Fundamentals of data acquisition, Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.	8
2	Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.	7
3	Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.	7
4	Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection.	8
5	IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).	8
6	Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Data Acquisition for Instrumentation and Control Systems	10 June 2003	John Park and Steve Mackay	Elsevier

Reference books:

SN	Title	Edition	Authors	Publisher
1	Electronic Analog Digital Conversion	1st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1st Edition , 1993	B. S. Sonde	Tata McGraw Hill

V Semester
EE2342 – OE II: Microprocessor Programming

Objective	Course Outcome
▪ To understand the architecture, programming and addressing modes of Intel 8085 ▪ To study the instruction set and programming of 8085 ▪ To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085. 2. Will demonstrate the ability to identify, Formulate and design Program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor in their respective field.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Will be able to understand the architecture of 8085.	3	3	3	3										

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2										
CO 3	Will be able to interface Peripheral devices	1	2	3	1										
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1										

V Semester
EE2342 – OE II: Microprocessor Programming

Unit No.	Contents	Max. Hrs.
1	Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.	8
2	Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization	7
3	Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses,Programs based on instructions.	7
4	Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.	8
5	MICROPROCESSOR APPLICATIONS - Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .	8
6	USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Interfacing 8085	1 Dec 2000	Ramesh Gaonkar	Penram Publication

Reference books:				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	8085 Microprocessor	2014	Ajit Pal	Tata Mc-Graw Hill ,
2	Microprocessors & interfacing	2005	D. V. Hall	Tata McGraw-hill

V Semester
EE2343 – OE II: Consumer Electronics

Objective	Course Outcome
➢ To give knowledge and competencies regarding consumer electronic equipments.	Students will be able to 1. Understand the knowledge of the safety aspects in the field of Electrical and Electronics products. 2. Analyze the basics of Audio and Video Systems. 3. Know about recent trends in Processors and computer peripherals, mobile and wireless technologies. 4. Understand the basics of refrigeration cycle and cooling system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO 1	Will be able to understand the architecture of 8085.	3	3	3	3	3									
CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2	2									
CO 3	Will be able to interface Peripheral devices	1	2	3	1	1									
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1	1									

V Semester
EE2343 – OE II: Consumer Electronics

Unit No.	Contents	Max. Hrs.
1	Standards and Safety norms:Electronics and Electrical safety norms and standards, Electronic products covered under compulsory registration	8
2	Audio Systems: Sound Recording and reproduction, Hi-Fi Sound System, Audio Mixers, Graphics Equalizers, Public Address System.	7
3	Video Systems:Color fundamentals, Luminance and Chrominance signal , Color camera, digital television systems.	7
4	Wireless Technology & Mobile phones:Mobile Phones, various wireless technologies, Introduction to 3G, WiFiTechnology, GSM	8
5	Air conditioner and Refrigerators:Fundamentals, Refrigeration cycles, compressors, home automation	8
6	Computers:Recent microprocessor, Pentium family architecture and salient features , Recent Memories technologies (RAM, HDD), Computer peripherals	7

Text books:				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Consumer Electronics	First Edition	S.P. Bali	Pearson Education
2	Consumer Electronics",	2000	B. R. Gupta, Vandana Singhal	S. K. Kataria& Sons,

V Semester
EE2310 – Industry Visit and its Report

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
6th Semester
Electronics Engineering

28 June 2019

VI Semester
GE2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

UNIT-1: Introduction to Economics and Consumers' Behaviors:

[illegible] **(8 Hours)**

UNIT-2: Production and Costs

[illegible] **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price

[illegible] **(7 Hours)**

UNIT-4: National income accounting:

[illegible] **(5 Hours)**

UNIT-5: Money, Banking and Public Finance

[illegible] **(7 Hours)**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
GE2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

[illegible] **(5 Hours)**

Text Books:

[illegible]

Reference Books:

[illegible]

VI Semester
EE 2351- Control System Engineering

Objective	Outcome
[illegible]	[illegible]

Unit I: Introduction to Control Systems:
[illegible], **Transfer function, block Diagram and signal flow graph:** [illegible]

Unit II: Mathematical modeling of physical system: [illegible] **Characteristics of Feedback Control Systems:** [illegible]

Unit III: Time Domain Analysis of Control Systems:
[illegible]

Unit IV: Stability of Linear Control Systems:
[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE 2351- Control System Engineering

Unit V: Root Locus Technique:

Unit VI: Frequency domain analysis of control systems

Stability in Frequency domain:

Lag, lead and lag-lead compensation

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**

VI Semester

EE2352- Transmission Lines and Wave Guides

Objective	Outcome
➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] 3 [illegible]

UNIT-1

[illegible]

[illegible]

UNIT-2

[illegible] reflection factor and reflection loss, T and ∏ Section equivalent to lines.

[illegible]

UNIT-3

[illegible]

[illegible]

UNIT-4:

[illegible]

[illegible]

UNIT-5

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2352- Transmission Lines and Wave Guides

UNIT-6:

[illegible]

[illegible]

Text books:				
1	[illegible]	[illegible]3	[illegible]	[illegible]
2	[illegible]	[illegible]3	[illegible]	[illegible]
3	[illegible]	[illegible]3	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics Engineering

SoE No.
EE-201

VI Semester
EE2353- Digital Communication

Objective	Outcome
➢ [illegible]	[illegible]

Unit I [illegible]

Unit II [illegible]

Unit III [illegible]

Unit IV [illegible]

Unit V [illegible]

Unit VI [illegible]

[illegible]				
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2354- Lab: Digital Communication

Objective	Outcome
[illegible]	[illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2361- PE II: Internet of Things

Objectives	Outcomes
➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] [illegible] 3 [illegible]

UNIT-1 :Introduction

[illegible]

(7Hr)

UNIT -2: Seven Generations of IOT Sensors

[illegible]

(7Hr)

UNIT -3 : Technological Analysis

[illegible]

(7Hr)

UNIT -4 :IOT Development Examples

[illegible]

(7Hr)

UNIT -5 :CreatingSensor Projects

[illegible]

(7Hr)

UNIT -6:PreparingIot Projects

[illegible]

(7Hr)

Text Books:

[illegible]

REFERENCES

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2362- Lab: PE II: Internet of Things

Objective	Outcomes
➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] [illegible] 3 [illegible] [illegible]

Expt. No.	Name of Experiments
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2363- PE II: Digital CMOS Circuits

Objective	Outcomes
➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] 3 [illegible]

UNIT-1: [illegible]

UNIT-2 [illegible]

UNIT-3: [illegible]

UNIT-4: [illegible]

UNIT-5: [illegible]

UNIT-6: [illegible]

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]				
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2364- Lab: PE II: Digital CMOS Circuits

Objective	Outcomes
➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] 3 [illegible]

Expt. No.	Name of Experiment (Any Ten)
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2365- PE II: Digital Image Processing

Objective	Outcomes
[illegible]	[illegible]

UNIT-1:

[illegible]

UNIT-2:

[illegible]

UNIT-3 :

[illegible]

UNIT-4:

[illegible]

UNIT-5 :

[illegible]

UNIT-6:

[illegible]

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2366- Lab:PE II: Digital Image Processing

Objective	Outcomes
➢ [illegible]	[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. EE-201

Electronics Engineering

VI Semester

EE2367- PE II: Object Oriented Programming

[illegible]	[illegible]

UNIT-1:

[illegible]

[illegible]

UNIT-2:

[illegible]

[illegible]

UNIT-3 :

[illegible]

[illegible]

UNIT-4:

[illegible]

[illegible]

UNIT-5 :

[illegible]

[illegible]

UNIT-6:

[illegible]

[illegible]

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2368- Lab:PE II: Object Oriented Programming

Objective	Outcomes
➢ [illegible]	[illegible]

Exp No	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2381- OE III : Fuzzy Logic & Neural Network

Objective	Outcome
[illegible]	**On completion of this course, Students will be able to** **CO1:** [illegible] **CO2:** [illegible] **CO3:** [illegible] **CO4:** [illegible]

UNIT-1:
Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α[illegible]

[illegible]

UNIT-2:
[illegible]

[illegible]

UNIT-3 :
[illegible]

[illegible]

UNIT-4:
[illegible]

[illegible]

UNIT-5:
[illegible]

[illegible]

UNIT-6:
[illegible]

[illegible]

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
EE2381- OE III : Fuzzy Logic & Neural Network

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

EE2382- OE III : Basics of Analog and Digital Communication Systems

➢ [illegible] ➢ [illegible]	[illegible] [illegible] [illegible] 3 [illegible] [illegible]

Unit I: [illegible]

Unit II: [illegible]

Unit III: [illegible]

Unit IV: [illegible]

Unit V: [illegible]

Unit VI: [illegible]

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. EE-201

Electronics Engineering

VI Semester

EE2383-OE III: Biomedical Instrumentation

Objective	Outcome
➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] 3 [illegible] [illegible]

UNIT-1

[illegible]

UNIT-2

[illegible]

UNIT-3

[illegible]

UNIT-4:

[illegible]

UNIT-5 :

[illegible]

UNIT-6:

[illegible]

Text Books				
SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
EE2383-OE III: Biomedical Instrumentation

Reference books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

EE2391- OE IV : Data Acquisition & Signal Conditioning

Objective	Outcome
[illegible]	[illegible]

UNIT-1

[illegible]

[illegible]

UNIT-2

[illegible]

[illegible]

UNIT-3

[illegible]

[illegible]

UNIT-4:

[illegible]

[illegible]

UNIT-5

[illegible]

[illegible]

UNIT-6:

[illegible]

[illegible]

Text books:		
1	[illegible]	[illegible]

Reference books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

EE2392- OE IV : Microprocessor Programming

Objective	Outcome
▪ [illegible] ▪ [illegible] ▪ [illegible]	[illegible] 3 [illegible]

Unit I: [illegible]

Unit II: [illegible]

Unit III: [illegible]

Unit IV: [illegible]

Unit V: [illegible]

Unit VI: [illegible]

Text books:				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

EE2393- OE IV : Consumer Electronics

Objective	Outcome
➢ [illegible]	[illegible]

Unit -I

[illegible]

Unit -II

[illegible]

Unit -III

[illegible]

Unit IV

[illegible]

Unit -V

[illegible]

Unit –VI

[illegible]

Text books:				
SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
7th & 8th Semester
Electronics Engineering

28 June 2019

VII Semester
EE2401 -Digital System Design

Objective	Outcome
Students should be able to 1. [illegible]	Students will be able to [illegible] 3. [illegible] 4. [illegible]

[illegible]

Text Books:				
	Title	Edition	Author	Publisher
1	[illegible]	[illegible]	[illegible]	[illegible]3
Reference Book:				
	Title	Edition	Author	Publisher
1	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
EE2402 – Lab.: Digital System Design

Objectives	Outcomes
Students should be able to 1. [illegible] [illegible]	Students will be able to [illegible] [illegible] 3. [illegible] 4. [illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Text Books:

	Title	Edition	Author	Publisher
1	[illegible]	[illegible]	[illegible]	[illegible]

Reference Book:

	Title	Edition	Author	Publisher
1	[illegible]	[illegible]	[illegible]	[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
EE2411 – PE III: Switching Theory & Finite Automata

Course Objective	Course Outcomes
[illegible]	Students will be able to [illegible] 3 [illegible] 4. [illegible]

UNIT-1

[illegible] **(06 Hours)**

UNIT-2:

[illegible] **(06 Hours)**

UNIT-3: [illegible] **(06 Hours)**

UNIT 4:

[illegible] **(06 Hours)**

Unit 5: [illegible] **(06 Hours)**

Unit 6:

[illegible] **(06 Hours)**

Text books:				
[illegible]	Switching & Finite Automata Theory [illegible]	ZviKohavi, Niraja K. Jha	Third Edition 2010 [illegible]	Cambridge University Press [illegible]
[illegible]	Fundamentals of Digital Logic With VHDL Design [illegible]	Stephen Brown	Second Edition, 2007 [illegible]	TMH [illegible]

Reference books:				
[illegible]	Modern Switching Theory and Digital Design	Lee S.C		PHI Edition
[illegible]	Digital Logic and Computer Design	M.Morris Mano		PHI Edition

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
EE2412 – PE III :Power Electronics

Objective	Outcome
➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] [illegible] 3 [illegible] [illegible]

UNIT-1

[illegible]

[illegible]

UNIT-2

[illegible]

[illegible]

UNIT-3

[illegible]

[illegible]

UNIT-4:

[illegible]

[illegible]

UNIT-5

[illegible]

[illegible]

UNIT-6:

[illegible]

[illegible]

Text books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
1	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
EE2413 – PE III: Wireless Sensor Network 7th Semester

Unit I: Introduction & architecture: Motivation of Wireless Sensor Nodes, Challenges, constraints for WSN, applications, single node architecture, Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments

Unit II: Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts

Unit III: communication protocols: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , Contention based Protocols, Schedule based protocols

Unit IV: link layer Protocols: Fundamental, Error Control, Framing, Link Management, Naming And Addressing – Fundamentals, Assignment of MAC Address, Distributed assignment of locally unique addresses, Content based and geographic addressing

Unit V: Naming and addressing, Time synchronization: Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement. Clustering

Unit VI :Data centric and content based networking:Data centric routing, Data aggregation, Data centric storage, Topology control-controlling topology in a flat network, Hirarical network by dominating set, Hierarchical network by clustering, transport layer and Quality of sevice.

Textbook:

1) Protocols and Architectures for Wireless Sensor Networks. H. Karl and A. Willig. John• Wiley & Sons, June 2005.
2) Fundamentals of wireless sensor networks: Theory and Practice. Waltenegus Dargie,Christian Poellabauer, Wiley & sons, 2010,

Reference books:

1) Wireless Sensor Networks: Technology, Protocols, and Applications. K. Sohraby, D. Minoli, and T. Znati. John Wiley & Sons, March 2007.

VII Semester
EE2414 – PE III: VLSI Signal Processing

Objective	Outcome
Objectives: 1. To learn pipelining & parallel processing techniques. 2. To understand folding & unfolding techniques. 3. To address folding techniques used to design time multiplexed architecture.	**Course Outcome:** By the end of the course, the students shall be able to 1. Design architectures for DSP algorithms. 2. Apply the optimisation concept in terms of area, speed and power on DSP systems. 3. Optimize DSP arithmetic 4. Design of algorithm structure for DSP algorithms based on algorithm transformation.

Unit I: Representations of DSP algorithms: Block diagram, SFG, DFG,DFGrepresentations Loop bound and iteration bound, Algorithms for computing Iteration bound.

Unit II: Pipelining and Parallel Processing: Introduction, pipelining of FIR Digital filters, parallel processing, Pipelining and parallel processing for low power.

Unit III: Retiming:Introduction, Definition and properties, solving system of inequalities, retiming techniques.

Unit IV: Unfolding: Introduction, algorithms for unfolding, Properties of unfolding, Critical path, unfolding and retiming.

Unit V: Folding: Introduction Folding Transformation,Register minimization techniques, Register minimization in folded architectures.

Unit VI: Fast Convolution, Introduction, Cook- Toom algorithm, Winogard algorithm.

Text Books:

1. Keshab K. Parhi. "VLSI Digital Signal Processing Systems" Wiley-Inter Sciences. 1999
2. Mohammed Ismail, Terri, Fiez, "Analog VLSI signal and information processing", McGraw Hill ,1994.
3. Keshab. Parthi, "VLSI Digital signal processing system Design and implementation" Wiley-Inter science, 1999.
4. kung. S.Y., H.J. While house T.Kailath "VLSI and Modern singal processing", prentice hall, 1985.
5. Jose E. France, Yannis Tsividls "Design of Analog Digital VLSI circuits for telecommunications and signal processing" prentice Hall, 1994.

VII Semester
EE2421 – PE V : Wireless Communication

[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
EE2422 – Lab: PE IV: Wireless Communication

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

VII Semester
EE2423 – PE IV: RF and Microwave

UNIT-1: Microwave linear beam tubes (O type): High frequency limitations of conventional microwave devices, Two cavity Klystron Amplifier – Mechanism and mode of Operation, Power output and Efficiency, Applegate diagram, applications, Reflex Klystron Oscillator – Mechanism and mode of Operation Power output, efficiency, mode curve, Electronic Admittance, Modulation of Reflex Klystron; Applications, Helix TWT, BWO. Slow wave structures. **(8 Hours)**

UNIT-2: Microwave cross-field tubes (M Type): Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Power output and Efficiency, Cylindrical magnetron, parallel plate magnetron, split anode magnetron, Types of strapping, Tuning of magnetron. Applications. **(7 Hours)**

UNIT-3 Microwave passive Devices (Reciprocal and non reciprocal):Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, Directional couplers, Wave guide Corners, Bends and Twists ,Attenuators, Isolators, Gyrators, Circulators, Phase shifter, Rectangular cavity resonator, Transmission line resonators. **(8 Hours)**

UNIT-4: Microwave Network Analysis: Introduction, Symmetrical Z and Y matrices for reciprocal network, Scattering matrix representation of multi port networks, comparison between [S], [Z] and [Y] matrices, Inter relationship between impedance matrix, admittance matrix and Scattering matrix, properties of scattering matrix, Scattering matrix of transmission lines, ABCD parameters with S parameters, Scattering matrix derivation for all components, Numerical Problems. **(8 Hours)**

UNIT-5 Microwave measurement: Introduction, Tunable detector, Slotted line Carriage, VSWR meter, Power measurements sensor, Bolo meter sensor, power sensor, Low and High power measurement, Insertion loss and Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement. Frequency measurement, Measurement of cavity Q, Dielectric measurement, Antenna Measurement – radiation pattern, Phase and gain. Types of Microwave filters: Image parameter method, Insertion loss method. **(7 Hours)**

UNIT-6 Microwave solid state devices and circuits: Microwave diodes – Gun diode – Mode of operation, Crystal diode, PIN diode , Application as Oscillator and Amplifiers, Strip lines: Micro strip lines, parallel strip lines. Coplanar, shielded , Basics of Microwave systems: Radar, RF ID, microwave imaging, modern trends in microwave engineering, effect of microwave on human body. **(8 Hours)**

Text books:				
	RF Circuit Design Theory And Application	2nd edition, 2011	Ludwig	Pearson Education India
	Microwave Devices and Circuits	1990	Samueal Liao	Pearson

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r r	d M r		r	

VII Semester
EE2424 – Lab. : PE IV: RF and Microwave

Expt. No.	Name of Experiment
	Introduction to Microwave Components.
	To find the frequency of reflex klystron & Determine electronic and mechanical tuning range.
3	To verify power verses repeller voltage characteristics of reflex klystron.
	To verify frequency verses repeller voltage characteristics of reflex klystron.
	To find attenuation of fixed attenuator and To verify the calibration of variable attenuators.
	To verify the performance of wave-guide tees i) E-plane tee ii) H-plane tee.
	To verify the performance of E-H plane tee (magic tee).
	To verify the relationship among free space wavelength, cut off wavelength, guide wavelength
	To find the Q-factor of absorption type frequency meter and it's insertion loss.
	To verify the performance of directional coupler i) multi hole ii) cross directional coupler.
	To determine coupling and isolation of a three port circulator.
	To determine the gain of pyramidal horn antenna, plot the beam pattern and find the lobe width.
3	To verify characteristics of Gunn diode.
	To measure the small V.S.W.R. and large V.S.W.R.
	To measure the V.S.W.R. of an unknown load, and determine impedance using smith chart.
	To verify various MIC Components.

Text books:

	RF Circuit Design Theory And Application	2nd edition, 2011	Ludwig	Pearson Education India
	Microwave Devices and Circuits	1990	Samueal Liao	Pearson

VII Semester
EE2425 – PE IV: Analog VLSI Design

Objectives	Outcomes
• [illegible] • [illegible] • [illegible]	[illegible] [illegible] 3 [illegible] [illegible]

[illegible]

(6 hours)

[illegible]

(7 hours)

[illegible]

(6 hours)

[illegible]

(6 hours)

[illegible]

(7 hours)

[illegible]

(6 hours)

[illegible]

[illegible]				

[illegible]

[illegible]				
[illegible]				
3 [illegible]				

VII Semester
EE2426 – Lab. : PE IV: Analog VLSI Design

[illegible]	[illegible]
➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] 3 [illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Text books:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VII Semester
EE2427 – PE IV: Operating Systems

Objective	Outcome
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
[illegible]	[illegible]

UNIT-1:

(8 Hours)

UNIT-2:

(7 Hours

UNIT-3 :

(8 Hours)

UNIT-4:

(7 Hours)

UNIT-5 :

(8Hours)

UNIT-6:

(7 Hours)

Text books:				
		3		
Reference books:				
		3		
		3		

VII Semester

EE2428 – PE IV: Lab.: Operating Systems

Objective	Outcome

[illegible]	[illegible]

Expt. No.	Name of Experiment
[illegible]	Implement process system calls
[illegible]	Thread management
3[illegible]	Thread synchronization
[illegible]	Deadlock Avoidance Using Semaphores
[illegible]	Linux Kernel configuration, compilation and rebooting from the newly compiled kernel.
[illegible]	Inter process communication in Linux
[illegible]	Implementing a CPU scheduling
[illegible]	Implementing a file system
[illegible]	Implement process system calls

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	M[illegible]	[illegible]3[illegible]	[illegible]	[illegible]
Reference books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]3[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]3[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
EE2431 – PE V: Industrial Automation

Objective	Outcome

Unit -1

Unit-II

Unit-III

Unit-IV

Unit-V

Unit-VI

Text Book

- [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
EE2432 – PE V: Nano Electronics

Objective	Outcome

Unit -1

Unit-II

Unit-III

Unit-IV

Unit-V

Unit-VI

Text Book

- [illegible]

VII Semester
EE2433 – PE V: Optical Communication

[illegible]	[illegible]
➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] [illegible] 3 [illegible] [illegible]

UNIT-1: INTRODUCTION TO OPTICAL FIBERS

[illegible]

[illegible]

UNIT-2:SIGNAL DEGRADATION IN OPTICAL FIBERS

[illegible]

[illegible]

UNIT-3 : FIBER OPTICAL SOURCES

[illegible]

[illegible]

UNIT-4: FIBER OPTICAL RECEIVERS

[illegible]

[illegible]

UNIT-5 : DIGITAL TRANMISSION SYSTEM

[illegible]

[illegible]

UNIT-6:MEASUREMENT IN OPTICAL FIBERS

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Text books:				
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
EE2434 – PE V: RF Circuit Design

Unit – I [illegible]

Unit – II [illegible]

Unit – III [illegible]

Unit – IV [illegible]

Unit – V [illegible]

Unit – VI [illegible] functions, Colpitt"s oscillators Resonators, Tuned Oscillators, Negative resistance oscillators, Phase [illegible]

Text book

[illegible]

Reference books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
EE2441 – PE-VI: E-Commerce and Data Analytics

The student should be able to 1) To understand the scope of e-commerce in the realm of modern Business. 2) To learn the marketing methods& Business strategies used in e-commerce. 3) To know how the electronic data interchange and how to manage commerce solutions 4) Understand the security threats &electronic payment system	On completion of this course, the student will be able to 1. Understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web. 2. Analyze and understand the human, technological and business environment associated with e-commerce. 3. Define and analyze the concept of electronic data interchange and its legal, social and technical aspects. 4. Define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system

UNIT I:

Internet &Introduction to Electronic Commerce: Introduction to Traditional commerce and E commerce The basics of internet access, email, FTP, TELNET, Introduction to WWW: The basics of WWW & browsing working of Web Browser & Web Server, Web Browser architecture. Introduction to Electronic Commerce: The scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade Cycle, Electronic Markets, Electronic Data Interchange, Internet Commerce, Advantage and disadvantages of e-Commerce.

UNIT II:

Business Models of e – commerce and Strategy: Model Based on Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C. Strategic Methods for developing E -commerce, the Value Chain System. Porters value chain Model.

UNIT III:

E-commerce Payment Systems (EPS) :- Payment through card systems, E – Cheque, E – Cash, E – Payment Threats & Protections. e-credit accounts, e-money, marketing on the Web, Marketing strategies, Advertising on the Web, Customer service and support, Introduction to m-commerce, Case study: e-commerce in passenger air transport.

UNIT IV:

E – Marketing And Electronic Data Interchange (EDI): Home –shopping, E-Marketing, Tele-marketing. Electronic Data Interchange (EDI): Concepts, Benefits and Applications; EDI Model, EDI Protocols (UN EDI FACT).

UNIT V:

The Elements of e-Commerce& e-Business: Elements, e-Visibility, The e-shop, Online Payments, Delivering the Goods, After-Sales Service. e-Business: Introduction, Internet Bookshops, Software Supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the Net.

UNIT VI:

Overview, Security for E – Commerce, Security Standards, secure electronic payment protocols, Password Systems, Digital certificates, Digital signatures

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	E-Commerce	2001	David Whiteley	McGrew Hill Pub
2.	Electronic Commerce	2nd Edition	Gary P. Schneider & James T. Perry	Course Technology

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Teach Yourself Web Technologies -Part 1	2003	Ivan Bayross	BPB Publications
2	Web Technologies TCP/IP Architecture, and Java Programming	2nd Edition	Achyut S. Godbole and Atul Kahate	McGraw-Hill Education (India)

VII Semester

EE2442 – PE-VI: Micro Electro Mechanical Systems (MEMS)

Objective	Outcome
➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] [illegible] 3 [illegible]

UNIT I

[illegible]

UNIT II

[illegible]

UNIT III

[illegible]

UNIT IV

[illegible]

UNIT V

[illegible]

UNIT VI

[illegible]

Text Books:

[illegible]

Reference Books:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VII Semester
EE2443 – PE-VI: Biomedical Instrumentation

Objective	Outcome
➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] [illegible] 3 [illegible] [illegible]

UNIT-1

UNIT-2

UNIT-3

UNIT-4:

UNIT-5:

UNIT-6:

Text books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
1	[illegible]		[illegible]	[illegible]
2	[illegible]		[illegible]	[illegible]
3	[illegible]		[illegible]	[illegible]
4	[illegible]		[illegible]	[illegible]
5	[illegible]		[illegible]	[illegible]

VII Semester
EE2444 – PE VI : Computer Organisation

Objective	Outcome
➢ [illegible] ➢ [illegible] ➢ [illegible] ➢ [illegible]	[illegible] [illegible] [illegible] 3 [illegible] [illegible]

UNIT-1

[illegible]

UNIT-2

[illegible]

UNIT-3

[illegible]

UNIT-4:

[illegible]

UNIT-5

[illegible]

UNIT-6:

[illegible]

1	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

ELECTRONICS ENGINEERING

VIII Semester

EE2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

ELECTRONICS ENGINEERING

VIII Semester

EE2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

[illegible]

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING
AUTONOMOUS INSTITUTION
SEAL
NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

3rd To 8th Semester

Electronics & Telecommunication Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ET-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	30	40	3 Hours
2	3	PC	ET2201	Electronic Devices and Circuits	**T**	3	1	0	4	4	30	30	40	3 Hours
3	3	PC	ET2202	Lab: Electronic Devices and Circuits	**P**	0	0	2	2	1		60	40	
4	3	PC	ET2203	Digital Circuits and Fundamentals of Microprocessor.	**T**	3	0	0	3	3	30	30	40	3 Hours
5	3	PC	ET2204	**Lab:** Digital Circuits and Fundamentals of Microprocessor.	**P**	0	0	2	2	1		60	40	
6	3	PC	ET2205	Electronic Measurement and Instrumentation	**T**	3	0	0	3	3	30	30	40	3 Hours
7	3	PC	ET2206	Lab: Electronic Measurement and Instrumentation	**P**	0	0	2	2	1		60	40	
8	3	PC	ET2207	Network Analysis	**T**	3	0	0	3	3	30	30	40	3 Hours
				TOTAL THIRD SEM		**15**	**1**	**6**	**22**	**19**				

Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	**T**	3	0	0	3	3	30	30	40	3 Hours
2	4	PC	ET2251	Electromagnetic Fields	**T**	3	1	0	4	4	30	30	40	3 Hours
3	4	PC	ET2252	Microcontroller and Interfacing	**T**	3	0	0	3	3	30	30	40	3 Hours
4	4	PC	ET2253	Lab: Microcontroller and Interfacing	**P**	0	0	2	2	1		60	40	
5	4	PC	ET2254	Analog Communication	**T**	3	0	0	3	3	30	30	40	3 Hours
6	4	PC	ET2255	Lab: Analog Communication	**P**	0	0	2	2	1		60	40	
7	4	PC	ET2256	Control Systems	**T**	3	0	0	3	3	30	30	40	3 Hours
8	4	PC	ET2257	Lab.: Control Systems	**P**	0	0	2	2	1		60	40	
				TOTAL FOURTH SEM		**15**	**1**	**6**	**22**	**19**				

List of Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.02**	**Applicable for AY 2020-21 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ET-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	30	40	3 Hours
2	5	PC	ET2301	Analog Integrated circuits	**T**	3	0	0	3	3	30	30	40	3 Hours
3	5	PC	ET2302	Lab: Analog Integrated circuits	**P**	0	0	2	2	1		60	40	
4	5	PC	ET2303	Fields & Radiating Systems	**T**	3	1	0	4	4	30	30	40	3 Hours
5	5	PC	ET2304	Signals & Systems	**T**	3	0	0	3	3	30	30	40	3 Hours
6	5	PC	ET2305	Lab. :Signals & Systems	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	30	40	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	30	40	3 Hours
9	5		ET2306	Lab.: Electronics Workshop	**P**	0	0	2	2	1		60	40	
10	**5/6**	**STR**	**ET2310**	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
					TOTAL FIFTH SEM	**18**	**1**	**6**	**25**	**23**				

Audit Courses														
1	5	IT	IT1121	Industrial Programmin Language	**A**	3	0	0	3	0				

Open Electives -I

1	5	OE 1	ET2311	OE I : Microcontroller & Embedded Systems
2	5	OE 1	ET2312	OE I : Principles of Communication Engineering
3	5	OE 1	ET2313	OE I : Fundamentals of Image Processing

Open Electives -II

4	5	OE 2	ET2321	OE II : Soft computing
5	5	OE 2	ET2322	OE II : Industrial Instrumentation
6	5	OE 2	ET2323	OE II : Medical Electronics
7	5	OE 2	ET2324	OE II : Display Technology & Applications
7	5	OE 2	ET2325	OE II : PLCs and SCADA

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
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SoE No.
ET-201

B.E. SCHEME OF EXAMINATION 2018-19

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
			3		T	3			3	3	3	3		3
			3		T	3			3	3	3	3		3
3			3		P									
					T	3			3	3	3	3		3
					P									
					T	3			3	3	3	3		3
					P									
					T	3			3	3	3	3		3
					T	3			3	3	3	3		3
				TOTAL SIXTH SEM		**18**	**0**	**6**	**24**	**21**				

Professional Electives -I

			3	
			3	
3			3 3	
			3	
			3	
			3	
			3	
			3	
			3	
			3	
			3	
			3 3	
			3	

Professional Electives -II

			3	
			3	
3			3	
			3	
			3	
			3	
			3 3	
			3	
			3	
			3	
			3	
			3	

Open Electives -III

		3	3	
		3	3	
3		3	3 3	

Open Electives -IV

			3	
			3	
			3	
			3	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
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(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	ET2401	RF & Microwave	**T**	3	0	0	3	3	30	30	40	3 Hours
2	7	PC	ET2402	Lab: RF & Microwave	**P**	0	0	2	2	1		60	40	
3	7	PC	ET2403	Digital Communication	**T**	3	0	0	3	3	30	30	40	3 Hours
4	7	PC	ET2404	Lab: Digital Communication	**P**	0	0	2	2	1		60	40	
5	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	30	40	3 Hours
6	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	30	40	3 Hours
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	30	40	3 Hours
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	30	40	3 Hours
9	7	STR	ET2409	Mini Project	**P**	0	0	4	4	2		60	40	
10	7	STR	ET2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SEVENTH SEM	**18**	**0**	**8**	**26**	**24**				

Professional Electives -III

1	7	PE	ET2411	PE III : Power Electronics
2	7	PE	ET2412	PE III : Data Compression & Encryption
3	7	PE	ET2413	PE III : Analog VLSI
4	7	PE	ET2414	PE III : Error Correcting Codes
5	7	PE	ET2415	PE III : Wireless Mobile Communication Systems

Professional Electives -IV

6	7	PE	ET2421	PE IV : Satellite Communication & RADAR Engineering
7	7	PE	ET2422	PE IV : Embedded System
8	7	PE	ET2423	PE IV : Switching Theory
9	7	PE	ET2424	PE IV : Topics in Machine Learning
10	7	PE	ET2425	PE IV : Multimedia Communications

Professional Electives -V

11	7	PE	ET2431	PE V : Display Technology
12	7	PE	ET2432	PE V : Biomedical Instrumentation
13	7	PE	ET2433	PE V : Fuzzy Logic & Neural Network
14	7	PE	ET2434	PE V : Wireless Sensor Networks
15	7	PE	ET2435	PE V : RF Circuit Design

Professional Electives -VI

16	7	PE	ET2441	PE VI : CMOS VLSI Design
17	7	PE	ET2442	PE VI : Digital Image Analysis for Remote Sensing
18	7	PE	ET2443	PE VI : Microwave Integrated circuits
19	7	PE	ET2444	PE VI : Communication Networks
20	7	PE	ET2445	PE VI : Computer Architecture and Organization
20	7	PE	ET2446	PE VI : PLCs & SCADA

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	ET2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	ET2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				

GRAND TOTAL	**84**	**3**	**44**	**131**	**163**

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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BE SoE and Syllabus 2018

ELECTRONICS & TELECOMMUNICATION ENGINEERING

III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
[illegible]	[illegible]

Unit I: Finite Differences

[illegible] **(6 hours)**

Unit II: Laplace Transform

Laplace Transforms: [illegible] **(7 hours)**

Unit III: Z-transform

[illegible] **(6 hours)**

Unit IV: Fourier Series

[illegible] **(7 hours)**

Unit V: Partial Differential Equation

[illegible] **(7 hours)**

Unit VI : Fourier Transform : [illegible] **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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ELECTRONICS & TELECOMMUNICATION ENGINEERING

III SEMESTER

ET2201	Electronic Devices and Circuits		L=3	T=1	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Learning Objective	Course Outcomes
Course learning objective: Students will be able to	**Course Outcome: Students are able to**

UNIT-1:
Introduction to Logic families & their characteristics. Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin, CMOS inverter. BCD arithmetic simplification of Boolean expressions, Implementations of Boolean expressions using logic gates, Karnaugh map, Quine Mcclauskey methods ,Formation of switching functions from word statements. **(6 Hours)**

UNIT-2:
Functions & implementation using Multiplexer, Demultiplexer, Encoder, Decoder. Combinational circuit analysis, Combinational circuits design using MSI and LSI chips, Code Converts **(5Hours)**

UNIT-3
Design of Arithmetic circuits: Half & Full adders, Half & Full Subtractions, Multibit parallel adders Carry Propagate adder & Carry Look ahead adder, BCD Adder, Comparators, Multi bit Application designs, ALU.. **(5 Hours)**

UNIT-4:
Edge &Level triggers. Need for sequential circuits, Binary cell, Latches and flip-flops. RS-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF's, Excitation & Truth Table, Flip-flop conversions, Shift registers , Synchronous and Asynchronous sequential Circuits. Counters Design, Ring counters. **(6 Hours)**

UNIT-5
Introduction to 8085 Microprocessor-Architecture, Addressing Modes, Instruction set, PIN configuration. **(7 Hours)**

UNIT-6:
8085 Advanced instructions, Assembly language programming, Interrupts. **(7 Hours)**

Text Books:

S.No.	Title	Edition	Authors	Publisher
	Digital Design	3rd edition 2007-06-15	M. Morris Mano,	Pearson PH
	Microprocessor Architecture, Programming and Applications with the 8085		Ramesh Gaonkar	Penram International Publications.

Reference Books:

S. No.	Title	Edition (Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

3rd edition 2007-06-15
Microprocessor Architecture, Programming and Applications with the 8085, ,

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

III SEMESTER

ET2201	Electronic Devices and Circuits		L=3	T=1	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

[illegible] parameters,CB,CE and CC Amplifier configurations , small signal operation of MOSFET using π model and T [illegible]

Unit – V **7Hrs**

[illegible]

Unit – VI **7Hrs**

[illegible]

Text Books:

S. No.	Title	Edition (Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Edition (Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

III SEMESTER

ET2202	Electronic Devices and Circuits		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	--	10	60	100	--	

Objective	Course Outcome
Course Objective [illegible] [illegible] [illegible] 3 [illegible] [illegible]	**Course Outcome** [illegible] [illegible] [illegible] 3 [illegible] [illegible]

Expt.No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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BE SoE and Syllabus 2018

ELECTRONICS & TELECOMMUNICATION ENGINEERING

III SEMESTER

ET2203	Digital Circuit and Fundamentals of Microprocessor	L=3	T=1	P=0	Credits=4

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Learning Objective	Course Outcomes
Course Objective: Students will be able	**Course Outcome: Students are able to**

UNIT-1:

(6 Hours)

UNIT-2:

(6 Hours)

UNIT-3

(6 Hours)

UNIT-4:

(6 Hours)

UNIT-5

(6 Hours)

UNIT-6:

(6 Hours)

III SEMESTER

ET2203	Digital Circuit and Fundamentals of Microprocessor	L=3	T=1	P=0	Credits=4

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Text Books:

S. No.	Title	Authors	Edition (Year of Publication	Publisher
[illegible]	[illegible]	M[illegible]M[illegible]rr[illegible]M[illegible]	3rd [illegible]d[illegible]	[illegible]r[illegible]
[illegible]	[illegible]r[illegible]	[illegible]	3rd [illegible]d[illegible]	[illegible]M[illegible]r[illegible]
3[illegible]	M[illegible]r[illegible]r[illegible]r[illegible]r[illegible]r[illegible]r[illegible]d[illegible]	[illegible]r[illegible]	[illegible]	[illegible]r[illegible]r[illegible]

Reference Books:

S. No.	Title	Authors	Edition (Year of Publication	Publisher
[illegible]	[illegible]r[illegible]M[illegible]r[illegible]r[illegible]r[illegible]	[illegible]r[illegible]	[illegible]d[illegible]	M[illegible]r[illegible]
[illegible]	[illegible]d[illegible]r[illegible]r[illegible]	[illegible]r[illegible]	[illegible]d[illegible]	[illegible]M[illegible]
3[illegible]	[illegible]r[illegible]	[illegible]r[illegible]	[illegible]d[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]r[illegible] [illegible]rd[illegible]
[illegible]r[illegible]	[illegible]d[illegible]M[illegible]r[illegible]	[illegible]	[illegible]r[illegible]	

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ELECTRONICS & TELECOMMUNICATION ENGINEERING

III SEMESTER

ET2204	Lab: Digital Circuit and Fundamentals of Microprocessor	L=3	T=1	P=0	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	3 Hours

Course Learning Objective	Course Outcomes
[illegible] [illegible] T[illegible]r[illegible]d[illegible]r[illegible]d[illegible]d[illegible] [illegible]r[illegible] [illegible]r[illegible]d[illegible]d[illegible] [illegible]d[illegible] d[illegible]d[illegible] [illegible] 3[illegible] [illegible]d[illegible] [illegible]d[illegible]r[illegible] [illegible] [illegible]d[illegible]M[illegible]r[illegible]r[illegible]	[illegible]d[illegible] 1. Design combinational and sequential logic circuits from given word statement. 2. Implement the developed logic on bread board and verify the truth table obtained. 3. Design combinational and sequential logic circuits using simulation tool 4. Write programme on 8085 Microprocessor 5.

Ten Experiments Based on

Expt.No.	Name of Experiment
[illegible]	A. To study and verify the truth table of basic logic gates using Universal gates B. To study and verify Demorgan's Theorem
[illegible]	To Design Half and Full Adder Circuit
3[illegible]	To Design Half and Full Subtractor Circuit.
[illegible]	Design a combinational logic circuit which has one output Z and a 4-bit input ABCD representing a binary number. Z should be 1 if A=B=C.
[illegible]	Convert 4- bit Binary number to Gray code.
[illegible]	To study and verify the truth table of A. Multiplexer B. Decoder
[illegible]	To design 2-Bit Comparator.
[illegible]	Realize F(w,x,y,z)=Σ (1,4,6,7,8,9,10,11,15) using 8 to 1 Mux
[illegible]	Implement S-R and J-K flip flop using NAND gate.
[illegible]	To verify the truth table of the Bidirectional Shift Resister using IC7495.
[illegible]	To Design Mod-n Up-Down Counter.
[illegible]	To design synchronous counter.
[illegible]3[illegible]	To design Asynchronous counter.
[illegible]	Write and execute an ALP for multiplication of two 8 bit numbers.
[illegible]	Write and execute an ALP to count number of 1's in 8 bit number.
[illegible]	Mini Project

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]r[illegible] [illegible]rd[illegible]
[illegible]r[illegible]	[illegible]d[illegible]M[illegible]r[illegible]	[illegible]	[illegible]r[illegible]	

III SEMESTER

ET2205	Electronic Measurement and Instrumentation	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

Unit – I **5 Hrs**

[illegible]

Unit – II **6Hrs**

[illegible]

Unit – III **6Hrs**

[illegible]

Unit – IV **6Hrs**

[illegible]

Unit – V **7Hrs**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

III SEMESTER

ET2205	Electronic Measurement and Instrumentation	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Unit – VI 6Hrs

[illegible]

Resources :

Text Books:

S. No.	Title	Authors	Edition/Year of Publication	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Text Books:

S. No.	Title	Authors	Edition/Year of Publication	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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ELECTRONICS & TELECOMMUNICATION ENGINEERING

III SEMESTER

ET2206	Lab : Electronic Measurement and Instrumentation	L=2	T=0	P=0	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

Sr. No	Experiment List
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

				[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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BE SoE and Syllabus 2018

ELECTRONICS & TELECOMMUNICATION ENGINEERING

III SEMESTER

ET2207	Network Analysis	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

UNIT-I

Nodal Analysis of Electric Circuits

[illegible]

UNIT-II:

Mesh Analysis of Electric Circuits

[illegible]

UNIT-III

Network Theorem

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

III SEMESTER

ET2207	Network Analysis	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

UNIT-IV:

Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform

UNIT-V :

Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions

UNIT-VI:

Two Port Parameters

Text Books:

S. No.	Title	Edition/Year of Publication	Authors	Publisher
		3rd		
3				

Reference Books:

S. No.	Title	Edition/Year of Publication	Authors	Publisher
		3rd		
3				

IV Semester

GE2204 - Advanced Mathematical Techniques

Objective	Outcomes
• [illegible] • [illegible] • [illegible] • [illegible]	• [illegible] • [illegible] • [illegible] • [illegible]

Unit I:

Numerical Methods for Algebraic And Transcendental Equations: [illegible]

Numerical Methods System of Algebraic Equations [illegible] **(7 hours)**

Unit II:

Numerical Methods for Differential Equations [illegible] **(6 hours)**

Unit III:

Random Variables and Probability Distribution [illegible] **(6 hours)**

UNIT IV:

Mathematical Expectation [illegible] **(7 hours)**

UNIT V:

Fuzzy Sets And Fuzzy Logic [illegible] **(7 hours)**

Unit VI:

OPTIMIZATION TECHNIQUES: [illegible] **(6 hours)**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV Semester

GE2204 - Advanced Mathematical Techniques

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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ELECTRONICS & TELECOMMUNICATION ENGINEERING

IV SEMESTER

ET2251	Electromagnetic Fields	L=3	T=1	P=0	Credits=4

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1 **6 Hrs**

[illegible]

UNIT-2: **7 Hrs**

[illegible]

UNIT-3: **7 Hrs**

[illegible]

UNIT-4: **6 Hrs**

[illegible]

UNIT-5: **6 Hrs**

[illegible]

UNIT-6: **7 Hrs**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV SEMESTER

ET2251	Electromagnetic Fields	L=3	T=1	P=0	Credits=4

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Resources :

Text Books:

S. No.	Title	Edition/Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Edition/Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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ELECTRONICS & TELECOMMUNICATION ENGINEERING

IV SEMESTER

ET2252	Microcontroller and Interfacing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1 **5 Hrs.**

[illegible]

UNIT-2: **7 Hrs**

[illegible]

UNIT-3: **6 Hrs**

[illegible]

UNIT-4: **8 Hrs**

[illegible]

UNIT-5: **7 Hrs**

[illegible]

UNIT-6: **7 Hrs**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV SEMESTER

ET2252	Microcontroller and Interfacing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Resources :

Text Books:

S. No.	Title	Edition/Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]
3[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]

Reference Books:

S. No.	Title	Edition/Year of Publication	Authors	Publisher
[illegible]	[illegible]		[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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ELECTRONICS & TELECOMMUNICATION ENGINEERING

IV SEMESTER

ET2253	Lab: Microcontroller and Interfacing	L=0	T=1	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

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ELECTRONICS & TELECOMMUNICATION ENGINEERING

IV SEMESTER

ET2254	Analog Communication	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Learning Objective	Course Outcomes
Course Objective	**Course Outcome**

Unit - I **[7 Hrs]**

Unit - II **[7 Hrs]**

Unit - III **[7 Hrs]**

Unit - IV **[7 Hrs]**

Unit - V **[6 Hrs]**

Unit - VI **[6 Hrs]**

IV SEMESTER

ET2254	Analog Communication	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Text Books:

S. No.	Title	Edition (Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Edition (Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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ELECTRONICS & TELECOMMUNICATION ENGINEERING

IV SEMESTER

ET2255	Lab : Analog Communication	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Learning Objective	Course Outcomes
Course Objective	**Course Outcome**

Expt. No.	Experiments based on

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BE SoE and Syllabus 2018

ELECTRONICS & TELECOMMUNICATION ENGINEERING

IV SEMESTER

ET2256	Control Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

UNIT I **(7 Hrs)**

[illegible]

UNIT II **(5 Hrs)**

[illegible]

UNIT III **(6 Hrs)**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

[illegible]

IV SEMESTER

ET2256	Control Systems		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

CA (Continuous Assessment)* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

UNIT IV (7 Hrs)

[illegible]

UNIT V (7 Hrs)

[illegible]

UNIT VI (7 Hrs)

[illegible]

Text Books:

S. No.	Title	Edition (Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

S. No.	Title	Edition (Year of Publication	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV SEMESTER

ET2257	Lab: Control Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

V Semester

ET 2301 - ANALOG INTEGRATED CIRCUITS

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	3[illegible]
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**OPERATIONAL AMPLIFIER FUNDAMENTALS** [illegible]	[illegible]
[illegible]	**OP AMP LIMITATIONS- STATIC and DYNAMIC** [illegible] [illegible]	[illegible]
3[illegible]	**LINEAR APPLICATIONS** [illegible]	[illegible]
[illegible]	**ACTIVE FILTERS** [illegible]	[illegible]
[illegible]	**NONLINEAR CIRCUITS** [illegible] [illegible] **WAVEFORM GENERATORS** [illegible]	[illegible]
[illegible]	**SPECIAL FUNCTION IC'S** [illegible] **New topic to be announced time to time.** [illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2301 - ANALOG INTEGRATED CIRCUITS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2302 – LAB: ANALOG INTEGRATED CIRCUITS

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	3[illegible]
[illegible]	[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2303 – FIELDS & RADIATING SYSTEMS

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**Transmission Lines** [illegible]	[illegible]
[illegible]	**Parallel Planes Waveguide** [illegible]	[illegible]
3[illegible]	**Rectangular Waveguide** [illegible]	[illegible]
[illegible]	**Antenna Terminology** [illegible]	[illegible]
[illegible]	**Antenna Arrays** [illegible]	[illegible]
[illegible]	**Types of Antenna** [illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2303 – FIELDS & RADIATING SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	M[illegible]

V Semester

ET 2304 – SIGNALS & SYSTEMS

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	3[illegible]
[illegible]	4) [illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**Signals and Systems.** [illegible]	[illegible]
[illegible]	**Fourier Series Representation of Periodic Signals.** [illegible]	[illegible]
3[illegible]	**Fourier Transform.** [illegible]	[illegible]
[illegible]	**Time & Frequency Characterization of Signals and Systems.** [illegible]	[illegible]
[illegible]	**The Laplace Transform.** [illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2304 – SIGNALS & SYSTEMS

	The Z-Transform. [illegible] **New topic to be announced time to time** [illegible]	

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2305– LAB: SIGNALS & SYSTEMS

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	3[illegible]
[illegible]	4) [illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2306– LAB: ELECTRONICS WORKSHOP

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**

Expt. No.	Experiments based on
01	
02	
03	
04	
05	
06	
07	
08	
09	
10	

V Semester

ET 2311/ET 2381– OE I/ OE III: MICROCONTROLLER & EMBEDDED SYSTEMS

Objective	Course Outcome
The student should be able to [illegible] [illegible] [illegible] 3[illegible] 4)[illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3[illegible] 4)[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible] **New topic to be announced time to time** [illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2311/ET 2381– OE I/ OE III: MICROCONTROLLER & EMBEDDED SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2312/ET 2382– OE I/ OE III: PRINCIPLES OF COMMUNICATION ENGINEERING

Objective	Course Outcome
The student should be able to [illegible] [illegible] 3 [illegible] [illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3 [illegible] [illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**ANALOG COMMUNICATION** [illegible]	[illegible]
[illegible]	**DIGITAL COMMUNICATION** [illegible]	[illegible]
3	**Digital Modulation** [illegible]	[illegible]
[illegible]	**SOURCE CODES, LINE CODES & ERROR CONTROL** [illegible]	[illegible]
[illegible]	**MULTIPLE ACCESS TECHNIQUES** [illegible]	[illegible]
[illegible]	**SATELLITE, OPTICAL FIBER – POWERLINE, SCADA** [illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2312/ET 2382– OE I/ OE III: PRINCIPLES OF COMMUNICATION ENGINEERING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2313/ET 2383– OE I/ OE III: FUNDAMENTALS OF IMAGE PROCESSING

Objective	Course Outcome
The student should be able to [illegible] [illegible] 3[illegible] 4)[illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3[illegible] 4)[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**Introduction** [illegible]	[illegible]
[illegible]	**Intensity Transformations** [illegible]	[illegible]
3[illegible]	**Spatial and Frequency Domain Filtering** [illegible]	[illegible]
[illegible]	**Image Segmentation** [illegible]	[illegible]
[illegible]	**Representation and Description** [illegible]	[illegible]
[illegible]	**Object Recognition**[illegible] [illegible] **New topic to be announced time to time**	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2313/ET 2383– OE I/ OE III: FUNDAMENTALS OF IMAGE PROCESSING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

V Semester

ET 2321/ET 2391– OE II/ OE IV: SOFT COMPUTING

Objective	Course Outcome
The student should be able to [illegible] 2) [illegible] 3) [illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3[illegible] [illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**Genetic Algorithm** [illegible]	[illegible]
[illegible]	**Neural Networks** [illegible]	[illegible]
3[illegible]	**Supervised Learning** [illegible]	[illegible]
[illegible]	**Unsupervised Learning** [illegible]	[illegible]
[illegible]	**Fuzzy Sets and Operations** [illegible]	[illegible]
[illegible]	**Fuzzy logic and Systems** [illegible] **New topic to be announced time to time**[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2321/ET 2391– OE II/ OE IV: SOFT COMPUTING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2322/ET 2392– OE II/ OE IV: INDUSTRIAL INSTRUMENTATION

Objective	Course Outcome
The student should be able to [illegible] [illegible] 3[illegible] [illegible] [illegible] [illegible]	**On completion of this course, the student will be able to** [illegible] [illegible] 3) [illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**INTRODUCTION** [illegible]	[illegible]
[illegible]	**PRESSURE MEASUREMENT** [illegible]	[illegible]
3[illegible]	**TEMPARATURE MEASUREMENT 1** [illegible]	[illegible]
[illegible]	**TEMPARATURE MEASUREMENT2: THERMOCOUPLES AND PYROMETERS** [illegible]	[illegible]
[illegible]	**FLOWMETERS** [illegible]	[illegible]
[illegible]	**MISCELLANEOUS MEASUREMENT** [illegible] **New topic to be announced time to time**	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2322/ET 2392– OE II/ OE IV: INDUSTRIAL INSTRUMENTATION

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Electronics & Telecommunication Engineering

SoE No. ET-201

V Semester

ET 2323/ET 2393– OE II/ OE IV: MEDICAL ELECTRONICS

Objective	Course Outcome
The student should be able to [illegible] 3[illegible] 4) [illegible]	**On completion of this course, the student will be able to** [illegible] 3[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	**Physical Measurement:** [illegible]	[illegible]
3[illegible]	**Recording Instrumentation:** [illegible]	[illegible]
[illegible]	**Measuring Instrumentation:** [illegible]	[illegible]
[illegible]	**X-rays:** [illegible]	[illegible]
[illegible]	**Advanced Imaging System:** [illegible] **New topic to be announced time to time** [illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET 2323/ET 2393– OE II/ OE IV: MEDICAL ELECTRONICS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	M[illegible]d[illegible]r[illegible]	[illegible]3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]d[illegible]r[illegible]d[illegible] M[illegible]r[illegible]	[illegible]d[illegible] [illegible]	[illegible]r[illegible]r[illegible]d[illegible] [illegible]r[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]d[illegible]d[illegible] [illegible]r[illegible]	[illegible]3[illegible]	[illegible]d[illegible]r[illegible]	[illegible]M[illegible]r[illegible]
[illegible]	[illegible]r[illegible]d[illegible]d[illegible] [illegible]	[illegible]r[illegible]	[illegible]rr[illegible]d[illegible] M[illegible]r[illegible]	[illegible]d[illegible] [illegible]

V Semester

ET 2324/ET 2394– OE II/ OE IV: DISPLAY TECHNOLOGY & APPLICATIONS

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible] specifications, display manufacturing [illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

V Semester

ET 2324/ET 2394– OE II/ OE IV: DISPLAY TECHNOLOGY & APPLICATIONS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

ET2325 /ET2400– OE II/ OE IV: PLCs and SCADA

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**

Unit No.	Contents	Max. Hrs.
3		
	MCR, JUMP, and FORCE Instructions.	

	Sequencers (Only for Allen Bradley SLC-500)	

V Semester

ET2325 /ET2400– OE II/ OE IV: PLCs and SCADA

[illegible]	[illegible]	[illegible]

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcomes
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Unit – 1 - Principle of Management

[illegible]

UNIT-2: Legal Aspects of Management

[illegible]

UNIT-3: Human Resource Management

[illegible]

UNIT-4: Project Management

[illegible]

UNIT-5: Marketing Management

[illegible]

UNIT-6: Financial Management

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

GE2311 - Fundamentals of Management

Text book and Reference

[illegible]

[illegible]

3 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[signature]	[signature]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2351 - Digital Signal Processing

Prerequisites	Signals and System
Course Objective	**Course Outcome**
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
[illegible]	[illegible]
[illegible] Study the design of IIR and FIR digital filters. [illegible]	[illegible]

UNIT-1Discrete Fourier transform

[illegible]

(06 Hours)

UNIT-2: Digital filter structures

[illegible]

(07 Hours)

UNIT-3: IIR filter design

[illegible]

(06 Hours)

UNIT 4: FIR filter design

[illegible]

(06 Hours)

Unit 5: Finite Word length Effect

[illegible]

(05 Hours)

Unit 6: Multirate Digital Signal Processing

[illegible] **New topic to be announced time to time** [illegible]

(06 Hours)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ET2351 - Digital Signal Processing

Text books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	3rd [illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

Reference books:				
1	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2352 - Lab: Digital Signal Processing

Course Objective	Course Outcome
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
[illegible]	[illegible]
[illegible] Study the design of IIR and FIR digital filters [illegible]	[illegible]

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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Electronics & Telecommunication Engineering

SoE No.
ET-201

VI Semester

ET2361 - PE I : Object Oriented Programming

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT-1 [illegible] **06Hrs**

UNIT-2: [illegible] **06Hrs**

UNIT-3: [illegible] **06 Hrs**

UNIT-4: [illegible] **06 Hrs**

UNIT-5: [illegible] **06Hrs**

UNIT-6: [illegible]

New topic to be announced time to time [illegible] **06 Hrs**

Text books:				
1	[illegible]	3rd [illegible]	[illegible]	M [illegible]
2	[illegible] M [illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M [illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ET2362 - Lab.: PE I: Object Oriented Programming

Course Objective	Course Outcome
[illegible]	[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

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Electronics & Telecommunication Engineering

SoE No.
ET-201

VI Semester

ET2363 - PE I : Discrete Structures

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT-1: LOGIC AND PROOFS, & Boolean Logic:

[illegible] **06 Hrs**

UNIT-2 ALGORITHMS:

[illegible] **06 Hrs**

UNIT-3: COUNTING METHODS, AND THE PIGEONHOLE PRINCIPALE:

[illegible] **06 Hrs**

UNIT-4: RECURRENCE RELATIONS & GRAPH THEORY:

Graphs: [illegible] **06 Hrs**

UNIT-5: TREES:

[illegible] **06Hrs**

UNIT-6:

NETWORKS MODELS:

[illegible] **Group & Ring Theory**

New topic to be announced time to time [illegible] **06 Hrs**

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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Electronics & Telecommunication Engineering

SoE No.
ET-201

VI Semester

ET2364 - Lab. : PE I : Discrete Structures

Course Objective:	Course Outcome:
[illegible]	[illegible]

S.N.	Experiment Based on
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	**Group Activity**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2365 - PE I : Microprocessors and Peripherals

Course Objectives	Course Outcome
[illegible]	[illegible]

Unit I:-

[illegible]

Unit II:

[illegible]

Unit III:

[illegible]

Unit IV:

[illegible]

Unit V:

[illegible]

Unit VI:

[illegible] **New topic to be announced time to time** [illegible]

Text books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
1.	[illegible]	[illegible]	[illegible]	[illegible]
2.	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2366 - PE I : Lab. Microprocessors and Peripherals

S.N.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

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Electronics & Telecommunication Engineering

SoE No.
ET-201

VI Semester

ET2367 - PE I : Electronic Instrumentation

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT-I INTRODUCTION

[illegible]

05 Hours

UNIT-II PRESSURE MEASUREMENT

[illegible]

06 Hours

UNIT-III TEMPARATURE MEASUREMENT, THERMOCOUPLES AND PYROMETERS

[illegible]

07 Hours

UNIT-IV FLOWMETERS& LEVEL MEASUREMENT

[illegible]

06 Hours

UNIT-V MISCELLANEOUS MEASUREMENT

[illegible]

06 Hours

UNIT- VI Data Logger & PLC

[illegible]

New topic to be announced time to time **06 Hours**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ET2367 - PE I : Electronic Instrumentation

Text books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ET2368 - PE I : Lab Electronic Instrumentation

S. N.	Name of Experiment
01	[illegible]
02	[illegible]
03	[illegible]
04	[illegible]
05	[illegible]
06	[illegible]
07	[illegible]
08	[illegible]

VI Semester

ET2371 - PE I : Fundamentals of Computing

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT-1

[illegible] **(06 Hours)**

UNIT-2:

[illegible] **(06 Hours)**

UNIT-3:

[illegible] **(06 Hours)**

UNIT 4

[illegible] **(06 Hours)**

UNIT 5:

[illegible] **(06 Hours)**

UNIT 6:

[illegible] **(06 Hours)**

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2372 - Lab: PE I -Fundamentals of Computing

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	M[illegible]

VI Semester

ET2373 - PE I : Algorithms and data structures

Course Objective	Course Outcome
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
[illegible]	[illegible]

UNIT-1

[illegible] **(06 Hours)**

UNIT-2:

[illegible] **(06 Hours)**

UNIT-3:

[illegible] **(06 Hours)**

UNIT 4

[illegible] **(06 Hours)**

UNIT 5:

[illegible] **(06 Hours)**

UNIT 6:

[illegible] **(06Hours)**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2373 - PE I : Algorithms and data structures

Text books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	M[illegible]	[illegible]
Reference books:				
1	[illegible]	[illegible]	M[illegible]	[illegible]
2	[illegible]	[illegible] 3	[illegible]	[illegible]
3	[illegible]	3rd [illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	

VI Semester

ET2374 - PE I :Lab Algorithms and data structures

Expt. No.	Experiments based on
01	[illegible]
02	[illegible]
03	[illegible]
04	[illegible]
05	[illegible]
06	[illegible]
07	[illegible]
08	[illegible]
09	[illegible]
10	[illegible]
11	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2377 - PE II : Antenna Theory & Design

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT I : BASIC ANTENNA CONCEPTS:

[illegible]

[illegible]

UNIT II : DIPOLE ANTENNA:

[illegible]

[illegible]

UNIT III : LOOP ANTENNAS AND ARRAYS

[illegible]

[illegible]

UNIT IV : TRAVELING WAVE ANTENNA

[illegible]

[illegible]

UNIT V: SPECIAL ANTENNAS:

[illegible]

[illegible]

UNIT VI: ANTENNA MEASUREMENTS

[illegible] **New topic to be announced time to time**

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ET2377 - PE II : Antenna Theory & Design

Text books:				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	M[illegible]
Reference books:				
[illegible]	[illegible]	[illegible]3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	M[illegible]

VI Semester

ET2378 - PE II : Lab. Antenna Theory & Design

SN	List of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
3	To measure radiation Pattern of λ/2 Dipole Antenna and its Characteristic using Antenna trainer Kit.
[illegible]	To measure radiation Pattern of 3λ/2 Dipole Antenna and its Characteristic using Antenna trainer Kit.
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3	[illegible]
[illegible]	[illegible]

VI Semester

ET2379 - PE II : Digital System Design

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT [illegible]

[illegible] **(06 Hours)**

UNIT-2 [illegible]

[illegible] **(06 Hours)**

UNIT-3

[illegible] **(06 Hours)**

UNIT-4: [illegible]

[illegible]

(06 Hours)

UNIT 5:

[illegible]

(06 Hours)

Unit 6: Advanced feature:

[illegible] **New topic to be announced time to time** [illegible] **(06 Hours)**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester
ET2379 - PE II : Digital System Design

Text books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
1	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2380- PE II : Lab. Digital system Design

Course Objective	Course Outcome
[illegible]	[illegible]

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication Engineering

SoE No.
ET-201

VI Semester

ET2381- PE II : Internet of Things (IoT)

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1 **5 Hrs.**

Introduction & Concepts: [illegible]

UNIT-2: **6Hrs**

Domain Specific IOTs: [illegible]

UNIT-3: **7Hrs**

M2M & System Management with NETCONF-YANG: [illegible]

UNIT-4: **6Hrs**

Developing Internet of Things & Logical Design using Python: [illegible]

UNIT-5: **6Hrs**

[illegible]

UNIT-6: **7Hrs**

[illegible]

New topic to be announced time to time

Text books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
Reference books:				
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

ET2382- PE II : Lab. Internet of Things (IoT)

Expt. No.	Name of Experiment
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

VI Semester

ET2383- PE II : Optical Communication

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT I : INTRODUCTION TO OPTICAL FIBERS

[illegible] **06Hrs**

UNIT II : SIGNAL DEGRADATION IN OPTICAL FIBERS

[illegible] **06Hrs**

UNIT III : FIBER OPTICAL SOURCES

[illegible] **06Hrs**

UNIT IV : FIBER OPTICAL RECEIVERS

[illegible] **06Hrs**

UNIT V: POWER LAUNCHING AND COUPLING IN DIGITAL TRANSMISSION SYSTEM

[illegible] **06Hrs**

UNIT VI: Measurement in optical fibers

[illegible] **New topic to be announced time to time**

06Hrs

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ET2383- PE II : Optical Communication

VI Semester

ET2384- PE II : Lab. Optical Communication

Sr. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	M[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	M[illegible]
[illegible]	[illegible]

Nagar Yuwak Shikshan Sanstha's

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication Engineering

SoE No.
ET-201

VI Semester

ET2385- PE II: Principles of image processing

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT I : Digital Image fundamental

[illegible] **06Hrs**

UNIT II : Filtering in spatial and frequency domain

[illegible] **06Hrs**

UNIT III : Image Restoration

[illegible] **06Hrs**

UNIT IV : Image compression

[illegible] **06Hrs**

UNIT V : Image Segmentation

[illegible] **06Hrs**

UNIT VI : Image Representation and Description

[illegible] **06Hrs**

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				
[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	

VI Semester

ET2386- PE II: Lab. Principles of image processing

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication Engineering

SoE No.
ET-201

VI Semester

ET2387- PE II: TV & Video Engineering

Course Objective	Course Outcome
[illegible]	[illegible]

UNIT-1: COLOUR SIGNAL GENERATION AND ENCODING: [illegible] **06 Hrs**

UNIT-2 TELEVISION SYSTEMS AND STANDARDS: [illegible]

06Hrs

UNIT-3 VIDEO AMPLIFIERS AND LUMINANCE CHANNEL [illegible]

06Hrs

UNIT-4: COLOUR TELEVISION RECEIVERS [illegible]

06Hrs

UNIT-5: CABLE TELEVISION, VIDEO DISC-RECORDING

[illegible]

06Hrs

UNIT-6: DIGITAL TELEVISION-TRANSMISSION AND RECEPTION [illegible]

06 Hrs

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

ET2387- PE II: TV & Video Engineering

[illegible]				
1	M[illegible]d[illegible]r[illegible] [illegible]r[illegible]d[illegible]r[illegible]	3rd [illegible]d[illegible] [illegible]	[illegible]	[illegible]r[illegible] [illegible]r[illegible]
2	[illegible]d[illegible]d[illegible]r[illegible]	[illegible]d[illegible] M[illegible]	[illegible]M	[illegible]M[illegible]r[illegible]
[illegible]r[illegible]				
1	[illegible]d[illegible]d[illegible]	[illegible]d[illegible]d[illegible] [illegible]	[illegible]r[illegible]r[illegible]d[illegible] [illegible]	M[illegible]r[illegible]

[illegible]r[illegible]	[illegible]d[illegible]M[illegible]r[illegible]	[illegible]	[illegible]	[illegible]r[illegible] [illegible]rd[illegible]

VI Semester

ET2388- PE II : Lab. TV & Video Engineering

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

VII Semester
ET 2401–RF & Microwave

Course Objective	Course Outcome
Students should be able to 1) Know various resonant and non resonant microwave power generators. 2) Study the concept of scattering matrix. 3) Understand working of various microwave passive devices 4) Know the various microwave measurement techniques. 5) Learn the working principle of microwave solid state devices	Students will be able to 1) Discuss the working and analyze the behavior of linear beam and cross field tubes. 2) Apply s-parameters to model and analyze output response of microwave transmission lines. 3) Analyze behavior of different passive components using s-matrix. 4) Measure performance parameters of microwave devices. 5) Explore various microwave solid state devices.

UNIT 1:

High frequency limitations of conventional vacuum tubes, Two cavity Klystron, Reflex Klystron – Mechanism and mode of Operation, Applegate diagram, Power output and efficiency, applications, Introduction to multicavity Klystron

(07 Hours)

UNIT2:

Travelling wave tube, Backward wave oscillator – working principles, characteristics. Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Tuning of magnetron, Applications

(07 Hours)

UNIT 3:

Introduction, scattering matrix representation of multi-port networks, Inter relationship between [S], [Z] and [Y] matrices, properties of scattering matrix. Scattering matrix of transmission lines, ABCD parameters.

(06 Hours)

UNIT 4:

Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, Directional couplers, Attenuators, Isolators, Gyrators, Circulators, Scattering Matrix Derivation for all components

(06 Hours)

Unit 5:

Introduction, Power sensitive elements, Low and High power measurement, Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement, Frequency measurement, Measurement of cavity Q, Methods of Microwave filters design overview of spectrum analyzer, various measurements using spectrum analyzer.

(06 Hours)

Unit 6:

Microwave diodes – Gunn diode – Mode of operation, Crystal diode, PIN diode, IMPATT diodes, Varactor diode, Parametric amplifier, Microwave transistors, Introduction to planar transmission lines, Introduction to devices working in Terahertz frequency range,new topic to be announced time to time

(07 Hours)

VII Semester
ET 2401–RF & Microwave

Text books:				
1	Microwave Devices and Circuits	Samuel Y. Liao	3rd edition	Pearson Education
2	Foundations for Microwave Engineering	Robert E. Collin	2nd edition	McGraw Hill

Reference books:				
1	Microwave Engineering	Annapurna Das, Sisir K. Das		McGraw Hill

VII Semester
ET 2402 – Lab: RF & Microwave

Course Objective	Course Outcome
Students should be able to 1) Know various resonant and non resonant microwave power generators. 2) Study the concept of scattering matrix. 3) Understand working of various microwave passive devices 4) Know the various microwave measurement techniques. 5) Learn the working principle of microwave solid state devices	Students will be able to 1) Discuss the working and analyze the behavior of linear beam and cross field tubes. 2) Apply s-parameters to model and analyze output response of microwave transmission lines. 3) Analyze behavior of different passive components using s-matrix. 4) Measure performance parameters of microwave devices. 5) Explore various microwave solid state devices.

Expt. No.	Name of Experiment	COs
1.	To determine frequency of reflex klystron & determine its electronic tuning range	CO1
2.	To verify power Vsrepellar voltage characteristics of Reflex Klystron.	CO1
3.	To verify frequency Vsrepellar voltage characteristics of Reflex Klystron.	CO1
4.	To verify performance of waveguide tees- E-Plane tee & H-plane Tee.	CO3
5.	To verify performance of E-H plane tee (Magic Tee)	CO3
6.	To verify performance of Directional Coupler.	CO3
7.	To verify performance of Cross-hole Coupler.	CO3
8.	To verify performance of 3-port circulator	CO3
9.	To verify performance of isolator.	CO3
10.	To find relationship between Cut-off wavelength, free space wavelength & guide wavelength using slotted line section	CO 4
11.	To verify V-I characteristics of Gunn diode.	CO 5

VII Semester
ET2403 – Digital Communication

Prerequisites	----------
Course Objective Students should be able to 1) Understand various source coding techniques. 2) Understand signal space concepts. 3) Understand the key modules of digital communication systems with emphasis on digital modulation techniques. 4) Learn different channel coding techniques 5) Understand the concept of spread spectrum modulation, its types and applications.	**Course Outcome** Students will be able to 1) Compare different source coding techniques. 2) Describe and analyze signal space concepts. 3) Distinguish various digital modulation techniques. 4) Describe & compare different channel coding techniques 5) Apply spread spectrum modulation for various applications of communication systems.

UNIT-1 Analog source coding

Review of Random variables, PDFs & CDFs, Central limit Theorem. Model of digital communication system, PCM, DM, ADM, ADPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding.

(06 Hours)

UNIT-2: Digital source coding

Introduction to information theory, channel capacity, Huffman, L-Z encoding algorithm. Rate distortion theory for optimum quantization.

(06 Hours)

UNIT-3: signal space concept

Gram-Schmitt procedure, Signal space representation of modulated signals, Error probability and optimum receivers for AWGN channels, Matched filters.

(06 Hours)

UNIT 4: Digital modulation methods

PSK, FSK, QPSK, MSK, GMSK, MPSK, OFDM

(06 Hours)

Unit 5: channel coding techniques

Introduction to Galois field, Construction of Galois field GF (2 m) & its basic properties. Review of channel coding, Linear block codes, cyclic codes, convolution, encoding and decoding, distance properties, Viterbi algorithm Turbo code, Reed Solomon code

(06 Hours)

Unit 6: Spread Spectrum

Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, synchronization methods for spread spectrum, application of spread spectrum

(06 Hours)

VII Semester
ET2403 – Digital Communication

Text books:				
1.	Digital communication	4th edition Date:2005	John G Prokis	TMG
2.	Digital communication	3rd edition August 2007	Simon Haykin	WEP

Reference books:				
1.	Modern Communication systems (Principles and application)	1st edition Publication: 1994	Leon W. Couch II	PHI
2.	Digital Communication	1st edition.	Shanmugham	CBS Publisher
3.	Modern Digital & Analog Communication Systems	4th edition Date: 2009	B.P.Lathi	Oxford Univ Pr Publication
4.	Principles of Communication Systems	2nd edition Pub Date: SEP-07	Taub Schilling	Publisher: Prentice Hall

VII Semester
ET2404 – Lab: Digital Communication

Course Objective	Course Outcome
Students should be able to 1) Understand various source coding techniques. 2) Understand signal space concepts. 3) Understand the key modules of digital communication systems with emphasis on digital modulation techniques. 4) Learn different channel coding techniques 5) Understand the concept of spread spectrum modulation, its types and applications.	Students will be able to 1) Compare different source coding techniques. 2) Describe and analyze signal space concepts. 3) Distinguish various digital modulation techniques. 4) Describe & compare different channel coding techniques 5) Apply spread spectrum modulation for various applications of communication systems.

Expt. No.	Name of Experiment	COs
12.	Sampling & reconstruction	
13.	Linear PCM system	
14.	Differential PCM system	
15.	Delta Modulation system	
16.	Adaptive Delta Modulation system	
17.	Companded PCM (A law & μ law)	
18.	Data formatting	
19.	Shift Keying Techniques- ASK & FSK	
20.	QPSK & BPSK	

VII Semester
ET 2411 – PE III : Power Electronics

Prerequisites	----------
Course Objective Students should be able to 1. Understand the characteristics of different power electronics switches and selection of components for different applications, 2. Learn different types of power devices 3. Understand the switching behaviour of power electronics circuits such as DC/DC converters. 4. Learn the role of different type of inverters.	**Course Outcome** Students will be able to 1. Analyze and design Power semiconductor devices. 2. Analyze and design DC/DC converter and Cyclo-converters. 3. Analyze and design inverter circuits. 4 . Apply the knowledge of power electronics to solve real Life problems.

UNIT I: Power semiconductor devices (part A)
Power Semiconductor Diodes, classification, reverse recovery Characteristics, series and shunt connection of power diodes, Power Transistors, Switching characteristics of power transistor, Base drive control.
06Hrs

UNIT II : Power semiconductor devices(part B)
Power MOSFETs, IGBT, Silicon controlled rectifier(SCR), dynamic Turn ON and Turn OFF characteristics of SCR, Firing circuit, Diac, Triac.
06Hrs

UNIT III : AC –DC Converter
Commutation methods of SCR, Single phase half wave and full wave Controlled Rectifier with resistive and inductive load,
06Hrs

UNIT IV: DC-DC Converters (Chopper**)** Step up, step down Choppers, design of choppers AC Voltage Controllers. Principle of ON-OFF control, Phase control, single phase cyclo-converter
06Hrs

UNIT V : DC –AC Converter
Inverters—Series resonant inverters, Modified series inverter, parallel inverter, single phase bride inverter, current source inverter, Three phase bridge Inverter: 120 degree and 180 degree mode, design of inverter applications.
06Hrs

UNIT VI:
Solar converter, buck converter, boost converter, Cuk converter, Design of Gate Drive circuits for SCR, SCR protection circuits, design of snubber circuit, Introduction to AC and DC drives, SMPS.
06Hrs

VII Semester
ET 2411 – PE III : Power Electronics

Text books:				
1	Power Electronics:Circuits,Devices and Applications	Fourth Edition	Muhammad H. Rashid	Academic press
2	Power Electronics	Second Edition 2008	M. D. Singh,K. B. Khanchandani	TATA McGraw-Hill
3	Industrial and power electronics	Third Edition 2007	Deodatta Y. Shinare	Electrotech Publication
4	Power Electronics and its application	Second Edition, 2004	Alok Jain	Penram International Publishing Pvt Ltd

Reference books:				
1	Power Electronics	Third Edition 2012	Ned Mohan	John Wiley & sons
2	Fundamentals of power electronics	Third Edition 2020	Erickson, Robert W., Maksimovic , Dragan	

VII Semester
ET2412 – PE III: Data compression and encryption

Course Objective	Course Outcome
Students should be able to 1. Understand text, audio and video compression techniques. 2. Understand data security issues 3. Understand Symmetric and Asymmetric Key Cryptography schemes. 4. Understand network security.	Students will be able to 1. Implement text, audio and video compression techniques. 2. Describe data security issues 3. Implement Symmetric and Asymmetric Key Cryptography schemes. 4. Describe network security issues.

Unit 1.Introduction to Data Compression

Data Compression : Modelling and Coding, Statstical Modelling, Dictionary Schemes, LZ, Lossy Compression Shannon – Fano Algorithm, Huffman Algorithm, Adaptive Huffman Coding

Difficulties in Huffman Coding, Arithmetic Coding – Decoding, Dictionary Based Compression, Sliding Window Compression: LZ-77, LZ-78, LZW **(6 hours)**

Unit2. Image Compression

DCT, JPEG, JPEG – LS, Differential Lossless Compression, DPCM, JPEG – 2000 Standards **(6 hours)**

Unit 3.Video and Audio Compression

Analog Video, Digital Video, MPEG – 2, H – 261 Encoder and Decoder Sound, Digital Audio, μ-Law and A-Law Companding, MPEG – 1 Audio Layer (MP3 Audio Format) **(6 hours)**

Unit 4. Data Security

Security Goals, Cryptographic Attacks, Techniques Symmetric Key: Substitution Cipher, Transposition Cipher , Stream and Block Cipher DES, AES **(6 hours)**

Unit 5. Number Theory and Asymmetric Key Cryptography

Prime Numbers, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Discreet Logarithms

Principles of Public Key Crypto System, RSA Key Management, Deffie-Hellman Key Exchange

Message Integrity, Message Authentication and Hash Functions, SHA, H MAC, Digital Signature Standards **(6 hours)**

Unit 6. Network Security

Email, PGP, S/MIME, Intrusion Detection System Web Security Considerations, SSL Architecture, SSL Message Formats, TLS, Secure Electronic Transactions Kerberos, X.509 Authentication Service, Public Key Infrastructure **(6 hours)**

VII Semester
ET2412 – PE III: Data compression and encryption

Text books:				
1	The Data Compression Book	Mark Nelson, Jean-Loup Gailly	2nd edition	BPB Publications
2	Cryptography and Network Security Principles and Practices	William Stallings	5th Edition	Pearson Education.
3	Introduction to Data Compression		2nd edition	Morgan Kaufmann

Reference books:				
1	Cryptography and Network Security, Tata McGraw-Hill.	BehrouzA. Forouzan	2nd edition	Tata McGraw-Hill.

VII Semester
ET 2413 –PE III : Analog VLSI Design

Prerequisites	----------
Course Objective Students should be able to 1. Understand the concept and basics of small signal model of MOS transistor &Perform analysis of single stage amplifiers with or without load 2. Understand small signal parameters of Differential Amplifier. 3. Understand current mirrors as bias element and single stage amplifiers in frequency domain 4. Study Performance parameters of CMOS op amp	**Course Outcome** Students will be able to 1. Analyze small signal model of MOS transistor &Perform analysis of single stage amplifiers with or without load. 2. Analyze small signal parameters of Differential Amplifier. 3. Analyze Performance parameters of CMOS op amp. 4. Analyze Performance parameters of converters.

UNIT-1 Basic MOS Device Physics

Threshold voltage, Derivation of I/V characteristics, second order effects, MOS device capacitance, MOS small signal models, MOS SPICE models

(06 Hours)

UNIT-2: Single stage amplifiers

Basic concept, common source, common source stage with resistive load, CS stage with source degeneration, source follower, common gate. **(06 Hours)**

UNIT-3: Differential amplifiers

Single ended & differential operation, Basic differential pair, qualitative and quantitative analysis, Common mode response.

(06 Hours)

UNIT 4: Operational amplifiers

Performance parameters, one stage op amp, Gain boosting, Noise in op amp

(06 Hours)

Unit 5: ADC converter and DAC converter

Converting Analog Signals to Digital Signals, Sample-and-Hold (S/H) Characteristics, Digital-to-Analog Converter (DAC) Specifications, Analog-to-Digital Converter (ADC) Specifications. **(06 Hours)**

Unit 6: Sigma Delta Converter

The Oversampling ADC, The First-Order **Sigma Delta** Modulator , The Higher Order **Sigma Delta** Modulators.

(06 Hours)

VII Semester
ET 2413 –PE III : Analog VLSI Design

Text books:				
1	Design of Analog CMOS Integrated circuits	Ninteenth reprint 2010	BehzadRazavi	Mc-graw-Hill

Reference books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

VII Semester
ET 2414 – PE III: Error Correcting Code

Prerequisites	----------
Course Objective Students should be able to 1) Understand the concept and basics of information theory and the basics of source and channel coding/decoding. 2) Understand various mathematical tools: groups and finite fields, Linear algebra in the development of codes and sequences and explain the conventional digital communication system with error control codes like block code, Linear code 3) Understand the properties of error control codes like Cyclic code, BCH code. 4) Understand various error control techniques for Convolutional codes.	**Course Outcome** Students will be able to 1. Apply the concept and basics of information theory and the basics of source and channel coding/decoding. 2. Apply various mathematical tools: groups and finite fields, Linear algebra in the development of codes and sequences and explain the conventional digital communication system with error control codes like block code, Linear code 3. Analyze the properties of error control codes like Cyclic code, BCH code. 4. Demonstrate competence in analyzing and evaluating the practice of different error control techniques for Convolutional codes.

UNIT-1 : CHANNEL CAPACITY AND CODING

Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Random Selection Of Codes, Hamming Distance, Few Points Of Information Theory. **(06 Hours)**

UNIT-2: BLOCK CODES

Coding for reliable digital transmission and storage. Groups, Rings, Vector Spaces, Galois Fields, Polynomial rings The Digital Communication Channel, Introduction To Block Codes, Single Parity Check Codes, Product Codes, Repetition Codes, Hamming Codes, Minimum Distance Of Block Codes, Soft – Decision Decoding, Automatic Repeat Request Schemes **(06 Hours)**

UNIT-3: LINEAR CODES

Definition of Linear Codes, Generator Matrices, The Standard Array, Parity - Check Matrices, Error Syndromes, Error Detection And Correction, Shortened And Extended Linear Codes.. **(06 Hours)**

UNIT 4: CYCLIC CODES

Definition Of Cyclic Codes, Polynomials, Generator Polynomials, Encoding Cyclic Codes, Decoding Cyclic Codes, Factors Of XN +1, Parity-Check Polynomials, Dual Cyclic Codes, Generator And Parity-Check Matrices Of Cyclic Codes **(06 Hours)**

Unit 5: BCH CODES

Linear Algebra, Galois Field, Definition and Construction of Binary BCH Codes, Error Syndromes In Finite Fields, Decoding SEC and DEC, Reed- Solomen Codes, LDPC codes **(06 Hours)**

Unit 6: CONVOLUTION CODES

Convolution, Encoding Convolutional Codes, Generator Matrices For Convolutional Codes, Generator Polynomials For Convolutional Codes, Graphical Representation Of Convolutional Codes, The Viterbi Decoder. Concept Of Interleaver And Puncture Coding, Applications of error control coding **(06 Hours)**

VII Semester
ET 2414 – PE III: Error Correcting Code

Text books:				
1	Introduction to Error Control Codes	Gravano Salvatore	1st Ed., 2007.	Oxford University Press,
2	Error Correction Coding Mathematical Methods and Algorithms	Moon Tood K	, 1st Ed., 2006	Wiley- Interscience
3	Digital Communications - Fundamentals and Applications	Sklar Bernard	2nd Ed., 2009.	Pearson Education-LPE,

Reference books:				
1	Information Theory, Coding and Cryptography	Bose Ranjan	, 1st Ed., 2007.	Tata McGraw-Hill
2	Error Control Coding-Fundamentals and Applications	-Shu Lin, Daniel J. Costello		Prentice Hall, Inc.

VII Semester
ET2415– PE III: Wireless Mobile Communication Systems

Prerequisites	Analog and Digital Communications, Digital Signal Processing
Course Objective Students should be able to 1. Study cellular concepts and techniques toimprove capacity in cellular system and Study fundamentals equalization and diversity technique. 2. Understand mobile radio environment and its different parameters. 3. Learn various multiple access system.. 4. Understand the operating principles of various wireless systems & standards. 5. Learn the fundamentals of GSM & wireless networking.	**Course Outcome** Students will be able to 1. Describe various generations of mobile communications and apply the concept of frequency reuse for design of cellular system. 2. Quantify causes and effects of path loss and signal fading on received signal characteristic and used various technique to improve signal quality. 3. Describe various types of equalization and diversity technique & Multiple access techniques for wireless communication.. 4. Analyze GSM & CDMA systems and Understand the fundamentals of wireless networking.

UNIT-1: Introduction to Wireless Communication Systems & Cellular Concept
Evolution of Mobile Radio communication, Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system. **(06 Hours)**

UNIT-2: Mobile Radio Propagation
Large & Small Scale Path Loss & Fading: Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models Small Scale Multipath Propagation, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh & Rician Distribution . **(06 Hours)**

UNIT-3: Equalization & Diversity
Fundamentals of equalization, Equalizers in communication receiver, Survey of equalizer Technique, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver **(06 Hours)**

UNIT 4: Multiple access techniques for wireless communication.
Introduction to Multiple Access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Code Division Multiple Access (COMA), Hybrid Spread Spectrum Techniques, Space Division Multiple Access (SOMA), Packet Radio, Packet Radio Protocols, Carrier Sense Multiple Access (CSMA) Protocols. **(06 Hours)**

UNIT-5: GSM
GSM - global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard (IS-95) , Routers 901, 920 and Switches Case studies on latest Generation
(06 Hours)

UNIT-6: Wireless Networking
Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signaling, Signaling System No7. An Example of SS7, introduction to various generation of mobile communication. Wi-max Technology, Unlicensed Band Radio (UBR) Case studies on latest wireless data Networks.
(**06 Hours)**.

VII Semester
ET2415– PE III: Wireless Mobile Communication Systems

Text books:				
1	Wireless communication Principles and practice	Second edition 5 January 2018	by T S. Rappaport	(Prentice Hall PTR, upper saddle river, New Jersey.)
2	"Modern Wireless Communications" (Indian Edition)	2011	Haykin & Moher	Pearson (Indian Edition)
Reference books:				
1	Wireless digital communication	1995	by Kamilo Feher	PHI
2	Mobile Communications Design fundamentals	1993	by William C. Y. Lee	John Willey
3	Mobile Cellular Communication	2005	by W .C .Y. Lee	Mc Graw Hill
4	Mobile Radio Propagation channel	1996	by J.D. Pearson	John Willey

VII Semester
ET2421 – PE IV: Satellite Communication & Radar Engineering

Prerequisites	----------
Course Objective Students should be able to 1) To understand the satellite system and Propagation on satellite. 2) To understand earth station technology. 3) To make the student understand the principles of Radar and various types of radars 4) To make them understand the RADAR antennas, clutters and Effects of weather on RADAR..	**Course Outcome** Students will be able to 1) Analyze satellite services , satellite system and Propagation on satellite. 2) Describe the Earth station technology. 3) Analyze the RADAR range equation and Doppler principle ,and types of radars 4) Analyze RADAR antennas, Duplexer, clutters and the effects of weather on radar

UNIT-1

Introduction: Origin of Satellite communication, Current state of satellite communication. Orbital aspect of satellite communication: Orbital mechanism, equation of orbit, locating satellite in orbit, orbital elements, and orbital perturbation. Space craft subsystem: Attitude and orbit control system, Telemetry tracking and command power system, and communication subsystem.

(06 Hours)

UNIT-2:

Propagation on satellite: Design aspects of satellite uplink and downlink**,** Earth's path – propagation effects, atmospheric absorption, Scintillation effects, Land and Sea multipath, Rain and ice effects, Rain drop distribution, calculation of attenuation. Rain effects on Antenna noise temperature

(06 Hours)

UNIT-3:

Earth Station technology: Earth Station design; antennas tracking, LNA, HPA, RF multiplexing, factors affecting orbit utilization, tracking, equipment for earth station. Case Study on trends in satellite communication

(06 Hours)

UNIT 4:

RADAR Range Equation, CW and FM modulated RADAR, MTI and Pulse Doppler RADAR, Tracking RADAR.

(06 Hours)

UNIT 5:

RADAR antennas, parabolic reflector, scanning field reflector, Lens antennas. Cassegrain reflector, types of feeds, RADAR Receivers, Displays and Duplexer, Detection of RADAR signals in noise, phase array antenna.

(06 Hours)

UNIT 6:

RADAR clutter, Effects of weather on RADAR, Detection of targets in Precipitation, Synthetic Aperture RADAR, HF over the Horizon RADAR.

(06 Hours)

VII Semester
ET2421 – PE IV: Satellite Communication & Radar Engineering

Text books:				
1	**Introduction of RADAR system**	Third edition	**Skolnik**	**McGraw Hill**
2	**Satellite Communication**	Fourth edition	**Dennis Roddy**	

Reference books:				
1	Satellite Communications		Varsha Agrawal Anil	Wiley India Pvt Ltd
2.	Satellite Communication Systems		M. Richharia	Mcgraw-Hill Telecommunications
3.	Radar Systems Principle		Harold R.Raemer	
4.	Satellite Communications	2nd Edition, 2003	Timothy Pratt, Charles Bostian and Jeremy Allnutt,	John Wiley & Sons,

VII Semester
ET2422- PE IV: Embedded System

Prerequisites	**----------**
Course Objective Students should be able to 1. Study & understand the detailed architectural features of ARM processor. 2. Study instruction set of ARM processor and apply the same for programming 3. Explore the details about LPC 2148 Develop programs in interfacing of different peripherals with NODE MCU ESP8266 4. Understand memory management in ARM and operating system..	**Course Outcome** Students will be able to 1. Explore the architectural features of ARM processors 2. Apply ARM instruction set in developing assembly language programs. 3. Explore Basic embedded C programs for GPIO and interfacing with LPC 2148 and Develop programs in interfacing of different peripherals with NODE MCU ESP8266 4. Acquire knowledge about memory management in ARM and operating system.

UNIT-1 Introduction to embedded system and ARM Processor

Difference between RISC & CISC, Advantages of architectural features of ARM Processor, Processor modes, Register Organization, Exceptions and its handling. 3/5- stage pipeline ARM organization. LPC2148 ARM 7 microcontroller, Features of LPC2148, Block diagram of LPC2148, Pin diagram of LPC2148, Architectural overview, On-chip flash program memory, On-chip RAM.

(06 Hours)

UNIT-2: Memory and memory-mapped I/Os

ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs. **(06 Hours)**

UNIT-3: ARM floating point architecture and DSP extensions

ARM floating point architecture and DSP extensions, ARM co-processors. ARM 9 TDMI ARCHITECTURAL STUDY: - H/W architecture, Timing diagrams for various accesses, Memory buses: AMBA, ASB, & APB. Architectural support for system development **(06 Hours)**

UNIT 4: Basic embedded C programs

Basic embedded C programs for GPIO and interfacing of different devices like LED, LCD, Stepper Motor, Study and programming of on-chip peripherals like timers, counters, on-chip ADC, DAC, Introduction to NODE MCU ESp8266 and ESP 32, NODE MCU ESP8266 Features & Using It with Arduino IDE, NODE MCU ESP8266 Pinout, Power requirement. **(06 Hours)**

VII Semester
ET2422- PE IV: Embedded System

Unit 5: memory Management

Memory Hierarchy, memory size and speed, on-chip memory, caches, cache design, memory management

(06 Hours)

Unit 6: Architectural Support of Operating System

Architectural support for operating system. RTOS issues, The shared Data Problem, Software Architectures (Round Robin, Round Robin with Interrupts, Function Queue Scheduling,) Selecting a software Architecture, Case for Real Time Operating System, Introduction to RTOS :tasks and task states, tasks and data, semaphores and shared data, message queues, mailboxes and pipes, events, RT Linux. **(06 Hours)**

Text books:				
1	ARM System–on-chip Architecture	2nd edition August 25, 2000	by Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2nd Edition 2002	by Craig Hallabaugh	Pearson Education Asia
3	Exploring Arduino: Tools and Techniques for Engineering Wizardry 2nd Edition	2nd Edition October 24, 2019	by Jeremy Blum	Wiley; 2 edition (October 24, 2019)

Reference books:				
1	System Developer's Guide: Designing and Optimizing	Publish Date: 2004	Sloss Andrew N, Symes Dominic, Wright Chris	Morgan Kaufman Publication
2	Arduino: A Technical Reference	Publish Date: May 2016	J. M. Hughes	O'Reilly Media, Inc.

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VII Semester
ET 2423 – PE IV: Switching Theory

Course Objective	Course Outcomes
Students should be able to 1) Understand various sequential logic design methods, Analysis of logic circuits and optimization techniques to minimize gate count. 2) Learn fault diagnosis, Threshold logic, analysis and design of sequential machines.	Students will be able to 1) Design and Analyze multilevel logic Network and Threshold logic for nanotechnologies. 2) Analyze testing of combinational circuits, Fault Models 3) Design and analyze the synchronous and asynchronous sequential circuits. 4) Identify and test the sequential machines with experiments.

UNIT-1

Multi-level logic synthesis, Technology-independent synthesis: Factoring, Decomposition, Extraction, Substitution, and Technology mapping: steps in technology mapping **(06 Hours)**

UNIT-2:

Threshold logic for nanotechnologies, threshold elements, synthesis of threshold networks: Unate function, Identification & Realization of threshold function. **(06 Hours)**

UNIT-3:

Testing of combinational circuits, Fault models, Structural testing, IDDQ testing, Delay fault testing, Synthesis for testability, Testing for nanotechnologies. **(06 Hours)**

UNIT 4:

Synchronous sequential circuits and iterative networks, memory elements and their excitation functions, synthesis of synchronous sequential circuits, Moore and Mealy machines, finite state machine flow charts, tables **(06 Hours)**

Unit 5:

State-identification experiments and testing of sequential circuits, Experiments, Homing experiments, Distinguishing experiments, Machine identification, Checking experiments, Built-in self-test (BIST). ,New topic to be announced time to time **(06 Hours)**

Unit 6

Asynchronous sequential circuits, Modes of operation, Hazards, Synthesis of SIC fundamental-mode circuits. **(06 Hours)**

VII Semester
ET 2423 – PE IV: Switching Theory

Text books:				
1	Switching & Finite Automata Theory	Zvi Kohavi, Niraja K. Jha	Third Edition 2010	Cambridge University Press
2	Fundamentals of Digital Logic With VHDL Design	Stephen Brown	Second Edition, 2007	TMH

Reference books:				
1	Modern Switching Theory and Digital Design	Lee S.C		PHI Edition
2	Digital Logic and Computer Design	M.Morris Mano		PHI Edition

VII Semester
ET 2424 – PE IV: Topics in Machine Learning

Prerequisites	Basic probability and statistics, linear algebra and calculus
Course Objective Students should be able to 1) Understand the concepts of machine learning and regression models 2) Understand the concept of classification for model evaluation. 3) Learn Supervised and unsupervised learning algorithms. 4) Learn the concept of artificial neural network and deep networks	**Course Outcome** Students will be able to 1) Apply and analyze the model using regression. 2) Apply and evaluate the performance of system for classification. 3) Apply Supervised and unsupervised learning for problem solving. 4) Apply neural network algorithms for classification. 5) Describe and evaluate deep neural network with computational complexity.

UNIT-1 Regression
Supervised and Unsupervised Learning, Regression, Model and Cost Function, Gradient Descent, Multivariate Linear Regression, Feature Scaling, Gradient Descent for multivariable **(06 Hours)**

UNIT-2: Classification
Classification, Hypothesis Representation, Decision Boundary, Cost function and Gradient Descent, Multi-classification, Regularization, Model Evaluation **(06 Hours)**

UNIT-3: Supervised Learning
KNN, SVM, Decision tree, Naive Bayes Classifiers, Random Forest **(06 Hours)**

UNIT 4: Unsupervised learning
K-means clustering, Hierarchical Clustering, DBSCAN Clustering, PCA, Anomaly Detection, Recommender System (**06 Hours)**

Unit 5: Artificial Neural Network
Introduction to neural network, Activation Functions, Perceptron rule, backpropagation **(06 Hours)**

Unit 6: Deep Learning
Introduction to deep learning, building blocks of CNN, Computational Complexity, case studies based on CNN architectures, **New topics to be announced time to time.** **(06 Hours)**

Text books:				
1	Understanding Machine Learning. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html	2017	Shai Shalev-Shwartz and Shai Ben-David.	Cambridge University Press.
2	The Elements of Statistical Learning. https://web.stanford.edu/~hastie/ElemStatLearn/	2009	Trevor Hastie, Robert Tibshirani and Jerome Friedman.	Second Edition
3	Pattern Recognition and Machine Learning. https://www.microsoft.com/en-us/research/people/cmbishop/downloads/	2006	Christopher Bishop.	Springer

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VII Semester
ET 2424 – PE IV: Topics in Machine Learning

Reference books:				
1	Foundations of Data Science.	2017	Avrim Blum, John Hopcroft and Ravindran Kannan.	
2	Learning, Part II, http://www.deeplearningbook.org/	2016	Goodfellow, I., Bengio, Y., Courville, A.	MIT Press
3	Machine Learning: A Probabilistic Perspective	2012	Kevin P. Murphy	MIT Press

VII Semester
ET 2425 – PE IV: Multimedia Communications

Prerequisites	Basics of digital data and computer networks
Course Objective Students should be able to 1. Learn the basics of image ,audio representation and transmission 2. Understand basic concepts of image ,audio and video compression 3. Learn basic concepts of multimedia communication networks. 4. Understand basic concepts of Content-Based Retrieval in Digital Libraries	**Course Outcome** Students will be able to 1. Explain basics of analog and digital video 2. Implement image compression techniques and describe video compression techniques 3. Describe various network protocols 4. Describe basics of image retrieval from digital libraries

UNIT-1:
Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video **(6 hours)**

UNIT-2:
Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio **(6 hours)**

UNIT-3:
Multimedia data compression: Lossless compression algorithm: DCT, Wavelet- Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT), Basic Audio Compression Techniques **(6 hours)**

UNIT-4:
Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, MPEG2, MPEG4 **(6 hours)**

UNIT-5:
Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications :Quality of Multimedia Data Transmission, Multimedia over IP, RTCP,RTP,SIP Transport of MPEG-4,DMIF, Media-on-Demand(MOD) **,**Multimedia Broadcasting schemes **(6 hours)**

UNIT-6:
Content-Based Retrieval in Digital Libraries C-BIRD— A Case Study ,C-BIRD GUI Color Histogram Color Density Color Layout Texture Layout Search by Illumination Invariance Search by Object Model **(6 hours)**

Text books:				
1	Fundamentals of Multimedia	Ze-Nian Li , Mark S Drew	2004	PHI/Pearson Education
2	Multimedia Applications	Steinmetz, Nahrst	2004	Springer.

Reference books:				
1	Multimedia Communications: Applications, Networks, Protocols and Standars	Fred Halsall	2001	Addison-Wesley

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VII Semester
ET2431-PE V: Display Technology

Prerequisites	----------
Course Objective Students should be able to 1. To provide the fundamental knowledge for understanding concepts of different display technologies related to manufacturing techniques and materials selection 2. To explore specifications required for display technologies and understand properties of Luminescence materials for different display types. 3. To understand the addressing methods, backplane Technology and Driver Integration part of different new displays. 4. To understand new displays properties of materials modes.	**Course Outcome** Students will be able to 1. Identify different display technologies and manufacturing process. 2. Characterized and analyzed specifications of display technology and Luminescence materials. 3. Explore design parameters for displays and analyze addressing matrix and backlight unit technologies. 4. Elaborate applications of different new displays.

UNIT I :
Overview of display technologies, information capacity of displays, introduction to different flat panel display technologies. LCD Display Internal structure and working, Fundamentals of Photometry,

(06 Hours)

UNIT II :
Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, driving power, efficiency, speed, memory and storage, degradation, resolution, addressability, physiological factors, and measurement instrumentation, Colorimetry, CIE colorimetry

(06 Hours)

UNIT III :
Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, processes responsible for the transfer of energy in luminescent materials, chemistry and preparation of luminescent materials, and emission properties of the prepared materials;

(06 Hours)

UNIT IV:
Basics of matrix addressing of displays: active and passive matrix. Technical discussion of display technologies: LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.

(06 Hours)

UNIT V:
Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.)

(06 Hours)

UNIT VI:
Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes

(06 Hours)

VII Semester
ET2431-PE V: Display Technology

Text books:				
1	Liquid crystal flat panel displays: manufacturing science & technology.	W. Mara	2012	Springer, Science & Business Media,
2	Introduction to Flat Panel Displays	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu		Wiley publications

Reference books:				
1.	Liquid crystal displays: fundamental physics and technology.	R. H. Chen	2011	John Wiley and Sons
2.	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	Vinod Kumar Khanna		CRC press

VII Semester
ET2432-PE V: Biomedical Instrumentation

Prerequisites	----------
Course Objective Students should be able to 1) Know the physiology of heart and brain , Understand the basic principles of physical parameters 2) Comprehend the working principle of recording instruments signal analysis techniques 3) Know the concepts of modern imaging systems 4) Understand the concept of Therapeutic Equipments	**Course Outcome** Students will be able to 1) Describe various parameters of human anatomy and physiology. 2) Explain the functioning of different measuring and recording instruments 3) Describe imaging systems. 4) Learn therapeutic equipments.

UNIT-1 : Fundamentals of Biomedical Instrumentation and its Electrodes.

Anatomy and Physiology, Physiological Systems of the Body, Sources of Biomedical Signals, Basic Medical Instrumentation System, Origin of Bioelectric Signals, Recording Electrodes, Electrodes for ECG. Electrodes for EEG, Electrodes for EMG. **(06 Hours)**

UNIT-2: Biomedical recorders and its Systems .

Basic Recording System, Biomedical Signal Analysis Techniques, Electrocardiograph Phonocardiograph (PCG), Electroencephalograph (EEG), Electromyograph (EMG) , Other Biomedical Recorders **(07 Hours)**

UNIT-3: Measuring Instrumentation

Blood pressure measurement, Heart sound measurement oximetry, Pulse Oximeter, Electromagnetic Blood Flowmeter, Ultrasonic Blood Flowmeters, Coulters Counters. **(06 Hours)**

UNIT 4: Analysers

Pulmonary Function Measurements, Spirometry, Pneumotachometers ,Measurement of Volume Respiratory Gas Analyzers, Acid-base Balance, Blood pH Measurement, Blood pO2 Measurement. **(06 Hours)**

Unit 5: Modern Imaging Systems

Basis of Diagnostic Radiology, Nature and Production of X-rays, Visualization of X-rays
Physical Parameters for X-ray Detectors, Ultrasonic Imaging Systems Medical Ultrasound, Basic Pulse-echo Apparatus, A-Scan , Echocardiograph (M-mode), B-Scanner, Real-time Ultrasonic Imaging Systems, MRI **(05 Hours)**

Unit 6: Therapeutic Equipment

Cardiac Pacemakers: Need for Cardiac Pacemaker, External Pacemakers *Implantable* Pacemakers. Cardiac Defibrillators: Need for a Defibrillator, DC Defibrillator, Implantable Defibrillators Ventilators: Its types and characteristics. **(06 Hours)**

Text books:				
1	Handbook of Biomedical Instrumentation	1st edition	R.S.Khandpur TMH	TMH
2	Introduction to Biomedical Instrumentation	-	By Mandeep Singh	**PHI**

Reference books:				
1	Biomedical Instrumentation & Measurement ,	2nd edition 1990	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer PHI	PHI

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VII Semester
ET 2433 – PE V: Fuzzy Logic & Neural Network

Prerequisites	**Basic set theory,** Basic probability and statistics**,** linear algebra and calculus
Course Objective Students should be able to 1. Learn computing algorithms in Neural network and Fuzzy logic concepts 2. Understand operation of basic elements in fuzzy controller, fuzzy reasoning, relations. 3. Understand supervised and unsupervised algorithms in neural networks. 4. Learn deep learning fundamentals and develop algorithms to solve real life applications.	**Course Outcome** Students will be able to 1. Comprehend and apply fuzzy/ neural network concepts to handle uncertainty in engineering problem. 2. Apply Fuzzy relation, implications and Design Fuzzy logic controller for solving real life problems 3. Apply supervised/unsupervised algorithms for pattern recognition/classification problems. 4. Describe Deep learning models and apply deep networks to computer vision analysis

UNIT-1 Fuzzy Logic & Arithmetic Operations
Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions, fuzzy compliments, t-norms and t-conorm**,** extension principle, Fuzzy arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations **(06 Hours)**

UNIT-2 Fuzzy Relations & Decision Making
Fuzzy relations, projections and cylindric extensions, binary fuzzy relations, fuzzy equivalence, Fuzzy Rules and Fuzzy Reasoning, Fuzzy implications, Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy controllers **(06 Hours)**

UNIT-3: Neural Network Concepts
Introduction to Biological neural network, and Artificial Neuron Models, Neural Network learning rules, NN architectures, Hebb Net, Learning in single discrete and continuous perceptron, Perceptron training algorithm**,** Feed forward vs feedback networks, ADALINE, MADALINE NN **(06 Hours)**

UNIT-4: Supervised Neural Networks
Supervised Learning Neural Networks, Backpropagation algorithm, factors affecting back propagation training, Radial Basis Function Networks, Recurrent Networks, Adaptive Multilayer NN **(06 Hours)**

UNIT 5: Unsupervised Neural Networks
Unsupervised Learning Neural Networks, Winner take networks, Adaptive Resonance architectures, Self-Organizing Map, Associate memory models **(06 Hours)**

Unit 6: Deep learning
Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Basic structure of Convolutional Network, Case studies: Alex net, VGGNet, GoogLeNet, Applications of CNN: Train deep neural networks for computer vision tasks, **New topic to be announced time to time**
(06 Hours)

VII Semester
ET 2433 – PE V: Fuzzy Logic & Neural Network

Text books:				
1	Fuzzy Sets and Fuzzy Logic:Theory and Applications	1996	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications	2017, 2nd edition	S. Rajasekaran and G. A. Vijayalakshmi Pai	Prentice Hall of India
3	Elements of Artificial Neural Network	2009	K. Mehrotra	Penram International Publishing Pvt Ltd; Second edition MIT, Cognet
4	Neural Networks and Deep learning	2018	Charu C. Aggarwal	Springer International Publishing

Reference books:				
1.	Fuzzy Logic with Engineering Applications	3rd Edition, 2011	Timothy J.Ross,	McGrawHill, New York
2.	Principles of Soft Computing	2011, 2nd edition	S. N. Sivanandam, S. N. Deepa	Wiley India Pvt Ltd
3.	"Neural Networks and Deep Learning", http://neuralnetworksanddeeplearning.com	2015	Michael Nielsen	Determination Press
4.	Deep learning .	2015	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville.	An MIT Press book in preparation

VII Semester
ET 2434 -PE V: Wireless Sensor Networks

Prerequisites	**----------**
Course Objective Students should be able to: 1. To Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology 2. Understand the medium access control protocols and address physical layer issues 3. Learn key routing protocols,transport layer protocols for sensor networks, and design requirements 4. Understand the Sensor management ,sensor network middleware, operating systems.	**Course Outcome** Students will be able to: 1. Understand and explain common wireless sensor node architectures. 2. Carry out simple analysis and planning of WSNs. 3. Demonstrate knowledge of MAC protocols, routing protocols developed for WSN. 4. Demonstrate knowledge of mobile data-centric networking principles.

UNIT-1:

Characteristics Of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs,

(06 Hours)

UNIT-2:

Network architecture-optimization goal and figure of merit-design principles for WSN, service interface of WSN, Gateway concept challenges of WSN, comparison with other network.

(06 Hours)

UNIT-3

Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention- based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol

(06 Hours)

UNIT-4:

Routing And Data Gathering Protocols Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

(06 Hours)

VII Semester
ET 2434 -PE V: Wireless Sensor Networks

UNIT-5
Naming and addressing, Time synchronization, Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement.

(06 Hours)

UNIT-6:
Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking .

(06 Hours)

Text books:				
1	Protocols and architecture for Wireless sensor Networks Wiley	2007	Holger Karl, Andreas Willig,	Wiley Publications
2	Wireless Sensor Network Designs,	2003	Anna Hac	Wiley Publications
3	Handbook of Algorithms for Wireless Networking and Mobile Computing	2006	Azzedine Boukerche	Chapman & Hall/CRC Publications

Reference books:				
1	Wireless Sensor Networks : A systems perspective	August 2005	NirupamaBulusu and Sanjay Jha,	Artech House Publications
2	Wireless Sensor Networks : Architecture and Protocols	2003, 2003.	Jr., Edgar H. Callaway,	Auerbach Publications
3	Wireless Sensor Networks	2005 C.S.	Raghavendra, Krishna M. Sivalingam and TaiebZnati	Springer Publications

VII Semester
ET2435 – PE V : RF Circuit Design

Prerequisites	----------
Course Objective Students should be able to	**Course Outcome Students will be able to**
1. Learn fundamentals of series and parallel RF circuits. **2.** Understand the use of HF component in design the RF circuit and bandwidth estimation techniques. **3.** Learn the design of high frequency amplifier an phase detectors **4.** Understand the concept of CMOS technology in RF circuits.	**1.** Compare the behavior of series and parallel RLC circuit at HF. **2.** Analyze the HF circuit design and Distinguish the different bandwidth estimation techniques. **3.** Compare the power amplifier parameters with HF amplifier with phase detector. **4.** Apply the knowledge of CMOS technology for design of supply independent bias circuit

UNIT-1 Fundamentals of RF Circuits

Introduction, History of wireless Communication, Noncellular wireless Applications, Propagation, Parallel RLC Tank Circuit, Series RLC Circuit , RLC Network as Impedance Transformer, Skin Effect, Resistor, Capacitor, Inductor **(06 Hours)**

UNIT-2: MOSFET and Transmission Lines

MOSFET Physics, MOS Device Physics in Short Channel Regime , Other Effects, Link Between Lumped and Distributed Regime ,Driving Point impedance at iterated structures , Transmission line , Behavior of finite length Transmission line. **(06 Hours)**

UNIT-3: Bandwidth Estimation

Review of Smith Chart and S-Parameter, Application of smith chart, Rise time, Delay, Bandwidth Estimation Techniques - Open Circuit Time Constant , Short Circuit Time constant

(06 Hours)

UNIT 4: HF RF Amplifier and Bandwidth Detection

Introduction to High Frequency Amplifier Design, Zeros as Bandwidth Enhancer , The shunt series Amplifier, Tuned Amplifiers, Neutralization and Unilateralization Cascaded Amplifiers,

(06 Hours)

Unit 5: Biasing of RF Circuit

Introduction to Voltage references and Biasing, Review of Diode Behavior, Diodes and Bipolar transistors in CMOS Technology Supply independent bias circuits, Band gap Voltage References, Amplifier linearity. **(06 Hours)**

Unit 6: RF Power Amplifier and Phase Detectors

Introductions to RF Power Amplifiers, Classification of Power Amplifiers, Modulation of Power Amplifiers, Introduction to Phase lock loops , Linear zed PLL Model, Phase Detector, Sequential Phase Detector, Loop Filters and Charge Pumps **(06 Hours)**

Text books:				
1.	The Design of CMOS Radio Frequency Integrated Circuits	2nd Edition	Thomas H. Lee	Cambridge University Press
2.	RF Circuit Design Theory and Applications	2nd Edition	R. Ludwig & P. Bretchko	Pearson Publication

Reference books:				
1.	Analysis and Design of Analog Integrated Circuits	4th Edition	Paul R. Gray	Whiley India Publication

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
ET2441-PE VI : CMOS VLSI Design

Prerequisites	Logic Circuit Design, MOSFET Operation, Sequential Circuits .
Course Objective Students should be able to 1. To understand and study analysis of the MOS transistor with first order and second order effects. 2. To study the static and dynamic operating principles of inverter circuit. 3. To understand the different CMOS implementation process. 4. To learn switching characteristics and interconnection effects of MOS device, advanced techniques in CMOS logic.	**Course Outcome** Students will be able to 1. An ability to analyze the characteristics of MOSFET. 2. An ability to analyze the voltage transfer characteristics of MOS inverters. 3. An ability to apply the LAMBDA design rules for design of optimized CMOS circuits and describe the process of fabrication for CMOS circuits 4. An ability to design and analyze switching characteristics and interconnection effects of MOS device, advance CMOS logic circuits.

UNIT –I : Basic MOS Device Physics

General Consideration: MOS as a switch, MOS Structure & Symbols, MOS I/V Characteristics, MOS Enhancement Transistor, Second order effect of MOS: Body Effect, Junction Effect, Gate Leakage Effect, Channel Length Effect, Tunneling Effect, Velocity Modulation, Mobility Variation **06 Hrs**.

UNIT-2:

MOSFET Inverter Characteristics

Resistive Load Inverter , Inverter with n type MOSFET load,CMOS Inverter, Principle of operation & DC Characteristics, Tri-stated Inverter, Noise Margin Calculation. **07 Hrs**

UNIT-3:

Fabrication & Layout of CMOS IC

CMOS Fabrication Technology: N-well, P-well, Twin Tub Process, Silicon on Insulator (SOI) Process, Physical Design of Logic Gates, Euler's Path, Stick Diagram, Layout, Latch-up Effect. **06 Hrs.**

UNIT-4:

Switching Characteristics & Interconnection Effect

MOS Device Capacitance Estimation, Switching Characteristics: Rise Time, Fall Time, Propagation Delay, Delay Estimation: Propagation Delay, Contamination Delay, Power Dissipation in CMOS: Static & Dynamic Power Calculation, Charge Sharing, Fan-in, Fan-out. **05 Hrs**

UNIT-5: Combinational Circuit Design

Circuit Families, Static CMOS , Ratioed Circuits , Cascode Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits, Circuit Pitfalls, More Circuit Families. **06 Hrs**

UNIT-6: Sequential **Circuit Design**

Introduction, Sequencing Static Circuits . . Sequencing Methods , Max-Delay Constraints, Min-Delay Constraints,Time Borrowing, Clock Skew, Circuit Design of Latches and Flip-Flops, Conventional CMOS Latches, Conventional CMOS Flip-Flops, Design Using Various Logic Families such as Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, Zipper Logic, Clocked CMOS Logic, CVSL, Bi-CMOS Logic Family **06 Hrs**

VII Semester
ET2441-PE VI : CMOS VLSI Design

Text books:				
1	"Introduction to VLSI Circuits and Systems"	First Edition	John P. Uyemura	Wiley Publication.
2	"Principle of CMOS VLSI Design"	2nd Edition, 1994.	Neil H. E. Weste, K. Eshraghian	Addison Wesley VLSI Series.

Reference books:				
1	"CMOS VLSI Design"	3rd Edition, 2005.	Pucknell, K. Eshraghian	Prentice Hall
2	"CMOS Digital Integrated circuits Analysis and Design"	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici,	Tata Mc- Graw Hill,

VII Semester
ET2442– PE VI: Digital Image Analysis for Remote Sensing

Prerequisites	Principles of Image Analysis
Course Objective Students should be able to 1) Understand Remote Sensing & sensor Concepts 2) Understand the fundamentals and image characteristics of remote sensing. 3) Learn image enhancement techniques 4) Study image classification technique and hyperspectral image analysis	**Course Outcome** Students will be able to 1) Comprehend the basic and applied principles of remote sensing, RS image characteristics 2) Understand and evaluate image spatial and spectral transforms and their effect on image quality and data integrity 3) Apply the image correction techniques and classification algorithms on remote sensing images 4) Analyze high-dimensional remote sensing imagery with appropriate remote sensing data and processing methods.

UNIT-1: Remote Sensing Concepts

Review of Remote Sensing Concepts: spatial and radiometric characteristics – spectral and temporal characteristics, Optical Radiation Model: The wave/ particle models - energy/matter interaction – Radiometric Correction–Atmospheric Correction, Image sensors

(06 Hours)

UNIT-2: Digital Image Formation and Characteristics

Digital Image Formation: point spread functions – sampling and quantization

Digital Image Characteristics: Univariate and multivariate image statistics – noise models- power spectral density- co-occurrence matrix

(06 Hours)

UNIT-3: Image Enhancement and Spectral Transforms

Contrast enhancement – band rationing – principal component analysis – vegetation transforms – texture transforms, Spatial Transforms: convolution concept - low and high pass filtering – spatial transformations – Fourier transform – wavelet transforms.

(06 Hours)

UNIT 4: Geometric Correction

Sensor geometry and empirical models for geometric corrections techniques.

(06 Hours)

Unit 5: RS Image Classification

Thematic Information Extraction: review of supervised and unsupervised Image classification – Maximum Likelihood and Bayesian classification, Non-parametric & parametric classification.

(06 Hours)

Unit 6: High Dimension Image Analysis

Subpixel classification: Linear mixing model, fuzzy set classification, Hyperspectral Image Analysis: Feature extraction, classification algorithms for hyperspectral data, Applications of Remote Sensing, **New topic to be announced time to time** **(06 Hours)**

VII Semester

ET2442– PE VI: Digital Image Analysis for Remote Sensing

Text books:				
1	Remote Sensing: Models and Methods for Image Processing	Third Edition, 2007	Robert A. Schowengerdt	Elsevier
2	Remote Sensing Digital Image Analysis	4th Edition, 2006	John A. Richards, Xiuping Jia	Springer

Reference books:				
1	Introductory Digital Image Processing: A Remote Sensing Perspective	Fourth Edition, 2016	Jhon R. Jensen	Pearson Series
2	Physical Principles of Remote Sensing	Third Edition, 2012	W.G. Rees	Cambridge University Press

VII Semester
ET 2443- PE VI : Microwave Integrated circuits

Prerequisites	RF & Microwave ,UHF.
Course Objective Students should be able to 1. To understand the various microwave Integrated circuits components 2. Develop the hands-on Trainer Kits of MIC. 3. To analyze the various passive & active MIC components. 4. To get hands on spectrum analyzer. and analyze different microstrip component on it.	**Course Outcome** Students will be able to 1. Identify the different MIC components. 2. Analyze the different passive and active Microstrip line devices in MIC. 3. Analyze the Microstrip Patch antenna. 4. Describe the fabrication process of MIC Devices and Components.

UNIT-1: Introduction to planar Transmission Lines:
Microwave Communication System, Microwave Component System, Microstrip lines, Striplines Characteristic impedance, Guide wavelength and loss, Slot line – Wave-guide analysis, coupling coaxial and micro strip lines Coplanar line: Analysis using conformal transformation and Hybrid mode method **06 Hrs**

UNIT-2: Micro strip line devices:
Micro strip coupler and branch-line couplers, even and odd mode analysis, coupling coefficient and bandwidth. Impedance transformers and filters, Lumped elements for MIC design and fabrication of inductors, resistors and capacitors, Non-reciprocal components, micro strip circulators, isolators, phase shifters **06 Hrs**

UNIT-3: Planar Antennas:
Types of Antennas, Radiation mechanism, radiation fields, patch antennas, traveling wave antennas, slot antennas, Excitation techniques, surface waves, Advantages and Disadvantages of Microstrip antennas , Methods of analysis **06 Hrs**

UNIT-4: Design of micro strip circuits:
High power circuits – Transistor Oscillator, step recovery diode frequency multiplier, avalanche diode oscillator, PIN diode switch, Low power circuits : Schottky diode, Balanced mixer, parametric amplifier,PIN diode limiter, Diode phase shifter . **06 Hrs**

UNIT-5: Hybrid MICs:
MIC substrate Materials, Dielectric Substrates properties, Fabrication Technology: Thick film technology, Thin film technology, Methods of testing, Encapsulation of devices, and mounting 0**5 Hrs**.

UNIT-6: Monolithic MICs fabrication:
Introduction to MMICs ,Fabrications, Technologies used in MMICs, Epitaxial growth, Diffusion, Ion implantation, Electron Beam technology for pattern delineation **06 Hrs**

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VII Semester
ET 2443- PE VI: Microwave Integrated circuits

Text books:				
1	"Microwave Engineering"	3rd Edition	David Pozar	Wiley Ind. Publishers
2	"Microwave Devices and Circuits"	. 3rd Edition	Samuel Liao	Prentice-Hall of India Ltd
3	"Antennas and Radio Wave Propagation,"	3rd Edition	R.E.Collin	McGraw Hill Publishers 1985
Reference books:				
1	"Strip like Transmission Line for MIC"	--	Bharti Bhat and S. K. Koul	New Age International.
2	"Microwave Integrated Circuits"	--	K. C. Gupta and Amarjit Singh	Wiley East. Ltd, 1974
3	"Micro strip Antennas"	--	I.J. Bahl and P. Bhartia	Artech House1980.

VII Semester
ET2444 – PE VI: Communication Networks

Prerequisites: Digital Communication	----------
Course Objective **Students should be able to** Understand Networks, Network topologies and service primitives. 1. Learn the structure and applications of Connecting devices. 2. Learn basics of LAN, MAN, WAN. 3. Understand Multimedia Networking. 4. Comprehend Network applications and Network Securities	**Course Outcome** **Students will be able to** 1. Compare data transmission protocols and understand the applications of communication network 2. Apply the knowledge of LAN structure to design data communication system. 3. Detect Data transmission errors in communication networks. 4. Compare different data security protocols.

Unit-1Computer Network and Internet **6 Hours**
Internet, the network edge, ISPs and Internet backbone, Protocol layers and their service models, History of Computer network and Internet

Unit-2 Application Layer **6 Hours**
Principles of Network Applications, the web and HTTP, FTP, Email, DNS,

Unit-3: Transport Layer **6 Hours**
Transport layer design issues, transport service primitives, internet transport protocol TCP/IP architecture, TCP/IP protocol, TCP/IP utilities, wireless TCP

Unit-4: Network layer **6 Hours**
Network layer design issues, IP packets, IP addressing, virtual circuit and datagram networks, router and routing algorithms, congestion, internetworking, UDP, routers and gateways

Unit-5: The link layer and Local area Network **6 Hours**
Services,error detection and correction techniques, multiple access protocols, and link layer addressing, Ethernet, Hubs and Switches, PPP

Unit-6: Security in Communication Networks **6 Hours**
Network Security, cryptography, authentication, Integrity, firewalls, attacks and countermeasures,

Text books:				
1	**Data Communication and Networking**	Behrouz Forouzan	**Fifth Edition**	McGraw Hill
2	**Computer Networking A top down Approach Featuring and Internet**	James F. Kurose	**Third Edition**	**Pearson**
Reference books:				
1	**Computer Networks**	Andrew Tanenbaum	**Fourth Edition**	Prentice Hall PTR

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
ET2445- PE VI: Computer Architecture and Organization

Prerequisites	
Course Objective Students should be able to 1) Study the fundamentals and advance concepts of computer architecture and different arithmetic operation including the algorithms & implementation for fixed-point and floating-point numbers. 2) Understand control unit operations and performances issues 3) Study and apply the Study the hierarchical memory system including cache memories and virtual memory.. 4) Study the concepts of pipelining and Parallel Processors.	**Course Outcome** Students will be able to 1) Describe the fundamentals and advance concept in computer organization and understand the different methods used by processor for arithmetic calculations, perform arithmetic operations and understand the storage format for floating point numbers. 2) Write control sequence for Instructions also understand performances issue in processor and memory. 3) Understand the hierarchical memory system including cache memories and virtual memory. 4) Understand the concepts of pipelining and Parallel Processors.

UNIT-1

Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - restoring and non-restoring techniques, floating point arithmetic. **(6Hrs)**

UNIT-2:

Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. CISC, RISC architecture Case study - instruction sets of a generic CPU. **(6Hrs)**

UNIT-3:

Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit **(6Hrs)**

UNIT-4:

Memory hierarchy – main memory – types and interfacing; Cache memory – its organizations and operations, levels of caches; Memory management module – paging and segmentation, virtual memory; Disk memory, RAIDs. Back-up memory **(6Hrs)**

UNIT-5:

Pipelining:Basic concepts of pipelining, throughput and speedup, pipeline hazards.Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency. **(6Hrs)**

UNIT -6

Peripheral devices and their characteristics: Input-output subsystems, I/O transfers - program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes - role of interrupts in process state transitions.

(6Hrs)

VII Semester
ET2445- PE VI: Computer Architecture and Organization

Text Books			
1	Computer Organization and Design: The Hardware/Software Interface	David A. Patterson and John L. Hennessy	5th Edition Elsevier
2	Computer Organization and Embedded Systems	Carl Hamacher	McGraw Hill Higher Education 6th Edition
3	Computer architecture and organization	Carl Hamacher	McGraw Hill Higher Education 4th Edition

Reference Books			
1	Computer Architecture and Organization	John P. Hayes	WCB/McGraw-Hill 3rd Edition
2	Computer Organization and Architecture: Designing for Performance	William Stallings	10th EditionPearson Education.
3	Computer System Design and Architecture	Vincent P. Heuring and Harry F. Jordan,	2nd Edition Pearson Education

VII Semester
ET2446 – PE VI: PLCs & SCADA

Prerequisites	----------
Course Objective **Students should be able to:** 1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Understand the working of Timing Circuits, Programming techniques with Input/Output Instructions and Addressing, overview of PLC timers and their application in industrial control. 3) Understand the PLC Counters, Data Comparators Instructions and application of sequencers based on these systems 4) Understand the networking using PLC systems and peripherals advanced PLC programming languages which are widely used in industrial automation.	**Course Outcome** **Students will be able to:** 1) Describe automation, its importance, expectations from automation and applications in industry. 2) Describe and analyze Timing Circuits and Program PLC using ladder diagram for various applications. 3) Analyze and apply various instructions of PLC, PLC counters. 4) Explain the basic concepts of networking using PLC systems and peripherals

UNIT-1 :-

Introduction to Programmable Controllers

Definition , A Historical Background , Principles of Operation , PLCs Versus Other Types of Controls , PLC Product Application Ranges, Ladder Diagrams and the PLC , Advantages of PLCs, PLC Sizes and Scopes of Applications

Processors, the Power Supply, and Memory

Introduction , Processors, Processor Scan , The System Power Supply , Programming Devices, Memory Overview , Memory Types, Memory Structure and Capacity. Configuring the PLC Memory—I/O Addressing.

The Input/Output System

Introduction to Discrete I/O Systems , I/O Rack Enclosures and Table Mapping , Remote I/O Systems PLC Instructions for Discrete Inputs, Types of Discrete Modules, PLC Instructions for Discrete Outputs Overview of Analog Input Signals , Analog Input Connections, Special Analog, Temperature, and PID Interfaces.

(06Hours)

UNIT-2:

Introduction to Programming Languages

Types of PLC Languages, Ladder Diagram Format , Ladder Relay Instructions , Ladder Relay Programming, IEC 1131-3 Programming Languages – FBD/ST/IL/SFC, Control Task Definition, Control Strategy , Implementation Guidelines.

Programming Instructions

NO-NC & coil based instructions(Relay based Instructions), Timers, Counters, Compare, Mathematics, Jump and Subroutines, Scaling (Analog Instructions).

Installation & Wiring

I/O Installation, Wiring, and Precautions ,PLC Start-Up and Checking Procedures.

(06 Hours)

VII Semester
ET2446 – PE VI: PLCs & SCADA

UNIT-3:

Introduction to SCADA

Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, the components of a SCADA system, Types of SCADA,

SCADA Programming

Graphics Building & Simulation, Tag types & Management, Tools, Programming techniques, Alarms & Trends Configuration, Screen Navigation, Properties, Scripts, Security.

Database & Controller Connectivity

Using Spreadsheets to Create Points Lists, ODBC Server, Excel communication, Creating Records for data, PLC connectivity through interface and protocols.

(06 Hours)

UNIT 4:

Introduction to HMI

FOUNDATIONS OF HMI: The Human: History of User Interface Designing, Types, Features, General architecture ,Conventional & current HMI systems, Difference between HMI & SCADA, HMI Hardware interfaces, Practical uses in Industries.

Programming HMI

Software Description, Tools Handling, Screen Developments, HMI objects & Object Libraries, Alarms generation, Trends Plotting & its usages, Security & Recipe Management. HMI interfacing with PLC's.

(06 Hours)

Unit 5:

Data comparison instructions & PLC sequencers

Data comparison instructions such as EQU, LES, and GRT,. Introduction to the principles of Data Transfer, Move Instruction, Introduction to Shift Registers & Its types.Purpose and application of PLC Sequencers, Masking techniques and the various types of Sequencers, SQO and SQC instructions.

(06 Hours)

Unit 6:

Distributed Control System:

Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

(06 Hours)

Text books:				
1	Introduction to Programmable Logic controllers		Gary Duning	Delmar Thomson Learning
2	SCADA: Supervisory Control and Data Acquisition	Fourth Edition	Stuart A Boyer	ISA 1999

Reference books:				
1	Programmable Logic Controllers	W.Bolton	Elsevier Publisher	

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

ELECTRONICS & COMMUNICATION ENGINEERING

VIII Semester

ET2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

ELECTRONICS & COMMUNICATION ENGINEERING

VIII Semester

ET2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible]

[illegible]

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
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NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
3rd to 8th Semester
Computer Technology

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CT-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	30	40	3 Hours
2	3	PC	CT2201	Computer Architecture & Organisation	T	4	0	0	4	4	30	30	40	3 Hours
3	3	PC	CT2202	Object Oriented Programming	T	3	0	0	3	3	30	30	40	3 Hours
4	3	PC	CT2203	Lab: Object Oriented Programming	P	0	0	2	2	1		60	40	
5	3	PC	CT2204	Data Structures	T	4	0	0	4	4	30	30	40	3 Hours
6	3	PC	CT2205	Lab: Data Structures	P	0	0	2	2	1		60	40	
7	3	PC	CT2206	Lab: Python Programming	P	0	0	2	2	1		60	40	
8	3	PC	CT2207	Lab: Web Technology	P	0	0	2	2	1		60	40	
					TOTAL	**14**	**0**	**8**	**22**	**18**				

Fourth Semster														
1	4	BS	GE2206	Discrete Mathematics and Probability Theory	T	3	0	0	3	3	30	30	40	3 Hours
2	4	PC	CT2251	Operating Systems	T	3	0	0	3	3	30	30	40	3 Hours
3	4	PC	CT2252	Lab:Operating Systems	P	0	0	2	2	1		60	40	
4	4	PC	CT2253	Advanced Data Structures	T	4	0	0	4	4	30	30	40	3 Hours
5	4	PC	CT2254	Lab: Advanced Data Structures	P	0	0	2	2	1		60	40	
6	4	PC	CT2255	Mathematical Foundations for Data Analysis	T	3	0	0	3	3	30	30	40	3 Hours
7	4	PC	CT2256	Lab: Mathematical Foundations for Data Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CT2257	Database Management Systems	T	3	0	0	3	3	30	30	40	3 Hours
9	4	PC	CT2258	Lab: Database Management Systems	P	0	0	2	2	1		60	40	
					TOTAL	**16**	**0**	**8**	**24**	**20**				

Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CT-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamentals of Economics	**T**	3	0	0	3	3	30	30	40	3 Hours
2	5	PC	CT2301	Computer Networks	**T**	3	0	0	3	3	30	30	40	3 Hours
3	5	PC	CT2302	Lab: Computer Networks	**P**	0	0	2	2	1		60	40	
4	5	PC	CT2303	Theoretical Foundations of Computer Science	**T**	4	0	0	4	4	30	30	40	3 Hours
5	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	30	40	3 Hours
6	5	PE		Lab: Professional Elective-I	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	30	40	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	30	40	3 Hours
9	**5/6**	**STR**	**CT2310**	**IND VISIT and its report**	**P**	**0**	**0**	**0**	**0**	**1**		100		
					TOTAL	**19**	**0**	**4**	**23**	**22**				

Professional Electives -I

1	5	PE-I	CT2311	PE I: Randomized Algorithm
	5	PE-I	CT2312	PE I: Lab Randomized Algorithm
2	5	PE-I	CT2313	PE I: Mobile Operating System
	5	PE-I	CT2314	PE I: Lab: Mobile Operating System
3	5	PE-I	CT2315	PE I: Advanced Web Technologies
	5	PE-I	CT2316	PE I: Lab: Advanced Web Technologies
4	5	PE-I	CT2317	PE I: Introduction to Geographical Information System
	5	PE-I	CT2318	PE I: Lab: Introduction to Geographical Information System
5	5	PE-I	CT2319	PE I: Computer Graphics
	5	PE-I	CT2320	PE I: Lab: Computer Graphics
6	5	PE-I	CT2321	PE I: Realtime Systems
	5	PE-I	CT2322	PE I: Lab:Realtime Systems
7	5	PE-I	CT2323	PEI : Privacy and Security in Online Social Networks
	5	PE-I	CT2324	PEI : Lab: Privacy and Security in Online Social Networks

Open Electives -I

1	5	OE-I	CT2325	OE I: Introduction to DBMS
2	5	OE-I	CT2326	OE I: Essentials of IT
3	5	OE-I	CT2327	OE I: Image Processing
4	5	OE-I	CT2328	OE I: Operating System Concepts
5	5	OE-I	CT2329	OE-I Introduction to Salesforce

Open Electives -II

1	5	OE-I	CT2331	OE II: Soft Computing
2	5	OE-I	CT2332	OE II: Software Testing
3	5	OE-I	CT2333	OE II: Internet Technology
4	5	OE-I	CT2334	OE II: Multimedia and Animation
5	5	OE-I	CT2335	OE II: Current Trends and Technologies

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	T	3	0	0	3	3	30	30	40	3 Hours
2	6	PC	CT2351	Design & Analysis of Algorithms	T	3	0	0	3	3	30	30	40	3 Hours
3	6	PC	CT2352	Lab: Design & Analysis of Algorithms	P	0	0	2	2	1		60	40	
4	6	PC	CT2353	Language Processor	T	3	0	0	3	3	30	30	40	3 Hours
5	6	PC	CT2354	Lab: Language Processor	P	0	0	2	2	1		60	40	
6	6	PC	CT2355	Software Engineering	T	3	0	0	3	3	30	30	40	3 Hours
7	6	PC	CT2356	Lab: Software Engineering	P	0	0	2	2	1		60	40	
8	6	PE		Professional Elective-II	T	3	0	0	3	3	30	30	40	3 Hours
9	6	PE		Lab: Professional Elective-II	P	0	0	2	2	1		60	40	
10	6	OE		Open Elective - III **	T	3	0	0	3	3	30	30	40	3 Hours
11	6	OE		Open Elective - IV **	T	3	0	0	3	3	30	30	40	3 Hours
					TOTAL	**21**	**0**	**8**	**29**	**25**				

Professional Electives -II

1	6	PE-II	CT2361	PE II: Digital Image Processing
	6	PE-II	CT2362	PE II: Lab: Digital Image Processing
2	6	PE-II	CT2363	PE II: Internet of Things
	6	PE-II	CT2364	PE II: Lab: Internet of Things
3	6	PE-II	CT2365	PE II: Business Intelligence
	6	PE-II	CT2366	PE II: Lab: Business Intelligence
4	6	PE-II	CT2367	PE II: Introduction to Natural Language Processing
	6	PE-II	CT2368	PE II: Lab:Introduction to Natural Language Processing
5	6	PE-II	CT2369	PE II: Customer Relationship Management
	6	PE-II	CT2370	PE II: Lab: Customer Relationship Management

Open Electives -III

1	6	OE-III	CT2371	OE III: Introduction to DBMS
2	6	OE-III	CT2372	OE III: Essestials of IT
3	6	OE-III	CT2373	OE III: Image Processing
4	6	OE-III	CT2374	OE III: Operating System Concepts
5	6	OE-III	CT2375	OE III: Introduction to Salesforce

Open Electives -IV

1	6	OE-IV	CT2381	OE IV: Soft Computing
2	6	OE-IV	CT2382	OE IV: Software Testing
3	6	OE-IV	CT2383	OE IV: Internet Technology
4	6	OE-IV	CT2384	OE IV: Multimedia and Animation
5	6	OE-IV	CT2385	OE IV: Current Trends and Technologies

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TA = for Practical : MSPA will be 15 marks each**

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						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CT2401	Artificial Intelligence	**T**	3	0	0	3	3	30	30	40	3 Hours
2	7	PC	CT2402	Lab: Artificial Intelligence	**P**	0	0	2	2	1		60	40	
3	7	PC	CT2403	Network Security	**T**	3	0	0	3	3	30	30	40	3 Hours
4	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	30	40	3 Hours
5	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	30	40	3 Hours
6	7	PE		Lab:Professional Elective-IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	30	40	3 Hours
8	7	STR	CT2409	Mini Project	**P**	0	0	4	4	2		100		
9	7	STR	CT2410	CRT	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE-III	CT2411	PE III: Neural Network & Fuzzy Logic
2	7	PE-III	CT2412	PE III: Adhoc Wireless Network
3	7	PE-III	CT2413	PE III: Information Retrival System
4	7	PE-III	CT2414	PE III: Human Computer Interaction

Professional Electives -IV

1	7	PE-IV	CT2421	PE IV: Pattern Recognization
	7	PE-IV	CT2422	PE IV: Lab: Pattern Recognization
2	7	PE-IV	CT2423	PE IV: Cyber Forensic
	7	PE-IV	CT2424	PE IV: Lab: Cyber Forensic
3	7	PE-IV	CT2425	PE IV: Machine Learning
	7	PE-IV	CT2426	PE IV: Lab: Machine Learning
4	7	PE-IV	CT2427	PE IV: Design Patterns
	7	PE-IV	CT2428	PE IV: Lab: Design Patterns
5	7	PE-IV	CT2429	PE IV: Mobile Communication
	7	PE-IV	CT2430	PE IV: Lab: Mobile Communication
6	7	PE-IV	CT2431	PE IV: Software Project Management
	7	PE-IV	CT2432	PE IV: Lab: Software Project Management
7	7	PE-IV	CT2433	PE IV: Numerical Computing
	7	PE-IV	CT2434	PE IV: Lab: Numerical Computing

Professional Electives -V

1	7	PE-V	CT2435	PE V: Cloud Computing
2	7	PE-V	CT2436	PE V: Parallel Programming
3	7	PE-V	CT2437	PE V: Data Mining
4	7	PE-V	CT2438	PE V: Embedded Systems
5	7	PE-V	CT2439	PE V: Operations Research
5	7	PE-V	CT2440	PE V: Bioinformatics

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

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TA = for Practical : MSPA will be 15 marks each**

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						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CT2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	CT2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				

GRAND TOTAL	**85**	**0**	**48**	**133**	**163**	

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TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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BE SoE and Syllabus 2018

COMPUTER TECHNOLOGY

III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
[illegible]	[illegible]

Unit I: Finite Differences

[illegible] **(6 hours)**

Unit II: Laplace Transform

Laplace Transforms: [illegible] **(7 hours)**

Unit III: Z-transform

[illegible] **(6 hours)**

Unit IV: Fourier Series

[illegible] **(7 hours)**

Unit V: Partial Differential Equation

[illegible] **(7 hours)**

Unit VI : Fourier Transform : [illegible] **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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COMPUTER TECHNOLOGY

III SEMESTER

CT2201	Computer Architecture and Organization	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT-1: **[6 hrs]**

[illegible]

UNIT- 2: **[7 hrs]**

[illegible]

UNIT-3: **[7 hrs]**

[illegible]

UNIT-4: **[7 hrs]**

[illegible]

UNIT-5: **[7 hrs]**

[illegible]

UNIT-6 : **[6 hrs]**

[illegible]

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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COMPUTER TECHNOLOGY

III SEMESTER

CT2202	Object Oriented Programming	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
[illegible]	[illegible]
[illegible]	[illegible]

UNIT I: **[06 Hrs]**

[illegible]

UNIT II **[06 Hrs]**

[illegible]

UNIT III **[06 Hrs]**

[illegible]

UNIT IV **[06 Hrs]**

[illegible]

UNIT V **[06 Hrs]**

[illegible]

UNIT VI **[06 Hrs]**

[illegible]

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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COMPUTER TECHNOLOGY

III SEMESTER

CT2203	Lab. : Object Oriented Programming		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Course Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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COMPUTER TECHNOLOGY

III SEMESTER

CT2204	Data Structures	L=3	T=0	P=0	Credits=4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
• [illegible] • [illegible] • [illegible] • [illegible]	• [illegible] • [illegible] • [illegible] • [illegible]

UNIT 1: **[7 Hrs]**

[illegible]

UNIT 2: **[7 Hrs]**

[illegible]

UNIT 3: **[5 Hrs]**

[illegible]

UNIT 4: **[6 Hrs]**

[illegible]

UNIT 5: **[7 Hrs]**

[illegible]

UNIT 6: **[4 Hrs]**

[illegible]

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

III SEMESTER

CT2205	Lab: Data Structures	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	---

Course Objective	Course Outcomes
• To make students familiar with syntaxes and usages of various programming constructs of C language • To make student understand concept of abstract data types like stacks and queues • To make student understand file handling operations • To create thinking ability needed for implementation of programming logic with proper use of memory	• To Identify programming constructs needed to solve real world problems • To Implement various abstract data types • To Write program for file handling by using various access modes and operations needed as per the requirement of given problem • To Implement programming logic needed for solving given problem

List of Programs

[illegible]

[illegible]

3 [illegible]

```
          1
       1   1
     1   2   1
   1   3   3   1
 1   4   6   4   1
1   5   10   10   5   1
```

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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COMPUTER TECHNOLOGY

III SEMESTER

CT2206	Lab: Python Programming		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Course Objective	Course Outcomes
[illegible]	[illegible]

Unit I: [04Hrs]

[illegible]

Unit II : [06 Hrs]

[illegible]

Unit III: [06 Hrs]

[illegible]

Unit IV: [06Hrs]

[illegible]

Unit V: [06 Hrs]

[illegible]

Unit VI: [06 Hrs]

[illegible]

Expt.No.	Experiments based on
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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COMPUTER TECHNOLOGY

III SEMESTER

CT2207	Lab: Web Technology		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	40	60	100	---	

Course Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	List of Experiments
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Text Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Web Resources:

SN	Title	Web link
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

4th Semester

Computer Technology

28 June 2019

IV Semester

GE2206 – Discrete Mathematics and Probability Theory

Objectives	Outcomes Students will be able to
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	Determine [illegible]
[illegible]	Calculate [illegible]

Unit I:

Mathematical Logic and Set Theory: [illegible]

(7 hours)

Unit II:

Relations and Functions: [illegible]

(6 hours)

Unit III:

Group Theory: [illegible]

(7 hours)

Unit IV:

Rings (Definitions and Examples): [illegible] **Fuzzy Sets and Fuzzy Logic:** [illegible]

(6 hours)

Unit V:

Random variables and probability distribution: [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(6 hours)

IV Semester

GE2206 – Discrete Mathematics and Probability Theory

Unit VI:

Mathematical Expectation

(6 hours)

Text Books:

Reference Books:

Nagar Yuwak Shikshan Sanstha's

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BE SoE and Syllabus 2018

COMPUTER TECHNOLOGY

IV SEMESTER

CT2251	Operating Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	Upon successful completion of the course, the student will be able to: [illegible] [illegible] 3[illegible] [illegible] 5.[illegible]

UNIT I **[06 Hrs]**

[illegible]

UNIT II **[08 Hrs]**

[illegible]

UNIT III **[07 Hrs]**

[illegible]

UNIT IV **[06 Hrs]**

[illegible]

UNIT V **[06 Hrs]**

[illegible]

UNIT VI **[06 Hrs]**

[illegible]

Text Books:

SN	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	3rd[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

COMPUTER TECHNOLOGY

IV SEMESTER

CT2252	Lab: Operating Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Objective	Course Outcomes
[illegible]	Upon successful completion of the course, the student will be able to: [illegible] A[illegible] [illegible] 3[illegible] [illegible] 5.[illegible]

Expt. No.	Experiments based on
[illegible]	Basics of Linux commands and its use.
[illegible]	(i) Write a shell script to find maximum of 3 numbers. (ii)Write a shell script to check whether entered number even or odd
[illegible]3[illegible]	(i) Write a shell script to find factorial of a number (ii)Write a shell script to find the sum of all the digits of a number
[illegible]	Write a program to create a process using fork( ) system call.
[illegible]	Write a program to implement Non-Preemptive Priority scheduling algorithm.
[illegible]	Write a program to implement FIFO page replacement algorithm.
[illegible]	Write a program to implement First-Fit/Worst-Fit strategies
[illegible]	Installation of Linux Operating System.
[illegible]	Case study on Advanced Operating System (Ameoba).

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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BE SoE and Syllabus 2018

COMPUTER TECHNOLOGY

IV SEMESTER

CT2253	Advanced Data Structures	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
• [illegible]	• [illegible]
• [illegible]	• [illegible]
• [illegible]	• [illegible]
• [illegible]	• [illegible]

UNIT 1: **[8Hrs]**

[illegible]

UNIT 2: **[5Hrs]**

[illegible]

UNIT 3: **[8 Hrs]**

[illegible]

UNIT 4: **[9Hrs]**

[illegible]

UNIT 5: **[5Hrs]**

[illegible]

UNIT 6: **[7Hrs]**

[illegible]

Text Books:

SN	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	3rd [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

COMPUTER TECHNOLOGY

IV SEMESTER

CT2254	Lab: Advanced Data Structures	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Objective	Course Outcomes
• [illegible] • [illegible] • [illegible] • [illegible]	• [illegible] • [illegible] • [illegible] • [illegible]

Expt. No.	List of Programs
[illegible]	Program based on Linked list
[illegible]	Program based on implementing one data structure using another data structure
3	Program to Print the Alternate Nodes in a Linked List using Recursion
[illegible]	Program based on Binary tree
[illegible]	Program based on Binary search tree
[illegible]	Program for Heap sort
[illegible]	Program based on Tries
[illegible]	Program based on graph
[illegible]	Program for detecting presence of cycle in given graph G
[illegible]	Program for printing topological sort of given graph

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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BE SoE and Syllabus 2018

COMPUTER TECHNOLOGY

IV SEMESTER

CT2255	Mathematical Foundations for Data Analysis	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

MSEs = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

Course Objective	Course Outcomes
[illegible]	[illegible]

UNIT I **[06 Hrs]**

[illegible]

UNIT II **[06 Hrs]**

[illegible]

UNIT III **[06 Hrs]**

[illegible]

UNIT IV **[06 Hrs]**

[illegible]

UNIT V **[06 Hrs]**

[illegible]

UNIT VI **[06 Hrs]**

[illegible]

Text Books:

SN	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	3rd [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SN	Title	Authors	Edition	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

COMPUTER TECHNOLOGY

IV SEMESTER

CT2256	Lab: Mathematical Foundations for Data Analysis	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Objective	Course Outcomes
[illegible]	[illegible]

Expt. No.	List of Experiments
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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BE SoE and Syllabus 2018

COMPUTER TECHNOLOGY

IV SEMESTER

	Database Management Systems			3		
	M					
	3				3	

MSEs = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

OBJECTIVES	OUTCOMES
1. To learn different database system concepts 2. To learn the designing of Entity Relationship Diagram. 3. To know relational data model, relational algebra& SQL Queries. 4. To understand relational database design. 5. To know about data integrity issues.	Upon successful completion of the course, the student will be able to: 1. Analyze & compare different levels of abstraction & data independence. 2. Design Entity Relationship Diagram for any scenario. 3. Solve queries based on relational algebra & SQL. 4. Identify functional dependencies & normalise the database andapply ACID properties. 5. Analysetransaction management,variousconcurrency control protocols and crash recovery methods.

UNIT I **[05 Hrs]**

Introduction to Database Management System:

UNITII **[06Hrs]**

Entity-Relationship Model

UNITIII **[07Hrs]**

Relational Data Model

Relational Algebra

UNITIV **[06Hrs]**

SQL:

Advanced SQL:

IV SEMESTER

	Database Management Systems		3			
	M					
	3				3	

UNITV **[06Hrs]**

Relational Database Design

Transaction Management

UNITVI **[06Hrs]**

Concurrency Control

Crash Recovery

TEXT BOOKS:

REFERENCE BOOKS

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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COMPUTER TECHNOLOGY

IV SEMESTER

CT2258	Lab: Database Management Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Objective	Course Outcomes
Student will be able: [illegible] [illegible] 3[illegible] 4.[illegible]	Upon successful completion of the course, the student will be able to: [illegible] [illegible] 3[illegible] [illegible]

Expt. No.	List of Programs
[illegible]	Design an ER Diagram.
[illegible]	Study and implement DDL Command.
[illegible]3[illegible]	Study and Implement Entity Constraints, Referential Constraints, Domain Constraints
[illegible]	Study and Implement DML Commands (select, Insert).
[illegible]	Study and Implement Update and Delete Command.
[illegible]	Study and Implement Aggregate function.
[illegible]	Study and Implement Inner join.
[illegible]	Study and Implement Outer Join.
[illegible]	To Design a full database system and queries for given topic

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

5th Semester

Computer Technology

28 June 2020

V Semester
GE 2312 - Fundamental of Economics

Objectives	Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
GE 2312 - Fundamental of Economics

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	M[illegible]d[illegible]r[illegible]	[illegible]3[illegible]d[illegible]	[illegible]	[illegible]d[illegible]r[illegible]
[illegible]	M[illegible]d[illegible]r[illegible]r[illegible]	3rd[illegible]d[illegible]	[illegible]	[illegible]d[illegible]r[illegible]

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]d[illegible]r[illegible]	[illegible]d[illegible]	[illegible]	[illegible]d[illegible]r[illegible]
[illegible]	[illegible]r[illegible]r[illegible]	[illegible]d[illegible]	M[illegible]	[illegible]dr[illegible]
3[illegible]	M[illegible]r[illegible]	[illegible]d[illegible]	M[illegible]	[illegible]dr[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	M[illegible]r[illegible]	[illegible]d[illegible]	M[illegible]	[illegible]dr[illegible]
[illegible]	[illegible]d[illegible]	[illegible]d[illegible]	[illegible]M[illegible]r[illegible]d[illegible]r[illegible]	[illegible]

[illegible]r[illegible]	[illegible]d[illegible]M[illegible]r[illegible]	[illegible]	[illegible]r[illegible]	[illegible]r[illegible]rd[illegible]

V Semester
CT2301 – Computer Networks

Objective	Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction: The uses of computer networks, LAN's, MAN's, WAN's., protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference models, Critique of OSI model & protocols, critique of TCP/IP reference model.	6
2	Transmission Impairments, Transmission Media: Guided, unguided, Architecture of the Internet, Wireless LANs: IEEE 802.11, IEEE 802.16 , The Public Switched Telephone Network, Switching: circuit, packet and message switching, Modems	5
3	The Data Link Layer: Data link layer design issues- Framing, Error Control, Flow Control, Link Management, Error detection and Correction-Error-Correcting Codes, error-detecting codes, Elementary data link protocols-An Unrestricted simplex Protocol, A simplex stop and wait protocol, A simplex protocol for a noisy channel, Sliding window protocols- A one bit sliding window protocol, Go Back N protocol, Selective Repeat Protocol.	6
4	The Medium Access Sublayer: Static and Dynamic Channel allocation in LAN's and MAN's, Access Protocols-ALOHA, Persistent and Non Persistent CSMA, CSMA/CD, Collision free protocols, Binary countdown, Limited-connection protocol: The adaptive tree walk protocol.	6
5	The Network Layer: Network Layer design issues-services provided to the transport layer, Logical Addressing: Classbase and classless, Subnetting and Supernetting, Routing and Routing Algorithms-Flooding, Flow-Based, Distance Vector, Link State, Hierarchical. Congestion Control algorithms- Preallocation of buffers, Packet discarding, Choke packets, Load shedding, Jitter control. Leaky bucket algorithm, token bucket algorithm, IP header format (IPv4, IPv6).	6
6	The Transport Layer: Transport layer design issues-services provided to the session layer, Quality of service, transport service primitives, Elements of transport protocols-Addressing, Establishing and Releasing a connection, Flow control and Buffering, Multiplexing, Crash Recovery. Transmission Control Protocol (TCP). The Application Layer: DNS, SMTP, FTP, TFTP.	5

Text Books

SN	Title	Edition	Authors	Publisher
1.	Computer Networks		A.S. Tanenbaum	Pearson Publication
2.	Computer Networking		Behrouz A. Forouzan	McGraw-Hill Publication

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester
CT2302 – Lab: Computer Network

Sr. No.	Practical List
1	How to bring two computers in the network. Configure TCP/IP to configure Internet on your computer.
2	Use Network Utility Command like ping, ipconfig, netstat, tracert to observe the network details.
3	To implement Hamming Code using C and C++.
4	To implement Dijkstra's Routing algorithm using backtracking approach.
5	Use traffic monitoring tool Wireshark to observe network traffic with packet details.
6	Configure router. Configure network using Cisco Packet Tracer software and show packet transmission from source to destination.
7	Configure Virtual LAN using cisco packet tracer.
8	Use Openssl command to perform Asymmetric key encryption (RSA) and also implement RSA algorithm.
9	To study Wireless network of YCCE campus
10	Advance Practical: Introduction to NS2

V Semester

CT 2303- Theoretical Foundation of Computer Science

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non-Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	8
2	Regular Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets (Proofs not required), Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church"s hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machin	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function unbounded minimization and recursive function	6

Text Books

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CT 2303- Theoretical Foundation of Computer Science

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Computer Tehnology

SoE No. CT-201

V Semester

CT 2311- PE I: Randomized algorithms

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction to Randomized Algorithms Probability Review	5
2	Regular Moments and Deviation The Probabilistic Method	5
3	Markov Chains – I Markov Chain – II	5
4	Number Theoretic Algorithms Graph Algorithms	5
5	Approximate Counting Data Structures	5
6	Computational Complexity Summary	5

Text Books

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

V Semester

CT 2312- PE I: Lab: Randomized algorithms

Sr. No.	Practical list
1	WAP to implement randomized quicksort algorithm.
2	WAP to implement randomized algorithm of your choice.
3	WAP to implement first probabilistic method
4	WAP to implement second probabilistic method.
5	WAP to implement first number theoretic algorithms
6	WAP to implement second number theoretic Algorithms
7	WAP to implement first randomized graph algorithms
8	WAP to implement second randomized graph algorithms
9	WAP to implement first approximate counting
10	WAP to implement second approximate counting

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Computer Tehnology

SoE No. CT-201

V Semester

CT2313 – PE1: Mobile Operating System

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Mobility Technology Trends, Mobile Ecosystem Overview, Mobile Devices Overview, Mobile Development, Methodology, Wireless Networks Overview, Proximity Technologies	5
2	Introduction to Android: Android Overview, Introduction to activities/Fragments, Introduction to services, broadcast receivers and content providers, Android Application Structure, Source Files, Resources, Assets and Manifest. IDE Usage: Basic IDE Operation (Eclipse), Project Creation and Handling (App Creation through Wizard), Running App on AVD and Device, DDMS and Debugging. User Interface Designing-1: Layout Overview, Linear Layout, Relative Layout, Frame Layout, Widgets (UI Controls) Overview and Text View, Image View, Button.	6
3	User Interface Designing-2: Notification Bar, Toast and DSialog, Listview, and Adapter, View Reusability, Spinner and Comples View. Broadcast Receivers: Broadcast receivers overview, Manifest Registration vs Component Registration, Unregistration, SMS Event Receiver, Boot Event Receiver and NetworkEvent Receiver. Service: Service Overview, Service Lifecycle, Service Usage Applicability and Message Binder, Action Bar and Context Menu.	5
4	Data Management: Data Storage Overview, Persistent v/s Local, Shared Preferences, Internal Storage and SQLite Database, Threads and Processes: Thread, Process overview, Async Task, Loaders, Handlers, Intent: Intent, Intent Filters and Intent Resolution, Component Activations: Activity Stack, Launch Modes and Activity Flags	6
5	Inter Application Communication: Inter app Communication requirement overview and Intents Based. Communication with Native application: Gallery, Camera, SMS App and Contacts, Content Providers: Content Provider Overview, Need and Usage, Content Provider Structure. Network Communication: Network Communication basics and Connecting to server/request creation, Response Formats XML/JSON and Rest/Web Services. URI Permissions, Views, Triggers	5
6	User Interface Designing-3: Style and Themes, View and Layout animation Application Configuration: Localization, Orientation and Config Change Handling, Handling multiple resolution devices, Device and Tablet consideration, Support Library. Application Publishing: Application Signing, Application Distribution, Application Publishing, Google Play	5

Text Books

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V Semester

CT2314 – PE1: Lab: Mobile Operating System

Sr. No.	Practical List
1	Create a dialog box having login functionality.
2	Create an application which has following features: • Show list of numbers on screen along with the type. • Bottom of the screen there should be a row that contains three elements: i. Spinner (Show the predefined phone number type like home, office, mobile, etc) ii. Text box to enter actual number iii. Button saying "Add" - Clicking on this should take the input from the first two items and add a new row item to the list. • On pressing back key (exiting from the application), it should show a confirmation dialog with appropriate title, message and two action buttons "OK" and "Cancel"
3	Create an application which has following features: • Clicking on "Cancel" should show a toast message "We are happy to be with you." and close the dialog. • Clicking on "OK" should close the dialog, exit from the application and generate a notification that says "Press me to go back to application". Then clicking on the notification should restart the application.
4	Create an application which has following features: • Launch phone contacts, display the selected contact in your application. • Try to launch Camera, Gallery & SMS application.
5	Create an application using Listview, Services, Navigation drawer & tab view
6	Create an application for changing background color based on selection from list view
7	Create an application for applying different themes on text views.
8	Create an application using Launch Modes.
9	Create an application displaying any animation.

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Computer Tehnology

SoE No. CT-201

V Semester

CT2315- PE I: Advanced Web Technologies

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Web Services: Overview of HTTP, FTP, SMTP Protocols, Web Servers, Server-side scripting, REST	6
2	Basics of Client side programming: Document Object Model (DOM), Overview of DOM Element Selector 6 (Examples in jQuery), Document ready function, HTML5, Audio and Video, Forms, CSS3 -Introduction to CSS3, What is CSS3? Differences between CSS3 and earlier CSS specifications, How browsers are handling CSS3? CSS3 Selectors- Selectors Overview, Explore specific selectors, Designing and Developing with CSS3-Background and color Typography, CSS3 Box Model, Page layout, Media Queries, Implementing CSS3, Best Practices, Advantages and limitations of working with CSS3.	8
3	Rich Internet Applications (RIA): Overview of Traditional Web Communication Processes and Technologies, Web 2.0, Introduction to AJAX-Create an XML Http Request Object, interacting with a Web Server, Processing Client Requests, Securing AJAX Applications, Progressive Web Apps, Form Factor detection, Browser detection, Feature detection	7
4	Advanced Client side programming: Semantic Elements, WebSockets, SSE, WebRTC, Web Graphics & Canvas, WebGL, WebWorkers, SVG. Libraries: Modernizer, Polyfills, Polymer	8
5	JavaScript: Functional programming, Asynchronous programming, Event driven systems, Debugging, Testing, Workflow optimization, and deployment pipelines, Web Components, Introduction to Web Frameworks-React, Node.js, Angular' JS	8
6	Server-Side Programming: Introduction to the server-side programming, Server-side web frameworks like Django, Express. etc.	6

Text Books

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Reference Books

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V Semester
CT2316- PE I: Lab: Advanced Web Technologies

Sr. No.	Practical List
1	Write a JavaScript function that creates a table, accept row, column numbers from the user, and input row-column number as content (e.g. Row-0 Column-0) of a cell.
2	Create employee registration webpage using HTML5 form objects
3	Implement CSS3 for Online shopping system
4	Create a dynamic web page which displays arithmetic operations [addition, subtraction, division, multiplication and modulus] using HTML Frame
5	Write a suitable script which show methods of Server object [HTML Encode, URL Encode, Mappath, Execute and Transfer]
6	Write a script which creates and retrieves Cookies information
7	Create a dynamic web page which displays capabilities of a web browser using Browser Capabilities Component using JavaScript
8	Create a simple XMLHttpRequest and retrieve data from a TXT file.
9	Create a simple XMLHttpRequest and retrieve data from a TXT file.
10	Create a simple script to download Images Using AJAX,
11	Create a simple script to Auto-Populate Select Boxes using AJAX

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Computer Tehnology

SoE No. CT-201

V Semester

CT2317– PE I: Introduction to Geographical Information System

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction to GIS: Concepts of GIS, Applications currently used by Industry &Govt and their common usages. Fundamental concepts of GIS: GIS terminologies, various components of GIS software and types of GIS applications. The GIS Software Market, Role of GIS in smart cities.	6
2	Fundamentals of Coordinate Systems and Map Projections: History of Coordinate Systems, Geographic Coordinate Systems, Map Projections and Geo referencing.	7
3	Fundamentals of Spatial Data: Introduction to Spatial Data Formats, Creation of Vector data, Organization of Spatial Data and Displaying Spatial Data, metadata and spatial data standards.	7
4	Making Sharing Maps: Map Creation and Design, Sharing Maps as Services, Sharing Spatial Data and using shared Spatial Data.	6
5	Fundamentals of Spatial Analysis: Spatial Analysis, analyzing Vector and Raster data, overview of analysis tools, analyzing Spatial Relationships and sharing Analysis Results	7
6	New trends in GIS: GIS Trends Changing the World, Machine learning in GIS, Geospatial big data, Integration of GIS with different technologies, GIS with LiDar data.	7

Text Books

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Reference Books

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V Semester
CT2318 – Lab - PE I: Introduction to Geographical Information System

Sr. No.	Practical List
1	To explore different proprietary GIS and Open GIS software.
2	To study the installation of GIS Desktop Software and explore various components of the GIS Desktop Software.
3	To explore various coordinate systems. Download any shape file and explore its coordinate system and change the existing coordinate system.
4	To create Geodatabase, layer files and shape files from the scratch.
5	To explore data formats using GIS Desktop Software and vector data points such as points, lines and polygon and create the map using simple vector data structure.
6	To create map in data view and layout view.
7	To install GIS Server, creating web services out of GIS maps or data, sharing maps, using GIS web services.
8	Geoprocessing tools
9	Model builder
10	Project

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Computer Tehnology

SoE No. CT-201

V Semester

CT2319- PE I: Computer Graphics

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction: Point Pixel Plotting. Line Generation Algorithms, polygon filling algorithms	8
2	2D Graphics: 2D Transformations, Clipping, Window, View Port Mapping, Graphical User Interfaces and Interactive input methods, picture construction techniques	6
3	3D Graphics: 3D Transformation, 3D Viewing, Visible Surface Detection, Back Face Detection, Depth Buffer Method, Scan Line Method, Virtual Reality Environment	7
4	Visual Communication: Creative Process, Digital Imaging Technology, Still Image, Digital Imaging, Using Images in Multimedia, Images on Web, Color Models.	8
5	Interactive Illustrated 3D with Images and Text: Generating Illustrated Documents, Consistency of Rendered Images and their Textual Labels, Architecture, Zoom Techniques for Illustration Purpose, Interactive handling of Images and Text, Figure Captions for Anatomical Illustrations.	8
6	Computer animation: Design of animation sequence, general computer animation functions raster animation, computer animation languages, key frame systems, motion specifications.	8

Text Books

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Reference Books

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V Semester
CT2320 – Lab - PE I: Computer Graphics

Sr. No.	Practical List
1	WAP to implement line generation using DDA algorithm.
2	WAP to implement Bresenham's line generation algorithm.
3	WAP to fill a polygon using any one of the polygon filling algorithms.
4	WAP to perform to perform simple 2D transformations like Translation, Rotation and Scaling.
5	WAP to perform to perform composite 2D transformations
6	WAP to create simple three-dimensional object like cube apply transformations like Translation, Scaling and Rotation.
7	Image enhancement, Image transformation from color to gray scale.
8	WAP to create simple GIF animated images.
9	Creation of moving ball or any object.

V Semester

CT2321 - PE-I: REAL TIME SYSTEMS

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction to real time systems: Digital control, high-level controls, signals processing, real time applications. Hard and soft real time system: Jobs & processors, release times, deadlines, timing, constraint, Hard & Soft timing constraint, Hard real time systems, soft real time systems. Modeling of real time systems.	6
2	Approach to real time scheduling: Clock-driven approach, weighted round-robin approach, priority-driven approach, dynamic versus static systems, effective release times and deadlines, optimality of EDF & LST algorithms, non optimality of the EDF & LST, challenges in validating timing constraints in priority-driven systems, off line versus on-line scheduling. Clock driven scheduling: notation & assumptions, static timer- driven scheduler, general structure of cyclic schedules, cyclic executives, improving the average response time of a periodic jobs, scheduling sporadic jobs, practical consideration and generalizations, algorithms for constructing static schedules, pros-cons of clock-driven scheduling.	10
3	Priority-driven scheduling: Static assumptions, fixed-priority versus dynamics priority algorithms, maximum schedulable utilization, optimality of the RM & DM algorithms, a schedulability test for fixed priority tasks with short response times & with arbitrary response times, sufficient schedulability conditions for the RM and DM algorithms.	8
4	Scheduling aperiodic & sporadic jobs in priority-driven systems: assumptions & approaches, deferrable servers, sporadic servers, constant utilization, total bandwidth and weighted fair-queuing servers, slack stealing in dead-line driven systems, slack stealing in fixed-priority systems, scheduling of sporadic jobs.	8
5	Resources and resource access control : assumption on resources and their usage, effects of resource contention & resource access control, non preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack-based priority ceiling protocol, use of priority-ceiling protocol in dynamic- priority systems, preemption-ceiling protocol, controlling accesses to multiple-resources, controlling concurrent accesses to data object.	6
6	Real-time Communication: model of real time communication, priority-based service discipline for switched networks, weighted round-robin service discipline, medium-access control protocols of broadcast network and resource reservation protocols, real-time protocol, and communication in multicomputer systems.	6

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V Semester
CT2321 - PE-I: REAL TIME SYSTEMS

Text Books				
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Reference Books				
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V Semester
CT2322 - PE-I: REAL TIME SYSTEMS

Sr. No.	Practical List
1	To study different types of Real Time Operating System
2	To study Commands of LINUX Operating System for real time application.
3	Write a program to create processes in LINUX environment.
4	Write a program to implement round robin scheduling in LINUX environment.
5	Write a program to implement Priority-driven scheduling
6	Write a program to create massages Queue for Inter Process communication.
7	Write a program to implement multithreading in LINUX environment.
8	To Study basic priority-inheritance protocol, basic priority-ceiling protocol.
9	To Study System calls for process creation, suspension and Termination.
10	To study shared memory in Inter-process Communications.

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Computer Tehnology

SoE No. CT-201

V Semester

CT2323 – PE - I: Privacy and Security in Online Social Networks

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Incidents, OSM APIs and tools for data collection, Trust and Credibility on OSM	7
2	Misinformation on Social Media, Privacy and Social Media, Privacy and Pictures on Online Social Media	7
3	Policing and Online Social Media	6
4	eCrime on Online Social Media, Link Farming in Online Social Media, Nudges, Semantic attacks: Spear phishing	8
5	Profile Linking on Online Social Media, Anonymous Networks	7
6	Privacy in Location Based Social Networks, Beware of What You Share Inferring Home Location in Social Networks, On the dynamics of username change behavior on Twitter, Boston Marathon Analyzing Fake Content on Twitter.	8

Reference Books

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V Semester
CT2324 – Lab - PE I: Privacy and Security in Online Social Networks

Sr. No.	Practical List
1	Collect data from Facebook using the graph API in Unix environment.
2	Collect data using twitter API in Unix environment.
3	Store the data collected from various OSNs in MySQL database.
4	Store the data collected from various OSNs in MongoDB.
5	Represent social media data in a graph format consisting of nodes and edges
6	Analyzing textual data obtained from Facebook using Python NLTK.
7	Generate graphs and clusters of data of social networks like Facebook and Twitter using Gephi.

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Computer Tehnology

SoE No. CT-201

V Semester

CT2325 – OE I: Introduction to DBMS

Objective	Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	An Overview of the Database Management System: What is database? Why database? database system, database management system (DBMS), advantages of DBMS	6
2	An Architecture of the Database system: Three levels of architecture, mappings, role of database administrator (DBA), E-R model, three approaches of DBMS relational, hierarchical and network.	6
3	Relational Database Management System (RDBMS): Introduction, RDBMS terminology, relational model, base tables, key	5
4	The SQL Language: Introduction, Characteristics of SQL, data definition command	5
5	Data manipulation commands	5
6	Introduction to XML	6

Text Books

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Reference Books

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Computer Tehnology

SoE No. CT-201

V Semester

CT2326 – OE I: Essentials of IT

Objectives	Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Programming fundamentals of Java: problem solving skills, Algorithm – representation using pseudo code, algorithm properties. Programming in java- programming constructs in JAVA, control structures type casting, SDLC overview and need for Object oriented approach, object-oriented concepts, introduction to UML.	8
2	OO fundamentals – Java Implementation: OO fundamentals, coding standards, reference variables and objects in memory, methods, „this" reference. Data structures: data structures, linear data structures, non- linear data structures.	8
3	Data base basics- data storage, need for DBMS, functions of DBMS, data perspectives in DBMS, types of data models, relational model and keys, Database Design – Database life cycle, Data requirements, logical design – ER modeling, converting ER model to relational schema, functional dependency, normalization.	8
4	SQL – need for SQL, types of SQL statements, data types in SQL, SELECT statement with various operators, single row and multi row functions, group by and having clauses.	8
5	Introduction to web technologies: Computer Networks, HTML tags and CSS, Implementation of Java Scripts, Operators and control structures, function and dialog boxes, DOM element.	8
6	Software Engineering – Basics, SE models and approaches, Requirement developing activities, software design and construction, software testing, introduction to user experience, Project categories and project management phases, software quality.	8

Text Books:

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V Semester

CT2327 – OE I: Image Processing

Objectives	Outcomes
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels.	5
2	Image Enhancement in the Spatial Domain: Introduction to Spatial domain, Basic Gray Level Transformations, Histogram Processing, Histogram Equalization, Spatial Domain Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6
3	Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Typical Applications. Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters.	6
4	Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Image compression models, Various compression methods.	6
5	Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	6
6	Image Representation: Chain Codes, Polygonal Approximations, Signatures, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to various color image processing models.	6

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V Semester
CT2327 – OE I: Image Processing

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V Semester
CT2328 - Operating System Concepts

Objectives	Outcomes
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction: History of Linux and Unix, Linux Overview, Linux releases, open linux	6
2	Linux Commands and Filters : Mkdir, CD, rmdir, pwd, ls, who, whoami, cat, more, fail, head, concept of, mv, chmod, grep,wc, comm., split, sort, diff, kill, write, wall, merge, mail, news	5
3	Shell: The command line special characters and file arguments, standard input/output and redirection, pipes, redirecting and piping with standard errors, shell scripts, jobs.	5
4	Linux file Structure: Linux files, file structure, listing displaying and printing files, managing directories, file and directory operations.	5
5	Vi Editor: Vi editing commands advanced Vi editing commands, line editing commands, options in Vi.	6
6	System Administration: System management, managing users, installing and managing devices, floppy disk management, file system administration, backups.	6

Text Books:

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V Semester

CT2329 – OE I: Introduction to Salesforce

Objectives	Outcomes
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction to Cloud: Definition of Cloud Computing, Cloud Architecture, Cloud Types, Service models, Deployment models, Examining the Characteristics of Cloud Computing, Benefits of cloud computing, Disadvantages of cloud computing.	8
2	CRM Concepts and its tools: Definition, History, Key Benefits, Service Level Agreements (SLAs), creating and managing effective SLAs. Architecture, Service Nature of Salesforce, Features, Products and its overviews, Traditional CRM vs. Salesforce CRM.	7
3	CRM Administration and Data Model Design: Lightning and classic UI and differences, Creation of org, Object Manager, App Manager, Setup, App creation, tabs, Types of Objects, Data Types, Sandboxes, Understanding Relationships and its limitations, Types of Relationship and their differences, Junction Object, formulas, Dependency picklist fields, Validation Rules.	7
4	Data Management with CRM Tool: Record details, List Views, Filters, Actions Page layouts, Compact Layouts, Introduction to Workflows, email templates, Limitation of workflows, approval processes, Process Builder, Lightning Flow, Community Creation, Reports and Dashboards.	8
5	Security Model: Introduction to Profiles and Permission Set, Overview of Data Security, Control access to org, object, field, record, OWD, Role and Roles Hierarchy, Sharing Rule, Sharings Objects, Apex Sharing.	7
6	CRM Tool Development: Introduction to Apex, Collections, SOQL and SOSL, DML Operations. Lightning Aura Component: Introduction to Aura component, Advantages, attributes handling in aura component.	8

Text Books

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V Semester

CT2329 – OE I: Introduction to Salesforce

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V Semester
CT2331 – OE II: Soft Computing

Objectives	Outcomes
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction to Soft Computing: Concept of computing systems, Soft computing versus Hard computing, characteristics of Soft computing, some applications of Soft computing techniques, Learning Process, Overview of Supervised and un-supervised learning, Single and Multi-Layer Network, Associative Memory	6
2	Introduction to Fuzzy Logic: Introduction to Classical Sets, Fuzzy sets, Fuzzy membership functions, properties and operations on Fuzzy sets	6
3	Fuzzy Relations: Fuzzy relations, propositions, rules, and inferences, Fuzzy logic controller design, Defuzzification, some applications of Fuzzy logic	7
4	Rough Set Theory: Fundamental concepts: Information system or information table, In-discernibility relation, Approximations, Decision tables and decision algorithms, Dependency of attributes, Reduction attributes in information system, Applications of rough set theory	7
5	Genetic Algorithms: Concept of Genetic algorithm, basic terminologies in Genetic algorithm, GA operators, stopping criteria for genetic algorithm, solving single-objective optimization problems using Gas, advantages and limitations of GA, applications of GA	8
6	Artificial Neural Network: Introduction to Biological neurons and it's working, simulation of biological neurons to problem solving, different ANN architectures, training techniques for ANNs, Applications of ANNs to solve some real life problems	7

Text Books

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Reference Books

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Computer Tehnology

SoE No. CT-201

V Semester

CT2332 – OE II: Software Testing

Objective	Outcome
[illegible]	[illegible] 1. [illegible] 2. [illegible] 3. [illegible]

Unit No.	Contents	Max. Hrs.
1	Basic concepts of Testing: Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.	6
2	Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing.	5
3	Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage.	6
4	Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.	5
5	System Testing: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.	6
6	Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.	6

Text Books

SN	Title	Edition	Authors	Publisher
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Reference Books

SN	Title	Edition	Authors	Publisher
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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Computer Tehnology

SoE No. CT-201

V Semester

CT2333 – OE II: Internet Technology

Objective	Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
1	Introduction: Overview, Network of Networks, Intranet, Extranet and Internet. World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. Internet Routing Protocol: Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail: POP3, SMTP.	6
2	HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value. Extensible Markup Language (XML): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts: Introduction, Environment Variable, GET and POST Methods.	6
3	JavaScript: Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object - string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies: Definition of cookies, Create and Store a cookie with example. Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications	6
4	Internet Telephony: Introduction, VoIP. Multimedia Applications: Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Search Engine and Web Crawler: Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	6
5	Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH).	6
6	Firewall: Introduction, Packet filtering, Stateful, Application layer, Proxy.E-Commerce and security: issues including symmetric and asymmetric key, encryption and digital signature, authentication, Emerging trends, virtual reality over the web, etc.	6

Text Books

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BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Computer Tehnology

SoE No. CT-201

V Semester

CT2334 – OE II: Multimedia and Animation

Objectives	Outcomes
[illegible]	[illegible]

Unit No.	Contents	Max Hrs.
1	Multimedia definitions, CD-ROM and the multimedia highway. Applications of multimedia, introduction to making multimedia, the stages of project, requirements to make good multimedia, multimedia skills and training, the multimedia tech.	7
2	Multimedia hardware, Macintosh and windows production platforms, hardware peripherals, connections, memory and storage devices, input devices output hardware, communication devices, media software, basic tools, making instant multimedia authoring tools.	6
3	Multimedia building blocks –text-using text in multimedia, computers and text, font editing and design tools, Sound-the power of sound , multimedia system sound, Digital audio, preparing digital audio files, Audio file format, images-Making still Images, Color, Image file format, video-Broadcast video standard, Analog video, Digital video, optimizing video files for CDROM	7
4	What is meant by Animation, why we need Animation, History of Animation, Uses of Animation. Types of Animation, Principles of Animation, Some Techniques of Animation, and Animation on the WEB, Special Effects, and Creating Animation.	6
5	Creating Animation in Adobe Animate: Introduction to Animate –Working with the Timeline and Frame-based Animation-Working with the Timeline and Tween-based Animation –Understanding Layers–Action script.	6
6	3D Animation & its Concepts, Types of 3D Animation, Skeleton & Kinetic, 3D Animation Texturing and Lighting of 3D Animation, 3D Camera Tracking, Applications & Software of 3D Animation.	7

Text Books

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V Semester

CT2334 – OE II: Multimedia and Animation

Reference Books				
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V Semester

CT2335 – OE I: Current Trends and Technologies

Objective	Outcome
[illegible]	[illegible]

Unit No.	Contents	Max Hrs.
1	Fundamentals of Communications: Types of communication-Wired, wireless, mobile, Modes of transmission: Simplex, Half Duplex, Full Duplex, Multiplexing techniques, History and evolution of wireless and mobile systems, Transition and characteristics of 1G, 2G, 3G, 4G, Spectrum, regulations, and frequency allocation	7
2	Fundamental of INTERNET: History, Internet working, Connections, Internet services, The World Wide Web, Tools for the WWW, Web servers, Web browsers, Web page makers and editors, Plug-ins and delivery vehicles.	6
3	e-Technologies: Electronic Commerce: Framework, Media Convergence of Applications, Consumer, Applications, Organization Applications, Electronic Payment Systems: Digital Token, Smart Cards, Credit Cards, Risks in Electronic, Payment System, Designing Electronic Payment Systems, Electronic Data Interchange (EDI): Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software, Implementation, EDI Envelope for Message Transport, Internet-Based EDI.	7
4	e-Learning: Definition, Introduction, Types of e-Learning: Learner-led e-Learning, Facilitated e-Learning, Instructor-led e-Learning, Embedded e-Learning, Telemonitoring And e-Coaching E-Learning Models: WBT, CBT, LMS, LCMS, Virtual School Systems, E-Learning Tools And Technologies: e-mail, Online Discussion, Chat and Instant Messaging, Voting, Whiteboard, Application Sharing, Conferencing, Online Meeting Tools, Case study.	6
5	Green Computing: Introduction, Why....Green Computing? Approaches to Green Computing-Virtualization, Power Management, Power supply, Storage, Video Card, Display, IT Equipment, Recycling, Remote Conferencing & Telecommuting Strategies, Product longevity, Resource allocation, Terminal servers, Operating system support, How to Implement? Industrial implementations of Green Computing- Blackle, Fit-PC, Zonbu computer, Sunray thin client.	6
6	Social Networking: Definition, Overview of Social Networking Sites, Types of Social Networking Sites: General purpose, Niche. Advantages of Social Networking Sites, Drawbacks of Social Networking Sites, Features and Need of Social Networking, Security Issues with Social Networking Sites, Case Studies	7

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V Semester
CT2335 – OE I: Current Trends and Technologies

Text Books				
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Reference Books				
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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

6th Semester

Computer Technology

28 June 2019

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcome
1. To introduce the fundamentals and legal provision of Management 2. To introduce the Human Resource and Financial practice of organization 3. To Introduce the Project Management 4. To provide knowledge of Marketing Activities of Management	Upon successful completion of the course, the student will be able to: 1. Explain the Legal provision and Functions of Management. 2. Analyze the role of Human Resource and Financial Management in the organization. 3. Analyze the project life cycles. 4. Identify tools and techniques for the marketing of goods and services.

Unit No.	Contents	Max Hrs.
1	Evolution of Management Thought: Scientific and Administrative Theory of Management Definition and Concept of Management, Functions of Management: Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership	6
2	The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company	6
3	Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure.	7
4	Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM & PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.	7
5	Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting	6
6	Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth Maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet	6

Text and Reference Books:

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)

9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

VI Semester

CT2351 - Design & Analysis of Algorithms

Objective	Outcome
1. Understand different asymptotic notations. 2. Have an appreciation of different mathematical principles of algorithm analysis 3. Gain an understanding and apply various algorithm design strategies like divide and conquer strategy, greedy strategy, dynamic programming strategy and backtracking strategy. 4. To understand various complexity classes like P, NP, NP-complete and NP-Hard.	Upon successful completion of the course, the student will be able to: 1. Compare different types of asymptotic notations and find the time complexity in terms of asymptotic notations 2. Solve recurrences using various techniques. 3. Implement divide and conquer strategy, greedy strategy, dynamic programming algorithms and backtracking strategy 4. Identify and differentiate between various types of complexity classes.

Unit No.	Contents	Max Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, $\sum n$, $\sum n^2$, bound summations using integration, analyzing control structures, worst case and average case analysis, Asymptotic notations, sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, External Sorting, lower bound proof	5
2	Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.	5
3	Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	5
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.	5
5	Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen's problem, graph coloring, Hamiltonian cycles etc.	5
6	NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook's Theorem, decision and optimization problems, polynomial reduction.	5

Text Books:

1. "Computer Algorithms", Horowitz, Sahni, Rajasekaran, Universities press
2. "Introduction to Algorithms", Cormen ,Leiserson, Rivest, Stein, Prentice Hall of India
3. "Fundamentals of Algorithms", Brassard, Bratley, Prentice Hall of India

VI Semester
CT2352 – Lab Design & Analysis of Algorithms

Sr. No.	Practical list
1	WAP to implement basic sorting algorithms.
2	WAP to implement basic sorting algorithms.
3	WAP to implement divide and conquer algorithms.
4	WAP to implement divide and conquer algorithms.
5	WAP to implement greedy algorithms.
6	WAP to implement greedy algorithms.
7	WAP to implement dynamic programming algorithms.
8	WAP to implement dynamic programming algorithms.
9	WAP to implement backtracking algorithms.
10	WAP to implement backtracking algorithms.

VI Semester

CT2353 - Language Processor

Objectives	Outcomes
1. To study the structure of Compiler and FLEX tool for generating lexical analyzer 2. To explore top down, Bottom up parsing approaches and YACC tool for generating syntax analyzer 3. To understand Syntax Directed Translation Scheme. 4. To introduce Symbol Table Management and Error Detection and Recovery with respect to all phases of compilation. **5.** To understand Code optimization and Code generation techniques.	Upon successful completion of the course, the student will be able to: 1. Design lexical analyzer using FLEX tool. 2. Implement syntax analyzer using YACC tool. 3. Create a syntax-directed definition and an annotated parse tree. 4. Demonstrate the use of a symbol table throughout compilation. 5. Apply various code optimizing transformations and code generation techniques.

Unit No.	Contents	Max Hrs.
1	Introduction to Compilation Process, Compilers & Translators, Phase structure of Compiler, Design of Lexical Analysis.	6
2	Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, Bottom Up Parsing, Predictive Parsers, Recursive Decent Parser.	7
3	Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table.	7
4	Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/ Flex, Yacc / Biason).	7
5	Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase.	6
6	Introduction to Code Optimization, the principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.	7

Text Books:

1. Compilers Principles, Techniques & Tools by Alfred V. Aho, Jeffrey D. Ullman & Ravi Sethi, 2nd Edition, Pearson Education
2. Principles of Compiler Design by Alfred V. Aho, Jeffrey D. Ullman, Addison Wesley Publication

VI Semester
CT2353 - Language Processor

Reference Book:

1. "Compiler Design", Dr. O.G. Kakde, Laxmi Publication.
2. "Introduction to Compiling Techniques: First Course Using ANSI C, Lex and Yacc", J. P. Bennett, McGraw-Hill Publication
3. "Building Your Own Compiler with C++", Jim Holmes, Prentice Hall

VI Semester
CT2354 – Lab: Language Processor

Sr. No.	Practical List
1	To Study Fast Lexical Analyzer Generator i.e. FLEX.
2	Write a Flex program to check whether the entered word is VOWEL or NOT with and without Function. Note: The word is called vowel if its first alphabet is a vowel.
3	Write a Flex program to recognize identifiers, constants, keywords, etc.
4	Write a Flex program to count the number of a. characters, words, spaces, and lines in each input text file. b. printf and scanf present in each input program fragment.
5	Write a Flex program to check whether the entered string of parenthesis is balanced or not in each input text file.
6	Write a Flex program to recognize a valid arithmetic expression and to recognize the identifier and operators present and print them separately.
7	Write a Flex program to Count the number of IF conditions in a program using the Lexical Analyzer.
8	Study of YACC and Write a YACC Program to display message "Have a good Day".
9	Write a YACC Program to recognize strings 'aaab', 'abbb', 'ab' and 'a' using the grammar for $L= (a^n b^n, n>= 0)$
10	Write a YACC program to recognize a valid arithmetic expression that uses operators +, -, *, / .

VI Semester

CT2355 – Software Engineering

Objective	Outcome
1. Study software engineering best practices and different strategies applicable for software development, software requirement and its design activity. 2. Explore the various testing types and its strategies. 3. Understand configuration management, version control and change control process of Software development. 4. Understand project management, planning, scheduling, risk management, project and process metrics. 5. Get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re-engineering and Reverse engineering.	Upon successful completion of the course, the student will be able to: 1. Choose appropriate software engineering process model, requirement engineering principles and software designing fundamentals for a given project. 2. Select appropriate testing strategy and apply testing principles for testing a given application. 3. Apply basics of software configuration management, version control and change control in software development. 4. Evaluate cost estimation, effort and severity of software risk for given application. 5. Perform basic operations on Sub-version for software version control.

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Engineering, A Generic View of process, Process models: Water fall Model, RAD Model, Prototyping Model, Component Development Model, Agile Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation	6
2	Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.	7
3	Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White-Box Testing, Basis Path testing: Flow Graph Notation, Independent Program Paths, Control Structure Testing, Black Box Testing, Introduction to object oriented testing.	7
4	Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards.	5
5	Project Management, Metrics for Process and Projects, Project Estimation, Risk Management: Reactive vs. Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection.	7
6	Advanced Topics in Software Engineering: Re engineering Computer aided software engineering, Open source SE tools introduction, Example-Subversion: Overview, Typical subversion usage and work flow.	5

VI Semester
CT2355 – Software Engineering

Text Books:
1. Software Engineering–A Practitioner's Approach (Sixth Edition) by Roger S. Pressman– McGraw Hill.
2. Object Oriented Software Engineering by Leth Bridge, Pearson Edu.

Reference Books:
1. Software Engineering, 9th Edition, Ian Sommerville, University of St Andrews, Scotland, ©2011 , Pearson

VI Semester
CT2356 – Lab : Software Engineering

S. No	Practical List
1	Introduction to Software Engineering fundamentals, UML and RATIONAL ROSE Interface.
2	To study and create Software Requirement Specification document for given case study
3	To study and draw UML Use Case diagram for the given case study.
4	To study and draw UML Class diagram for given Case Study.
5	To study and draw UML Activity diagram for given Case Study.
6	To study and draw UML Sequence Diagram for given Case Study.
7	To study and draw State Diagram for given Case Study.
8	Write a Program to find out the Estimation (cost and effort) by using COCOMO model.
9	To Perform Manual and Automated testing using CASE tool for given Case Study
10	To Study and execute Version Control using Subversion

VI Semester

CT2361– PE II: Digital Image Processing

Objectives	Outcomes
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description	Upon successful completion of the course, students will be able to: 1. Describe and understand Basic relationships between pixels. 2. Compare and Implement various image enhancement techniques in spatial domain and frequency domain. 3. Compare and illustrate different image compression techniques to understand the advantage of image compression 4. Identify and demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation. 5. Interpret and illustrate various representation techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception, Fundamentals of Image processing, A Simple Image Model, Sampling and Quantization, Some Basic Relationships. between Pixels, Image Geometry in 2D.	6
2	Image Enhancement in the Spatial Domain: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6
3	Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Discrete Cosine Transform, Typical Applications. Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering, Implementation	7
4	Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Fidelity criteria, Image compression models, compression standards, Basic compression methods, Huffman coding, colomb coding, arithmetic coding, LZW coding, runlength coding	7
5	Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	8
6	Image Representation: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models, introduction to image file formats: TIFF, JPEG, BMP, etc.	7

VI Semester
CT2361– PE II: Digital Image Processing

Text Books:
1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
2. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

Reference Books:
1. Fundamentals of Digital Image Processing by A.K.Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya &Ajoy K. Ray, Willey Inter-Science.

VI Semester
CT2362 – PE II: Lab: Digital Image Processing

Sr. No.	Practical List
1	Write a program in MATLAB for following Point processing techniques in spatial domain a. Negation of an image b. Thresholding of an image c. Contrast Stretching of an image
2	Write a Program in MATLAB to Create a Histogram of a given Image.
3	Write a program in MATLAB to perform following smoothing operations on an image a. Average filter b. Ordered Statistics filter
4	Write a program to sharp an image using Laplacian mask.
5	Write a program to compress an image using Huffman Coding
6	Write a program to segment an image using multilevel thresholding.
7	Write a program to apply split and merge algorithm on a given image.
8	Write a program to find the code chain of a given image.
9	Write a program to find the shape number of a given image.
10	Write a program to find Euler number of image a given image.

VI Semester
CT2363 – PE II: Internet of Things

Objectives	Outcomes
1. Get acquainted with various IOT environments. 2. Study IOT architecture and its enabling technologies. 3. Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, students will be able to: 1. Develop various IOT environments 2. Demonstrate IOT architecture and its enabling technologies 3. Analyze IOT environments using various communication technologies 4. Apply various IOT enabling technologies for creation of IOT environments

Unit No.	Contents	Max. Hrs.
1	Introduction: Concepts behind the Internet of Things, Characteristics of IoT, IoT enabling technologies, IoT Communication Model, IoT architecture, Applications of IoT, Transducers, Sensors, Sensor classes, Sensor types, Actuators and its types	6
2	IOT Protocols: Application layer: MQTT, COAP, XMPP, AMQP, Network Layer: IPv4, IPv6, 6LoWPAN, IoT Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID	7
3	Wireless Sensor networks: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.	6
4	Cloud Computing: Recent Trends in Computing, Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Case studies, Middleware for IoT	6
5	Machine to Machine Communication: Node types, IP and Non-IP based M2M network Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability	6
6	Software-Defined Networking: Current Network to SDN, SDN Architecture, Challenges, OpenFlow Protocol, APIs in SDN, Controller Placement, Recent Advances of SDN in IoT, Industrial internet of things, Case studies	6

Reference Book:

1. Internet of Things: A hands on approach by Arshdeep Bahga and Vijay K. Madisetti
2. NPTEL course material on Introduction to Internet of Things

VI Semester
CT2364 – PE II: Lab: Internet of Things

Sr. No.	Practical List
1	To study Arduino Uno IoT Kit with ATMega 328 Microcontroller
2	Design a sketch for running of LEDs
3	Design a sketch to monitor state of switch by establishing serial communication between Arduino and computer
4	Design a sketch to read analog value of potentiometer by establishing serial communication between arduino and computer.
5	Design a sketch for blinking LEDs without using delay.
6	Design a sketch to develop switch based binary LED counter. Also observe output on serial monitor.
7	Design a sketch to create a simple digital clock using LCD display.
8	Design a sketch to make use of EEPROM to control devices (LED).
9	To log data of temperature sensor over internet and analysis it.
10	Advance Practical: Study and setup of ESP -32 board

VI Semester

CT2365 – PE II: Business Intelligence

Objective	Outcome
1. Understand the concept of business intelligence, digital data and the multidimensional data modeling 2. Have an appreciation of the process of building of multidimensional data model and various operations that can be performed on it 3. Gain an understanding of how to measure and present the business information 4. Develop an understanding of application of the business intelligence in the real-world scenario	Upon successful completion of the course, students will be able to 1. Reveal the knowledge of basic concepts of Business Intelligence and multidimensional modelling and able to compare digital data types. 2. Build and operate the multidimensional data model for the specific scenario to extract the information. 3. Analyze the business information to construct the reports from it. 4. Decide the mode / channel to implement the business intelligence solution for the specific problem.

Unit No.	Contents	Max Hrs.
1	Introduction to Business Intelligence: Introduction to digital data and its types – structured, semi-structured and unstructured, BI Definitions & Concepts, BI Framework, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices	6
2	Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP) Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, Data Warehousing concepts and its role in BI	6
3	Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data – types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle).	7
4	Identifying Dimension tables and fact table, designing of dimension and fact tables" schema, design of snowflake schema, query redirection. Aggregations: Why aggregate? designing Summary tables, which summaries to create	7
5	Introduction to business metrics and KPIs, creating cubes using Microsoft Excel, Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards	6
6	Case study: Overview and use of products from Pentaho and other open software. BI road Ahead: BI and mobility, BI and cloud computing, BI for ERP systems, Social CRM and BI	7

VI Semester
CT2365 – PE II: Business Intelligence

Text Books:
1. Fundamentals of Business Analytics by R. N. Prasad, Seema Acharya Wiley India
2. Data Warehousing in the real world A practical guide for building Decision Support System by Sam Anahory, Dennis Murray, PEARSON

Reference Books:
1. Business Intelligence by David Loshin.
2. Business intelligence for the enterprise by Mike Biere.
3. Business intelligence roadmap by Larissa Terpeluk Moss, Shaku Atre.
4. An introduction to Building the Data Warehouse, IBM.
5. Business Intelligence For Dummies, Swain Scheps.
6. Successful Business Intelligence: Secrets to making Killer BI Applications by Cindi Howson Information dashboard design by Stephen Few

VI Semester
CT2366 – PE II: Lab: Business Intelligence

Sr. No.	Practical List
1	Design a conceptual multidimensional model for the given data.
2	Create a table for Time dimension using existing data source
3	Extract the data from various sources and move it to backup area. Load the data from backup area to staging area and then Load data in data warehouse from staging area.
4	Create a chart report, by considering module names on the X-axis, Percentage Scored in the Various Modules on Y-axis.
5	Create a table report to display Year, Quarter, Month, Module name of the assessment conducted in the current month, Assessment type of the module conducted in the current month. Enable drill down for "Year," "Quarter, and "Month."
6	Graph the percentage sales over time to see the trends using given dataset. Also Pivot the data to see total sales by quarter and category and analyze the data
7	Report the sales by category and the corresponding freight charges. Filtering should be enabled in the Year and Quarter columns, and the selected Year and Quarter need to be visible. Also Sort the Sales data in terms of Year, Quarter and Month.
8	Extract the data from various sources using PENTAHO and apply the transformation on the data.
9	Describe the characteristics of data imported in R by using R functions.
10	Consider a data set and visualize it using appropriate visualization technique in 'R'
11	Apply data transformation and represent the data model in Orange tool
12	Perform data visualization using Tableau

VI Semester

CT2367 – PE II: Introduction to Natural Language Processing

Objectives	Outcomes
1. To understand basic aspects of Natural languages used in processing of text. 2. To get acquainted with the basic concepts and algorithmic description of the main levels of language levels: morphology, syntax, semantics, and pragmatics. 3. To Learn the mathematical and linguistic foundations 4. To appreciate underlying approaches for the various areas in NLP.	Upon successful completion of this course, the student will be able to: 1. Describe linguistic phenomena with formal grammars. 2. Illustrate and test algorithms for NLP problems 3. Examine NLP applications 4. Devise real world NLP applications using NLP techniques

Unit No.	Contents	Max. Hrs.
1	Introduction: History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP	5
2	Morphology fundamentals: Morphological Diversity of Indian Languages, Morphology Paradigms, Shallow Parsing, Named Entities, Maximum Entropy Models, Random Fields. Word Level Analysis, Morphology analysis –survey of English and Indian language Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.	8
3	Structures: Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents, Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.	7
4	Meaning: Lexical Knowledge Networks, Wordnet Theory, Indian Language Wordnets and Multilingual Dictionaries, Semantic Roles, Word Sense Disambiguation, WSD and Multi-linguality. Semantic Analysis: Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, Robust Word Sense Disambiguation (WSD), Dictionary based approach.	8
5	Pragmatics Discourse: Coreferences, reference resolution, reference phenomenon, syntactic and semantic constraints on co reference.	7
6	Natural language Processing applications (preferably for Indian regional languages): Sentiment Analysis, Text Entailment, Robust and Scalable Machine Translation, Question Answering in Multilingual Setting, Cross Lingual Information Retrieval (CLIR).	7

Text Books:

1. Jurafsky, Daniel, and James H. Martin, Speech and Language Processing:An Introduction to Natural Language Processing, Speech Recognition,and Computational Linguistics, PrenticeHall, 2000.
2. Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing. Cambridge, MIT Press, 1999.

VI Semester

CT2367 – PE II: Introduction to Natural Language Processing

Reference Books:

1. James Allen, Natural Language Understanding, Benjamin/Cummings, 2ed, 1995.
2. Eugene Charniak, Statistical Language Learning, MIT Press, 1996.
3. Martin Atkinson, David Britain, Harald Clahsen, Andrew Redford, Linguistics, Cambridge University Press, 1999.

VI Semester
CT2368 – PE II: Lab: Introduction to Natural Language Processing

Sr. No.	Practical List
1	Implement Linguistic features of Language: Write a Program to tokenize words and sentences of given paragraph
2	Morphological features: 2.1 Write a program to perform lemmatization of language words using wordnet. 2.2 Write a program to return morphological features of input text in any Indian language Morphological Analyzer.
3	Write a program to demonstrate usage of Regular expression.
4	Identify ambiguity present in the given text. (Use a tool to check ambiguity)
5	Write a program to create parse tree for given text in given paragraph.
6	Illustrate utility of NLTK: 6.1 Write a program to remove stop words using NLTK 6.2 Implement NLTK features
7	Write a program to get Antonyms for given word from Wordnet for Indian languages.
8	Write a program to design a spam mail recognition system.
9	Create a spellchecking application for Indian Language.
10	Create Mini application based on NLP domains.

VI Semester

CT2369 – PE II: Customer Relationship Management

Objectives	Outcomes
1. To understand the concepts and principles of Salesforce CRM. 2. To appreciate the role and changing face of Salesforce CRM as an IT enabled function. 3. To implement a CRM using apex in aura framework by understanding the business case and importance of implementing such a systemin an organization.	Upon successful completion of this course, the student will be able to: 1. Apply the knowledge of customer-centered organization and implement the integral processes within an organization that are automated and how does the automation create predictability and efficiencies. 2. Design a customize a CRM application for organization to suit their business needs. 3. Analyze the result of developed CRM application from various perspectives for implementing it.

Unit No.	Contents	Max. Hrs.
1	Introduction to Cloud: Definition of Cloud Computing, Cloud Architecture, Cloud Types, Service models, Deployment models, Examining the Characteristics of Cloud Computing, Benefits of cloud computing, Disadvantages of cloud computing. CRM Concepts and its tools: Definition, History, Key Benefits, Service Level Agreements (SLAs), creating and managing effective SLAs. Architecture, Service Nature of Salesforce, Features, Products and its overviews, Traditional CRM vs. Salesforce CRM.	8
2	CRM Administration and Data Model Design: Lightning and classic UI and differences, Creation of org, Object Manager, App Manager, Setup, App creation, tabs, Types of Objects, Data Types, Sandboxes, Understanding Relationships and its limitations, Types of Relationship and their differences, Junction Object, formulas, Dependency picklist fields, Validation Rules.	7
3	Data Management with CRM Tool: Record details, List Views, Filters, Actions Page layouts, Compact Layouts, Introduction to Workflows, email templates, Limitation of workflows, approval processes, Process Builder, Lightning Flow, Community Creation, Reports and Dashboards.	7
4	Security Model: Introduction to Profiles and Permission Set, Overview of Data Security, Control access to org, object, field, record, OWD, Role and Roles Hierarchy, Sharing Rule, sharings Objects, Apex Sharing.	8
5	CRM Tool Development: Introduction to Apex, Collections, SOQL and SOSL, DML Operations, Controllers In APEX, Email Service Using Apex Class and Triggers, Asynchronous APEX, Batch APEX, Apex Test Classes.	7
6	Lightning Aura Component: Introduction to Aura component, attributes handling in aura component, handle action in controller, Parent and child component, Events handling in aura component, Server-side controller.	8

Reference Books:

1. Salesforce Handbook Paperback – 20 Mar 2011 by Wes Nolte (Author), Jeff Douglas (Author) , Publisher: Lulu.com, ISBN-10: 1446108538 , ISBN-13: 978-1446108536
2. Salesforce CRM: The Definitive Admin Handbook Paperback – Import, 24 Jul 2013 by Paul Goodey, Publisher: Packt Publishing Limited; 2nd edition edition

3. Alok Kumar Rai, CUSTOMER RELATIONSHIP MANAGEMENT CONCEPT & CASES, Prentice Hall of India Private Limted,New Delhi. 20112
4. S. Shanmugasundaram, CUSTOMER RELA TIONSHIP MANAGEMENT, Prentice Hall of India Private Limted,New Delhi, 20083.
5. Kaushik Mukherjee, CUSTOMER RELATIONSHIP MANAGEMENT, Prentice Hall of India Private Limted,New Delhi, 20084.
6. Jagdish Seth, et al, CUSTOMER RELA TIONSHIP MANAGEMENT5.
7. V. Kumar & Werner J., CUSTOMER RELA TIONSHIP MANAGEMENT, Willey India, 2008

CRM Tool Links:- http://help.salesforce.com

VI Semester

CT2370 – PE II: Lab: Customer Relationship Management

Sr. No.	Practical List
1	Introduction to Salesforce CRM.
2	Creation of Custom Objects.
3	To create Look-up and Master Details Relationship with objects.
4	To implement formula field.
5	To form dependencies among fields.
6	To study different layouts.
7	To implement a workflow.
8	To Customize process flow using process builder.
9	To create clone user and assigned permissions.
10	To create an Email templates
11	A. Write an Apex code to perform the DML Operations on Standard or the custom objects created by the user. B. Write an Apex Code to display the list of books with its issuing Members with starting letters of Books
12	A. To Create a Hello world Aura Component B. To Create and Edit Aura Component
13	Write an aura component to display the addition of two integer numbers, define a button called submit. When a submit button is clicked the result will be displayed on the screen.
14	Case Study- Introduction about community cloud
15	Case Study- Creation of salesforce custom Domain.

VI Semester
CT2371 – OE III: Introduction to DBMS

Objective	Outcome
To understand basic database concepts by students whose basic degree is not in Computer or IT.	Upon successful completion of this course, the student will be able to: Students should be able to design database forgiven situation, write appropriate queries for accessing database.

Unit No.	Contents	Max. Hrs.
1	An Overview of the Database Management System: What is database? Why database?, database system, database management system (DBMS), advantages of DBMS	6
2	An Architecture of the Database system: Three levels of architecture, mappings, role of database administrator (DBA), E-R model, three approaches of DBMS relational, hierarchical and network.	6
3	Relational Database Management System (RDBMS): Introduction, RDBMS terminology, relational model, base tables, key	5
4	The SQL Language: Introduction, Characteristics of SQL, data definition command	5
5	Data manipulation commands	5
6	Introduction to XML	6

Text Books:

1. Silberschatz A, Korth H.F and Sudarshan S, "Data base System Concepts", Fifth Edition, Tata McGraw-Hill.
2. R. Elmasri, S. B Navathe, "Fundamentals of Database System", Pearson Education.

Reference Books:

1. Leon A and Leon M, "Fundamentals of DBMS", Vijay Nicole & Tata McGraw-Hill.
2. Gill P.S, "DBMS", I.K. International.
3. Singh S.K, "Database Systems: Concepts, Design & Applications", Pearson Education.
4. Leon A and Leon M, "Database Management Systems", Vikas Publishing House.

VI Semester

CT2372 – OE III: Essentials of IT

Objectives	Outcome
1. To understand basics of algorithm design, object-oriented concepts and Java programming fundamentals. 2. To understand the database system concepts, relational database design basics and learn SQL for various data operations. 3. To understand basics of web page design and Javascript programming fundamentals 4. To understand software engineering basics and various SDLC phases.	Upon successful completion of the course, the student will be able to: 1. Develop algorithm and write pseudo code for a given problem statement. 2. Construct Entity-Relationship Model and design RDBMS for a given problem statement. 3. Design static and dynamic web pages using HTML and Javascript and write simple programs in Javascript. 4. Apply software engineering concepts in any software project implementation.

Unit No.	Contents	Max. Hrs.
1	Programming fundamentals of Java: problem solving skills, Algorithm – representation using pseudo code, algorithm properties. Programming in java- programming constructs in JAVA, control structures type casting, SDLC overview and need for Object oriented approach, object-oriented concepts, introduction to UML.	8
2	OO fundamentals – Java Implementation: OO fundamentals, coding standards, reference variables and objects in memory, methods, „this" reference. Data structures: data structures, linear data structures, non- linear data structures.	8
3	Data base basics- data storage, need for DBMS, functions of DBMS, data perspectives in DBMS, types of data models, relational model and keys, Database Design – Database life cycle, Data requirements, logical design – ER modeling, converting ER model to relational schema, functional dependency, normalization.	8
4	SQL – need for SQL, types of SQL statements, data types in SQL, SELECT statement with various operators, single row and multi row functions, group by and having clauses.	8
5	Introduction to web technologies: Computer Networks, HTML tags and CSS, Implementation of Java Scripts, Operators and control structures, function and dialog boxes, DOM element.	8
6	Software Engineering – Basics, SE models and approaches, Requirement developing activities, software design and construction, software testing, introduction to user experience, Project categories and project management phases, software quality.	8

Text books:

Java: The complete reference	7th Edition	Herbert Schildt.	McGraw-Hill
Database System Concepts	5th Edition	Silberschatcz, Korth, Sudarshan	McGraw-Hill Education
Software Engineering: A Practitioner's Approach	6hEdition	Roger Pressman	McGraw Hill Higher Education

VI Semester
CT2373– OE III: Image Processing

Objectives	Outcomes
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description.	Upon successful completion of the course, the student will be able to: 6. Describe and understand Basic relationships between pixels. 7. Compare and Implement various image enhancement techniques in spatial domain and frequency domain. 8. Compare and illustrate different image compression techniques to understand the advantage of image compression 9. Identify and demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation. 10. Interpret and illustrate various representation techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels.	5
2	Image Enhancement in the Spatial Domain: Introduction to Spatial domain, Basic Gray Level Transformations, Histogram Processing, Histogram Equalization, Spatial Domain Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6
3	Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Typical Applications. Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters.	6
4	Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Image compression models, Various compression methods.	6
5	Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	6
6	Image Representation: Chain Codes, Polygonal Approximations, Signatures, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to various color image processing models.	6

Text Books:

1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
3. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

VI Semester
CT2373– OE III: Image Processing

Reference Books:

2. Fundamentals of Digital Image Processing by A.K.Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya &Ajoy K. Ray, Willey Inter-Science.

VI Semester
CT2374– OE III: Operating System Concepts

Objectives	Outcomes
1. To understand the concepts of Linux and its potential. 2. To get a knowledge of shells	Upon successful completion of the course, the ent will be able to: 1. Use LINUX operating system. 2. Write Shell scripts

Unit No.	Contents	Max. Hrs.
1	Introduction: History of Linux and Unix, Linux Overview, Linux releases, open linux	6
2	Linux Commands and Filters : Mkdir, CD, rmdir, pwd, ls, who, whoami, cat, more, fail, head, concept of, mv, chmod, grep,wc, comm., split, sort, diff, kill, write, wall, merge, mail, news	5
3	Shell: The command line special characters and file arguments, standard input/output and redirection, pipes, redirecting and piping with standard errors, shell scripts, jobs.	5
4	Linux file Structure: Linux files, file structure, listing displaying and printing files, managing directories, file and directory operations.	5
5	Vi Editor: Vi editing commands advanced Vi editing commands, line editing commands, options in Vi.	6
6	System Administration: System management, managing users, installing and managing devices, floppy disk management, file system administration, backups.	6

Text Books

1. Linux – The Complete Reference by Richard Peterson, Tata McGraw Hill, New Delhi
2. Linux – Install and Configuration Black Book by Die Annleblanc and Issac Yates, IDG Books India Private Ltd., Delhi
3. Unleashed Linux by Tech Media Publishers.

VI Semester

CT2375– OE IIII: Introduction to Salesforce

Objectives	Outcomes
1. To realize the concepts and principles of Salesforce CRM. 2. To appreciate the role and changing face of Salesforce CRM as an IT enabled function. 3. To have knowledge of a CRM implementation in aura framework by understanding the business case and importance of implementing such a system in an organization.	Upon successful completion of this course, the student will be able to: 1. Employ the knowledge of customer-centered organization and implement the integral processes within an organization that are automated and how does the automation create predictability and efficiencies. 2. Represent a customize a CRM application for organization to suit their business needs. 3. Determine CRM strategies by understanding customers' preferences for the long-term sustainability of the Organizations.

Unit No.	Contents	Max. Hrs.
1	Introduction to Cloud: Definition of Cloud Computing, Cloud Architecture, Cloud Types, Service models, Deployment models, Examining the Characteristics of Cloud Computing, Benefits of cloud computing, Disadvantages of cloud computing.	8
2	CRM Concepts and its tools: Definition, History, Key Benefits, Service Level Agreements (SLAs), creating and managing effective SLAs. Architecture, Service Nature of Salesforce, Features, Products and its overviews, Traditional CRM vs. Salesforce CRM.	7
3	CRM Administration and Data Model Design: Lightning and classic UI and differences, Creation of org, Object Manager, App Manager, Setup, App creation, tabs, Types of Objects, Data Types, Sandboxes, Understanding Relationships and its limitations, Types of Relationship and their differences, Junction Object, formulas, Dependency picklist fields, Validation Rules.	7
4	Data Management with CRM Tool: Record details, List Views, Filters, Actions Page layouts, Compact Layouts, Introduction to Workflows, email templates, Limitation of workflows, approval processes, Process Builder, Lightning Flow, Community Creation, Reports and Dashboards.	8
5	Security Model: Introduction to Profiles and Permission Set, Overview of Data Security, Control access to org, object, field, record, OWD, Role and Roles Hierarchy, Sharing Rule, Sharings Objects, Apex Sharing.	7
6	CRM Tool Development: Introduction to Apex, Collections, SOQL and SOSL, DML Operations. Lightning Aura Component: Introduction to Aura component, Advantages, attributes handling in aura component.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Salesforce CRM: The Definitive Admin Handbook Paperback	2nd	Paul Goodey	Packt Publishing Limited
2	Customer Relationship	1st (2013)	Alok Kumar Rai	Prentice Hall of India

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

	Management Concept & Cases			Private Limted
3	Customer Relationship Management	1st (2012)	V. Kumar & Werner J.	Wiley

Reference Books		
SN	**Title**	**Link**
1	**CRM Tool Links (Online)**	http://help.salesforce.com

VI Semester
CT2381– OE IV: Soft Computing

Objectives	Outcomes
1. Understand the applications of soft computing in various domains. 2. Have an appreciation of Fuzzy logic and its applications. 3. Gain an understanding of Rough Set theory and its usage as soft computing. 4. Develop an understanding of single-objective optimization problems using gas. 5. Introduce artificial neural networks and its applications	Upon successful completion of the course, the students will be able to: 1. Reveal different applications of soft computing to solve problems from different domains 2. Demonstrate Fuzzy logic and its applications 3. Explain Rough Set theory and its usage as soft computing 4. Relate single-objective optimization problems using GAs. 5. Describe Artificial neural networks and its applications

Unit No.	Contents	Max. Hrs.
1	Introduction to Soft Computing: Concept of computing systems, Soft computing versus Hard computing, characteristics of Soft computing, some applications of Soft computing techniques, Learning Process, Overview of Supervised and un-supervised learning, Single and Multi-Layer Network, Associative Memory	6
2	Introduction to Fuzzy Logic: Introduction to Classical Sets, Fuzzy sets, Fuzzy membership functions, properties and operations on Fuzzy sets	6
3	Fuzzy Relations: Fuzzy relations, propositions, rules, and inferences, Fuzzy logic controller design, Defuzzification, some applications of Fuzzy logic	7
4	Rough Set Theory: Fundamental concepts: Information system or information table, In-discernibility relation, Approximations, Decision tables and decision algorithms, Dependency of attributes, Reduction attributes in information system, Applications of rough set theory	7
5	Genetic Algorithms: Concept of Genetic algorithm, basic terminologies in Genetic algorithm, GA operators, stopping criteria for genetic algorithm, solving single-objective optimization problems using Gas, advantages and limitations of GA, applications of GA	8
6	Artificial Neural Network: Introduction to Biological neurons and it's working, simulation of biological neurons to problem solving, different ANN architectures, training techniques for ANNs, Applications of ANNs to solve some real life problems	7

Text Books:
Principles of soft computing, S, N, Sivanandam, S. N. Deepa (Wiley)

Reference Books:
An Introduction to Genetic Algorithm, Melanic Mitchell (MIT Press)
Fuzzy set theory: Foundations and Applications, George J. Klir

VI Semester
CT2382– OE IV: Software Testing

Objective	Outcome
1. Understand Software testing fundamentals / principles. 2. Learn systematic approach to software testing using strategies. 3. Explore Methods and tools of testing software.	Upon successful completion of this course, the student will be able to: 1. Formulate problem by following Software testing life cycle. 2. Design Manual Test cases for Software Project. 3. Demonstrate utilization of testing automation though testing tool.

Unit No.	Contents	Max. Hrs.
1	Basic concepts of Testing: Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.	6
2	Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing.	5
3	Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage.	6
4	Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.	5
5	System Testing: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.	6
6	Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.	6

Text Books:
1.Software Testing and Quality Assurance by Kshirsagar Naik and Priyadarshini Tripathi (Wiley)
2.Software Testing Concepts and Tools by Nageswara Rao Pusuluri (Dream Tech Press)
3.Software Testing Principles, Techniques and tools, 1stEdition, by M.G. Limaye McGraw Hills

Reference Books:
1. "Foundations of Software Testing" 2 E by Aditya P. Mathur, Pearson Education
2. Software Testing Tools by Dr. K. V. K. K. Prasad (Dream Tech).

VI Semester

CT2383– OE IV: Internet Technology

Objective	Outcome
1. To understand the current topics in Web & Internet technologies. 2. To learn fundamental tools and technologies for web design 3. To understand various threats and security hazards on internet	Upon successful completion of this course, the student will be able to: 1. Describe the basic concepts for network implementation. 2. Comprehend the technologies and effectively deal with programming issues relating to web page creation 3. Figure out the various security hazards on the Internet and need of security measures.

Unit No.	Contents	Max. Hrs.
1	Introduction: Overview, Network of Networks, Intranet, Extranet and Internet. World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. Internet Routing Protocol: Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail: POP3, SMTP.	6
2	HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value. Extensible Markup Language (XML): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts: Introduction, Environment Variable, GET and POST Methods.	6
3	JavaScript: Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object - string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies: Definition of cookies, Create and Store a cookie with example. Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications	6
4	Internet Telephony: Introduction, VoIP. Multimedia Applications: Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Search Engine and Web Crawler: Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	6
5	Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH).	6
6	Firewall: Introduction, Packet filtering, Stateful, Application layer, Proxy.E-Commerce and security: issues including symmetric and asymmetric key, encryption and digital signature, authentication, Emerging trends, virtual reality over the web, etc.	6

Text Books

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.

VI Semester

CT2384– OE IV: Multimedia and Animation

Objectives	Outcomes
1. Gain fundamental knowledge of multimedia. 2. Understand the technologies in multimedia and animation. 3. Learn the basics of animation	Upon successful completion of the course, the student will be able to: 1.To understand multimedia basics - hardware and software. 2.To develop skills in design, illustration, image manipulation, graphic designing, video editing, visual effects and game designing. 3. To develop the skills in animation software.

Unit No.	Contents	Max Hrs.
1	Multimedia definitions, CD-ROM and the multimedia highway. Applications of multimedia, introduction to making multimedia, the stages of project, requirements to make good multimedia, multimedia skills and training, the multimedia tech.	7
2	Multimedia hardware, Macintosh and windows production platforms, hardware peripherals, connections, memory and storage devices, input devices output hardware, communication devices, media software, basic tools, making instant multimedia authoring tools.	6
3	Multimedia building blocks –text-using text in multimedia, computers and text, font editing and design tools, Sound-the power of sound , multimedia system sound, Digital audio, preparing digital audio files, Audio file format, images-Making still Images, Color, Image file format, video-Broadcast video standard, Analog video, Digital video, optimizing video files for CDROM	7
4	What is meant by Animation, why we need Animation, History of Animation, Uses of Animation. Types of Animation, Principles of Animation, Some Techniques of Animation, and Animation on the WEB, Special Effects, and Creating Animation.	6
5	Creating Animation in Adobe Animate: Introduction to Animate –Working with the Timeline and Frame-based Animation-Working with the Timeline and Tween-based Animation –Understanding Layers–Action script.	6
6	3D Animation & its Concepts, Types of 3D Animation, Skeleton & Kinetic, 3D Animation Texturing and Lighting of 3D Animation, 3D Camera Tracking, Applications & Software of 3D Animation.	7

Text Books:

1. Multimedia Making Work by Tay Vaughan (TMH), 3rd Ed.
2. Principles of Multimedia by Ranjan Parekh, 2007, TMH.
3. Multimedia Technologies by Ashok Banerji, Ananda Mohan Ghosh, McGraw Hill Publication.

VI Semester
CT2384– OE IV: Multimedia and Animation

Reference Books:

1. Multimedia systems design by K. Andleigh, K. Thakkrar, Phi Pub.
2. Multimedia: Computing, Communications & Applications by Raif Stein Metz and Kiara Nahrstedt.
3. Advanced Multimedia Programming by Steve Rimmer, McGraw Hill Pub.

VI Semester

CT2385– OE-IV: Current Trends and Technologies

Objective	Outcome
1. Gain fundamental knowledge of electronic communication. 2. Understand the technologies in Internet, e-Technologies & e-Learning. 3. Learn the basics of Green Computing and its implementation in industries 4. Develop the understanding of concepts in Social Media.	Upon successful completion of this course, the student will be able to: 1. Use the basics of internet for deployment of various servers and recourses. 2. Design and implement technologies for e-Commerce and e-Learning. 3. Choose appropriate implementation of Green Computing. 4. Make use of Social Networking properly and securely.

Unit No.	Contents	Max Hrs.
1	Fundamentals of Communications: Types of communication-Wired, wireless, mobile, Modes of transmission: Simplex, Half Duplex, Full Duplex, Multiplexing techniques, History and evolution of wireless and mobile systems, Transition and characteristics of 1G, 2G, 3G, 4G, Spectrum, regulations, and frequency allocation	7
2	Fundamental of INTERNET: History, Internet working, Connections, Internet services, The World Wide Web, Tools for the WWW, Web servers, Web browsers, Web page makers and editors, Plug-ins and delivery vehicles.	6
3	e-Technologies: Electronic Commerce: Framework, Media Convergence of Applications, Consumer, Applications, Organization Applications, Electronic Payment Systems: Digital Token, Smart Cards, Credit Cards, Risks in Electronic, Payment System, Designing Electronic Payment Systems, Electronic Data Interchange (EDI): Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software, Implementation, EDI Envelope for Message Transport, Internet-Based EDI.	7
4	e-Learning: Definition, Introduction, Types of e-Learning: Learner-led e-Learning, Facilitated e-Learning, Instructor-led e-Learning, Embedded e-Learning, Telemonitoring And e-Coaching E-Learning Models: WBT, CBT, LMS, LCMS, Virtual School Systems, E-Learning Tools And Technologies: e-mail, Online Discussion, Chat and Instant Messaging, Voting, Whiteboard, Application Sharing, Conferencing, Online Meeting Tools, Case study.	6
5	Green Computing: Introduction, Why....Green Computing? Approaches to Green Computing-Virtualization, Power Management, Power supply, Storage, Video Card, Display, IT Equipment, Recycling, Remote Conferencing & Telecommuting Strategies, Product longevity, Resource allocation, Terminal servers, Operating system support, How to Implement? Industrial implementations of Green Computing- Blackle, Fit-PC, Zonbu computer, Sunray thin client.	6
6	Social Networking: Definition, Overview of Social Networking Sites, Types of Social Networking Sites: General purpose, Niche. Advantages of Social Networking Sites, Drawbacks of Social Networking Sites, Features and Need of Social Networking, Security Issues with Social Networking Sites, Case Studies	7

VI Semester

CT2385– OE-IV: Current Trends and Technologies

Text Books:

1. Impact of E-Business Technologies on Public and Private Organizations by OzlemBak, Nola Stair.
2. Mobile Computing by Tomasz Imielinski , Henry F. Korth .
3. Broadband telecommunications technology by Byeong Gi Lee, Minho Kang, Jonghee Lee.

Reference Books:

1. Introduction to broadband communication systems by Cajetan M. Akujuobi, Matthew, N. O. Sadiku.
2. E-Learning Tools and Technologies William Hortan, Katherine Hortan,Wiley Pub
3. Internet (Use of Search Engines Google & Yahoo etc).

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

7th & 8th Semester

Computer Technology

28 June 2019

VII Semester
CT2401 - Artificial Intelligence

Objective	Course Outcome
1. To understand fundamental concepts in Artificial Intelligence, its applications, techniques, related fields and different types of AI agents. 2. To describe different searching algorithms in AI (uninformed, informed, heuristic, constraint satisfaction) 3. To explain different knowledge representation approaches and their fundamentals 4. To understand AI planning and scheduling operations. 5. To comprehend various uncertain reasoning techniques and its applications.	**Upon successful completion of the course, the student will be able to:** 1. Describe different concepts of AI, and illustrate working of different types of intelligent agents and co-relate them in real life. 2. Differentiate between searching algorithms and apply appropriate algorithm to solve real life problems as well as in gaming domain. 3. Select appropriate knowledge representation technique to represent real life facts. 4. Analyze planning approaches and its operation for real life problem. 5. Demonstrate the working knowledge of reasoning in the presence of incomplete and/or uncertain information.

Unit No.	Contents	Max. Hrs.
1	Introduction: AI , History, Overview, Intelligent Agents, Performance Measure, Rationality, Structure of Agents, Problem-solving agents, Problem Formulation, Uninformed Search Strategies	6
2	Informed (Heuristic) Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions, inventing admissible Heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing	8
3	Constraint Satisfaction Problems, Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs, Adversarial Search, Games, The minimax algorithm, Alpha-Beta pruning, Imperfect Real-Time Decisions	7

4	Knowledge Based Agents, Logic, Propositional Logic: Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Models for first order logic, Symbols and Interpretations, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification, Forward Chaining, Backward Chaining, Resolution	7
5	Planning, Language of planning problems, planning with state-space search, forward and backward state-space search, Heuristics for state-space search, partial order planning, planning graphs, planning with propositional logic	7
6	Uncertainty, Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact inference in Bayesian Networks.	5

SN	Title	Authors	Publisher
1	Artificial Intelligence A Modern Approach	S. Russell and P. Norvig.	Pearson Education
1	First course in AI	Deepak Khemani	McGraw Hill
2	Artificial Intelligence	E. Rich and K. Knight and Shivashankar B. Nair.	McGraw Hill

SN	Title	Authors	Publisher
1	Introduction to Artificial Intelligence and Expert System	D. W. Patterson,	PHI
2	Artificial Intelligence	George F. Lugar,	Pearson Education
3	Expert Systems: Design and Development	J.Durkin, Macmillan	Prentice Hall

VII Semester

CT2402 – Lab. : Artificial Intelligence

Sr. No.	List of Experiment
1	Write a family tree program to include following rules 1. M is the mother of P if she is a parent of P and is female 2. F is the father of P if he is a parent of P and is male 3. X is a sibling of Y if they both have the same parent. 4. Then add rules for grandparents, uncle-aunt, sister and brother.
2	Write a program to implement DFS (for 8 puzzle problem or Water Jug problem or any AI search problem).
3	Write a program to implement BFS (for Missionaries and Cannibal Problem)
4	Write a program to Implement Heuristic (Steepest Ascent) Search for Tic-Tac-Toe game problem.
5	Write a program to Implement Min-Max/Alpha Beta Pruning Algorithm for game solving.
6	Write a program to Implement Best First search for Travelling Salesman Problem
7	Write a program to Implement A* Algorithm.
8	Write a Program to solve 8 Queen Problem.
9	Write Program for Resolution algorithm.
10	Write a Program to Implement Naive Bayes Classifiers .

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VII Semester

CT2403 – Network Security

Objective	Course Outcome
Students will be able to: 1. Understand the security threats aimed at computer network and describe various security mechanisms and services to counter them. 2. study cryptographic mathematics to solve network security problems. 3. study of various cryptographic algorithms 4. Understand different security protocols at various layers of network model	Upon successful completion of the course, the student will be able to: 1. Identify threats to network security , associated attacks and countermeasures against attack. 2. Use appropriate mathematical techniques in cryptography. 3. Apply various algorithms/ mechanisms to formulate appropriate solution. 4. Use of different security protocols at various networking layers.

Unit No.	Contents	Max.
1	Introduction: Security goals, cryptographic attacks, Services and mechanism, techniques. Mathematics of cryptography : Integer arithmetic, modular arithmetic, matrices, linear congruence. Mathematics of symmetric key cryptography: Algebraic structure, GF(2^n) Fields	7
2	Traditional symmetric key ciphers: Introduction, substitution ciphers, Transposition ciphers, stream and block ciphers. Introduction to modern symmetric-key ciphers: Modern block ciphers, modern stream ciphers.	7
3	DES, AES, Encipherment using modern symmetric key ciphers: Use of modern block ciphers, use of stream ciphers: RC4. Mathematics of asymmetric key cryptography: Primes, primality testing, factorization, Chinese remainder theorem, Exponentiation and logarithms. Asymmetric key cryptography: RSA,	8
4	Message integrity and authentication: Message integrity, Random oracle model, message authentication. Cryptographic hash functions: Introduction, Description of MD hash family, Digital signature: Comparison, process, services, attacks on digital signature, Digital signature schemes. Entity authentication: Introduction, passwords, Challenge-Response, Zero knowledge, Biometric. Key management: Symmetric key distribution, Kerberos, symmetric key agreement, Public key distribution.	8

5	Security at application layer : E-mail, PGP, S/MIME. Security at transport layer: SSL architecture, four protocols, SSL message formats, Transport layer security. Security at network layer IPSec : Two modes, two security protocols, security association, security policy, ISAKMP	6
6	System security: Description of the system, Users, Trust and trusted systems, Buffer overflow and malicious software, malicious programs, worms, viruses, Intrusion detection systems, Firewalls: Definitions, construction and working principles	6

Text Books

SN	Title	Authors	Publisher
1	Cryptography and Network Security	Behrouz A. Forouzan, and Debdeep Mukhopadhyay	McGraw-Hill Publication

Reference Books

SN	Title	Edition	Authors	Publisher
1				
2				
3				

VII Semester

CT2411 – PE III: Neural Network & Fuzzy Logic

Objective	Course Outcome
1. Understand the fundamentals of biological neural network and artificial neural network 2. Understand the architecture of feed forward and feedback word neural networks. **3.** Understand the operations and properties of classical crisp set and fuzzy set theory with arithmetic operations **4.** Understand defuzzification methods used in fuzzy controller system	Upon successful completion of the course students will be able to: 1. Illustrate the fundamentals of Biological Neural Network and Artificial Neural Network with its working 2. Develop the solution for problem based on ANN using feed forward and Feed backward architecture 3. Comprehend the various concepts of fuzziness involved in fuzzy set theory and solve the problems based on it 4. Formulate fuzzy inference system using fuzzification and defuzzyfication methods

Unit No.	Contents	Max. Hrs.
1	**Fundamentals concepts and models of artificial neural systems:** Biological neurons and their artificial models, models of artificial neural networks, learning and adaptation, neural network learning rules, overview of neural networks, Programming exercise.	7
2	**Single-layer perceptron classifiers:** Discriminant functions, linear machine and minimum distance classification, training and classification using the discrete perceptron: algorithm and example, single layer continuous perceptron networks for linearly separable classification.	7
3	**Multi-layer feedback networks:** linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors, Hopfield networks, Applications of Neural Networks.	6
4	**From classical (CRISP) sets to fuzzy sets:** introduction crisp sets: an overview, fuzzy sets: basic types, fuzzy sets: basic concepts, characteristics and significance of the paradigm shift. Fuzzy sets versus crisp sets, representation of fuzzy sets, alpha cuts, cardinality, Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersection : T-norms, fuzzy unions: T-Conorms, Distinction between Probability, Fuzzy and Random System.	7

5	Linguistics variables, linguistic edges, Fuzzy relations, Binary Operation on a single set, projection and cylindrical extension, Extension principles for fuzzy sets, Fuzzy Arithmetic:fuzzy numbers, arithmetic operations on fuzzy numbers, Fuzzy Equations.	6
6	Defuzzification methods, design fuzzy rule base, Fuzzy Inference Systems: Mamdani Vs Sugeno, Steps in design of a fuzzy controller, applications of fuzzy logic.	6

Text Books

SN	Title	Authors	Publisher
1	Introduction to Artificial Neural System	J. M. Zurada	Jaico Publishing House, India
2	Fuzzy logic & Neural Network	T. J. Ross	Tata McGraw hill

Reference Books

SN	Title	Authors	Publisher
1	Principal of Soft Computing	S. N. Sivanandam & S. N. Deepa	Wiley India Pvt. Limited
2	Fuzzy Sets & Fuzzy Logic Theory and Applications	George J. Klir & Bo Youn	world scientific

VII Semester
CT2412 – PE III: Adhoc Wireless Network

Objective	Course Outcome
1. Understand the design issues and application areas of Ad hoc network. 2. Understand design issues and operation of protocols at each layer 3. Introduce Quality of Service and energy management techniques in Ad-hoc network.	**On completion of this course, the student will be able to** 1. Identify the need of Adhoc network compare infrastructure base and infrastructure less wireless network 2. Identify the design issues involved in the design of protocols at each layer, Compare and classify different protocols 3. Classify QoS approaches and Identify the need of energy management in ad hoc network.

Unit No.	Contents	Max. Hrs.
1	Adhoc Wireless Networks: Introduction, Issues in Ad hoc wireless Networks, Ad hoc Wireless Internet.	4
2	MAC Protocols for Ad hoc Wireless Networks: Introduction, issues in designing MAC protocol, Design goals of MAC protocols, classification, Contention based protocols: MACAW. Floor acquisition multiple access Protocols. Contention based protocols with reservation mechanism: Distributed Packet reservation multiple access protocol, Collision avoidance Time allocation protocol. Contention based MAC protocols with scheduling mechanism: Distributed priority scheduling and medium access in ad hoc networks.	6
3	Routing Protocols for Ad hoc Wireless Networks: Introduction, Issues in designing routing protocol, classification, table driven routing protocols: DSDV, cluster head gateway switch routing protocol. On demand routing protocols: DSR, AODV. Hybrid routing protocols: core extraction distributed routing protocol, Zone routing protocol. Routing protocols with efficient flooding mechanisms, hierarchical routing protocols, Power aware routing protocols.	6
4	Multicast routing in adhoc wireless networks: Introduction, Issues in designing multicast routing protocol, operation of multicast routing protocols, An architecture reference model, classification, Tree based multicast routing protocol: Bandwidth efficient multicast routing protocol, Multicast routing protocol based on zone routing, Multicast core extraction distributed Ad hoc routing, MAODV. Mesh based multicast routing protocols:	6

	on demand multicast routing protocol, Dynamic core based multicast routing protocol. Energy efficient Multicasting: Energy efficient reliable broadcast and multicast protocols, A distributed power aware multicast routing protocol. Multicasting with Quality of Service guarantees, Application dependent multicast routing.	
5	Transport layer and security protocols: Introduction, Issues in designing transport layer protocol, design goals of transport layer protocol, Classification of transport layer solutions, TCP over ad hoc wireless networks, Other transport layer protocols for ad hoc wireless network, security in ad hoc wireless network, network security requirements, Issues and challenges in security provisioning, Network security attacks, Key management, Secure routing in AD hoc Wireless networks: Requirements of secure routing protocol, security aware ad hoc routing protocol.	6
6	Quality of service and energy management in Ad hoc Wireless networks: Introduction, Issues and challenges in providing Quality of service, classification of Quality of service solutions. Introduction to energy management, Need for energy management, classification, Battery management schemes, transmission power management schemes, system power management schemes.	5

SN	Title	Authors	Publisher
1	Ad Hoc Wireless Networks Architecture and protocols	C. Siva Ram Murthy, B. S. Manoj.	Pearson Publication.

SN	Title	Authors	Publisher
1	Ad hoc Networking	Charles E. Perkins	Addison Wesley.
2	The hand book of ad hoc wireless networks	Mohammad Ilyas	CRC press.

VII Semester

CT2413 – PE III: Information Retrival System

Objective	Course Outcome
1. To provide an overview of Information Retrieval. 2. To introduce students about insights of the several topics of Information retrieval such as – Boolean retrieval model, Vector space model, Latent semantic indexing, XML and Image retrieval model. 3. To provide comprehensive details about various evaluation methods.	**On completion of this course, the student will be able to** 1. understand different Information retrieval models. 2. know about evaluation methods of the information retrieval model. 3. know the challenges associated with each topic

Unit No.	Contents	Max. Hrs.
1	**Introduction to Information retrieval**: Information retrieval process, Indexing, Information retrieval model, Boolean retrieval model **Dictionary and Postings:** Tokenization, Stop words, Stemming, Inverted, index, Skip pointers, Phrase queries	7
2	**Tolerant Retrieval** : Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex **Term Weighting and Vector Space Model:** Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex	7
3	**Evaluation**: Precision, Recall, F-measure, E-measure, Normalized recall, Evaluation problems **Latent Semantic Indexing**: Eigen vectors, Singular value decomposition, Low rank approximation, Problems with Lexical Semantics	7
4	**Query Expansion** : Relevance feedback, Rocchio algorithm, Probabilistic relevance feedback, Query Expansion and its types, Query drift **Probabilistic Information Retrieval**: Probabilistic relevance feedback, Probability ranking principle, Binary Independence Model, Bayesian network for text retrieval	6
5	**XML Indexing and Search**: Data vs. Text-centric XML, Text-Centric XML retrieval, Structural terms	6
6	**Web Information Retrieval** Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Information Retrieval	-	Christopher D. Manning, Raghavan and Schutze,	Cambridge University Press,2008

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Natural Language Processing And Information Retrieval	-	Tanveer Siddiqui and U. S. Tiwary	Oxford Higher Education,2008

VII Semester

CT2414 – PE III: Human Computer Interaction

Objective	Course Outcome
The student should be able to 1. To study and understand interface design tools, and demonstrate the Interaction between the human and computer components 2. To study and understand the screen designing and its various concepts with design rules 3. To study and understand software tools related to HCI process. 4. To understand the interaction devices.	**On completion of this course, the student will be able to** 1) Apply the knowledge of human components for interaction with computer 2) To understand basics of Computer components functions regarding interaction with human. 3) Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept. 4) To Produce Implementation supports for HCI by using various tools.

Unit No.	Contents	Max. Hrs.
1	Introduction: The human: Human memory, Thinking reasoning and problem solving, Individual differences, Psychology and the design of interactive systems ,Interaction and paradigms: Models of interaction, Frame work and HCI, Ergonomics, Interaction styles, Elements of the WIMP(windows, icons, pointers, menus) interface, interactivity, The context of the interaction, paradigms for interaction	7
2	Interaction Design: What is interaction design, Good and poor design, The process of design, User focus, Scenarios, Navigation design, Understanding the problem space, Conceptualizing the design space, Theories, models and frameworks, Screen design and layout, Interaction and prototyping	7
3	HCI in software process and Design rules: The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale, Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns	7
4	Implementation supports and Evaluation techniques: Elements of windowing system, Programming application, Using toolkits, User interface management systems, What is evaluation? Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing evaluation methods, analytical evaluation	7

5	Universal Design and User Support: Universal design principles, Multi-modal interaction, Design for diversity, Requirements of user support, Approach to user support, Adaptive help systems, Design user support systems	7
6	Cognitive Models and Distributed Cognition: Goal and task hierarchies, Linguistics models, The challenge of display-based system, Physical and device models, Cognitive architectures, Scientific Foundation, Description, Case Study	7

Text Books

SN	Title	Authors	Publisher
1	"Human - Computer Interaction"	Alan Dix, Janet Fincay, Gregory D. Abowd and Russell Bealg,	Pearson Education, 2003.
2.	"Designing the user interface",	Ben Shneiderman	Pearson Education Asia, 2004

Reference Books

SN	Title	Authors	Publisher
1	"Interaction Design",	Preece and Rogers, Sharp	Wiley-India, 2008.
2	"The essential guide to user interface design",	Wilbert O Galitz	Wiley DreamTech, 2009

VII Semester

CT2421 – PE IV: Pattern Recognization

Objective	Course Outcome
1. The study of Pattern Recognition to equip the students with the brief knowledge of Statistical. 2. Decision Theory, Image processing, clustering, different error at pattern recognition, decision making techniques and application of pattern recognition in different fields.	1. Apply Pattern Recognition techniques for recognition. 2. Know and Apply knowledge of Statistical Decision Theory. 3. Perform Image processing concepts on images. 4. Understand and apply clustering concepts on raw 5. Apply decision making techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Statistical Decision Theory, Image Processing and Analysis, Probability-probabilities of events, random variables, joint distribution & densities.	7
2	Moments of random variables, estimation of parameters from samples, minimum risk estimators.	7
3	Non parametric decision Making- Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error, estimation functions, choosing a decision making technique.	7
4	Linear Classifier Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Least Squares Methods, Mean Square Estimation Revisited, Support Vector Machines .	6
5	Feature Generation Introduction, Basis Vectors and Images, The Karhunen-Loeve Transform, The Singular Value Decomposition, Independent Component Analysis, The Discrete Fourier Transform, The Haar Transform.	6
6	Clustering-Introduction, hierarchical clustering, partition clustering.	6

Text Books

SN	Title	Authors	Publisher
1	Pattern recognition & Image Processing	Ealr Gose, Richard Johnson daugh & Steve Jost	PHI
2	Pattern Classification	Richard O. Duda, Peter E. Hart and David G. Stork	John Wiley

Reference Books

SN	Title	Authors	Publisher
1	Pattern recognition	Sergios Theodoridis, Konstantinos Koutroumbas	Academic Press

VII Semester
CT2422 – PE IV: Lab. : Pattern Recognization

Sr. No.	List of Experiment
1	Enhance an image using Average Filter.
2	Detect the edges using Sobel operator.
3	Plot a histogram of a given image.
4	Classify an objects based on adadptive desion boundary technique.
5	Classify an objects based on nearest neighbor classification techniques.
6	Implement The Perceptron Algorithm.
7	WAP to implement SVM.
8	Extract features using ICA.
9	Extract features using DFT.

VII Semester

CT2423 – PE IV: Cyber Forensic

Objective	Course Outcome
1. To Comprehend different modern techniques with respect to Computer System and various accepts of Information security 2. To Comprehend different forensic tools used in cyber forensics 3. To Understand different legal techniques and aspects for securing data 4. To Understand the process of compilation of report writing tools and techniques used in digital forensics.	1. Investigate hardware parts of a computer system for evidences 2. Use different tools for data acquisition and duplication for forensic study 3. Securely store data and evidence collected 4. Create report of forensic investigation made

Unit No.	Contents	Max. Hrs.
1	Types of Cyber Crime, Security Attacks, Overview of computer forensics in today's world, computer hardware basics, Computer forensics investigation process, understanding hard disks and file systems, Types of computer forensics.	6
2	Computer forensic: Data acquisition and duplication, defeating anti-forensics techniques, operating system forensics, Log analysis and event viewer, File auditing, identifying rogue machines, Malware forensic Database forensic.	6
3	IT fraud, Recovery of deleted files, Live Data collection and investigating Linux environment. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), email crimes.	6
4	Network forensics, investigating web attacks, Gathering Tools to create a response toolkit. Hidden files and unauthorized access points. Analyzing network traffic, sniffers Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc.	6
5	Mobile Forensics, Live Data collection and investigating on android, ios, windows environment, Investigating report generation, investigation process, acquisition types, tools, report generation	6
6	Forensics report writing and presentation, Case studies	6

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Incident Response & Computer Forensics	Mandia, K., Prosise, C., Pepe, M.	Tata-McGraw Hill
2	Guide to Computer Forensics and Investigations	Bill Nelson, Amelia Phillips, Frank Enfinger, and Chris Steuart	Thomson Learning

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	File System Forensic Analysis	Brian Carrier	Wesley
2	Digital Evidence and Computer Crime	Eoghan Casey	Academic Press
3	Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM),	Harlan Carvey	Syngress Publication
4	EnCE: The Official EnCase Certified Examiner Study Guide	Steve Bunting	Sybex Publication

VII Semester
CT2424 – PE IV: Lab. : Cyber Forensic

Sr. No.	List of Experiment
1	Study practical on cyber-crime and generation of Hash values on file system
2	Perform data accusation and imaging on digital evidences
3	Perform recovery and data carving on digital evidence
4	Explore and analyses tools on Email analysis an investigation
5	Password recovery tools, from RAR, DOC, PDF, windows password
6	Mobile forensics SIM card analysis
7	Mobile data Analysis
8	Vulnerability Analysis on Windows
9	Report and Evidence Submission using Tools

VII Semester
CT2425 – PE IV: Machine Learning

Course Objectives	Course Outcomes
1. The basic concepts of machine learning and the relative strengths and weaknesses of different machine learning methods. 2. To understand the concepts of different types of machine learning algorithms and how to apply learning algorithms to sample. 3. To understand the different methods of evaluation of machine learning algorithms 4. To understand different ensembling methods and new techniques like deep and shallow learning.	**Upon successful completion of the course students will be able to:** 1. Interpret machine learning techniques suitable for a given problem 2. Apply machine learning techniques to solve the problems 3. Compare machine learning techniques 4. Evaluate different machine learning techniques

Unit No.	Contents	Max. Hrs.
1	Introduction, machine learning classes (i.e., supervised, unsupervised and reinforced), well posed and ill posed learning problems, designing a learning system, perspective and issues in machine learning, applications	6
2	Introduction, Factors, Response, and Strategy of Experimentation, Guidelines for Machine Learning Experiments, Cross-Validation and Resampling Method, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing, Assessing a Classification Algorithm Performance, Comparing Two Classification Algorithms, Comparing Multiple Algorithms: Analysis of Variance, Comparison over Multiple Datasets	8
3	Learning a class from Bayesian learning, learning theory (bias/variance tradeoffs; VC theory; large margins), Generative/discriminative learning, parametric/non-parametric learning linear and logistic regression, svm	7
4	Introduction, Density Estimation, Clustering Dimensionality reduction, PCA, kernel methods	7

5	Introduction, decision tree representation, appropriate problems for Decision Tree learning, the basics decision tree learning algorithm, hypothesis space search, inductive bias in decision tree learning, issues in decision tree learning.	6
6	Ensemble methods, Introduce the concepts behind deep learning and benefits of deep over shallow networks, introduce the concepts of reinforcement learning	6

SN	Title	Authors	Publisher
1	Introduction to Machine Learning	Ethem Alpaydin	The MIT Press
2	Machine Learning	Tom Mitchell	McGraw-Hill Science/Engineering/Math

Reference Books:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning. http://research.microsoft.com/enus/um/people/cmbishop/prml/.
2. R. Sutton and A. Barto, An Introduction to Reinforcement Learning (http://webdocs.cs.ualberta.ca/~sutton/book/ebook/thebook.html)
3. C. Szepesvari, Algorithms for Reinforcement Learning (http://www.sztaki.hu/~szcsaba/papers/RLAlgsInMDPslecture.pdf)
4. Deep learning:Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning (http://www.deeplearningbook.org/)

VII Semester
CT2426 – PE IV: Lab. : Machine Learning

Sr. No.	List of Experiment
1	Implementation of basic concepts of performance evaluation
2	Implementation of hypothesis testing for the given problems.
3	Implementation of Naive bayes Algorithm for the given problem.
4	Implementation of Nearest neighbour algorithm.
5	Implementation of SVM
6	Implementation of Clustering algorithm.
7	Implementation of PCA
8	Implementation of decision tree
9	Project

VII Semester

CT2427 – PE IV: Design Patterns

Objective	Course Outcome
● The aim of the course is to appreciate the idea behind Design Patterns in handling common problems faced during building an application ● This course covers all pattern types from creational to structural, behavioral to concurrency and highlights the scenarios when one pattern must be chosen over others.	● Create software designs that are scalable and easily maintainable ● Use creational design patterns in software design for class instantiation ● Use structural design patterns for better class and object composition ● Use behavioral patterns for better organization and communication between the objects ● Use refactoring to compose the methods for proper code packaging, to better organize the class responsibilities of current code

Unit No.	Contents	Max. Hrs.
1	Introduction to Design Patterns and Observer Pattern:Basics of Design patterns, Description of design patterns, Catalog and organization of catalog, design patterns to solve design problems, selection of design pattern, Use of design patterns.	8
2	Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Creational Patterns	7
3	Structural Pattern: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy, Discussion of Structural Patterns	7
4	Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns	6
5	A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation, Summary	6
6	Complexity Analysis of Design Patterns, Methods to analyze the complexity of design patterns, Implementation techniques and applications of design pattern in game design, product design,	6

Text Books				
	Title	**Edition**	**Authors**	**Publisher**
1	Head First Design Patterns,		Eric Freeman and Elisabeth Freeman	
2	Design Patterns Explained		Shalloway and Trott	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Pattern's in JAVA Vol-I		Mark Grand	Wiley DreamTech.
2	Pattern's in JAVA Vol-II		Mark Grand	Wiley DreamTech.
3	Introduction to design Patterns in C++ with Qt		Alan Ezust, Paul Ezust	

VII Semester
CT2428 – PE IV: Lab. : Design Patterns

Sr. No.	List of Experiment
1	Write a java program to create a shape and concrete class implementing these interfaces. (factory pattern).
2	Write a java program to create a single object class. (singleton pattern).
3	Write a java program to create an abstract class shape and concrete classes extending the shape class. (Prototype design pattern).
4	Write a java program to create an adapter class media adapter which implements the media player interface and uses advance media player object to play required format (adapter design pattern).
5	Write a java program to create employee class to add department level hierarchy and print all employees. (Composite design Pattern)
6	Write a Java Program to create Shape interface and add a Shape Decorator Class an additional feature as Red Shape Decorator and give output as Red Shape Circle or Rectangle(Decorator Pattern)
7	Write a java program to create draw api interface which is acting as a bridge implementer and concrete classes redcircle, greencircle implementing drawapi interface.(bridge design pattern).
8	Write a java program to create a Shape interface and concrete classes implementing the Shape interface. A facade class Shape Maker is defined as a next step.(Façade Pattern)
9	Write a java program to create two objects , Stock which gives command and Broker which invokes the object and implement the interface Order.(Command Pattern)

VII Semester

CT2429 – PE IV: Mobile Communication

Objective	Course Outcome
1. To study wireless networks its standards and protocol 2. Understand different generations of wireless network	Select appropriate standards for the given situation Illustrate the generations of telecommunication systems in wireless network 3 Develop an application using different tools

Unit No.	Contents	Max. Hrs.
1	Introduction to wireless communication, introduction to cellular system, wireless transmission: frequencies for radio transmission, signal prorogation. Introduction to medium access control: TDMA, CDMA GSM: System architecture protocols, localization and calling, handover, Modulation Techniques.	5
2	Wireless LAN: IEEE 802.11, Bluetooth, Zigbee etc. Satellite Systems: GEO, LEO, MEO routing, localization and handover Mobile network Layer: Mobile IP, dynamic host, configuration protocol, adhoc networks, IPv6. Mobile transport layer: traditional TCP, indirect TCP & mobile TCP	6
3	2G-Global System for mobile communication (GSM) Introduction, GSM Architecture, Database and Data Elements, GSM Interfaces, GSM Protocol Architecture, GSM Versions	5
4	2G: IS95 cellular system (CDMA): Introduction, Motivation for CDMA to use in Mobile Communication, IS95 cellular System (CDMA) forward Channel, Reverse Channel Parameters of CDMA, wireless Local Loop Radio System. 4G LTE, 5G Introduction, LIFI	5
5	2.5 G: General Packet Radio service (GPRS) Introduction, Advantages of GPRS, GPRS Application, GPRS Architecture, GPRS Interfaces Logical Channels in GPRS, Protocol Architecture, Internetworking with IP Networks, GPRS terminals	6
6	3G: Universal Mobile Telecommunication System (UMTS) Introduction, UMTS Services, UMTS Architecture, UMTS Core Network, 4G introduction, Architecture of wireless Application protocol (WAP), Issues of Mobile Application.	6

SN	Title	Authors	Publisher
1	Mobile communication	Jochen Schiller	Addison Wesley pub
2	Mobile Communication Systems	KrzysztofWesolowski	Wiley Publication
	Wireless Communication principles & Practice	T.S.Rappaport	PHI pub

SN	Title	Authors	Publisher
1	Mobile communications Design Fundamentals	William C.Y.Lee	John Wiley & Sons pub

VII Semester
CT2430 – PE IV: Lab. : Mobile Communication

Sr. No.	List of Experiment
1	Installation of JDK1.6 and SDK1.3.
2	Study of JDK (Eclipse) Tool kit and software development kit.
3	Study of WML: Wireless Markup Language and its examples.
4	Develop an application in Android to store contacts in mobile handheld device.
5	Develop an application in Android to read an user input text.
6	Develop a Standup Timer in an Android that acts as a simple, stand-up meeting stop watch.
7	Study of Wireless Application protocol (WAP)
8	To study Pervasive Computing.

VII Semester

CT2431 – PE IV: Software Project Management

Objective	Course Outcome
1. To learn basic concepts project contract and to get an overview of various activities under project planning. 2. To understand techniques for cost benefit analysis And risk evaluation. 3 To understand project scheduling and various network planning models. 4. To understand Risk Management, Risk Planning and control. 5. To understand various activities like visualizing progress, earned value analysis etc. under monitoring and controlling of a project. 6. To understand the role of continuing training and learning, to improve group working and to select appropriate leadership styles	1. To understand basic concepts about project, project management and project planning. 2. To assess given requirements and perform cost benefit analysis. 3. To create a project schedule using some network planning model for given requirements. 4. To identify and create a risk management plan for given requirements. 5. To perform earned value analysis for given requirements and current completion state of project. 6. To form teams for any given exercise, work as a team and understand leadership qualities.

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered By Software Project Management, Overview of Project Planning, Stepwise Project Planning	8
2	UNIT II Project Evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation.	7
3	Activity Planning: Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks.	7
4	Risk Management: Risk Management, Nature Of Risk, Types Of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning And Control.	6
5	Monitoring and Control: Creating Framework , Collecting The Data , Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting Project Back To Target, Change Control, Managing Contracts, Introduction, Types Of Contract, Stages In Contract Placement, Typical Terms of A Contract, Contract Management, Acceptance.	6

6	Managing People and Organizing Teams: Introduction, Understanding Behavior, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods , Motivation, The Oldman – Hackman Job Characteristics Model, Working In Groups– Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety.	6

SN	Title	Authors	Publisher
1	"Software Project Management",	Bob Hughes, Mikecotterell,	Tata McGraw Hill.

SN	Title	Authors	Publisher
1	Managing Global Projects,	Ramesh, Gopalaswamy	Tata McGraw Hill
2	"Software Project Management",	Royce,	Pearson Education.
3	"Software Project Manangement in Practive",.	Jalote,	Pearson Education

VII Semester
CT2432 – PE IV: Lab. : Software Project Management

Sr. No	List of Experiment
1	Introduction to Software Project Management fundamentals.
2	To analyze requirements for a given case study.
3	To create a WBS for the given case study.
4	To perform risk management for the case study – 1.
5	To perform risk management for the case study – 2
6	Overview of Planning tool.
7	To create Project Schedule for the case study -1
8	To create Project Schedule for the case study -2.
9	To perform cost benefit analysis for case study
10	To study contract management and contract document.

VII Semester

CT2433 – PE IV: Numerical Computing

Objective	Course Outcome
1. To understand basics of error induced in numerical computation 2. To develop numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer 3. Learn technologies to solve integration numerically 4. Understand techniques to solve differential equations and systems of equations for convergence of iteration method.	1. Apply appropriate formula to find different types of error in numerical computation and mitigate it. 2. Choose and apply appropriate *numerical* techniques for problem solving interpret the *results* and assess accuracy. 3. Apply appropriate techniques for numerical integration 4. Demonstrate basics of conditioning of problems and stability of numerical algorithms

Unit No.	Contents	Max. Hrs.
1	Introduction to numerical computing: Characteristics of Numerical computing, Approximations and errors in numerical computations, types of errors, analysis, error estimation, numerical instabilities in computation, convergence (convergence of iterative method)	6
2	Roots of Non-linear equations: Methods of solutions, Iterative methods, Horner‟s rule, Bisection method, Regula Falsi method, Iteration method, Newton Raphson method, Secant method	8
3	Solutions to System of Linear Algebraic Equations: Existence of Solution, Solution By Elimination, Cramers rule, Basic Gauss Elimination Method, Gauss Elimination With Pivoting, Gauss – Jordan Method, Tringularization Methods, Choleskey‟s Method, Gauss Siedel method of iteration. Round Off Errors And Refinement, Ill – Conditioned System, Matrix Inversion Method.	8
4	Interpolation and Approximation: Linear interpolation and high order interpolation using Lagrange and Newton Interpolation methods, finite difference operators and interpolation polynomials using finite differences.	8
5	Numerical Differentiation and Integration: Numerical differentiation and errors in numerical differentiation, NewtonCotes formulae, trapezoidal rule, Simpson‟s rule, Double integrals by Trapezoidal and Simpson rule, Romberg Integration.	8
6	Numerical Solution of Ordinary Differential Equation: Solution By Taylor‟s Series, Picard‟s Method Of Successive Approximation, Euler‟s Method, Error Estimates For The Euler Method, Runge-Kutta Method for 2nd and 4th order, Predictor-Corrector Methods	8

SN	Title	Authors	Publisher
1	Introductory Methods of Numerical Analysis	Sastry, S. S	Prentice- Hall of India, New Delhi (2002).

SN	Title	Authors	Publisher
1	Numerical Methods	E. Balagurusamy	Tata McGraw hill.
2	Schaum's Outlines: Numerical Analysis	-	Tata McGraw Hill Publishing Co. Limited.
3	Numerical Computational Methods	P.B. Patil, U.P. Verma	Narosa Publishing, New Dellhi, 2006

VII Semester
CT2434 – PE IV: Lab. : Numerical Computing

S.N	List of Practicals
1	To find the absolute, relative percentage error in given function when: i. Three terms ii. Five terms are considered. The given function is: **$y = e^x$**
2	To find solution for Algebraic and Transcendental equation using Bisection Method.
3	To find solution for Algebraic and Transcendental equation using Regula Falsi Method.
4	To find solution for Algebraic and Transcendental equation using Newton Raphson Method
5	To find solution of Linear System of equations using Gauss Elimination Method.
6	To find solution of Linear System of equations using Gauss - Siedal Method of Iteration.
7	To Implement Lagrangian method of interpolation.
8	To calculate numerical Differentiation using Newton's Forward Interpolation formula
9	To calculate Integration using Simpson's rule/Trapezoidal Rule

VII Semester

CT2435 – PE V: Cloud Computing

Objective	Course Outcome
1. Understand cloud architecture and identify various parameters. 2. Identify and explore cloud computing stack and various cloud framework. 3. To understand and apply abstraction and virtualization in the cloud context. 4. Explore cloud infrastructure and understand cloud management lifecycle. 5. Classify various cloud security management standards and study various cloud applications methodologies	1. Explain software and hardware support for enterprise and cloud computing. 2. Perform data modeling for enterprise and cloud knowledge bases. 3. Design enterprise and cloud software applications. 4. Implement and run distributed and cloud applications. 5. Ensure security and privacy in enterprise and cloud application while implementing cloud applications methodologies.

Unit No.	Contents	Max. Hrs.
1	**Introduction to Cloud Computing**: Defining Cloud Computing; Cloud Types and different models-The NIST model, The Cloud Cube Model, Deployment models, Service models; Examining the Characteristics of Cloud Computing; Benefits of cloud computing; Disadvantages of cloud computing; Assessing the Role of Open Standards.	8
2	**Cloud Architecture, Services and Applications**: Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frame works, Software as a Service, Identity as a Service, Compliance as a Service.	7
3	**Abstraction and Virtualization**: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.	7
4	**Exploring Cloud Infrastructures**: Managing the Cloud-Administrating the Clouds, Management responsibilities, Lifecycle management Cloud Management Products, Emerging Cloud Management Standards, Understanding Service Oriented Architecture-Introducing Service Oriented Architecture.	8

5	**Managing & Securing the Cloud:** Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, the security boundary, Security service boundary, Security mapping, Brokered cloud storage access, Establishing Identity and Presence.	7
6	**Advance Clouds and Case Studies**: Cloud Computing Cost Analysis, basic, Selecting an IaaS Provider, Capacity Planning and Disaster, Recovery in Cloud Computing, AWS Cloud architectural principles, basic/core characteristics of deploying and operating in the AWS Cloud, the key services on the AWS Platform and their common use cases, Define the billing, account management, and pricing models, Introduction to Amazon EC2. Case Studies: Microsoft Azure, Dropbox.	8

SN	Title	Authors	Publisher
1	Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online.	Michael Miller	Springer
2	Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc.	Rajkumar Buyya, James Broberg, Andrzej Goscinski,	A John Wiley & Sons, Inc. Publication

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Mastering cloud computing	Rajkumar buyya, Christian vecchiola, S Thamarai Selvi	Tata Mc-Graw Hill Education Private Limited
2	Cloud Computing a Practical Approach	Anthony T .Velte, Toby J. Velte, Robert Elsenpeter	Tata Mc-Graw-HILL
3	Cloud computing bible	Barrie sosinsky	Wiley publishing
4	https://cloud.google.com/appengine/docs https://www.chef.io/solutions/cloud-management/ https://aws.amazon.com/documentation https://dev.twitter.com/overview/documentation https://developers.facebook.com/ https://www.cloudfoundry.org/ https://puppet.com/blog/implement-a-message-queue-your-cloud-applicati		

VII Semester

CT2436 – PE V: Parallel Programming

Objective	Course Outcome
1. To provide basics of concepts of parallel computing 2. To understand principles of parallel algorithm design 3. To understand performance measuring metrics for parallel system 4. To understand basics of thread programming 5. To familiarize with different directives of parallel programming framework i.e OpenMp 6. To understand concepts of Dynamic Programming formulations w.r.t parallel perspective	1. identify areas where parallel computing is applicable 2. implement parallel version of different algorithms using thread programming and openMp 3. find the speedup factor by analyzing parallel programs 4. develop real life applications using parallel programming

Unit No.	Contents	Max Hrs.
1	**Introduction to Parallel Computing:** Motivating Parallelism , Applications, Parallel ProgrammingPlatforms: Implicit Parallelism: Limitations of Memory System Performance, Dichotomy ofParallel Computing Platforms, Physical Organization of Parallel Platforms, CommunicationCosts in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact ofProcess Processor Mapping and Mapping Techniques.	6
2	**Principles of Parallel Algorithm Design**: Preliminaries Decomposition Techniques,Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods forContaining Interaction Overheads, Parallel Algorithm Models, Basic Communication operations:One to All Broadcast and All to One Reduction, All to All Broadcast and Reduction, All Reduceand Prefix Sum Operations, Scatter and gather, All to All Personalized Communication, CircularShift, Improving the Speed of Some Communication Operations	7
3	**Analytical Modeling of Parallel Programs:**Analytical Modeling of Parallel Programs: Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time andMinimum Cost Optimal Execution Time,Asymptotic Analysis of Parallel Programs, OtherScalability Metrics,	7

4	**Programming Shared Address Space Platforms**: Programming Using the Message Passing Paradigm: Principles of Message PassingProgramming, The Building Blocks: Send and Receive Operations , MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation,Collective Communication and Computation Operations, Groups and Communicators.	8
5	**Programming Shared Address Space Platforms**: Thread Basics, Why Threads? OpenMP: aStandard for Directive Based Parallel Programming, Dense Matrix Algorithms: Matrix VectorMultiplication, Matrix Matrix Multiplication, Issues in Sorting on Parallel Computers, BubbleSort and its Variants s	5
6	**Dynamic Programming:**Dynamic Programming: Overview of Dynamic Programming, Serial Monadic DP Formulations,Monadic DP Formulations, The Longest Common Subsequence Problem, Serial Polyadic DPFormulations, All Pairs Shortest Paths Algorithm**.**	6

SN	Title	Authors	Publisher
1	Introduction to Parallel Computing,	Ananth Grama	Pearson Education

SN	Title	Authors	Publisher
1	Fundamental of Paralle Processing,	Harry F. Jordan, Gita Alaghband,	Pearson Education
2	Parallel Programming	Michael Allen, Barry Wilkinson	Pearson Education

VII Semester
CT2437 – PE V: Data Mining

Objective	Course Outcome
1. To understand the concepts related to knowledge extraction and data preparation 2. To comprehend the concepts of association rule mining 3. To appreciate the working of supervised algorithms for data analysis 4. To understand various advanced data mining techniques	1. Use the data preprocessing techniques to prepare data for knowledge extraction 2. Apply the association rule mining on data 3. Apply various supervised techniques to mine the data 4. Describe various advanced concepts and techniques of data mining

Unit No.	Contents	Max. Hrs.
1	**Introduction to data mining (DM):** What is data mining, Related technologies - Machine Learning, DBMS, OLAP, Statistics Data Mining Goals, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications, Data pre-processing, Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies	8
2	**Data mining algorithms: Association rules** Motivation and terminology, Example, Basic idea: item sets, generating item sets and rules efficiently, Advanced Association Rule Techniques, Measuring the Quality of rules Correlation analysis	7
3	**Classification** Basic learning/mining tasks, inferring rudimentary rules: 1R algorithm, Decision trees, Covering rules, accuracy and error measures, evaluation of the accuracy of a classifier	7
4	**Prediction** The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbour), Linear models, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression	6

5	**Cluster Analysis** Clustering: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering -K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering – Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Strengths and Weakness; Outlier Detection, Clustering high dimensional data	6
6	**Advanced techniques, Data Mining software and applications** Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing). Bayesian approach to classifying text, Web mining: classifying web pages, extracting knowledge from the web, Data Mining software and applications	6

SN	Title	Authors	Publisher
1	Data Mining practical Machine Learning Tools And Techniques	Mark A. Hall Ian H. Witten ,Eibe Frank	ELSEVIER
2	Data Mining –Concepts and Techniques"	Jiawei Han & Micheline Kamber	ELSEVIER

SN	Title	Authors	Publisher
1	Data Mining Techniques	Arun K Pujari	

VII Semester

CT2438 – PE V: Embedded Systems

Objective	Course Outcome
Students will be able to: 1. To understand the types of processors & architectures used, design & co-design concepts used in ES. 2. To empower students to perform a rigorous analysis of a given problem, while taking into account the classical constraints of an embedded system. 3. To understand the concepts of Real Time Operating System. 4. To make students capable of deciding the type of operating system to use in ES. 5. Provide skills in embedded C programming.	Upon successful completion of the course, the student will be able to: 1. Use the basics of ES, decide the components of a particular ES. 2. Design & implement the hardware & software and integrate them to develop the final device. 3. Distinguish real-time embedded systems from other systems 4. Choose proper type of OS for the proposed embedded device. 5. Choose proper microcontroller / microprocessor for a particular ES design. 6. Develop the program for core functionality & communication of ES with other devices.

Unit No.	Contents	Max. Hrs.
1	Embedded Systems concepts and definition, Embedded System design: Requirement analysis, Hardware and Software Design, co-design, I/O interface co-design for distributed embedded system, Applications of Embedded system.	7
2	Embedded Computing platform Software Development tools and debugging technologies Host and Target machines, Cross Assemble &Cross Compiler, Linker/Loader for embedded software, study and use of simulator, EPROM emulator, In Circuit Emulator, concept of tool chain.	7
3	Concept of Real Time Operating System, Real Time IO, R/T Multitasking & multithreading processes, RTOS Task Scheduling models Inter-task Communication, memory management.	8
4	Overview of Embedded Operating Systems, Real Time operating System, Handheld operating system, Some Representative Embedded Systems.	8

5	ARM Architecture Block Diagram, Pin Description Memory Organization, Register Description, I/O Ports, Interrupts	6
6	Thumb Instruction Set and Programming Timers, Serial communication, interfacing with analog and digital circuits.	6

SN	Title	Authors	Publisher
1	"Introduction to Embedded Systems",	Shibu. K. V,	Tata Mcgraw Hill

SN	Title	Authors	Publisher
1	"Embedded System Design"	Steve Heath	Elsevier,
2	"An Embedded Software Primer"	David E. Simon	Pearson Education,

VII Semester

CT2439 – PE V: Operations Research

Objective	Course Outcome
1. To understand the meaning, purpose and tools of Operation Research, study the different phases involved in solving Operation Research problems, its application and limitations in business and industrial organization. 2. To understand and formulate Linear Programming problem, perform graphical analysis of the linear programming problem and solve the problem graphically, understand and solve Linear Programming problem by using different Simplex Methods (Simplex, Big M, 2 Phase, etc.). 3. To understand the concepts of duality in Linear Programming problem, properties of dual, and Integer Programming concepts and solve Linear Programming problem using dual method. 4. To understand different Allocation models (Assignment and Transportation models) and use them to solve various real life problems using different methods for solving assignment and transportation problems. 5. To understand different kind of restrictions on transportation model, degeneracy, study and apply sequencing and scheduling methods to solve real life problems. 6. To understand and solve the problem of constrained optimization using Karush-Kuhn-Tucker conditions. Study and use different Operation Research tools for solving optimization problem and applying different Operation Research models using this tools. eg. Mathematica.	Upon successful completion of the course, the student will be able to: 1. To describe at an intuitive level, the process of operations research. 2. To solve Linear Programming problems from the description of the real systems using different Operation Research models. 3. To solve Linear Programming problem using duality and find alternative constraints. 4. To solve Assignment and Transportation problem so as to optimize the results of allocation models. 5. To solve sequencing and scheduling problem. 6. To use the mathematical tools that are needed to solve optimization problem.

Unit No.	Contents	Max. Hrs.
1	**MODELING APPROACH** Definitions, Characteristics, Scope and Limitations of OR, phases of OR modeling OR tools and techniques of OR	8
2	**LINEAR PROGRAMMING** Linear Programming, assumptions and formulation of LP model, solution of LPP by graphical method, simplex method, Dual Simplex Method, Two Phase Simplex Method, Big M Method, Duality in LP	7
3	**ALLOCATION MODELS** Assignment models: Definition and assumptions, formulation and solution, multiple optimum solutions, prohibited assignment	7
4	**ALLOCATION MODELS** Transportation model Definition, Solution of Transportation Model, prohibited and preferred routes, and degeneracy in transportation problem.	6
5	**INTEGER PROGRAMMING** Definition, applications, Branch and Bound Method to solve Travelling Salesman Problem.	6
6	**Machine Sequencing:** n jobs through two machines, n jobs through three machines, n jobs through m machines, two jobs through m machines sequencing problem. Constrained Optimization: Karush-Kuhn-Tucker Conditions for Constrained Optimization, exposure to tools e.g. Mathematica	6

SN	Title	Authors	Publisher
1	Optimization technique	Radrin	pearson ,Ed. Publication
2	Problems in Operation Research	P.K.Gupta & Man Mohan	Khanna Pub.

SN	Title	Authors	Publisher
1	Introduction to Operation research	Hiller & Liberman	
2	Operation Research	Kantiswaroop & Gupta	S.Chand Pub
3	Principles of Operation Research	Wagner	PHI Pub.
4	Mathematical Models in Operation Research	J. K. Sharma	Mac millan Pub.

VII Semester
CT2440 – PE V: Bioinformatics

Objective	Course Outcome
1. To understand various kinds of biological data 2. To provide concepts of mathematics and statistics for handling biological data 3. To understand working computational algorithms and biological tools	1. To interpret various kinds of biological data for understanding etiology of disease 2. To develop algorithms for handling biological data 3. To use various biological tools for handling biological data

Unit No.	Contents	MaxHrs.
Prerequisite: Basic knowledge of Biology, Mathematics and Statistics		
1	Introduction to molecular biology, Probability and theoretical distributions, various biological database and tools in computational biology (NCBI, EMBL etc.), data acquisition for computational analysis.	6
2	Introduction to computational algorithms, sequence alignment, Smith-Waterman algorithm (local alignment), Needleman-Wunsch algorithm (global alignment), one-to-one sequence alignment, one-to-many sequence alignment, many-to-many sequence alignment	7
3	BLAST (online/offline), BioEdit software, BLASTZ, MUMmer for genome alignment, Phylogentic tree analysis, DNA pattern search using suffix-tree analysis, longest common substring search, introduction to online tools like ClustalW, clustal omega for multiple sequence alignment and phylogenetic tree construction	7
4	Computational analysis of next generation sequencing (NGS) data, alignment of NGS reads, identification and annotation of mutations, software tools for variant identification, differentially expressed gene analysis using RNAseq data.	8
5	Basic concepts in Statistical Genetics, mutation models, principal component analysis in genetics, linear mixed models in genetics, major public data source like HapMap	5
6	Case study for various biological tools	6

SN	Title	Authors	Publisher
1	Fundamentals of Bioinformatics	Harisha S.	Wiley
2	A Textbook of Bioinformatics Information-theoretic Perspectives of Bioengineering and Biological Complexes	Perambur S Neelakanta	World Scientific

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	**https://www.ncbi.nlm.nih.gov/**		
2	Bioinformatics : Sequence and Genome Analysis	David W. Mount	CBS Publishers

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

Computer Technology

VIII Semester

CT2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]

Mapped Program Outcomes : [illegible] 3 [illegible] **PSO** [illegible]

[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

Computer Technology

VIII Semester

CT2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	3 [illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Mapped Program Outcomes : [illegible]	

[illegible]

Dean (Acad)
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road
NAGPUR - 441 110

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

3rd **to 8th** Semester

Information Technology

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. IT-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	30	40	3
2	3	PC	IT2201	Digital Circuits & Microprocessors	**T**	3	0	0	3	3	30	30	40	3
3	3	PC	IT2202	Digital Circuits & Microprocessors Lab	**P**	0	0	2	2	1		60	40	
4	3	PC	IT2203	Object Oriented Programming	**T**	3	0	0	3	3	30	30	40	3
5	3	PC	IT2204	Object Oriented Programming Lab	**P**	0	0	2	2	1		60	40	
6	3	PC	IT2205	Data Structures and Program Design-I	**T**	4	0	0	4	4	30	30	40	3
7	3	PC	IT2206	Data Structures and Program Design-I Lab	**P**	0	0	2	2	1		60	40	
8	3	PC	IT2207	Computer Architecture & Organization (Self -Learning-Online)	**T**	3	0	0	3	3	30	30	40	3
9	3	PC	IT2208	Software Lab	**P**	0	0	2	2	1		60	40	
				TOTAL THIRD SEM		**16**	**0**	**8**	**24**	**20**				

Fourth Semster														
1	4	BS	GE2206	Discrete Mathematics and Probability Theory	**T**	3	0	0	3	3	30	30	40	3
2	4	PC	IT2251	Data Structures and Program Design-II	**T**	3	0	0	3	3	30	30	40	3
3	4	PC	IT2252	Data Structures and Program Design-II Lab	**P**	0	0	2	2	1		60	40	
4	4	PC	IT2253	Computer Networks	**T**	4	0	0	4	4	30	30	40	3
5	4	PC	IT2254	Computer Networks Lab	**P**	0	0	2	2	1		60	40	
6	4	PC	IT2255	Operating Systems	**T**	3	0	0	3	3	30	30	40	3
7	4	PC	IT2256	Operating Systems Lab	**P**	0	0	2	2	1		60	40	
8	4	PC	IT2257	Theory of Computation	**T**	3	0	0	3	3		60	40	
				TOTAL FOURTH SEM		**16**	**0**	**6**	**22**	**19**				

Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.02**	**Applicable for AY 2020-21 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

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SoE No. IT-201

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(Revised Scheme of Examination w.e.f. 2020-21 onward)

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	30	40	3
2	5	PC	IT2301	Data Base Management Systems	**T**	3	0	0	3	3	30	30	40	3
3	5	PC	IT2302	**Lab :** Data Base Management Systems	**P**	0	0	2	2	1		60	40	
4	5	PC	IT2303	Software Engineering (Self -Learning-Online)	**T**	3	0	0	3	3	30	30	40	3
5	5	PE		**Professional Elective - I**	**T**	3	0	0	3	3	30	30	40	3
6	5	PE		**Lab : Professional Elective-I**	**P**	0	0	2	2	1		60	40	
7	5	OE		**Open Elective-I**	**T**	3	0	0	3	3	30	30	40	3
8	5	OE		**Open Elective-II**	**T**	3	0	0	3	3	30	30	40	3
9	5	STR	IT2310	**Industrial Visit and Learning**	**P**	0	0	0	0	1		100		
					TOTAL FIFTH SEM	**18**	**0**	**4**	**22**	**21**				

Professional Electives -I

1	5	PE-1	IT2311	PE I: Web Programming
	5	PE-1	IT2312	PE I: Lab.: Web Programming
2	5	PE-1	IT2313	PE I: Data Analysis and Statistics
	5	PE-1	IT2314	PE I: Lab.: Data Analysis and Statistics
3	5	PE-1	IT2315	PE I: Customer Relationship Management
	5	PE-1	IT2316	PE I: Lab. Customer Relationship Management

Open Electives -I

1	5	OE I	IT2321	OE I: Industry 4.0
2	5	OE I	IT2322	OE I: Core JAVA

Open Electives -II

1	5	OE-II	IT2331	OE II: Introduction to Machine Leqarning
2	5	OE-II	IT2332	OE II: Information Security

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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SoE No. IT-201

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(Revised Scheme of Examination w.e.f. 2020-21 onward)

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	**T**	3	0	0	3	3	30	30	40	3
2	6	PC	IT2351	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	30	40	3
3	6	PC	IT2352	**Lab:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
5	6	PC	IT2353	Principles of Compiler Design	**T**	3	0	0	3	3	30	30	40	3
6	6	PC	IT2354	**Lab:** Principles of Compiler Design	**P**	0	0	2	2	1		60	40	
7	6	PE		**Professional Elective - II**	**T**	3	0	0	3	3	30	30	40	3
8	6	PE		**Lab : Professional Elective-II**	**P**	0	0	2	2	1		60	40	
9	6	OE		**Open Elective-III**	**T**	3	0	0	3	3	30	30	40	3
10	6	OE		**Open Elective-IV**	**T**	3	0	0	3	3	30	30	40	3
				TOTAL SIXTH SEM		**18**	**0**	**6**	**24**	**21**				

List of Professional Electives-I & II

Professional Electives -II				
1	6	PE-2	IT2361	PE II::Machine Learning
	6	PE-2	IT2362	PE II:Machine Learning Lab
2	6	PE-2	IT2363	PE II: Business Intelligence
	6	PE-2	IT2364	PE II: Lab.: Business Intelligence
3	6	PE-2	IT2365	PE II: Internet of Things
	6	PE-2	IT2366	PE II: Lab.: Internet of Things

Open Electives -III

1	6	OE-III	IT2371	OE-III: Industry 4.0
2	6	OE-III	IT2372	OE-III : Core JAVA

Open Electives -IV

1	6	OE-IV	IT2381	OE-IV : Introduction to Machine Learning
2	6	OE-IV	IT2382	OE-IV : Information Security

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TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2020-21 Onwards
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SoE No. IT-201

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	IT2401	Data Mining	**T**	3	0	0	3	3	30	30	40	3
2	7	PC	IT2402	Data Mining Lab	**P**	0	0	2	2	1		60	40	
3	7	PC	IT2403	Principles of Artificial Intelligence	**T**	3	0	0	3	3	30	30	40	3
4	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	30	40	3
5	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	30	40	3
6	7	PE		Lab.: Professional Elective IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	30	40	3
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	30	40	3
8	7	STR	IT2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	IT2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

List of Professional Electives-III, IV,V & VI

Professional Electives -III				
1	7	PE-3	IT2411	PE III: Cloud Computing
2	7	PE-3	IT2412	PE III:Real Time Systems
3	7	PE-3	IT2413	PE III: Network Security
4	7	PE-3	IT2414	PE III: Information Retrieval
Professional Electives -IV				
1	7	PE-4	IT2421	PE IV: Neural Network and Fuzzy Logic
	7	PE-4	IT2422	PE IV: Lab.: Neural Network and Fuzzy Logic
2	7	PE-4	IT2423	PE IV: Ethical Hacking and Cyber Forensics
	7	PE-4	IT2424	PE IV:Lab:Ethical Hacking and Cyber Forensics
3	7	PE-4	IT2425	PE IV: Human Computer Interaction
	7	PE-4	IT2426	PE IV: Lab:Human Computer Interaction
4	7	PE-4	IT2427	PE IV: Parallel Computing
	7	PE-4	IT2428	PE IV: Lab: Parallel Computing
Professional Electives - V				
1	7	PE-5	IT2431	PE V: Digital Image Processing
2	7	PE-5	IT2432	PE V: Distributed Systems
3	7	PE-5	IT2433	PE V: Coding Standardand and Technical Documentation
Professional Electives - VI				
1	7	PE-6	IT2441	PE VI: Advanced Computer Architecture
2	7	PE-6	IT2442	PE VI: Mobile Communication
3	7	PE-6	IT2443	PE VI: E-commerce
4	7	PE-6	IT2444	PE VI: Natural Language Processing

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TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2021-22 Onwards
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SoE No. IT-201

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eighth Semester														
1	8	STR	IT2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	IT2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
TOTAL EIGHTH SEM						**0**	**0**	**12**	**12**	**10**				
GRAND TOTAL						**86**	**0**	**44**	**130**	**162**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	1.02	Applicable for AY 2021-22 Onwards
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III Semester
GE2201 - Engineering Mathematics III

Objectives	Outcomes
[illegible]	[illegible]

Unit I: Finite Differences

[illegible] **(6 hours)**

Unit II: Laplace Transform

Laplace Transforms: [illegible] **(7 hours)**

Unit III: Z-transform

[illegible] **(6 hours)**

Unit IV: Fourier Series

[illegible] **(7 hours)**

Unit V: Partial Differential Equation

[illegible] **(7 hours)**

Unit VI : Fourier Transform : [illegible] **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reference Books:

SNo	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

III SEMESTER

IT2201	Digital Circuits and Microprocessors	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Learning Objective	Course Outcomes
1. To acquaint students with knowledge of basic electronics using digital number systems, Boolean algebra, logic gates. 2. To understand combinational and sequential circuits and their applications in real time. 3. Students will Study the hardware and software components, different modes of working and accessing memory & I/O ports of a microprocessor based system work together to implement system–level features. 4. Students will Study the assembly language programming structure of 8086 & various types of instruction set with encoding format.Students will Study to Design & interface the memory & I/O with 8086 & Working principal of 8255 PPI	**After completion of this course:** 1. Student will able to be to understand designing of basic circuits using logic gates and Boolean algebra, and designing of combinational logic circuits. 2. Student will able to understand designing of counters and registers. 3. Students will be able to understand the architecture and organization of microprocessor along with instruction coding formats,addressing modes, Instructions sets of 8086. 4. Students will be able to understand the interfacing of memory And I/O with 8086 and interfacing and working principle of 8255 PPI.

[illegible]	[illegible]	M[illegible]d[illegible]												[illegible]	
		[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

III SEMESTER

IT2201	Digital Circuits and Microprocessors	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment.**

	[illegible]	3	3												3
[illegible]															

Unit No.	Contents	Max. Hrs.
	Basic logic circuits, Boolean laws, Simplification of function using algebraic methods, basic combinational logic circuits: Encoder, Decoder, Multiplexer, De-multiplexer, Totem pole and tristate output.	
	Simplification of sum of product and product of sum, K-maps (Up to 4 Variable), simplification of completely/ incompletely specified functions using K-maps & Quine McCluskey's method, Introduction to Flip Flops (RS, D, T, JK), Memory organization using Flip-Flops. Racing Condition, J-K Master Slave Flip flop. Excitation tables, Conversion of one type to another type flips flop.	
3	Excitation tables, Introduction to sequential Circuits, Counters, Registers, Synchronous/Asynchronous Designs, modulo N counter with Reset or Clear facility, Design of Mod N counters Using K-map, Lock Free Counters.	
	Introduction: Internal architecture & pin diagram of 8086/8088 microprocessor, Minimum & Maximum mode, even & odd memory banks, Accessing memory & I/O ports, Memory mapping in minimum mode.	
	Programming with 8086/8088: Addressing Modes, Instruction set, Instruction encoding format, Timing diagram Assembler directives, 8086 programming examples, String operations, File I/O processing, Far & Near procedures, Macros, Timing & delay loops	
	Interfacing with 8086/8088: Memory interfacing, Programmable parallel ports, Intel 8255 PPI, Block diagram & interfacing, Modes & initialization.	

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BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

III SEMESTER

IT2201	Digital Circuits and Microprocessors	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment.**

Text Books				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	M[illegible]	[illegible]
[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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INFORMATION TECHNOLOGY

III SEMESTER

IT2202	Lab: Digital Circuits and Microprocessors	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment.**

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

Sr. No	Problem Statements
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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INFORMATION TECHNOLOGY

III SEMESTER

IT2203	Object Oriented Programming	L=3	T=0	P=0	Credits=4

Evaluation Scheme	MSEs-	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

[illegible]	[illegible]	M[illegible]												[illegible]	
		[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO1[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO2[illegible]	[illegible]	3[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO3[illegible]	[illegible]	[illegible]	3[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO4[illegible]	[illegible]	[illegible]	3[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO5[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		3	3	3											

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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INFORMATION TECHNOLOGY

III SEMESTER

IT2203	Object Oriented Programming		L=3	T=0	P=0	Credits=4
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	
Prerequisite Courses						

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit No.	Contents	Max. Hrs.
[illegible]	**UNIT I** [illegible]	[illegible]
[illegible]	**UNIT II** [illegible]	[illegible]
3[illegible]	**UNIT III** [illegible]	[illegible]
[illegible]	**UNIT IV** [illegible]	[illegible]
[illegible]	**UNIT V** [illegible]	[illegible]
[illegible]	**UNIT VI** [illegible]	[illegible]

Text Books			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Reference Books			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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INFORMATION TECHNOLOGY

III SEMESTER

IT2204	Lab: Object Oriented Programming	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	3 Hours

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

[illegible]	[illegible]	M[illegible]												[illegible]	
		[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sr. No	Experiments Base On
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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INFORMATION TECHNOLOGY

III SEMESTER

IT2205	Data Structures and Program Design- I	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Text Books/Reference Book			
Sr. No.	Title	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

III SEMESTER

IT2206	Lab : Data Structures and Program Design- I	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

Sr. No	Problem Statements
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible] 1 1 1 1 2 1 1 3 3 1 1 4 6 4 1 1 5 10 10 5 1
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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INFORMATION TECHNOLOGY

III SEMESTER

IT2207	Computer Architecture and Organization	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Learning Objective	Course Outcomes
Student will able to 1. Study the fundamentals and advance concepts of computer architecture and organization. 2. understand control unit operations and performances issues. 3. Study and apply the different arithmetic operation including the algorithms & implementation for fixed-point and floating-point numbers. 4. Study the hierarchical memory system including cache memories and virtual memory.	**Students will be able to** [illegible] D[illegible] [illegible] 3[illegible] [illegible]

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	[illegible]	3												3	
CO2	[illegible]	3	2											3	
CO3	[illegible]	3	3											3	
CO4	[illegible]	3	2											3	

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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INFORMATION TECHNOLOGY

III SEMESTER

IT2207	Computer Architecture and Organization	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Text Books			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]
Reference Books			
[illegible]	[illegible]	[illegible]	[illegible] 3rd [illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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INFORMATION TECHNOLOGY

III SEMESTER

IT2208	Lab: Software Lab	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

[illegible]	[illegible]	M[illegible]												[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Contents:

Module 1: Introduction [illegible]

Module 2: Python Functions, Modules and Packages: [illegible]

Module 3: Python Object and Classes: [illegible]

Module 4: Developing applications [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

III SEMESTER

IT2208	Lab: Software Lab	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Sr. .	Topics to be Covered	Sample Problem Statement
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] i) [illegible] ii) [illegible]
3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] [illegible]3 3[illegible]
[illegible]	[illegible] M[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] M[illegible]	[illegible]	[illegible]	

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Yeshwantrao Chavan College of Engineering

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

4th Semester

Information Technology

28 June 2019

IV Semester

GE2206 – Discrete Mathematics and Probability Theory

Objectives	Outcomes Students will be able to
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	Determine [illegible]
[illegible]	Calculate [illegible]

Unit I:

Mathematical Logic and Set Theory: [illegible] **(7 hours)**

Unit II:

Relations and Functions: [illegible] **(6 hours)**

Unit III:

Group Theory: [illegible] **(7 hours)**

Unit IV:

Rings (Definitions and Examples): [illegible]

Fuzzy Sets and Fuzzy Logic: [illegible] **(6 hours)**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

IV Semester

GE2206 – Discrete Mathematics and Probability Theory

Unit V:

Random variables and probability distribution: [illegible] **(6 hours)**

Unit VI:

Mathematical Expectation [illegible] **(6 hours)**

Text Books:

[illegible] [illegible] 3rd [illegible]

[illegible]

3 [illegible]

Reference Books:

[illegible]

[illegible] 3rd [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

IV SEMESTER

IT2251	Data Structures and Program Design-II	L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses	[illegible]				

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Text Books/Reference Book

Sr. No.	Title	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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Yeshwantrao Chavan College of Engineering

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INFORMATION TECHNOLOGY

IV SEMESTER

IT2252	Lab: Data Structures and Program Design-II	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses	[illegible]				

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Learning Objective	Course Outcomes
[illegible]	[illegible]

Sr. No	Problem Statements
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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INFORMATION TECHNOLOGY

IV SEMESTER

IT2253	Computer Networks	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	[illegible]

Course Outcomes	Statement	M[illegible]													
		[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO1	[illegible]	[illegible]	2	-	3	-	-	-	-	-	-	-	-	3	-
CO2	[illegible]	[illegible]	1	-	2	-	-	-	-	-	-	-	-	3	
CO3	[illegible]	[illegible]	-	1	2	3	-	-	-	-	-	-	-	3	
CO4	[illegible]	[illegible]	1	-	2	-2	-	-	-	-	-	-	-	3	

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV SEMESTER

IT2253	Computer Networks	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible] computer networks, LAN"s, MAN"s, WAN"s. topologies and their characteristics, [illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	**Transport Layer:** [illegible]	[illegible]
[illegible]	**Application Layer:** [illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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INFORMATION TECHNOLOGY

IV SEMESTER

IT2254	Lab: Computer Networks	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Objective	Course Outcome
[illegible]	[illegible]

[illegible]	[illegible]	M[illegible]												[illegible]	
		[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2	2											1	
[illegible]	[illegible]	2	2		1	3								2	
[illegible]	[illegible]	2	2		1	3								1	

Sr. No	Problem Statements
[illegible]	[illegible]
[illegible]	[illegible]
3[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

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INFORMATION TECHNOLOGY

IV SEMESTER

IT2255	Operating Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses	[illegible]				

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Course Learning Objective	Course Outcomes
Student will study : [illegible] 3[illegible]	**After undergoing this course students will be able to** [illegible] 3[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	**Introduction to OS:** [illegible]	[illegible]
[illegible]	**Process management:** [illegible]	[illegible]
3[illegible]	**Interposes communication:** [illegible]	[illegible]
[illegible]	**File systems : introduction,** [illegible]	[illegible]
[illegible]	**Memory management techniques: -** [illegible]	[illegible]
[illegible]	**Virtual memory:** [illegible] **Deadlocks** [illegible]	[illegible]

Text Books			
Sr. No.	**Title**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Reference Books			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

IV SEMESTER

IT2256	Lab: Operating Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Course Learning Objective	Course Outcomes
To [illegible]	**Students will be able to:** [illegible] [illegible] 3 [illegible]

Sr. No	Problem Statements
[illegible]	[illegible]
[illegible]	[illegible]
3 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

IV SEMESTER

IT2257	Theory of Computation	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Objective	Course Outcome
[illegible]	**After completion of the course students will be able to:** [illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible] omation, Equivalence between NFA and DFA , NFA with ε [illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

IV SEMESTER

IT2257	Theory of Computation	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

Text Books				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd [illegible]	[illegible]	[illegible]

Reference Books				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
5th Semester
Information Technology

28 June 2020

V Semester

IT 2301 - Data Base Management Systems

Objective	Course Outcome
The student should be able to 1) Understand Database management system's basic operations & design process using ER, EER diagram, SQL and with the use of Normalization. 2) Understand Transaction with ACID properties and their implementation. 3) Understand various storage structures, Query Processing and query optimization techniques to build a robust database management system. 4) Understand concurrency control mechanism using various concurrency control protocols.	**On completion of this course, the student will be able to** 1) To obtain sound knowledge in the theory, principles and applications of database management system. 2) Design and develop data model given their specifications and within performance and cost constraints. 3) Acquire and understand new knowledge, use them to develop data centric application and to understand the importance of lifelong learning. 4) Perform experiments in different disciplines of database management system.

Unit No.	Contents	Max. Hrs.
1	Introduction to Database Management System: General File System vs. DBMS, Data Abstraction, Data Independence, Keys, Data Modeling using the Entity Relationship(ER) Model, The enhanced Entity Relationship(EER) model.	8
2	Relational Model: Structure of Relational Databases, The Relational Algebra and Relational Calculus(TRC & DRC) Introduction to SQL Programming: (DDL, DML, Joins, Nested Queries/Sub Queries/Inner Queries) Integrity Constraints.	7
3	Database Design: Functional Dependency and Normalization for Relational Databases, Desirable properties of decomposition.	7
4	Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions. Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results.	8
5	Transaction Processing: Introduction to Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels.	8
6	Concurrency control Techniques: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, and Timestamp-Based Protocols. Data Control Language: GRANT, REVOKE; Concept of Triggers and Views.	8

V Semester
IT 2301 - Data Base Management Systems

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Database System	5th Edition(2006)	Elmasri & Navathe	
2	Database System Concepts	6th Edition, (2010)	Abraham Silberschatz, Henry F. Korth and S. Sudarsha	McGraw-Hill Education
3	Database Management Systems	Second Edition	Raghu Ramakrishnan, Johannes Gehrke	McGraw-Hill, 2002

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database in Depth – Relational Theory for Practitioners		C.J. Date	O`Reilly Media, 2005
2	Database design, Application Development and Administration	4th Edition(2008)	Michael Mannino	

V Semester

IT 2302- Data Base Management Systems Lab

List of Practical's

Sr. No..	Problem Statements
1	Database design using E-R Model for: Payroll processing system, Banking system Library Information System Student Information System, etc.
2	Mapping of E-R model to relational Schema and creation of Tables using DDL (Data DefinitionLanguage).
3	Modification of Database objects using DDL and DML
4	Querying the Database based on various inbuilt functions (Date Function, Numeric Function, Character Function, Conversion Function, Miscellaneous Function, etc.).
5	Querying the Database based on Set, Arithmetic and Logical operator.
6	Implementation of Joins(all types).
7	Queries based on Data Grouping Restricting and sorting.
8	To create and manipulate various database objects of the Table using Views:
9	Querying the Database based on to create triggers for various events such as insertion, updation, etc.
10	Exploring NOSQL Database.

V Semester

IT 2303 - Software Engineering

(Self-learning- online)

Objective	Course Outcome
The student should be able to 1. To understand the different Software Process Model and Architectural Style for Developing a Software 2. To acquire knowledge of Different Software Testing Techniques 3. To understand the various UML Diagrams 4. To understand different Tools and Techniques for Engineering Practice.	**On completion of this course, the student will be able to** 1. Analyze and evaluate the different software process model and appropriate architectural style while developing a software 2. Understand and Apply the software testing techniques in a variety of ways to test the software. 3. Analyze and design various UML diagram and UML based design and analysis with the help of various diagrams. 4. Demonstrate an ability to use the techniques and tools necessary for engineering practice

Unit No.	Contents: NPTEL Videos As Per Syllabus	Max. Hrs.
1	1.Introduction to Software Engineering ,2 Introduction to Software Engineering,3 Overview of Phases 4 Overview of Phases,5 Requirements Engineering / Specification,25 Software Evolution, 8 Systems Modeling Overview.	8
2	17 Architectural Design,16 Class and Component Level Design, 9 Process Modeling - DFD , Function Decomp,10 Process Modeling - DFD, Function Decomp ,11 Data Modeling - ER Diagrams, Mapping , 15 Design Patterns, 14 Software Design - Primary Consideration, 26 Agile Development.	8
3	18 Software Testing – I, 19 Software Testing – II.	6
4	21 Software Metrics and Quality, 22 Verification and Validation, 29 Introduction to Project Management 30 Project Scope Management, 31 Project Time Management,32 Estimation – I,33 Estimation - II 34 Project Quality Management,35 Quality Management Systems – I,36 Quality Management Systems 37 Project Configuration Management,38 Project Risk Management,39 Other PM Processes, 13 Production Quality Software – Introduction.	7
5	12 Data Modeling - ER Diagrams, Mapping.	7
6	23 Case Study,24 Case Study, 27 Software Reuse,28 Reuse Continued	6

Semester
IT 2303 - Software Engineering
(Self-learning- online)

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Software Engineering -A Practitioner's Approach	Seventh Edition	Roger S. Pressman	Pressman
2	Object Oriented Software Engineering	2nd Edition,2005	Lethbridge and Pearson	Pearson Education

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Software Engineering	10th Edition, 2014,	I. Somerville	Oxford University Press
2	An integrated approach to software Engineering'	3rd Edition,1991,	Dr. Pankaj Jalota	Narosa Pub

Reference: NPTEL Guru Course Name: Software Engineering

Instructors: Prof. Rushikesh K Joshi , Prof. Umesh Bellur , Prof. N. L. Sarda, IIT Bombay

http://122.15.102.21/LocalGuru

Username : ycce, Password: ycce

http://122.15.102.21/LocalGuru/listLectures.php?cid=1daf52be74f11d45&lid=&opt=&pg=1

V Semester

PE-1: IT 2311 - Web Programming

Objective	Course Outcome
The student should be able to 1. Get familiar with basics of HTML, HTML tags, DHTML CSS. 2. Get familiar with client server architecture and able to develop a web application using java technologies 3. Get familiar with markup languages with their structures and syntax. 4. To get familiarised with PHP frame work	On completion of this course, the student will be able to 1. Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS. 2. Understand client server architecture and Develop interactive web pages using java script and client and server side programming. 3. Understand the concept of Markup languages and Make the use of mark up languages in development of web pages. 4. Understand the concepts of PHP and Develop web applications using PHP

Unit No.	Contents	Max. Hrs.
1	Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames	8
2	Dynamic HTML (DHTML): Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections	8
3	Scripting Languages:- Java Script objects and forms, server side and client side scripting languages	6
4	XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
6	Introduction to AngularJS, AngularJS Expressions: Numbers, Strings, Objects, Arrays, Expressions using {{ }} and ng-bind. Modules: Creating a module, adding a controller & directive, myApp.js, myCtrl.js, Loading library. Directives: Data Binding, ng-init, ng-repeat, ng-app & ng-model directives, custom directives.2 way binding, Validating User Input, Status, ng-empty, ng-touched, ng-valid, ng-pending. Data Binding: Synchronization between model and view. AngularJS Controllers: ng-controller, Controller Methods, External Files.Scope: $scope, understanding the scope, $rootScope	6

V Semester

IT 2311 - PE-1: Web Programming

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The Complete Reference HTML and XHTML		Thomas A.Powell	McGraw Hill Pub
2	Learning angular JS		Dayley, Brad Dayley	

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites		Robin Nixon	

V Semester

IT 2312 - PE-1: Lab Web Programming

List of Practical's

Sr. No..	Problem Statements
1	Program based on HTML Tags
2	Program based on Table Tag
3	Program based on HTML Forms
4	Program based on CSS
5	Program based on JavaScript
6	Program based on JavaScript (Advanced)
7	Program based on Node JS(Linear)
8	Program based on Node JS(Advanced)
9	Program based on Angular JS (Linear)
10	Program based on Angular JS (Advanced)

V Semester

IT 2313 - PE-1: Data Analysis and Statistics

Objective	Course Outcome
The student should be able to 1. Know basics of data analysis using statistics and probability. 2. Become familiar with different statistical methods. 3. Determine parameters given in problem statement, analyze it and find the solution and Draw inference from obtained solutions and know applications of data analysis. 4. Use and explore a tool to perform data analysis using it	On completion of this course, the student will be able to 1. Apply fundamental concepts of statistics and probability for data analysis(PO1-3) 2. Apply appropriate statistical methods on simple datasets(PO2-3) 3. 3.Formulate and solve problems in a systematic manner and Interpret output obtained from statistical analysis on datasets.(PO2-3, PO4-3) 4. Obtain hands on experience with some popular software (like R)for analysis and visualization of data (PO2-3,PO4-3,PO5-3)

Unit No.	Contents	Max. Hrs.
1	INTRODUCTION TO STATISTICS & PROBABILITY: Statistics,–Definition, Types. Types of variables–organizing data , Descriptive Measures. Basic definitions and rules for probability, conditional probability independence of events, Baye's theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.	6
2	SAMPLING DISTRIBUTION: Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques.	7
3	ESTIMATION THEORY: Estimation: Point and Interval estimates ,confidence intervals ,calculating interval estimates for population parameters of large sample and small samples, determining the sample size	6
4	TESTING OF HYPOTHESIS: Hypothesis testing: statistical hypothesis null hypothesis, tests of hypothesis and significance, type I and type II errors, one tailed and two tailed tests , p-value one sample tests for means and proportions of large samples (z-test), one sample tests for means of small samples (t-test), Chi-square tests for goodness of fit. Analysis of variance.	7
5	NON-PARAMETRIC METHODS: Sign test for paired data. Rank sum test. Mann –Whitney U test and Kruskal Wallis H test. One sample run test, rank correlation. Kolmogorov-Smirnov –test.	7
6	REGRESSION and CORRELATION: Estimation of regression line by least square method, linear and multiple regressions, Correlation analysis, Time series analysis: components of Time series, Variations in time series, trend analysis.	7

V Semester
IT 2313 - PE-1: Data Analysis and Statistics

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Probability and Statistics ,	Third edition .	Murray R. Spiegel, John J.Schiller, R AluSrinivasan	Mc Graw Hill education
2	Statistics for Management, ,	7th edition	Levin R.I. and Rubin D. S.	Prentice Hall India Pvt.Ltd., New Delhi, 2001

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Business forecasting	8th Edition	John Hanke,Dean W. Wichern	Prentice Hall India

V Semester

IT 2314 - PE-1:Lab Data Analysis and Statistics

List of Practical's

Sr. No..	Problem Statements
1	Introduction to R, R Objects , R datasets, packages , R installation and executing basic commands in R
2	Using objects in R- vectors,□lists,□arrays□,matrices□,tables□,data frames□.
3	Data import / export using R
4	Demonstrate Statistical functions using R- Measurement of Central tendency and Dispersion and frequency distribution
5	Demonstrate Finding probability and probability distribution using R
6	Demonstrate sampling and sampling distribution using R
7	Demonstrate Hypothesis testing using R
8	Demonstrate linear and multiple Regression using R
9	Demonstrate Visualization using R

V Semester

IT 2315 - PE-1: Customer Relationship Management

Objective	Course Outcome
The student will study 1. To understand the principles of CRM and concepts of Salesforce CRM 2. To Understand object, Tabs and Security Features in Salesforce CRM 3. To Understand Automated Business Process and Approval Process in CRM 4. To Understand Advanced Featured in Salesforce CRM	On completion of this course, the student will be able to 1. Analyze and Evaluate the CRM and Concepts of Salesforce CRM 2. Understand and Apply the Security Features of Salesforce CRM 3. Analyze and Evaluate the Automated Business Process and Approval Process in CRM 4. Understand and Apply the Advanced Features in Salesforce CRM

Unit No.	Contents	Max. Hrs.
1	**Introducing the Force.com Platform**. - Introduction to the Force.com Platform. The Basics of an App's User Interface. The Benefits of a Force.com Data-Centric, Collaborative Apps, The Technologies Behind a Force.com Platform App, Multitenant Architecture, A Metadata-Driven Development Model, Apex . Custom User Interface Mobile, AppExchange.	7
2	**Objects and Tabs:** Introduction to Objects ,The Position Custom Object, Introducing Tabs , Setup Detail Pages and Related Lists ,Introduction to Fields , Advanced Fields, Data Validation, and Page Layouts , Adding Advanced Fields , Introduction to Picklists , Field Dependencies , Dependent Picklist ,Custom Formula Fields , Dynamic Default Values , Validation Rules ,Page Layouts , Page Layout Editor Group Fields Edit Field Properties , Page Layouts , Compact Layouts.	7
3	**Relationships:** Introduction to Relationship Custom Fields, Page Layout Properties, Record Highlights, Introduction to Search Layouts, Additional Search Layouts Managing Review Assessments, Introduction to Roll-Up Summary Fields, Many-to-Many Relationship, Customizing Related Lists in a Many-to-Many Relationship.	6
4	**Securing and Sharing Data:** Controlling Access to Data in App, Data Access Concepts. Controlling Access to Objects, Introduction to Profiles ,Standard Profiles ,Introduction to Permission Sets ,Profiles and Permission Sets ,Introduction to Field-Level Security ,Controlling Access to Records, , Set Org-Wide Defaults, Introduction to Hierarchies ,Comparing Roles, Profiles, and Permission Sets ,Role, Introduction of Sharing Rules , Define a Public Group ,Define Sharing Rules ,Introduction to Manual Sharing , Manual Sharing Rule ,Displaying Field Values and Page Layouts According to Profile ,Overriding Sharing with Object Permissions ,Delegated Administration Groups .	8
5	**Automating Business Processes**: Introduction to Process Builder, Process Builder: A Closer Look Creating a Process That Updates Field Values, Introduction to Queues, Introduction to Scheduled Actions, Email Alerts, Introduction to Email Templates, Introduction to Approvals, Planning for Approval Processes Analyzing Data with Reports and Dashboards, Introduction to Reports, Report Formats	7
6	**Apex and Lightning Aura:** Introduction to Apex, Collections, SOQL and SOSL, DML Operations, Controllers In APEX Using Apex Class and Triggers, Asynchronous APEX, Batch APEX, Introduction to Aura component, attributes handling in Aura component.	7

V Semester

IT 2315 - PE-1: Customer Relationship Management

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Force.com Platform Fundamentals An Introduction to Custom Application Development in the Cloud		Phil Choi, Chris McGuire Caroline Roth	salesforce.com
2	Salesforce Handbook Paperback – 20 Mar 2011		Wes Nolte, Jeff Douglas	Publisher: Lulu.com

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Salesforce CRM: The Definitive Admin Handbook Paperback –	Second Edition	Paul Goodey	Packt Publishing Limited

V Semester

IT 2316 - PE-1:Lab Customer Relationship Management

Objective	Course Outcome
Student will study: 1. To Understand object, Tabs and Security Features in Salesforce CRM 2. To Understand Automated Business Process and Approval Process in CRM	After completion of the course students will be able to: 1. Understand and Apply the Security Features of Salesforce CRM 2. Analyze and Evaluate the Automated Business Process and Approval Process in CRM

List of Practical's

Sr. No..	Problem Statements
1	Demonstrate the Standard and Custom Objects
2	Demonstrate the Page Layout Model
3	Demonstrate the Master Detail and Lookup Relationship
4	Demonstrate the OWD, Object and Record Level Securities
5	Demonstrate the Profiles, Roles and Permission Sets
6	Demonstrate the Sharing and Manual Sharing Rules
7	Demonstrate Field Level Securities
8	Demonstrate the Approval Process and Process Builder
9	Demonstrate the Reports and Dashboard
10	Demonstrate the Standard and Custom Controller
11	Write a Program to Demonstrate the Apex Triger
12	Demonstrate the Lighting Component.

V Semester

IT 2321 - OE-1: Industry 4.0

Objective	Course Outcome
Students will: 1) Able to learn an introduction to Industry 4.0 (or the Industrial Internet) 2) Will able to understand its applications in the business world. 3) Will able to understand Business Model and Reference Architecture in Industry 4) Will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.	After completion of this course: 1) Students will be Understand the basics of IoT and basics of Industry 4.0. 2) Students will be Understand Business Model and Reference Architecture 3) Students will be able to understand the different Business issues in Industry 4.0 and how to solve them. 4) Students will be able to understand the need of Security and Fog Computing and applications of IIoT.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, IoT Sensing and Actuation, IoT Connectivity, IoT Networking. Introduction to Industry 4.0: History, Concept, The Journey so far: Developments in USA, Europe, China and other countries, The Fourth Revolution, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, Globalization and Emerging Issues.	7
2	Basics of Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Life-cycle Management, Augmented Reality and Virtual Reality, Introduction to Artificial Intelligence, Big Data and Advanced Analysis, Cyber-Security in Industry 4.0, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems.	7
3	Business Model and Reference Architecture: IIoT-Business Models, IIoT Reference Architecture, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.	6
4	Business issues in Industry 4.0:IIoT case studies, Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world	6
5	Security and Fog Computing: Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT. Application Domains: Factories and Assembly Line, Food Industry, Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications),	7
6	Industrial IOT- Application domain: Milk Processing and Packaging Industries, Manufacturing Industries, Virtual Reality Lab, Steel Technology Lab. Facility Management, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries. Facility Management.	7

V Semester
IT 2321 - OE-1: Industry 4.0

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Industry 4.0: The Industrial Internet of Things		Alasdair Gilchrist	Apress
2	Industrial Internet of Things: Cyber manufacturing Systems		Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat	Springer

V Semester

IT 2322 - OE-1: Core JAVA

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	After completion of the course students will be able to: 1. Demonstrate the understanding of Object oriented concepts. 2. Apply the programming language JAVA efficiently in object oriented software development 3. Able to analyze problem statement and identify appropriate objects and methods 4. Design and implement a small programs using classes

Unit No.	Contents	Max. Hrs.
1	Introduction to Programming Methodologies, Introduction to Object oriented programming, Objects and Classes, Characteristics of OOP, Encapsulation and data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Structured Versus Object oriented programming, Merits and demerits of object oriented methodology, introduction to Java as OOP language	7
2	Building blocks of java, Data types, Variable declarations, operators and Assignments, control structures, Identifying objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	7
3	Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	6
4	Arrays and Strings: Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes	6
5	Exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses	7
6	I/O Streams: Introduction to stream classes, use of stream classes, I/O stream, bytes stream, character stream, pre-defined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files ,transient and volatile modifiers	7

V Semester
IT 2322 - OE-1: Core JAVA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Thinking in Java		Bruce Eckel	Prentice Hall

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Programming with Java		E Balagurusamy	TATA Mc Graw-Hill
2	Java2CompleteReference		Herbert Schildt	Mc Graw-Hill

V Semester

IT 2331 - OE-2: Introduction to Machine Learning

Objective	Course Outcome
1. To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To learn to apply supervised and unsupervised learning algorithms to solve the problem	After undergoing the course, student will be able to: 1. Understand various models of supervised and unsupervised learning 2. analyze a problem and identify appropriate learning paradigm to solve it. 3. apply supervised learning for the given set of labeled samples and design the model to meet the desired output 4. apply unsupervised learning for the given set of samples, and design the model to meet the desired output

Unit No.	Contents	Max. Hrs.
1	Introduction to machine learning. What Is Machine Learning, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Supervised and Unsupervised Learning, Reinforcement Learning, Generalization, Overfitting, and Underfitting	6
2	Supervised Learning-1: k-Nearest Neighbors, linear Models, Naive Bayes Classifiers, Decision Trees	6
3	Supervised Learning-2: Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers, The Decision Function, predicting Probabilities, Uncertainty in Multiclass Classification	6
4	Unsupervised Learning: *k*-Means Clustering , Expectation-Maximization Algorithm, Supervised Learning after Clustering , Hierarchical Clustering, Choosing the Number of Clusters	6
5	Design and Analysis of Machine Learning Experiments: Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Comparing Two Classification Algorithms.	5
6	Advances in Machine Learning: Introduction to learning using Neural networks, shallow and deep networks.	6

V Semester
IT 2331 - OE-2: Introduction to Machine Learning

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Machine Learning, Second Edition		Ethem Alpaydın	The MIT Press
2	Introduction to Machine Learning with Python, A Guide for Data Scientists		Andreas C. Müller and Sarah Guido	ORIELLY

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Machine Learning	Tom M. Mitchel	McGraw Hill	
2				

V Semester

IT 2332 - OE-2: Information Security

Objective	Course Outcome
Student will able: 1. To focus on the foundations Computer Security and Threats to security 2. To understand basic concepts of Threats and Intruders. 3. To demonstrate and understand the concepts and application of Communication, Server, System , Network, Internet and cyber security and understanding standards. 4. To know the working of Server security, various System and Application Security, IT Act.	After completion of the course: 1. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security. 2. Students will be able to understand how to protect information and provide authentication using Communication, Server, System, Network, Internet and cyber security 3. Students will able to effectively use of encryption standards and its implementation. 4. Students will be able to understand various technologies and Internet Application with the understanding of IT Act and its protection.

Unit No.	Contents	Max. Hrs.
1	**Introduction**- Computer Security, History of Computer security, Computer Security Concepts (CIA), The OSI security architecture, security attacks, security mechanism, a model for network security, Threats to security, Computer System Security and Access Controls (System access and data access), Key Terms.	7
2	**Malicious software:** Types of Malicious software, Viruses, Virus countermeasures, Worms , Trojan horse, bombs, Trap doors, spoofs, Email virus, Macro viruses, Remedies, Intruders, vulnerabilities & threats, distributed Denial of service attack and Firewalls.	8
3	**Communication security**- Encryption, classical encryption techniques, Block cipher and data encryptions standards, advance encryption standard.Kerberos,X.509	8
4	**Principles of public key cryptosystems:** RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm. Hash Function: Authentication requirements - authentication functions - message authentication code hash functions - birthday attacks	8
5	**Network and Internet Security-** Transport-Level Security-Secure Socket Layer and Transport Layer Security, SSL Architecture. Electronic Mail security-Pretty Good Privacy, S/MIME.	7

V Semester
IT 2332 - OE-2: Information Security

6	System security and cyber security - Security for network server, web servers, Intrusion detection techniques,intruders,Passwordmanagement,. Cybercrime and Computer Crime Types of Computer Crime, Law Enforcement Challenges, Working With Law Enforcement , Intellectual Property[Types of Intellectual Property, Intellectual Property Relevant to Network and Computer Security], Ethical Issues [Ethics and the IS Professions, Ethical Issues Related to Computers and Information Systems],Security tools, The Information Technology ACT, 2008.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Cryptography and Network Security		William Stallings	Pearson Education
2	Computer Security: Art and Science		Matt Bishop	Addison Wesley

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to computer Security		Mathew Bishop	Pearson
2	Network Security: Private Communication in a Public World (Prentice Hall Series in Computer Networking and Distributed)		Charlie Kaufman, Radia Perlman, Mike Speciner	Pearson Education
3	Computer Security		Dieter Gollmann	John Wiley & Sons

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

6th Semester

Information Technology

28 June 2019

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcomes
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Unit – 1 - Principle of Management

[illegible]

UNIT-2: Legal Aspects of Management

[illegible]

UNIT-3: Human Resource Management

[illegible]

UNIT-4: Project Management

[illegible]

UNIT-5: Marketing Management

[illegible]

VI Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

[illegible]

Text book and Reference

[illegible]

VI Semester

IT2351 - Design & Analysis of Algorithms

Objective	Course Outcome
The student should be able to 1. Study asymptotic notations and recurrence relation. Analysis of iterative and recessive algorithms, complexity of algorithms 2. Use of various algorithmic design techniques in problem solving 3. Performance analysis (time and space complexities) of algorithms in best, worst and average cases. 4. How to synthesize and design efficient algorithms for real world problems	**After completion of the course students will be able to** 1. Understand asymptotic analysis of iterative and recursive algorithms, complexity of algorithms 2. Apply important algorithmic design techniques for problem solving 3. Analyze the performance of algorithms 4. Synthesize and design efficient algorithms for real world problems

Unit No.	Contents	Max. Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions.	8
2	Asymptotic notations of analysis of algorithms, analyzing control structures, worst case and average case analysis, amortized analysis, External Sorting, lower bound proof.	7
3	Divide and conquer basic strategy, quick sort, merge sort etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, optimal binary search trees, Matrix-chain Multiplication, traveling salesman problem.	8
5	Connected components, Branch and bound, Backtracking basic strategy, 8 – Queen's problem, graph coloring, Hamiltonian cycles etc.	8
6	NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook's Theorem, decision and optimization problems, polynomial reduction	8

VI Semester
IT 2351 - Design and Analysis of Algorithms

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Algorithms	2nd Edition	Horowitz, Sahani, Rajsekharan	Silicon Press
2	Introduction to Algorithm	3rd Edition, 2009	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	MIT press
3	Fundamentals of Algorithms	1st edition,1995	Brassard, Bratley	Prentice Hall
4	The Algorithm Design Manual	2nd Edition	Steven S. Skiena	Springer

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation,	3rd Edition, 2013	Michael Sipser	Cengage Learning
2	Algorithms	1st Edition, 2006	S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani	
3	The art of Computer programming Vol. 3	2nd Edition, 1998	Donald E. Knuth	Addison-Wesley

VI Semester

IT 2352- :Lab- Design & Analysis of Algorithms

Course Learning Objective	Course Outcomes
Students will study : 1. Study of different analysis method 2. Study of different techniques of algorithm like divide and conquer, greedy and dynamic.	Students will be able to: 1. Understand different analysis method and analyze it. 2. Understand different techniques and apply it.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT2352.1	Understand different analysis method and analyze it	3													
IT2352.2	Understand different techniques and apply it		3												
IT2352		3	3												

List of Practical's

Sr. No..	Problem Statements
1	Implement and analyze different sorting algorithms.
2	Practical Based on Amortized Analysis
3	Practical Based on Minimum Cost Spanning Tree
4	Practical Based on An Activity Scheduling Problem
5	Practical Based on Single Source Shortest Path
6	Practical Based on Dynamic Programming
7	Practical Based on divide and conquer

VI Semester

IT 2353 - Principles of Compiler Design

Objective	Course Outcome
The student should be able to 1. To study the basic concept of compiler fundamentals & design of lexical analysis 2. To study the different parsing techniques. 3. To study the construction of parsers for different CFG. 4. To study Syntax Directed Translation of different programming language constructs. 5. To study symbol table organization & error detection & recovery 6. To study code optimization & designing of code	**On completion of this course, the student will be able to** 1. Understand different phases of compilation process and lexical analyzer tool "Lex" OR "Flex" 2. Apply parsing techniques to design and implement parsers using YACC /Bison tool 3. Apply syntax directed translation scheme to programming language constructs and analyze errors in lexical and syntactic phase of compiler 4. Apply different optimization techniques in the design of compiler and generate target code

Unit No.		Max. Hrs.
	Introduction to Abstract Model & Grammar , Introduction to Compilation Process, Compilers & Translators, Phase structure of Compiler, Role of Lex, Design of Lexical Analysis.	6
	Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, and Bottom up Parsing, Predictive Parsers, and Recursive Decent Parser	8
3	Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table	7
	Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/Flex, Yacc /Biason).	8
	Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase	6
	Introduction to Code Optimization, The principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.	8

VI Semester

IT 2353 - Principles of Compiler Design

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
	Compilers Principles, Techniques & Tools	2nd Edition	Alfred V. Aho , Ravi Sethi , Jeffrey D.	Addison Wesley.
	Principles of Compiler Design	2nd Edition	Alfred V. Aho ,Jeffrey D. Ullman	Addison Wesley.

	Compiler Design	4th edition	O.G. Kakde	Laxmi Publication
	Introduction to Compiling Techniques: First Course Using ANSI C, LEX and YACC	2nd Revised edition Edition	J.P. Bennett	Alfred Waller Ltd

VI Semester
IT 2354- : Lab - Principles of Compiler Design

Course Learning Objective	Course Outcomes
Students will study: 1. To study the different phases and passes of compiler design. 2. To write a program using Lex Tool. 3. To write a program using YACC Tool	After completion of the course: 1. Students will be able to understand and apply Lex Tool for the development of program. 2. Students will be able to understand and apply YACC Tool for the development of program.

List of Practical's

Sr. No	Experiments Base On
1	LEX TOOL
2	YACC TOOL

VI Semester

PE-II: IT 2361 - Machine Learning

Objective	Course Outcome
The student should be able to 1. To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To understand different methods of evaluation of machine learning models	After undergoing the course, student will be able to: 1. Understand various models of supervised and unsupervised learning 2. analyze a problem and identify the machine learning algorithm appropriate for its solution 3. apply supervised learning for the given set of labelled samples and design the model to meet the desired needs 4. apply unsupervised learning for the given set of samples, and design the model to meet the desired needs

Unit No.	Contents	Max. Hrs.
1	**Introduction to machine learning**. What Is Machine Learning, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Supervised and Unsupervised Learning, Reinforcement Learning, Generalization, Over-fitting, and Under-fitting	(6)
2	**Supervised Learning-1:** k-Nearest Neighbors, linear Models, Naive Bayes Classifiers, Decision Trees	(6)
3.	**Supervised Learning-2:** Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers, The Decision Function, predicting Probabilities, Uncertainty in Multiclass Classification, multivariate classification and regression.	(6)
4	**Unsupervised Learning**: *k*-Means Clustering , Expectation-Maximization Algorithm, Supervised Learning after Clustering , Hierarchical Clustering, Choosing the Number of Clusters	(6)
5	**Design and Analysis of Machine Learning Experiments:** Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Bootstrapping, Measuring Classifier Performance, Hypothesis Testing, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms,Basics of feature engineering.	(5)
6	**Advances in Machine Learning**: Combining multiple learners, bagging and boosting, introduction to learning using Neural networks, shallow and deep networks.	(6)

VI Semester
PE-II: IT 2361 - Machine Learning

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Machine Learning, Second Edition		Ethem Alpaydın	The MIT Press
2	Introduction to Machine Learning with Python, A Guide for Data Scientists		Andreas C. Müller and Sarah Guido	ORIELLY

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	Machine Learning		Tom M. Mitchel	McGraw Hill

VI Semester

IT 2362 - PE-II: Lab - Machine Learning

Course Learning Objective	Course Outcomes
To understand the working of Machine learning, algorithms practically.	Students will be able to: Implement the Machine learning algorithms to solve the given problem

Sr. No..	Problem Statements
1	Experiment on k-Nearest Neighbors, ,
2	Experiment on Naive Bayes Classifiers
3	Experiment on Decision Trees
4	Experiment on Kernelized Support Vector Machines
5	Experiment on *k*-Means Clustering
6	Experiment on Hierarchical Clustering
7	Experiment on K-Fold Cross-Validation
8	Experiment on combining multiple learners
9	Experiment on neural networks using backpropagation algorithm
10	Experiment on deep neural networks

VI Semester

IT 2363 - PE-II: Business Intelligence

Objective	Course Outcome
Student will : 1. Understand the business relevance and technical basics of business intelligence (BI), knowledge management (KM), and decision support and describe how OLAP is different from OLTP. 2. Appreciate the use of SQL for BI 3. Understand principles of dimensional modeling. 4. Understand Business intelligence system architecture, its building blocks, life cycle of a typical BI project. 5. Get acquainted to BI tool	After completion of the course: 1. Students will be able to : ➢ Assemble BI as a Process, identify its application in various domains and functional area, its roles and responsibilities. ➢ Identify functions of building blocks in N_tier BI ecosystem ➢ Identify different stages in Lifecycle of a BI project. ➢ Differentiate between traditional BI and self service BI **(PO1-2)** **2.** Apply SQL as a universal language for BI (**PO23)** **3.** Model a business scenario; identify the metrics, indicators, various dimensions, and aggregation strategies and make recommendations to achieve the business goal (**PO3-3)** **4.** Obtain hands on experience with some popular BI software for analysis, reporting, visualization of results **(PO1-2, PO2-2,PO3-2,PO5-3)**

Unit No.	Contents	Max. Hrs.
1	**Introduction to Business Intelligence** What is business intelligence, why do we need BI, EIS,MIS,DSS& BI, information pyramid- data, information, Knowledge & intelligence. Basis For operational, tactical & strategic decision making , OLTP vs. OLAP, Requirement gathering in BI through business question BI in various domains and functional area.	6.
2	**SQL the universal language for Business Intelligence** Introduction to RDBMS, Language for retrieving data from a database, various clauses in a SQL retrieving data from multiple tables- joins filtering, sorting & grouping datasets, Introduction to DDL & DML statements, various built- in functions in SQL, Use of sub-queries, data dictionary and dynamic SQL.	7

VI Semester
IT 2363 - PE-II: Business Intelligence

3	**Principles of Dimensional modeling** Foundation for fact based decision making, star and snowflake schema, Pros& cons of the star/snowflake schema dimensional model, Slowly changing dimension tables, Fact-less fact strategy, Time dimension.	6
4	**Business Intelligence system architecture** Need for enterprise class business intelligence infrastructure, The BI ecosystem, Building blocks of a n- tier BI system-servers & communication protocols, The central repository-metadata, Information consumption user interfaces-desktop vs. web vs. Mobile. Open architecture, Scalability, performance in BI-in memory analytics.	7
5	**BI Project Lifecycle** Typical BI project lifecycle, Requirements gathering & analysis-functional & non- functional requirements, reports and dashboards design- mock – up and storyboarding, Testing in a BI project, BI project deployment, Post production support, Applications of BI, BI best practices	7
6	**Self-service Analytics** What is Self-service Analytics, What are the use cases of self-service analytics, Business Paradigm vs IT paradigm and the Paradigm Shift with self-service analytics, Challenges of Self-service Analytics, Introduction to MicroStrategy Desktop – Overview	7

VI Semester
IT 2363 - PE-II: Business Intelligence

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Data Warehousing ETL toolkit, Indian edition.		Ralph Kimball and Margy Ross	
2	Fundamentals of Business Analytics2nd edition		R. N. Prasad, Seema Acharya	Wiley.
3	Business Intelligence: The Savvy Manager's Guide,2nd Edition		David Loshin	

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	Business intelligence for the enterprise		Mike Biere,	IBM

		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

IT 2364 - PE-II: Lab - Business Intelligence

Course Learning Objective	Course Outcomes
Students will 1. Understand the SQL and details of algorithms made available by popular commercial BI Tools 2. Get acquainted with one BI tool and obtain an hands on experience with some popular BI Tool	After completion of the course: 1. Students will be able to apply SQL as a universal language for BI. 2. Students will able to obtain hands on experience with some popular BI software And demonstrate the ability to use BI tool for analysis, designing schema, reporting, visualization of results

Sr. No	Problem Statements
1	Exploring HR schema of Oracle, Implementation of queries based on range, relational operators, sorting, concatenation.
2	Implementation of queries based on character matching, aggregate functions, set operations
3	Implementation of queries based on Joins (joining 2 or more tables), sub queries.
4	a. Design a multidimensional data cube for given data Using EXCEL b. Perform OLAP- slicing operation on it
5	Creation Of Dashboard Using EXCEL
6	Exploring MICROSTRATEGY ANALYTIC DESKTOP (MSTR) : Installation Of Microstrategy Analytic Desktop And Importing Data from file, Data Wrangling (Editing Data).
7	Visualization Of Data Using different visualizations in MSTR analytic desktop, Filtering data, and delivering Insights from data
8	Create reports and Dashboard with defined insights /requirements in MSTR analytic desktop. (Sample Data to be provided)

VI Semester

IT 2365 - PE-II: Internet of Things

Course Objective	Course Outcome
The student will study 1. The students will be able to describe IoT as a Process, its architecture and Management, compare and contrast old and new challenges in IoT 2. The students will be able to Apply various communication protocol and its building blocks in IoT applications. 3. The students will be able to Illustrate relevance of IoT with cloud and Web and analyze various security challenges and also evaluate various control strategies for the same 4. The students will be able to create, Design and Develop various applications based on IoT concepts	On completion of this course, the student will be able to 1. Students will able to describe various communication protocol and its building blocks. 2. Students will able to describe relevance of IoT with cloud and the application areas of IOT. 3. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor 4. Able to understand building blocks of Internet of Things and characteristics. 5. The students will study and implement IoT project by studying different IoT components, electronic board and their uses.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, The 6LoWPAN,Domains of IOT, M2M vs IOT, Management of IOT, IOT Platforms, IOT Languages, IOT Physical Systems, Tools for IOT	8 hrs
2	IoT Communication Protocols: Protocol Standardization for IOT, Issues with IOT Standardization, M2M and WSN Protocols, SCADA and RFID Protocols, IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Unified Data Standards.	8 hrs
3	Web of Things: Web of Things versus Internet of Things, The Two Pillars of the Web, Architecture Standardization for Web of Things, Platform Middleware for Web of Things, Unified Multitier Web of Things Architecture, Web of Things Portals and Business Intelligence	7 hrs

VI Semester
IT 2365 - PE-II: Internet of Things

4	Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards, Cloud Providers & Systems, Mobile Cloud Computing, Cloud of Things Architecture. Models of Implementation, Service Level Agreement (SLA), Examples of Applications.	7 hrs
5	Security Aspects: Security in IOT: Introduction, Purpose, Issues, Challenges. IOT Threats to Individual and Organizations, Challenges to Secure IOT Development, Recommended Security Controls. Cybersecurity and IOT. Layered Security Protections to Defend IOT Assets.	7 hrs
6	IoT Applications: IOT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IOT electronic equipment. Use of Big Data and Visualization in IOT. Role of IOT for Increased Autonomy and Agility in Collaborative Production Environments, Resource Management in the IOT.	7 hrs

Text Books

SN	Title	Edition	Authors	Publisher
1	Internet of Things: A Hands-on-Approach		Arshdeep Bahga & Vijay Madisetti	Orient Blackswan Publisher
2	The Internet of Things: Key Applications and Protocols		Olivier Hersent, David Boswarthick & Omar Elloumi	Wiley publication

VI Semester
IT 2366 - PE-II: Lab - Internet of Things

Objective	Course Outcome
Student will study: 1. The students will be able to Illustrate relevance of IoT with cloud and Web and analyze various security challenges and also evaluate various control strategies for the same 2. The students will be able to create, Design and Develop various applications based on IoT concepts	After completion of the course students will be able to: 1. Students will able to describe relevance of IoT with cloud and the application areas of IOT 2. The students will study and implement IoT project by studying different IoT components, electronic board and their uses.

List of Practical's

Sr. No..	Problem Statements
1	Study of Ardunio Kit
2	Study of Raspberry Pi Kit
3	Study of different electronics components
4	Study of different sensors in IoT
5	Case study: Smart Irrigation System using IoT and cloud
6	Case Study: IOT Car Parking System
7	Case Study: IOT Based ICU Patient Monitoring System
8	Case Study: Smart Dustbin With IOT Notifications
9	Project: Designing of Home Automation System
10	Mini Project

VI Semester

IT 2371 - OE-III: Industry 4.0

Objective	Course Outcome
Students will: 1) Able to learn an introduction to Industry 4.0 (or the Industrial Internet) 2) Will able to understand its applications in the business world. 3) Will able to understand Business Model and Reference Architecture in Industry 4) Will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.	After completion of this course: 1) Students will be Understand the basics of IoT and basics of Industry 4.0. 2) Students will be Understand Business Model and Reference Architecture 3) Students will be able to understand the different Business issues in Industry 4.0 and how to solve them. 4) Students will be able to understand the need of Security and Fog Computing and applications of IIoT.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, IoT Sensing and Actuation, IoT Connectivity, IoT Networking. Introduction to Industry 4.0: History, Concept, The Journey so far: Developments in USA, Europe, China and other countries, The Fourth Revolution, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, Globalization and Emerging Issues.	7
2	Basics of Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Life-cycle Management, Augmented Reality and Virtual Reality, Introduction to Artificial Intelligence, Big Data and Advanced Analysis, Cyber-Security in Industry 4.0, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems.	7
3	Business Model and Reference Architecture: IIoT-Business Models, IIoT Reference Architecture, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.	6

VI Semester

IT 2371 - OE-III: Industry 4.0

Unit No.	Contents	Max. Hrs.
4	Business issues in Industry 4.0:IIoT case studies, Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world	6
5	Security and Fog Computing: Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT. Application Domains: Factories and Assembly Line, Food Industry, Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications),	7
6	Industrial IOT- Application domain: Milk Processing and Packaging Industries, Manufacturing Industries, Virtual Reality Lab, Steel Technology Lab. Facility Management, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries. Facility Management.	7

Text Books

SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

IT 2372 - OE-III: Core JAVA

Objective	Course Outcome
[illegible]	[illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

VI Semester

IT 2372 - OE-III: Core JAVA

Text Books				
SN	Title	Edition	Authors	Publisher
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VI Semester

IT 2381 - OE-IV: Introduction to Machine Learning

Objective	Course Outcome
[illegible]	[illegible] 1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible]

Unit No.	Contents	Max. Hrs.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester

IT 2381 - OE-IV: Introduction to Machine Learning

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
[illegible]	[illegible]	[illegible]	Ethem Alpaydın [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Machine Learning	Tom M. Mitchel	McGraw Hill	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

VI Semester
IT 2382 - OE-4: Information Security

Objective	Course Outcome
Student will able: 1. To focus on the foundations Computer Security and Threats to security 2. To understand basic concepts of Threats and Intruders. 3. To demonstrate and understand the concepts and application of Communication, Server, System , Network, Internet and cyber security and understanding standards. 4. To know the working of Server security, various System and Application Security, IT Act.	After completion of the course: 1. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security. 2. Students will be able to understand how to protect information and provide authentication using Communication, Server, System, Network, Internet and cyber security 3. Students will able to effectively use of encryption standards and its implementation. 4. Students will be able to understand various technologies and Internet Application with the understanding of IT Act and its protection.

Unit No.	Contents	Max. Hrs.
1	**Introduction**- Computer Security, History of Computer security, Computer Security Concepts (CIA), The OSI security architecture, security attacks, security mechanism, a model for network security, Threats to security, Computer System Security and Access Controls (System access and data access), Key Terms.	7
2	**Malicious software:** Types of Malicious software, Viruses, Virus countermeasures, Worms , Trojan horse, bombs, Trap doors, spoofs, Email virus, Macro viruses, Remedies, Intruders, vulnerabilities & threats, distributed Denial of service attack and Firewalls.	8
3	**Communication security**- Encryption, classical encryption techniques, Block cipher and data encryptions standards, advance encryption standard.Kerberos,X.509	8
4	**Principles of public key cryptosystems:** RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm. Hash Function: Authentication requirements - authentication functions - message authentication code hash functions - birthday attacks	8
5	**Network and Internet Security-** Transport-Level Security-Secure Socket Layer and Transport Layer Security, SSL Architecture. Electronic Mail security-Pretty Good Privacy, S/MIME.	7

VI Semester
IT 2382 - OE-4: Information Security

6	System security and cyber security - Security for network server, web servers, Intrusion detection techniques,intruders,Passwordmanagement,. Cybercrime and Computer Crime Types of Computer Crime, Law Enforcement Challenges, Working With Law Enforcement , Intellectual Property[Types of Intellectual Property, Intellectual Property Relevant to Network and Computer Security], Ethical Issues [Ethics and the IS Professions, Ethical Issues Related to Computers and Information Systems],Security tools, The Information Technology ACT, 2008.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Cryptography and Network Security		William Stallings	Pearson Education
2	Computer Security: Art and Science		Matt Bishop	Addison Wesley

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to computer Security		Mathew Bishop	Pearson
2	Network Security: Private Communication in a Public World (Prentice Hall Series in Computer Networking and Distributed)		Charlie Kaufman, Radia Perlman, Mike Speciner	Pearson Education
3	Computer Security		Dieter Gollmann	John Wiley & Sons

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

7th & 8th Semester

Information Technology

28 June 2019

VII Semester
IT2401 – Data Mining

Objective	Course Outcome
The student should be able to 1. Introduce the data mining fundamentals, different techniques and identify the scope and necessity of Data Mining for the society. 2. Understand the basic concepts of data mining functionalities, its algorithms and applications. 3. Understand the importance of mining web data, ,text data and different approaches for mining. 4. Become familiar with popular data mining tools , able to use it and perform data mining on data sets	**On completion of this course, the student will be able to** **1.** Apply basic concepts in data mining, Identify the scope and necessity of Data Mining for the society and for business applications. **2.** Apply different data mining algorithms on given data set. **3.** Analyze about appropriate data preprocessing tasks, data mining technique applicable for different type of data like web data, text data 4. Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset, analyze their results, interpret the results using different visualization techniques.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply basic concepts in data mining, Identify the scope and necessity of Data Mining for the society and for business applications.	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	Apply different data mining algorithms on given data set.	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	Analyze about appropriate data preprocessing tasks, data mining technique	2	3	-	-	-	-	-	-	-	-	-	-	-	-

	applicable for different type of data like web data, text data														
CO4	Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset ,analyze their results, interpret the results using different visualization techniques.	-	**2**	-	-	**3**	-	-	-	-	-	-	-	-	-

Unit No.	Contents	Max. Hrs.
1	Introduction to data mining: Data mining definitions & task, data mining on what kind of data ,Knowledge Discovery vs. Data mining, DBMS vs. Data Mining, Data mining functionalities, data mining task primitives , Major issues in data mining , applications of data mining.	5
2	Association Rule Mining: what is Frequent itemsets, closed itemsets, and association rules, frequent pattern mining, applications of Association Rule mining, The Apriori algorithm for finding frequent itemset using candidate generation, generating association rules from frequent itemsets .Improving effieciency of Apriori , FP- growth algorithm.	6
3	Classification and prediction: What is classification , prediction., Issues regarding Classification and prediction, Decision tree construction principle, Decision tree construction algorithms ID3, C4.5, Classification using decision tree Induction , naive bayes algorithm, KNN algorithm ,prediction using Linear regression.	7
4	**C**luster Analysis : What is cluster analysis, its applications, clustering paradigms, Partioning algorithms: K- means, K-medoids, Hierarchial clustering: Agglomerative and Divisive hierarchical clustering, Density based clustering -DBSCAN	7
5	Web Mining: Introduction, web content mining, web structure mining, web usage mining, mining multimedia data on web, page rank algorithm , web crawlers	6
6	Text mining:Text data analysis and Information retrieval, Unstructured texts, text mining approaches, text preprocessing ,episode rule discovery for texts, Hierarchy of categories, text clustering. Introduction to NLP	6

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Data Mining: Concepts and Techniques	Jiawei Han, Micheline Kamber and Jian Pei	Morgan Kaufmann Publishers

Reference Books			
SN	Title	Authors	Publisher
1	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach, Vipin Kumar,	Pearson Addison Wesley,
2	Discovering Knowledge in Data: An Introduction to Data Mining	Daniel T. Larose	Wiley
3	Data mining with R	Chapman and Hall	CRC press

VII Semester
IT2402- Data Mining Lab

Objective	Course Outcome
The student should be able to Become familiar with popular data mining tools , able to use it and perform data mining on data sets	**On completion of this course, the student will be able to** Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset , analyze their results, interpret the results using different visualization techniques.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset ,analyze their results, interpret the results using different visualization techniques.	-	2	-		3	-	-	-	-	-	-	-	-	-

List of Practical's

Sr. No.	Problem Statements
1	Introduction to R - fundamentals and basic data types, import / export data and **Preprocessing** on data set using R
2	Implementation of association rule mining in R
3	Implementation of Data Classification using Bayes classification **in R**
4	Implementation of Data Classification using decison tree **in R**
5	Implementation of Data Clustering using K-means in **R**
6	Implementation to PREDICT DATA using linear regression methods.
7	Mining text data using R
8	Data exploration and visualization
9	Develop one Application (eg sentiment analysis)

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Information Technology

VII Semester

IT2403 – Principles of Artificial Intelligence

Objective	Course Outcome
The student should be able to 1. Familiarity with AI and fundamental problem solving using AI 2. Understand the strengths and limitations of Various state-space search algorithms, and choose the appropriate algorithm for a problem. 3. Ability to implement and evaluate intelligent agents for representative AI problems – e.g., constraint satisfaction, automated theorem proving, etc. 4. Represent domain knowledge in propositional and first-order logic and in various knowledge represent 5. Ability to design intelligent agents for problem solving, reasoning, planning, and decision making. 6. Understand probabilistic reasoning techniques and use them to solve problems with noise, incomplete information, and uncertainty.	**On completion of this course, the student will be able to** 1. Students will able to understand basics of AI, apply and choose proper state space search algorithm for the given problem (1 & 2) 2. Students will able to make intelligent choices from among available algorithms and knowledge representation schemes subject to specific design and performance constraints. (3 & 4) 3. Students will able to solve problems with appropriate algorithms, perform its implementation and their experimental evaluation for incomplete and/or uncertain information (5 & 6)

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	Students will able to understand basics of AI, apply and choose proper state space search algorithm for the given problem	3	3	3	3	2									2
CO2	Students will able to make intelligent choices from among available algorithms and knowledge representation schemes subject to specific design and performance constraints.	3	3	3	3	2									2
CO3	Students will able to solve problems with appropriate algorithms, perform its implementation and their experimental evaluation for incomplete and/or uncertain information	3	3	3	3	2	3								2

Unit No.	Contents	Max. Hrs.
1	Introduction: -: What is AI?, History, Overview, Intelligent Agents, Performance Measure, Rationality, structure of agents, problem solving agents, Problem Formulation, searching for solutions – uniformed search	[08 Hrs.]
2	Informed (Heuristic) Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions, inventing admissible heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing, Genetic Algorithms, Online search	[09 Hrs.]
3	Constraint Satisfaction Problems, Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs, Adversarial Search, Games, The minimax algorithm, Alpha-Beta pruning, Imperfect Real-Time Decisions, Games that include an Element of Chance	[09 Hrs.]
4	Knowledge Based Agents: Logic, Propositional Logic, Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, Local search algorithms, First Order Logic, Models for first order logic, Symbols and Interpretations, Terms, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.	[08 Hrs.]
5	Planning, Language of planning problems, planning with state-space search, forward and backward state-space search, Heuristics for state-space search, partial order planning, planning graphs, planning with propositional logic	[07 Hrs.]
6	Uncertainty, Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact and Approximate inference in Bayesian Networks. Introduction to machine learning, Responsible AI, Explainable AI, Case studies of AI	[08 Hrs.]

Text Books

SN	Title	Authors	Publisher
1	Artificial Intelligence a Modern Approach	Russel and Norvig	Pearson Education
2	Introduction to Artificial Intelligence & Expert System	D.W Patterson	PHI

Reference Books

SN	Title	Authors	Publisher
1	Artificial Intelligence	E.Rich and K.Knight	McGraw-Hill
2	Principles of Artificial Intelligence	N.J Nilsson	Narosa
3	Artificial Intelligence	George F. Lugar	Pearson Education, 4th edition

VII Semester

IT2411 : PE-III - Cloud Computing

Course Learning Objective	Course Outcomes
1. To study the different Computing Systems with the comprehensive and in-depth knowledge of Cloud Computing. 2. To study the basics of Cloud Computing Concepts and Technology 3. To study the Cloud Computing architecture and its applications, Fundamental issues and Technologies. 4. To Study of Cloud application design considerations and its methodology 5. To Study basics of Cloud Computing Security mechanisms. 6. To Study applications of Hadoop and MapReduce in Cloud Computing	After After completion of the Course Students will be able to CO1: Understand the different computing paradigm, analyze and apply cloud computing services, deployment model for building cloud CO2: Apply the concepts and techniques in cloud computing CO3: Analyze the problems and apply design considerations for cloud application CO4: Provide the appropriate cloud computing solutions for building cloud application

CO	State ment	Mapped PO												PSO	
		PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
CO1															
CO2															
CO3															

Unit No.	Contents	Max. Hrs.
1	Overview of Computing Paradigm, Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing, Evolution of cloud computing, Business driver for adopting cloud computing, Introduction to Cloud Computing, Cloud Computing (NIST Model), History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages of Cloud Computing, Benefits of Cloud Computing, Role of Open Standards.	[07 Hrs.]
2	Cloud Computing Architecture, Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS), Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS). Deployment Models, Public cloud Private cloud, Hybrid cloud, Community cloud	[08 Hrs.]

3	Virtualization Technology: Fundamental concepts of compute, storage, networking, desktop and Application virtualization. Types of Virtualization, Virtualization benefits, server virtualization, Block and file level storage virtualization, Hypervisors, Hypervisor management software, Infrastructure Requirements, Virtual LAN (VLAN) and Virtual SAN (VSAN) and their benefits.	[07 Hrs.]
4	Service Management in Cloud Computing, Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data: Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing	[07 Hrs.]
5	Cloud Security, Infrastructure Security: Network level security, Host level security, Application level security, Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations	[07 Hrs.]
6	Case Study on Open Source & Commercial Clouds: Google App Engine, Microsoft Azure, Amazon EC2	[06 Hrs.]

Text Books

SN	Title	Authors	Publisher
1	Cloud Computing Bible	Barrie Sosinsky,	Wiley-India, 2010
2	Cloud Computing: Principles and Paradigms	Rajkumar Buyya, James Broberg, Andrzej M. Goscinski	WileY, 2011

Reference Books

SN	Title	Authors	Publisher
1	Cloud Computing: Principles, Systems and Applications,	Nikos Antonopoulos, Lee Gillam,	Springer, 2012
2	Cloud Security: A Comprehensive Guide to Secure Cloud Computing	Ronald L. Krutz, Russell Dean Vines	Wiley-India, 2010
3	"Cloud Computing"	Kumar Saurabh	Wiley Pub

VII Semester
IT2412 :PE-III - Real Time Systems

Objective	Course Outcome
The student should be able to 1) To understand the Real-time scheduling and schedulability analysis 2) To study and understand the concepts of priority driven scheduling and schedulability test. 3) To study and understand the concepts of execution of periodic, sporadic, and aperiodic jobs. 4) To understand Design methods for real-time systems , Formal specification and verification of timing constraints and properties	**On completion of this course, the student will be able to** 1) Understand the basics and importance of real-time systems and explain & address the fundamental problems of real-time systems; 2) Compare different scheduling algorithms and the schedulability criteria and Determine schedulability of a set of periodic tasks given a scheduling algorithm. 3) Develop algorithms to decide the admission criterion of sporadic jobs and the schedule of aperiodic jobs. 4) Integrate resource access mechanisms with the scheduling techniques and develop integrated schedulaibility criteria.

CO	Statement	Mapped PO												PSO	
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Understand the basics and importance of real-time systems and explain & address the fundamental problems of real-time systems	3.	2.												
CO2	Compare different scheduling algorithms and the schedulability criteria and Determine schedulability of a set of periodic tasks given a scheduling algorithm.		2.	2.											
CO3	Develop algorithms to decide the admission criterion of sporadic jobs and the schedule of aperiodic jobs.		3.	2.											
CO4	Integrate resource access mechanisms with the scheduling techniques and develop integrated schedulibility criteria		3.	3.											

Unit	Contents	Max.
1	**Introduction to real time systems:** The Concepts of Real-Time Systems, real time applications according to timing attributes. Hard and soft real time system: The Concept of Real-Time Tasks, Jobs & processors, release times, deadlines, timing constraint, Hard & Soft timing constraint, Hard real time systems, soft real time systems. Modeling of real time systems: Processors and Resources, Temporal Parameters of Real Time Work load, Periodic task Model, Precedence Constraints and Data Dependency. **Approach to real time scheduling:** Clock-driven approach, weighted round-robin approach, priority-driven approach, dynamic versus static systems, effective release times and deadlines, optimality of EDF & LST algorithms, Non-optimality of the EDF & LST, challenges in validating timing constraints in priority-driven systems, off line versus on-line scheduling.	6
2	**Clock driven scheduling:** Notations & assumptions, static timer-driven scheduler, general structure of cyclic schedules, cyclic executives, improving the average response time of a periodic jobs, scheduling sporadic jobs, practical consideration and generalizations, algorithms for constructing static schedules, pros-cons of clock-driven scheduling.	7
3	**Priority-driven scheduling:** Static assumptions, fixed-priority versus dynamics priority algorithms, Rate-Monotonic and Deadline-Monotonic Algorithms , maximum schedulable utilization of EDF Algorithm, optimality of the RM & DM algorithms	6
4	**Priority-driven scheduling:** A schedulability test for fixed priority tasks with short response times & with arbitrary response times, Critical Instants, Time Demand Analysis, sufficient schedulability conditions for the RM & DM algorithms.	7
5	**Scheduling aperiodic & sporadic jobs in priority-driven systems:** Assumptions & approaches, deferrable servers, sporadic servers, constant utilization, total bandwidth and weighted fair-queuing servers, slack stealing in dead-line driven systems, slack stealing in fixed-priority systems, scheduling of sporadic jobs.	8
6	**Resources and resource access control:** Assumption on resources and their usage, effects of resource contention & resource access control, non-preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack-based priority –ceiling protocol, use of priority-ceiling protocol in dynamic-priority systems, preemption-ceiling protocol, controlling accesses to multiple-unit resources, controlling concurrent accesses to data object.	8

Text Books			
Sr. N.	Title	Authors	Publisher
1	Real Time Systems	Jane W. S. Liu	Pearson education
Reference Books			
1	Real Time Systems	C.M. Krishna & Kang G. Shin	McGraw Pub.

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Information Technology

VII Semester

IT2413 :PE-III – Network Security

Objective	Course Outcome
The student should be able to 1) Understand basics of Cryptography and Network Security. 2) Secure a message over insecure channel by various means. 3) Learn about how to maintain the Confidentiality, Integrity and Availability of a data. 4) Understand various protocols for network security to protect against the threats in the networks.	**On completion of this course, the student will be able to** 1) Understand how to provide security of the data over the network. 2) Do research in the emerging areas of cryptography and network security 3) Understand how to Implement various networking protocols 4) Understand how to protect any network from the various threats in the world.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Understand how to provide security of the data over the network.	3													
CO2	Do research in the emerging areas of cryptography and network security	3	2	2											
CO3	Understand how to Implement various networking protocols	3	2	2											
CO4	Understand how to protect any network from the various threats in the world.	3	2												

Unit No.	Contents	Max. Hrs.
1	Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography	6
2	Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - fiestal structure , data encryption standard(DES) , strength of DES , differential and linear crypt analysis of DES , block cipher modes of operations , triple DES	6
3	Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring ,Groups ,field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing ,Galois field,AES	6
4	Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Message Authentication .Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks	6
5	Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME	6
6	IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.	6

Text Books

SN	Title	Authors	Publisher
1	Cryptography and Network security Principles and Practices	William Stallings	Pearson/PHI.
2	Cryptography & Network Security	Behrouz A. Forouzan	McGraw-Hill

Reference Books

SN	Title	Authors	Publisher
1	Introduction to Cryptography with coding theory	Wade Trappe, Lawrence C Washington	Pearson
2	Modern Cryptography	W. Mao	Pearson Education

VII Semester
IT2414 - PE III: Information Retrieval

Objective	Course Outcome
1. To provide an overview of Information Retrieval. 2. To introduce students about insights of the several topics of Information retrieval such as – Boolean retrieval model, Vector space model, Latent semantic indexing, XML and Image retrieval model. 3. To provide comprehensive details about various evaluation methods.	**On completion of this course, the student will be able to** 1. Understand different Information retrieval models. 2. Know about evaluation methods of the information retrieval model. 3. Know the challenges associated with each topic

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO0	P11	PO 12	PSO 1	PSO 2
CO1	Understand different Information retrieval models.	**3**	**3**	**2**										**2**	
CO2	know about evaluation methods of the information retrieval model.	**3**	**3**	**3**										**2**	
CO3	know the challenges associated with each topic	**2**	**2**	**2**										**1**	

Unit No.	Contents	Max. Hrs.
1	**Introduction to Information retrieval**: Information retrieval process, Indexing, Information retrieval model, Boolean retrieval model **Dictionary and Postings:** Tokenization, Stop words, Stemming, Inverted, index, Skip pointers, Phrase queries	6
2	**Tolerant Retrieval** :Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex **Term Weighting and Vector Space Model:** Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex	6
3	**Evaluation**: Precision, Recall, F-measure, E-measure, Normalized recall, Evaluation problems **Latent Semantic Indexing**: Eigen vectors, Singular value decomposition, Low rank approximation, Problems with Lexical Semantics	6

4	**Query Expansion** :Relevance feedback, Rocchio algorithm, Probabilistic relevance feedback, Query Expansion and its types, Query drift	6
5	**Probabilistic Information Retrieval** :Probabilistic relevance feedback, Probability ranking principle, Binary Independence Model, Bayesian network for text retrieval	6
6	**XML Indexing and Search** :Data vs. Text-centric XML, Text-Centric XML retrieval, Structural terms **Web Information Retrieval:** Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS	5

Text Books

SN	Title	Authors	Publisher
1	Introduction to Information Retrieval	Christopher D. Manning, Raghavan and Schutze,	Cambridge University Press,2008

Reference Books

SN	Title	Authors	Publisher
1	Natural Language Processing And Information Retrieval	Tanveer Siddiqui and U. S. Tiwary	Oxford Higher Education,2008

VII Semester

IT2421 - PE IV: Neural Network and Fuzzy Logic

Objective	Course Outcome
The student should be able to 1. To familiarize with neural networks and learning methods for neural networks 2. To demonstrate neural network applications on real-world tasks 3. To introduce the ideas of fuzzy sets, fuzzy logic and to emphasize the need for fuzzy logic to model linguistic knowledge in human experts 4. To know fuzzy Arithmetic and inference techniques along with its applications 5. To understand fuzzy inference and reasoning to build systems based on fuzzy control and to understand of Neuro-Fuzzy Systems	**On completion of this course, the student will be able to** 1. To understand the working of Neural Networks as pattern classifier 2. Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms 3. Effectively use existing software tools to solve real problems using a neural network approach 4. Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and to build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C	To understand the working of Neural Networks as pattern classifier		3												
C	Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms	2		3		3							3	2	
C	Effectively use existing software tools to solve real problems using a neural network approach	3		3		2							3		

C	Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and To build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning	3													
	IT2421	3	3	3		2.5							3	2	

Unit No.	Contents	Max. Hrs.
1	Neural Networks: History, overview of biological neuro-system, mathematical models of neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, Learning Tasks, Applications of Artificial Neural Networks	8
2	Feed forward and feedback networks, Single-layer perceptron classifiers, Discriminant functions, linear machine and minimum distance classification, training and classification using the discrete perception - ANN training Algorithms-Single layer perceptron, multi-layer perceptron, RDPTA algorithm	7
3	Multilayer feed forward networks, linearly non-separable pattern classification, delta learning rule, Feed forward recall and error back-propagation training, Hopfield learning algorithm, Self-organizing Map, Introduction to Deep Learning	8
4	Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.	7
5	Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Application of Fuzzy Logic: Medicine, Economics etc.	6
6	Fuzzy control, Fuzzy Inference Engines, Graphical Techniques of Inference, Fuzzyifications/ DeFuzzification, Fuzzy System Design and its Elements, Design options.	6

Text Books

SN	Title	Authors	Publisher
1	Introduction to the theory of Neural Computation	John Hertz, Anders Krogh, Richard Palmer	Addison Wesley
2	Fuzzy Logic with Engineering Applications	Timothy Ross	McGraw-Hill

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Neuro-Fuzzy and Soft Computing: A computational Approach to Learning & Machine Intelligence	Roger Jang, Tsai Sun, EijiMizutani,.	PHI
2	Fuzzy sets and Fuzzy logic, Theory and Applications	George J. Klir and Bo Yuan	Prentice Hall
3	Soft Computing and Its Applications	R.A. Aliev, R.R. Aliev	World Scientific
4	Elements of Artificial Neural Networks	Kishan Mehrotra, C. K. Mohan, S. Ranka	Penram International Publishing (India)
5	Neural Networks and Fuzzy Systems	Bar Kosko	Prentice-Hall
6	Artificial Neural Network	B. Yegnanarayana	PHI
7	Neural Networks: A Comprehensive Foundation	Simon Haykin	PHI

VII Semester

IT2422- PE IV: Lab.: Neural Network and Fuzzy Logic

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
1. To familiarize with neural networks and learning methods for neural networks 2. To demonstrate neural network applications on real-world tasks 3. To introduce the ideas of fuzzy sets, fuzzy logic and to emphasize the need for fuzzy logic to model linguistic knowledge in human experts 4. To know fuzzy Arithmetic and inference techniques along with its applications 5. To understand fuzzy inference and reasoning to build systems based on fuzzy control and to understand of Neuro-Fuzzy Systems	1. To understand the working of Neural Networks as pattern classifier **2.** Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms **3.** Effectively use existing software tools to solve real problems using a neural network approach 4. Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and to build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	To understand the working of Neural Networks as pattern classifier		3												
CO2	Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms	2		3		3							3	2	
CO3	Effectively use existing software tools to solve real problems using a neural network approach	3		3		2							3		

CO4	Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and To build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning	3													
		3	3	3		2.5							3	2	

List of Practical's

Sr. No..	Problem Statements
1	Design and Implement n-input NAND and NOR gates using Mc-Culloch Pits Model of a neuron
2	Implement A-Z character recognition using Feedforward Neural Network.
3	Implement clustering algorithm.
4	Design and Implement a linear classifier using SDPTA algorithm for a 3 input logical NAND Problem
5	Implement Back Propagation training algorithm, for any non-linear complex problem
6	Implement SOM algorithm, for any clustering problem
7	Development of fuzzy membership functions and fuzzy set properties
8	Development and verification of logic for fuzzy relations
9	Design of a fuzzy controller for the following system using fuzzy tool of Matlab
10	Application development using NN/Fuzzy logic

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Information Technology

VII Semester

IT1423 – PE IV: Ethical Hacking and Cyber Forensics

Objective	Course Outcome
The student should be able to 1) To learn foundations of Cyber Security and Ethical Hacking analysis using programming languages like python. 2) To learn various types of algorithms and its applications of Cyber Security and Ethical Hacking using forensic detection 3) To learn python toolkit for required for programming Cyber Security, Ethical Hacking concepts. 4) To understand the concepts of Cyber Security, Ethical Hacking Forensic detection image processing ,pattern recognition, and natural language processing	**On completion of this course, the student will be able to** 1) Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information. 2) Identify & Evaluate Information Security threats and vulnerabilities in Information Systems and apply security measures to real time scenarios 3) Identify common trade-offs and compromises that are made in the design and development process of Information Systems 4) Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information	3	3	3	3									3	
CO2	Identify & Evaluate Information Security threats and vulnerabilities in Information Systems and apply security measures to real time scenarios	3	3	3										3	
CO3	Identify common trade-offs and compromises that are made in the design and development process of Information Systems													3	
CO4	Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection	3	3	3	3									3	

Unit No.	Contents	Max. Hrs.
1	Hacking windows – Network hacking – Web hacking – Password hacking. A study on various attacks – Input validation attacks – SQL in jection attacks – Buffer overflow attacks - Privacy attacks.	**07**
2	TCP / IP – Checksums – IP Spoofing port scanning, DNS Spoofing. Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS – Models Firewalls – Packet filter firewalls, Packet Inspection firewalls – Application Proxy Firewalls. Batch File Programming	**07**
3	Fundamentals of Computer Fraud – Threat concepts – Framework for predicting inside attacks – Managing the threat – Strategic Planning Process.	**06**
4	Understanding the Cyberspace Environment and Design Cyberspace environment and its characteristics, Developing a design approach, Planning for cyberspace operation Cyberspace Operational Approaches	**07**
5	Foundational approaches that utilize cyberspace Capabilities to support organizational missions, The pros and cons of the different approaches.	**07**
6	Cyberspace Operations Network Operations (NETOPS), Defensive Cyberspace Operations (DCO), Offensive Cyberspace Operations (OCO), Defense and Diversity of Depth network design, Operation al methodologies to conduct cyberspace operations	**06**

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Introduction of Cyber Warfare: A Multidisciplinary Approach	Paulo Shakarian	Elsevier 2013.
2	Inside Cyber Warfare: Mapping the Cyber Underworld	Jeffery carr	O'Reilly Publication December 2012
3	Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners	Jason Andress	Syngress, Elsevier 2013.
4	Insider Computer Fraud	Kenneth C.Brancik	Publications Taylor & Francis Group 2008.
5	Ethical Hacking	Ankit Fadia	second edition Ma cmillan India Ltd, 2006

Reference Books			
SN	Title	Authors	Publisher
1	Cryptography, Network Security and Cyber Laws	Bernard Menezes, Cengage Learning	Oxford university press

VII Semester
IT2424 – PE IV: Lab: Ethical Hacking and Cyber Forensics

List of Practical's

Sr. No.	Problem Statements
1	TCP scanning using NMAP Tool
2	Port scanning using NMAP Tool
3	TCP / UDP connectivity using Netcat (networking utility)
4	Network vulnerability using OpenVAS
5	Web application testing using DVWA (Damn Vulnerable Web App (DVWA))
6	Manual SQL injection using DVWA(Damn Vulnerable Web App (DVWA))
7	XSS using DVWA (Damn Vulnerable Web App (DVWA))
8	Automated SQL injection with SqlMap

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Information Technology

VII Semester

IT2425 – PE IV: Human Computer Interaction

Objective	Course Outcome
The student should be able to 1. To study and understand interface design tools, and demonstrate the Interaction between the human and computer components 2. To study and understand the screen designing and its various concepts with design rules 3. To study and understand software tools related to HCI process. 4. To understand the interaction devices.	**On completion of this course, the student will be able to** 1. Apply the knowledge of human components for interaction with computer 2. To understand basics of Computer components functions regarding interaction with human. 3. Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept. 4. To Produce Implementation supports for HCI by using various tools.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Apply the knowledge of human components for interaction with computer	3	3											3	
CO2	To understand basics of Computer components functions regarding interaction with human.	3	3											3	
CO3	Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept.	3	3			3								3	
CO4	To Produce Implementation supports for HCI by using various tools.	3	3			3								3	

Unit No.	Contents	Max. Hrs.
1	Introduction: The human: Human memory, Thinking reasoning and problem solving, Individual differences, Psychology and the design of interactive systems ,Interaction and paradigms: Models of interaction, Frame work and HCI, Ergonomics, Interaction styles, Elements of the WIMP(windows, icons, pointers, menus) interface, interactivity, The context of the interaction, paradigms for interaction	**6**
2	Interaction Design: What is interaction design, Good and poor design, The process of design, User focus, Scenarios, Navigation design, Understanding the problem space, Conceptualizing the design space, Theories, models and frameworks, Screen design and layout, Interaction and prototyping	**5**
3	HCI in software process and Design rules: The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale, Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns	**5**
4	Implementation supports and Evaluation techniques: Elements of windowing system, Programming application, Using toolkits, User interface management systems, What is evaluation? Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing evaluation methods, analytical evaluation	**5**
5	Universal Design and User Support: Universal design principles, Multi-modal interaction, Design for diversity, Requirements of user support, Approach to user support, Adaptive help systems, Design user support systems	**6**
6	Cognitive Models and Distributed Cognition: Goal and task hierarchies, Linguistics models, The challenge of display-based system, Physical and device models, Cognitive architectures, Scientific Foundation, Description, Case Study	**6**

Text Books

SN	Title	Authors	Publisher
1	Human - Computer Interaction	Alan Dix, Janet Fincay, Gregory D. Abowd and Russell Bealg,	Pearson Education, 2003.
2.	Designing the user interface	Ben Shneiderman	Pearson Education Asia, 2004

Reference Books

SN	Title	Authors	Publisher
1	Interaction Design	Preece and Rogers, Sharp	Wiley-India, 2008.
2	The essential guide to user interface design	Wilbert O Galitz	Wiley DreamTech, 2009
3	User Interface Design	Soren Lauesen	Pearson Education, 2005.

VII Semester

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Information Technology

IT2426 – PE IV: Lab- Human Computer Interaction

Objective	Course Outcome
The student should be able to 1. To study and understand interface design tools, and demonstrate the Interaction between the human and computer components 2. To study and understand the screen designing and its various concepts with design rules 3. To study and understand software tools related to HCI process. 4. To understand the interaction devices.	**On completion of this course, the student will be able to** 1) Apply the knowledge of human components for interaction with computer 2) To understand basics of Computer components functions regarding interaction with human. 3) Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept. 4) To Produce Implementation supports for HCI by using various tools.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Apply the knowledge of human components for interaction with computer	3	3											3	
CO2	To understand basics of Computer components functions regarding interaction with human.	3	3											3	
CO3	Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept.	3	3			3								3	
CO4	To Produce Implementation supports for HCI by using various tools.	3	3			3								3	

List of Practical's

Sr. No.	Problem Statements
1	Study base on Exploration of Human-Computer Interaction (HCI) Applications in 1. Hospitality Industry. 2. e-Shopping System 3. e-Panchayat (e-Government Services) System 4. e-Hotel Reservation System 5. e-Banking System 6. Software Download System ,etc
2	Practical demonstration/implementation based on-Design analysis
3	Practical demonstration/implementation based on-Copy work
4	Practical demonstration/implementation based on-Fonts database
5	Practical demonstration/implementation based on-Style tiles
6	Personal project mockups-phase 1
7	Personal project mockups-phase 2
8	Personal project mockups-phase 3

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Information Technology

VII Semester

IT2427 – PE-IV- Parallel Computing

Objective	Course Outcome
1. To study different parallel processing architectures based on relationships between processing elements, instruction sequence, memory and interconnected networks. 2. To study and understand the concepts of dependence analysis. 3. To study and Understand, the concepts of shared and distributed memory programming using OpenMP and MPI. 4. Study and understand the concepts of GPU computing and heterogeneous parallel programming environments.	After completion of course students will be able to- 1. **Compare & Compute** speedup, efficiency, and scaled speedup of parallel computations. 2. **Analyze and resolve** the dependences in single, double and multi-level loops. 3. **Design and develop** parallel algorithms suited for Shared and Distributed memory models using Open-MP & MPI. 4. **Write** code using accelerator technologies of GPGPUs with CUDA for heterogeneous parallel programming environments.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**Compare & Compute** speedup, efficiency, and scaled speedup of parallel computations.	3	2												
CO2	**Analyze and resolve** the dependences in single, double and multi-level loops.	3	3												
CO3	**Design and develop** parallel algorithms suited for Shared and Distributed memory models using Open-MP & MPI.	3	2	3											2
CO4	**Write** code using accelerator technologies of GPGPUs with CUDA for heterogeneous parallel programming environments.	3	3			3									2

Unit No.	Contents	Max. Hrs.
1	**Introduction to parallel computing**: Need of ever increasing performance, building parallel systems, need to write parallel programs, Parallel hardware, Parallel Software, Coordinating the processes/threads, Shared-memory, Distributed-memory, Programming hybrid systems. **Parallel Programming Platforms:** Implicit parallelism, Limitation of Memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, communication cost in parallel machines.	7
2	**Principles of Parallel Algorithm Design:** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing. Methods for Containing Interaction Overheads Parallel Algorithm Models.	7
3	**Dependence Concepts*:*** Basic introduction of dependence in single loop and double loop, Loop-carried and Loop-independent dependences, Techniques for extraction of parallelism, index and iteration spaces and perfect loop nest, test for dependences, GCD test, Bound test.	7
4	**Shared-Memory Programming with OpenMP:** What is OpenMP, creating team of threads, OpenMP Memory model, thread synchronization, Directives, Sharing the Work among Threads in an OpenMP Program : Loop Construct, The Sections Construct , The Single Construct , Workshare Construct, Combined Parallel Work-Sharing Constructs ,Clauses to Control Parallel and Work-Sharing Constructs, OpenMP Synchronization Constructs ,Interaction with the Execution Environment, OpenMP Clauses : If Clause , Num threads Clause, Ordered Clause, Reduction Clause, Copyin Clause ,Copyprivate Clause ,Advanced OpenMP Constructs: Nested Parallelism , Flush Directive , Thread private Directive.	9
5	**Distributed-Memory Programming with MPI :** Compilation and execution, MPI programs ,MPI_Init and MPI_Finalize, Communicators: MPI_Comm_ size and MPI_ Comm_rank, MPI_Send ,MPI_Recv, Message matching, Semantics of MPI_Send and MPI_Recv, Dealing with I/O, Collective communication, MPI derived data types.	8
6	**Compute Unified Device Architecture (CUDA):** CUDA Architecture, Introduction to CUDA C, Kernel Call, Passing parameters, Querying Devices, Thread Cooperation: Splitting blocks, Shared Memory and Synchronization.	7

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Introduction to Parallel Computing	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar,	Pearson Edn.
2	Dependence Concept	Utpal Banerjee	Intel Corp.
3	CUDA by Example: An Introduction to General-Purpose GPU Programming	Jason Sanders, Edward Kandrot	Addison-Wesley

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Using OpenMP	Barbara Chapman, Gabriele Jost, Ruud van der Pas	MIT Press
2	An Introduction to Parallel Programming	Peter S. Pacheco , Morgan Kaufmann	MORGAN KAUFMANN ELSEVIER

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Information Technology

VII Semester

IT 2428- PE-IV- Lab : Parallel Computing

Objective	Course Outcome
1.To study and Understand, the concepts of shared and distributed memory programming using OpenMP and MPI. 2.Study and understand the concepts of GPU computing and heterogeneous parallel programming environments	1. **Design and develop** parallel algorithms suited for Shared and Distributed memory models using Open-MP & MPI. 2. **Write** code using accelerator technologies of GPGPUs with CUDA for heterogeneous parallel programming environments

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	**Design and develop** parallel algorithms suited for Shared and Distributed memory models using Open-MP & MPI.	3	2	3											2
2	**Write** code using accelerator technologies of GPGPUs with CUDA for heterogeneous parallel programming environments.	3	3			3									2

List of Practical's

Sr. No.	Problem Statements
1	Open-MP program based on Loop Constructs
2	Open-MP program based on Work Sharing Constructs (shared & Private clause)
3	Open-MP program based on Synchronization Constructs
4	Open-MP program based on Nested Parallelism
5	MPI Program based on basic MPI calls to exchange the data
6	MPI Program based on collective MPI calls
7	CUDA program based on threads and kernel
8	CUDA program based on shared memory synchronization & thread cooperation
9	CUDA program based on Constant Memory & Texture Memory
10	CUDA program based on Nested parallelism

VII Semester

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Information Technology

IT 2431- PE-V- Digital Image Processing

Objectives	Course Outcome
1. To introduce basic concept of Image processing in the spatial and frequency domain 2. To introduce basics of image representation and description. 3. To introduce the basics of color image processing, image segmentation and morphological operations on images 4. To learn various algorithms for image processing	**On completion of this course, the student will be able to** 1. Understand basic concepts of image processing, in the spatial and frequency domain 2. understand basics of image representation and description. 3. comprehend the basics of color image processing, image segmentation and morphological operations on images 4. understand various algorithms for image processing and apply them on given image data

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Understand basic concepts of image processing, in the spatial and frequency domain	3	2	3										1	
CO2	understand basics of image representation and description.	3	2	2										1	
CO3	comprehend the basics of color image processing, image segmentation and morphological operations on images	3	2											2	
CO4	understand various algorithms for image processing and apply them on given image data	3	2	2										2	

Unit	Contents	Hrs.
1	**Introduction**: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception. Fundamentals of Image processing: A Simple Image Model, Sampling and Quantization, Basic Image operations: Subtraction, Averaging, multiplication, etc., Basic Relationships between Pixels	6
2	**Image Enhancement in the Spatial Domain**: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	7
3	**Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform, Discrete Fourier Transformation, Properties of DFT, Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering	7
4	**Image Segmentation**: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Hough transform, Thresholding Region-oriented Segmentation.	7
5	**Image Representation and description**: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region, Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors	6
6	**Basics of morphological Image Processing**, **Introduction to colour image processing**: colour models, pseudo colour image processing, introduction to image file formats: TIFF, JPEG, BMP, etc.	6

Notes: Assignments in TA should be based on Programming on Image Processing concepts learned.

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Digital Image Processing	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall, 2007

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Image Processing Principles & Applications	Tinku Acharya & Ajoy K. Ray	Willey Inter-Science, 2005

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Information Technology

VII Semester

IT2432 – PE-V: Distributed Systems

Objective	Course Outcome
The student should be able to 1) To study basic techniques in the design and development of Distributed Systems 2) To understand the concepts of Interprocess communication and Remote Procedure Calls. 3) Understanding solutions of the fundamental problems in distributed systems like mutual exclusion, deadlock detection, termination detection, leader election, fault tolerance,	**On completion of this course, the student will be able to** 1. Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc. 2. Design and develop distributed programs using sockets and RPC/RMI. 3. Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems. 4. Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constrain

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.	2	3												
CO2	Design and develop distributed programs using sockets and RPC/RMI	3	2	2											
CO3	Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems	3	2	3											
CO4	Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constrain		3	3											

Unit No.	Contents	Max. Hrs.
1	**Architecture of Distributed Systems:** Characteristics of Distributed System, Motivation, challenges /Issues in the design & development of Distributed System. System Models: Architecture Model, System Architecture, Types of Architectural Model: Client server model, Search engine, Proxy server & caches, Variation on client server model: mobile code, mobile agents. Fundamental Models: Interaction model, failure model, Security model. **Distributed Objects & Distributed file system :** Inter-process communication, Sockets, middle ware, Group communication, and Remote procedure calls. CORBA, RMI, Distributed file system, Name services, Directory services, File Service types, download/upload model, File sharing semantics, session semantics, Server design: stateless & stateful server, Cache update policies.	6
2	**Theoretical Foundations:** Inherent limitations of distributed systems, Timing issues, clock synchronization, Network time protocol, Lamport's logical clocks, Vector clocks, Casual ordering of messages, Global state, Cuts of Distributed computation, Termination detection.	6
3	**Distributed Mutual Exclusion:** Leader election: Chang Robert Ring based leader election algorithm, Bully algorithm. Classification of mutual exclusion algorithms, Requirements and performance measures of mutual exclusion algorithms, Non Token Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm.Token Based Algorithms: Suzuki-Kasami's Algorithm, Raymond's Algorithm, Comparative performance analysis	6
4	**Distributed Deadlock Detection:** Resource vs Communication deadlocks, graph theoretic model, deadlock prevention, avoidance, detection, Issues in deadlock detection and resolution, Centralized deadlock detection algorithms, distributed deadlock detection algorithms	8
5	**Agreement Protocols:** Synchronous vs. asynchronous computations, model of process failures, authenticated vs. non-authenticated messages. A classification of Agreement problems, Solutions to Byzantine Agreement problem, Applicatons of Agreement algorithms.	8
6	**Failure recovery and Fault Tolerance:** Classification of failures. Backward and forward error recovery, Basic approaches of backward error recovery, recovery in concurrent systems, consistent set of checkpoints, synchronous check pointing and recovery, asynchronous check pointing and recovery. **Fault Tolerance:** Atomic actions and committing, commit protocols, non-blocking commit protocols, Voting protocols, Dynamic voting protocols, Dynamic Vote Reassignment Protocols.	7

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Advanced Concepts In Operating Systems: Distributed, Multiprocessor and Database Operating Systems	Mukesh Singhal and Niranjan G. Shivaratri	McGraw Hill
2	Distributed Operating Systems Concepts and Design	G Coulouris, Jean Dollimore, Tim Kindberg	Addison Wesley

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Distributed Algorithms	Nancy Lynch	Morgan Kaufman
2	Modern Operating Systems	Andrew S. Tanenbaum	Pearson Education
3	Distributed Operating Systems: Concepts and Design	Pradeep K. Sinha	Prentice-Hall of India Pvt.Ltd

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Information Technology

VII Semester

IT2433– PE V: Coding Standard and Technical Documentation

Course Learning Objective	Course Outcomes
Student will able: To learn various concepts of coding & documentstandards. To learn basic programming elements of Javaprogramming. 3 To apply various technical documents needed in software development. To write basics of report writing.	After completion of the course: Students will be able to differentiate between various programming standards and styles of programming. Students will be able to write efficient Java programs based on styles of Java. 3 Students will be able to differentiate between different patterns and standards of coding in Java. Students will be able to prepare better manuals, case reports and software documents.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT2433.1	Students will be able to differentiate between various programming standards and styles of Programming	3.0	3.0	2.0											
IT2433.2	Students will be able to write efficient Java programs based on styles of Java	3.0	3.0		2.0	2.0									
IT2433.3	Students will be able to differentiate between different patterns and standards of coding in Java	3.0	3.0	2.0		2.0									
IT2433.4	Students will be able to prepare better manuals, case reports and software Documents	3.0				3.0									2.0
IT2433		3.0	3.0	2.0	2.0	2.3									2.0

Unit No.	Contents	Max. Hrs.
1	Introduction to general coding standards, Internal document Standards, Coding Standards: Indentation, Inline comments, procedure oriented programming, Object based programming, Structured Programming, Classes, Function, Subroutines, Methods, Source Files, and Variable Names.	5
2	Coding Guidelines: Line Length, Spacing, Wrapping Lines, Variable declarations, Program Statements, use of parentheses, Coding for efficiency vs. Coding for readability, Meaningful error messages, Reasonable sized Functions and Methods, Number of routines per File, Elements of Programming Style.	5
3	The elements of Java Style: Introduction, General Principles, Formatting Conventions, Naming Conventions: Package Names, Method Names, Constant Names. Documentation Conventions, Programming Conventions: Type safety, Statements & Expressions, Construction, Exception Handling, Assertions, Concurrency, Synchronization, Efficiency. Packaging Conventions.	6
4	Java Coding Standards: The Prime Directive: Naming conventions, Documentation, Java comments, Standards for member functions, Member function visibility, Documenting Member Functions, Techniques for writing clean code, standards for fields (Attributes/Properties), standards for local variables, Standards for parameters, Standards for classes, standards for Interfaces, standards for Packages, standards for Compilation Units (Source code file)	8
5	Introduction to Technical Writing: Prewriting, Writing & Rewriting, Objectives in technical writing, correspondence: Memos, Letters, Writing effective resumes, Visual appeal: document design, graphics, electronics communication: writing email, online help & websites, writing instructions & users manuals	8
6	Report strategies: writing research reports, feasibility reports, Lab reports, Progress reports, Writing proposals	8

Text books:

1	The elements of Programming Style	Brain W. Kernighan and P.J.Plauger	MGraw Hill
2	The elements of Java Style	Allan Vermeulen, Scoff W. Ambler, Greg Bumgardner, Eldon Metz, Trevor Misfeldt,Jim Shur, Cao Tieou	Cambridge University
3	Technical Writing Process & Product	T Sjaron J. Gerson & Steven M. Gerson	Prentice Hall

VII Semester

IT2441– PE VI: Advanced Computer Architecture

Objective	Course Outcome
The student should be able to 1) To understand the basic concept of different computer architecture and parallelism. 2) To study of different pipelining processor and its applications. 3) To understand the basic concept of array processor and SIMD. 4) To understand basic concept of Multiprogramming/Multiprocessing Architecture. 5) To study different data dependence for improvement of system performance. 6) To understand different techniques of parallelism and its extraction.	**On completion of this course, the student will be able to** 1) Analyze different computer architecture and its parallelism. 2) Apply different pipelining techniques in an application. 3) Discuss the basic concept of array processor and SIMD architecture. 4) Apply the knowledge of Multiprogramming/Multiprocessing processing for improvement of system performance. 5) Analyze different data flow dependent and it effects on parallelism. 6) Apply different parallelism techniques and its extractions to application

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Analyze different computer architecture and its parallelism.		2												2
CO2	Apply different pipelining techniques in an Application.	3													3
CO3	Discuss the basic concept of array processor and SIMD architecture.		2												2
CO4	Apply the knowledge of Multiprogramming/Multiprocessing processing for improvement of system performance.	3	3												3
CO5	Analyze different data flow dependent and it effects on parallelism	3													3

CO6	Apply different parallelism techniques and its extractions to application		**2**												**3**

Unit No.	Contents	Max. Hrs.
1	Introduction to parallel processing : memories and IO subsystem : Evolution of computer system, parallelism in uniprocessor system, parallel computer structure, architecture classification schemes, parallel processing application, Hierarchical memory structure, virtual memory system, memory allocation and , management, I/O subsystem.	10
2	Pipelining and vector processing : Pipeline, overlapped pipelining, instruction and arithmetic pipelining, pipelined processor, vector processing, vector processor, architecture of cray-1, parallel memory organization	8
3	Array Processor : SIMD array processor, (organization and inter connection networks), Parallel algorithms for array processor, SIMD matrix multiplication, parallel sorting on array processor, associative array processing, associative memory organization associative processors.	8
4	SIMD Computer and Multiprocessor Architecture : III IAC-IV System architecture and its applications, performance enhancement methods, parallel memory allocation, array processing, languages, multiprocessors, loosely and tightly coupled multiprocessor, time shared and crossbar interconnection networks, parallel memory organization, interleaved memory configuration.	8
5	Multiprocessing control and Data Flow Computers: Intercrosses communication mechanisms system deadlocks and protection parallel algorithms for multiprocessors, classifications of parallel algorithms data driven computing, data flow computer architecture.	8
6	Techniques for Extraction of parallelism.	5

Text Books

SN	Title	Authors	Publisher
1	Advanced Computer Architecture	Kai Hwang	McGraw-Hill

Reference Books

SN	Title	Authors	Publisher
1	Computer Architecture and Parallel Processing	Hwang & Briggs	Mc-Graw Hill Pub
2	"Computer Architecture :A Quantitative Approach"	John Hennessy David Patterson	Morgan Kaufmann

VII Semester

IT2442 – PE VI: Mobile Communication

Objective	Course Outcome
The student should be able to 1. Student will be able to study evolution of wireless telecom system. 2. Student will be able to study the concepts employed in wireless LAN systems and Protocol Architecture. 3. Student will be able to study the Ad Hoc networks and new trends in Mobile/wireless communication. 4. Student will be able to study the TCP and Mobile IP concepts.	**On completion of this course, the student will be able to** Understand different wireless mobile architecture. Understand control mechanism and Radio Interfaces. 3 Understand the concepts of Adhoc Network. Understand the need and the trend toward mobility.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO	Understand different wireless mobile architecture	3	3												
CO	Understand control mechanism and Radio Interfaces.	3													
CO	Understand the concepts of Adhoc Network.	3		2											
CO	Understand the need and the trend toward mobility	3				2									

Unit No.	Contents	Max. Hrs.

1	Review of radio transmission, antennas, modulation & demodulation, Radio propagation. Concept of cellular working, Multiplexing in space, frequency time, Code division multiplexing, Spread spectrum medium access methods.	6
2	Wireless telecom Systems: Evolution, study of 2G system GSM. Network architecture, radio interface, System's internal interfaces, role of VLRs & HLRs. Handover algorithms, security, Operation Maintenance systems	6
3	3G Systems & beyond : Evolution towards 3G systems based on GSM & CDMA networks. Radio interface, system internal functioning, handover scenarios, security,	6
4	Wireless LAN systems : Medium access control mechanism in 802.11 networks. Radio interface, protocol architecture.	5
5	Mobile adhoc networks. Networking with a view of 4G Wireless Imperatives and Challenges ,Algorithms for routing & overall network function. Mobile satellite networks.	6
6	Support for mobility : Mobile IP, TCP for mobile hosts. Other developments in the TCP/IP stack for mobility support, Introduction to IoT, Introduction to 5G Technology.	5

Text Books

SN	Title	Authors	Publisher
1	Mobile Communications	J.Schiller	Pearson Education
2	Mobile and Personal Communication Systems & Services	Raj Pandya	Prentice Hall

Reference Books

SN	Title	Authors	Publisher
1	Mobile Ad Hoc Networking	Stefano Basagni,Marco Conti	Wiley India Edition

VII Semester

IT2443 – PE VI: E-commerce

Objective	Course Outcome
The student should be able to 1) To understand the scope of e-commerce in the realm of modern Business. 2) To learn the marketing methods& Business strategies used in e-commerce. 3) To know how the electronic data interchange and how to manage commerce solutions 4) Understand the security threats &electronic payment system	**On completion of this course, the student will be able to** **1.** Understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web. 2. Analyze and understand the human, technological and business environment associated with e-commerce. 3. Define and analyze the concept of electronic data interchange and its legal, social and technical aspects. 4. Define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO	Understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web.	2	2												
CO	Analyze and understand the human, technological and business environment associated with e-commerce.	3	3												
CO	Define and analyze the concept of electronic data interchange and its legal, social and technical aspects.	3	3				3								
CO	Define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system	2	3				3							2	

Unit No.	Contents	Max. Hrs.
1	Internet &Introduction to Electronic Commerce: The basics of internet access, email, FTP, TELNET, Introduction to WWW: The basics of WWW & browsing working of Web Browser & Web Server, Web Browser architecture. Introduction to Electronic Commerce: The scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade.	7
2	Business Strategy in an Electronic Age: The Value Chain System, Competitive Advantage, Business Strategy, Introduction to Stock-Keeping Unit (SK).	7
3	Business to Business Electronic Commerce: Inter-organisational Transactions, Electronic Markets, Electronic Data Interchange, EDI: EDI Technology, EDI Standards, EDI, Communication, EDI Implementation, EDI Security, EDI and Business, Inter-organisational e-Commerce.	8
4	Business to Consumer Electronic Commerce: Consumer Trade transactions, What you want, when you want it, internet e-commerce, Internet Shopping and the Trade cycle, Advantage and Disadvantage of Consumer e-commerce.	7
5	The Elements of e-Commerce & e-Business: Elements, e-Visibility, The e-shop, Online Payments, Delivering the Goods, After-Sales Service. e-Business: Introduction, Internet Bookshops, Software Supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the Net.	7
6	Security Threats to E-Commerce, Electronic Payment Systems (EPS).	6

Text Books

SN	Title	Authors	Publisher
1	E-Commerce	David Whiteley	McGrew Hill Pub
2.	Electronic Commerce	Gary P. Schneider & James T. Perry	Course Technology

Reference Books

SN	Title	Authors	Publisher
1	Teach Yourself Web Technologies -Part 1	Ivan Bayross	BPB Publications
2	Web Technologies TCP/IP Architecture, and Java Programming	Achyut S. Godbole and Atul Kahate	McGraw-Hill Education (India)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2021-22 onward)

Information Technology

VII Semester

IT2444 – PE VI: Natural Language Processing

Objective	Course Outcome
The student should be able to **1.** Know fundamental concepts and techniques of natural language processing (NLP). 2. Recognize the significance of pragmatics for natural language understanding. 3. Describe the application based on natural language processing	**On completion of this course, the student will be able to** 1. Understand approaches to syntax and semantics in NLP. 2. Understand the concepts behind n-gram models. 3. Understand approaches to POS tagging, Word sense disambiguation, summarization and information retrieval within NLP. 4. Understand machine learning techniques used in NLP, including hidden Markov models.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO	Understand approaches to syntax and semantics in NLP	3	3												
CO	Understand the concepts behind n-gram models	3													
CO	Understand approaches to POS tagging, Word sense disambiguation, summarization and information retrieval within NLP.	3		2											
CO	Understand machine learning techniques used in NLP, including hidden Markov models.	3				2									

Unit No.	Contents	Max. Hrs.
1	Introduction: What is Natural Language Processing, Brief history of the NLP, Stages of NLP,Applications of NLP, Challenges for NLP, Approaches to NLP .introduction to word tokenization, sentence segmentation, stemming, word normalization.	6
2	Language Models: The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.	6
3	Part Of Speech Tagging and Sequence Labeling: Lexical syntax. Hidden Markov Models. Morphology analysis(Indian languages),Accuracy measures.	6
4	Word net and Word sense Disambiguation: Supervised , unsupervised methods and semi supervised methods. Resource-Constraints WSD, Word embedding and phrase embedding.	5
5	Pragmatics Discourse: Coreferences, reference resolution, reference phenomenon, syntactic and semantic constraints on co reference.	6
6	Natural language Processing applications (Indian regional languages): Sentiment Analysis, Text Entailment, Robust and Scalable Machine Translation, Question Answering in Multilingual Setting.	5

Text Books

SN	Title	Authors	Publisher
1	Speech and Language processing	Daniel Jurafsky and James H. Martin (ISBN13: 978-0131873216)	Prentice Hall, 2008

Reference Books

SN	Title	Authors	Publisher
1	Natural Language Processing with Python	Steven Bird, ewan Klein, and Edward Loper	Reilly Media, 2009

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Information Technology

VII Semester
IT2409– Mini Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	On successful completion of the course students will be able to: 1. Understand the knowledge gained from the various courses undergone in earlier years. 2. Able to work in team and adapt professional ethics and practice and how to write technical documents in professional style, and to demonstrate the product/software to technical audience. 3. Able to evaluate and analyze critically evaluate and analyze different sources of data available in the literature. 4. Able to learn and to apply the knowledge of tools/Technology.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii	

The students group will be formed by the project coordinator, based on the field of interest project guides will be allotted to the groups. Students need to carry the literature survey and implementation under the guidance of their project guides. Project groups' needs to submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

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BE SoE and Syllabus 2018

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Information Technology

VII Semester

IT2410 - Campus Recruitment Training (CRT)

COURSE OBJECTIVE	COURSE OUTCOMES
[illegible]	[illegible] [illegible] 3 [illegible]
Mapped Program Outcomes : [illegible]	

[illegible]

VIII Semester
IT2451– Major Project (Semester Long Internship)

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	On successful completion of the course students will be able to: 1. Understand the knowledge gained from the various courses undergone in earlier years. 2. Able to work in team and adapt professional ethics and practice and how to write technical documents in professional style, and to demonstrate the product/software to technical audience. 3. able to evaluate and analyze critically evaluate and analyze different sources of data available in the literature. 4. able to learn and to apply the knowledge of tools/Technology.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii	

The students will appear for the entrance examination of industry for Internship. After selection, students will join industry for a semester as a intern and will continue the project allotted by the industry and also will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII Semester
IT2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 2. To develop creative talent, self-confidence, sense of achievement. 3. To be able to design process on environmental, social, political, ethical, health and safety. 4. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 1,2,3,45,6,7,9,10,11	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

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