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2017-18

Summary

1.1.3 Average percentage of courses having focus on employability/ Entrepreneurship / skill development offered by the institution during the last five years

Year	2020-21	2019-20	2018-19	2017-18	2016-17
Employability/ Entrepreneurship/ skill development Focused Courses	348	399	375	364	326
No. of Courses offered	410	434	443	440	449

- *Highlighted Curriculum/ Syllabus of the courses*
- *Minutes of the Boards of Studies meetings with approvals*

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Y. C. COLLEGE OF ENGINEERING * AN AUTONOMOUS INSTITUTION * NAGPUR
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1	ighlighte Curri ulum/Syllabus of the Courses C	3
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9	Mapping of Courses to Employability/ Entrepreneurship/ Skill Development	513 519

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: 1,4,11	

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.

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 determine the Index properties of soil 2. An ability to determine the Engineering properties of soil
Mapped Program Outcomes: 1,2,4,9,10	

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.

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 :1,2,3,5	

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,

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 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	

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.

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:1,2,5,9,11	
Mapped Program Specific Outcomes: 1	

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.

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 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	

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

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
1To be able to identify various building elements, and their require ements 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:- 1,8,9,10	
Mapped Program Specific Outcomes:3	

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 buildingincluding 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

CV1302	Lab : Surveying – II		L=0	T=0	P=2	Credits = 1
Evaluation Scheme	**MSEs ***	**TA**	**ESE**		**Total**	**ESE Duration**
	-----	**40**	**60**		**100**	**-----**

MSEs = Three 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
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:1,2,5,9	

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.

CV1308	Lab : Structural Analysis-I		L=0	T=0	P= 2	Credits = 1
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**		**ESE Duration**
	-----	**40**	**60**	**100**		**-----**

MSEs = Three 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	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:1,2,4,	
Mapped Program Specific Outcomes:1	

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.

CV1305	Lab : Transportation Engineering – I		L=0	T=0	P=2	Credits= 1
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**	**ESE Duration**	
	-----	**40**	**60**	**100**	**-----**	

MSEs = Three 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
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: 1,2,3,4,11,	

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.

CV1311	Lab: Fluid Mechanics – II		L=0	T=0	P=2	Credits = 1
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**	**ESE Duration**	
	-----	**40**	**60**	**100**	**-----**	

MSEs = Three 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
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:1,2,3,5	

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.

CV1314	Seminar		L=0	T=0	P=2	credits = 1
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**	**ESE Duration**	
	-----	**40**	**60**	**100**	**-----**	

MSEs = Three 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	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:2,4,5,7,10,	

The students are expected to deliver presentations related to the subjects of their choice. The topic ofpresentation will be related to Civil Engineering.
The evaluation will be based on the presentation skill and subject knowledge of the student.

CV1403	Lab: Structural Analysis – II		L=0	T=0	P=2	Credits = 1
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**	**ESE Duration**	
	-----	**40**	**60**	**100**	-----	

MSEs = Three 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
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 multi storied 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: 1,2,4,5,10,11,	

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.

7th SEMESTER

CV1403	Lab: Structural Analysis – II		L=0	T=0	P=2	Credits = 1
Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration	
	-----	40	60	100	-----	

MSEs = Three MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

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

CV1442	Lab : Computer Application in Civil Engineering		L=0	T=0	P= 2	Credits = 1
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**	**ESE Duration**	
	-----	**40**	**60**	**100**	-----	

MSEs = Three 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
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: 1,2,3,5,9,11	

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.

CV1406	Industrial Training / CRT		L=3	T=0	P=4	Credits = 3
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**	**ESE Duration**	
	-----	-----	-----	**100**	-----	

MSEs = Three 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
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. 3. An ability to implement the field knowledge to the practical applications.
Mapped Program Outcomes: 1,2,5,10,11	

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.

CV1424	Comprehensive Viva-Voce		L=0	T=0	P=0	Credits = 3
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**	**ESE Duration**	
	-----	-----	**100**	**100**	-----	

MSEs = Three 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	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. 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: 2,4,5,6,10	

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.

CV1426	Extra / Co-Curricular / Competitive Examination		L=0	T=0	P=0	Credits = 2
Evaluation Scheme	**MSEs ***	**TA**	**ESE**	**Total**	**ESE Duration**	
	-----	**100**	-----	**100**	-----	

MSEs = Three 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	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.

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
1. To understand study various types of pavement, design parameters and material characteristic for flexible and rigid pavements. 2. To analyze and design of flexible and rigid pavements for highway and airfields pavement. 3. To understand various standards and specifications of highway and airfields pavement. 4. Pavement testing and evaluation and strengthening of the pavement.	Students will be able to 1. identify various types of pavement, design parameters and material characteristic for flexible and rigid pavements. 2. analyze and design of flexible and rigid pavements for highway and airfields pavement. 3. identify and refer various standards and specifications related to highway and airfields pavement. 4. rectify various pavement distresses and their repair or maintenance strategies.
Mapped Program Outcomes: 1,2,3	

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.

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: 1,2,10	

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

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: 1,2,4,5	
Mapped Program Specific Outcomes:1	

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

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 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: 1,4,5,10,11	

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

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
Students will be introduced to 1. losses, various valves and its operation, pumps, three reservoirs and multy-reservoirs 2. analysis of water distribution network by various method 3. design of water distribution network and rising main 4. optimal design of water distribution network	Students will be able to 1. examine the fundamental principles of fluid mechanics and related applications. 2. estimate discharges in multy -reservoir system connected by pipes 3. analyze the water distribution network by using various method 4. design optimal diameter of rising main and water distribution network 5. optimize water distribution network
Mapped Program Outcomes: 1,2,3	

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: 1,8,11	
Mapped Program Outcomes:1	

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

Regular: - 3rd Semester Theory

ME1201	Material Science and Metallurgy	L=3	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) Student will be able to understand microstructure and the effect of microstructure and Crystalline nature property of metals .	(1) Student will be able to distinguish microstructure and analyse the effect of Crystalline nature on property of metals .
(2) Student will be able to understand 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) Student will be able to understand heat treatment process for imparting specific properties in cast iron and steels.	(3) Student will be able to justify suitable heat treatment process for imparting specific properties in cast iron and steels.
(4) Student will be able to understand the basics of powder Metallurgy and metal, alloys, non-metal powder used for powder metallurgical components.	(4) Student will be able to perceive the basics of powder Metallurgy and suggest proper metal, alloys ,non-metal and powder metallurgical component for specific application requirement

Syllabus

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. **[a,b,h]**

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

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. **[a,b,k]**

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

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

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,

Regular: - 3rd Semester Practical

ME1202	Material Science and Metallurgy Laboratory	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 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. **[a,b,e,h,k,l,m]**	(1) Student will be able to distinguish microstructure and analyse the effect of Crystalline nature on property of metals . (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) Student will be able to justify suitable heat treatment process for imparting specific properties in cast iron and steels. (4) Student will be able to perceive the basics of powder Metallurgy and suggest proper metal, alloys ,non-metal and powder metallurgical component for specific application requirement

List of Practical

A set of 10 Experiments from following list to be performed.

1) Study of Metallurgical Microscope. **[a,b,e]**
2) Preparation of Specimen for metallographic examinations. **[a,b,e]**
3) Study and drawing of microstructures of Steels. **[a,b,e]**
4) Study and drawing of microstructures of Cast Iron. **[a,b,l]**
5) Study and drawing of microstructures of Non Ferrous Metals. **[a,b,e]**
6) Study of the effect of annealing and normalizing on properties of steels. **[a,e,l]**
7) Determination of hardenability of steels by Jominy End Quench test. **[a,b,e]**
8) Tensile test on Mild Steel and Aluminum test specimen. **[a,b,k]**
9) Measurement of hardness of ferrous and non-ferrous materials with the help of Brinell hardness tester. **[a,b,e]**
10) Measurement of hardness of ferrous and non-ferrous materials with the help of Vicker hardness tester. **[a,b,e]**
11) Measurement of hardness of ferrous and non-ferrous materials with the help of Rockwell hardness tester. **[a,b,e]**
12) Study the heat treatment of high speed steels. **[a,k]**
13) Study the heat treatment of stainless steel. **[a,k]**
14) Study of effect of alloying elements on properties of steels. **[a,b,]**
15) Study of macroscopic examinations. **[a,k]**

16) Study of mechanisms of quenching. **[a,k]**

17) Study of Pack carburizing of steel samples. **[a,k]**

Regular: - 3rd Semester Theory

ME1203	Mechanics of Material	L=3	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 student should be able to understand the fundamentals of solid mechanics. Acquire elementary knowledge of stresses, strains and material properties. Understand and analyze the basic principles involved in the behavior of machine parts under load in the context of designing it. Understand and analyze the mechanical properties of the various materials **[a,b,c,d,e,l,m]**	Students will be able to: 1. Describe the concept of stress, strin and their variations under different types of loadings. 2. Apply the basic concepts like bending moment, shear force, stresses in beams to solve problems. 3. Analyze members subjected to impact load and buckling. Investigate the stresses in circular shaft subjected to torsion. 4. Evaluate the simple member under combined stresses.

Syllabus

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. **[a,b,c,e]**

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

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

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.

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

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

Unit 6

[8 hrs]

Principal stresses and strains: 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) **[a,b,e,l]**

Text books:				
1	Strength of Materials	16th Edition (2010)	Ramamrutham S.	Dhanpat Rai Publishing
2	Strength of Materials	4th Edition (2009)	Beer and Johnston	McGraw-Hill

Reference books:				
1	Design Data for Machine Elements	3rd Edition (2008)	Shiwalkar B. D	Denett & Co.
2	Design Data Book	7th Edition (2007)		PSG Tech, Coimbatore, India
3	Design of Machine Elements	3rd Edition (2007)	Shiwalkar B. D	Denett & Co.
4	Strength of Materials	Seventh Edition 1984	Timoshenko and Young	CSB Publisher
5	Strength of Materials	4th (February 1987)	Singer F. L	Harper and Row Publications
6	Introduction to Mechanics of solids	2nd (June 1998)	Popov E.P	Prentice Hall Publication

Regular: - 3rd Semester Practical

ME1204	Mechanics of Material Laboratory	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
The student should be able acquire elementary knowledge of stresses, strains and material properties. Understand and analyze the basic principles involved in the behavior of machine parts under load in the context of designing it. Understand and analyze the mechanical properties of the various materials	Students will be able to: 1. Describe the concept of stress, strin and their variations under different types of loadings. 2. Apply the basic concepts like bending moment, shear force, stresses in beams to solve problems. 3. Analyze members subjected to impact load and buckling. Investigate the stresses in circular shaft subjected to torsion. 4. Evaluate the simple member under combined stresses.

List of Practical

A set of 8 Experiments from following list to be performed.

1. Study and demonstration of Universal Testing Machine & its attachments. **[a,b]**
2. Study & demonstration of Extensometer.**[a,b,l]**
3. Tension Test on mild steel, Aluminum & compression test on cast iron on Universal Testing Machine.**[a,b,e,m]**
4. Direct Shear Test of mild steel on Universal Testing Machine. **.[a,b,e,m]**
5. Izod & Charpy - Impact tests of a standard specimen. **.[a,b,e,m]**
6. Torsion Test on Mild steel bar. **.[a,b,c,l]**
7. Assignments: Drawing sheet on shear force & bending Moment diagrams for a given loading (At least four problems.) **[a,b,d]**
8. Estimation of principal stresses and maximum shear strain for a given combined loading by analytical & Mohr's circle method. (At least two problems**).[a,b,e,l]**
9. Experiment on fatigue analysis. **[a,b,l,m]**
10. Experiment on bending test.**[a,b,c]**

Regular: - 3rd Semester

ME1205	Fluid Mechanics	L=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
Develop an understanding of fluid statics, kinematics and dynamics in Mechanical. Learn to apply Bernoulli's 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.	**CO:1** The student will be able to describe, analyze and evaluate various fluid properties; and will analyze and evaluate hydrostatic forces acting on submerged bodies.
	CO:2 The students will be able to describe, analyze and evaluate the various flow pattern, velocity and acceleration using fluid kinematics
	CO:3 The students will be able to describe and analyze ideal flow and real flow problems related to hydraulic systems, flow measuring devices and flow through pipes.
	CO:4 The students will be able to describe, analyze and evaluate the various parameters related to fluid flow over bodies .

Unit1
[8 hrs]
Introduction to Fluid Mechanics: Properties of fluids, Newton's law of viscosity and its application Pascal's law, Basic equation of fluid static, Fluid pressure & its measurement (Manometers & Bourdon's pressure gauge) Hydrostatics: Pressure variations in compressible & incompressible fluids. **[CO-1]**

Unit2
[7 hrs]
Forces on submerged plane surfaces and curved surfaces, Buoyancy.
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, Potential lines, Flow net, Stream function, Velocity potential, Circulation, Vortex motion. **[CO-1,2]**

Unit3
[8 hrs]
Dynamics Of Fluid Flow: One-dimensional method for flow analysis, Euler's equation of motion, Derivation of Bernoulli's equation for incompressible flow & its applications. **[CO-3]**

Unit4
[7 hrs]
Measurement Of Fluid Flow: Through ducts or pipes: Venturi meter, Orifice meter, Pitot tube.
Through reservoirs: Orifice, Mouthpiece. Through open channels: Discharge over Notches (Triangular, Rectangular, Trapezoidal only) Rota meter, Vane Anemometer, Turbine meter. Error analysis in flow measurements. **[CO-3]**

Unit5
[8 hrs]
Viscous Flow: Introduction to laminar and turbulent flow, Reynolds number and its significance, Boundary layer concept, Wall shear and boundary layer thickness, Displacement thickness and Momentum thickness, Momentum integral equations for the boundary layer (Von Karman), Separation, Drag and Lift on immersed bodies. Flow of viscous fluids through parallel plates, Pipes, Kinetic energy correction factor, Momentum energy correction factor. **[CO-4]**

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-3]**

Reference books:

1	Fluid Mechanics: Fundamentals and Applications	9th Edition (2006)	Yunus A. Cengel and John M. Cimbala	McGraw-Hill
2	Fluid Mechanics & Fluid Power Engineering	17th Edition (2007)	D. S. Kumar	S. K. Kataria Publication
3	Basic Fluid Mechanics	Fourth Edition 2006	C.P. Kothandaraman & R. Rudramoorthy	New Age Publication
4	Fluid Mechanics	Third Edition 2009	J.F.Douglas, J.M.Gasiorek & J.A. Swaffield	ELBS Publication
5	Fluid Mechanics	Fourth Edition 2009	A.K.Mohanty	Prentice Hall Publication
6	Fluid Mechanics	8th edition, 1995	A.K.Jain	Khanna Publishers

Regular: - 3rd Semester Theory

ME1206	Kinematics of Machinery	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
The main objective to study kinematics of machinery is Mechanisms and machines have considerable fascination for most students of mechanical engineering since the theoretical principles involved have immediate application to practical problems. It 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. **[a,b,c,e,k]**	Students will be able to: 1.Analyze the various mechanisms and investigate relative movements, evaluate the velocity and acceleration of simple mechanism. 2.Justify the motion of the follower as per given application and design the profile for cam – follower mechanism.. 3.Differentiate between various gear profiles , justify the selction and types of gears and gear trains, investigate the kinematics of gears and gear trains. 4.Estimate the forces on links due to static orces acting on a mechanism.

Syllabus

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, energy paths. Various types of mechanism such as Geneva wheel, Pawl and ratchet mechanism, Exact straight line mechanism, Approx. straight line mechanism, steering mechanism, Transport mechanism. **[a,c,k]**

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. **[a,k]**

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. **[a,b,e]**

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. **[a,b,e]**

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. **[a,b,e]**

Unit 6

[7hrs]

Static force analysis: Free body diagram, condition of equilibrium. Analysis of all links of given linkage, cam, gear mechanism and their combinations without friction. **[a,c]**

Text books:				
1	Theory of mechanisms & machines	Second Edition (1995)	Shigley J. E	Tata McGraw-Hill
2	Theory of Mechanism and Machine	Second Edition (1988)	Ghosh & Malik	Affiliated East-West Press
3	Mechanism and Machine Theory	Second Edition (1992)	Rao J.S & DukkiPati R.V.	New Age International (P) Limited
4	Theory of Machine	Third Edition	Rattan S.S	Tata McGraw-Hill

Reference books:				
1	Theory of machines	Third Edition	Thomas Bevan	Pearson Education India
2	Theory of Machines	Fourth Edition	Sandor & Erdman	Tata McGraw-Hill

Regular: - 3rd Semester Theory

ME1207	Manufacturing Processes-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

Objective	Course Outcome
To enable students gain basic understanding metals cutting and manufacturing processes used in industry today. **[a,c,k]**	Upon successful completion of the course, the student will be able to: I. Distinguish among various cutting tool materials and tool geometries. II. Examine the different processes and machine tools for cylindrical surface machining. III. Differentiate various machining processes and conditions for flat surface machining using SPCT. IV. justify machining processes for flat surfaces marching using MPCT.

Syllabus

Unit 1

[7 hrs]

Introduction to Machining Parameters: Introduction to machining, Tool materials, nomenclature and tool geometry of single point cutting tool, tool materials properties, classification, HSS, carbide tool, coated tools, diamond coated tool, coolant materials. Theory of metal cutting: Introduction, Orthogonal and Oblique cutting, Mechanics of metal cutting, Shear plane, Stress, Strain and Cutting Forces, Merchant Circle(Analytical treatment), Chip formation, Cutting Fluids, Estimation of Tool life **[a,c,k]**

Unit 2

[8 hrs]

Lathe: Introduction, type, construction of simple lathe, mechanism and 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. **[a,c,k]**

Unit 3

[7 hrs]

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, standard planner, open side planner, pit 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 machines - production slotter, puncher slotter, tool room slotter, slotter tools. Introduction to NC, CNC machines. **[a,c,k]**

Unit 4

[8 hrs]

Milling: Introduction, specifications, types, column & knee type milling machine, fixed bed type milling machines, production milling machines, special purpose milling machines such as thread milling machines, profile milling machine, Gear Milling/Hobbing machines. Mechanisms & Attachments for Milling. Cutting parameters, Types of milling operations, Types of milling cutters, Tool geometry & their specifications. Indexing- simple, compound and differential. Introduction to gear manufacturing. **[a,c,k]**

Unit 5

[7 hrs]

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. **[a,c,k]**
Unit 6 **[8 hrs]** Drilling: Introduction, tools for drilling, classification of drills, twist drills, drill size and specifications, carbide tipped drills, type of drilling machines-portable drilling machine, bench drilling machine, upright drilling machine, radial drilling machine, universal drilling machine, multispindle drilling machine. 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, microboring, boring operations. Broaching: Introduction, type of broaches, and nomenclature of broaches, type of broaching machines. **[a,c,k]**

Text books:				
1	Manufacturing Technology (Metal Cutting & Machine Tools)	2nd Edition (2009)	P N Rao	The McGraw-Hill Companies
2	Manufacturing Science	2nd Edition (2010)	Ghosh & Malik	East West
3	Workshop Technology (Volume-II)	2nd Edition (2009)	Hajra Choudhary	The McGraw-Hill Companies

Reference books:				
1	Manufacturing Engineering & Technology	1st Edition (2009)	S Kalpakjian & SR Schmid	Pearson Education Canada
2	Technology of machine Tools	1st Edition (1984)	Krar & Oswald	Gregg Division, McGraw-Hill
3	Manufacturing Processes	1st Edition (1974)	M Begman	Ballinger Pub. Co
4	Processes & Materials of Manufacture	1st Edition (1990)	R Lindberg	Allyn and Bacon Technology & Engineering
5	Production Technology	1st Edition (2008)	s. Karunakaran	HMT
6	Workshop Technology (Volume I & II)	2nd Edition (2009)	Bawa	The McGraw-Hill Companies

Regular: - 3rd Semester Practical

ME1208	Manufacturing Processes-I- Laboratory	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 enable students gain basic understanding metals cutting and manufacturing processes used in industry today. **[a,c,k]**	Upon successful completion of the course, the student will be able to: I. Distinguish among various cutting tool materials and tool geometries. II. Examine the different processes and machine tools for cylindrical surface machining. III. Differentiate various machining processes and conditions for flat surface machining using SPCT. IV. Justify machining processes for flat surfaces marching using MPCT.

List of Practical

A set of 8 Experiments from following list to be performed.

1. Single point cutting tool-Nomenclature and its analysis **[a,b,c]**
2. Tools for left hand & right hand turning **[a,b,c]**
3. Tools for external & internal turning (Boring) **[a,b,c]**
4. Study of cutting tool manual (any one) **[a,b,c]**
5. Study of mechanisms in Lathe **[a,b,c]**
6. Study of mechanism in drilling **[a,b,c]**
7. Study of mechanism in shaper **[a,b,c]**
8. Study of mechanism in milling **[a,b,c]**
9. Practical on turning involving facing, step turning, taper turning, boring, boring with internal steps & taper, drilling (on lathe), internal & external threading **[a,b,c]**
10. Practical on Shaper with exposure to auto feed **[a,b,c]**
11. Practical on Milling machine-Gear Milling **[a,b,c]**
12. Practical on use of drilling machines **[a,b,c]**
13. Introduction to NC,CNC machines **[a,b,c]**

Regular: - 4td Semester Theory

ME1210	Mechanical Measurement	L=3	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 study the various measuring systems, principles and their characteristics. To study the applications of measurements method, instrumentation technique. To evaluate mechanical parameters of different system. **[a,b,e,k,m]**	The Students will be able to – 1. Demonstrate the basic knowledge of measuring instruments and Evaluate various Static Characteristics. 2.Use mathematical models to Evaluate various Dynamic Characteristics of Instruments. 3.Differentiate between various Inputs and Explain Signal processing. 4.Select proper measuring instrument and Use it for measuring various mechanical parameters.

Syllabus

Unit 1 **[7 hrs]**
Purpose, Structure, and elements of a general measurement system. Static characteristics of measurement system, including systematic and statistical characteristics, Generalized model of measurement system, measurement error, Error probability density function, Error reduction. Type of inputs, methods of corrections. **[a,b,,m]**

Unit 2 **[8 hrs]**
Dynamic characteristics of measurements system, Mathematical modeling, transfer function, order of system, Standard input signals. Response of Zero, First and second order instruments, to Step, Ramp, impulse and, Sinusoidal inputs, dynamic Errors. **[a,b,m]**

Unit 3
[8 hrs]
Signal processing: Analogue to digital conversion. Structure and elements of microcomputer system. Introduction to Data Acquisition and communication system Signals and Noise in measurement system (No Mathematical treatment) Including Deterministic and Random signals, Noise, Interference, Noise Sources and couplings, Reduction of Noise.**[a,k,m]**

Unit 4 **[7 hrs]**
Classification, Principle, Sensing Elements, Signals Conditioning Elements, constriction, Range and working of instruments for measurements of linear & angular displacement, speed, acceleration and Strain . **[e,k,m]**

Unit 5 **[7 hrs]**
Classification, Principle, Sensing elements, signal conditioning elements construction, Range and working of instruments for measurement of, Force, Torque, Power, Pressure, and Sound. **[e,k,m]**

Unit 6 **[7 hrs]**
Classification, Principle, Sensing elements, signal conditioning elements construction, Range and working of instruments for measurement of temperature, level, and flow.**[e,k,m]**

Text books:

1	Principles of measurements system	4 edition (2005)	John P. Bentley	Pearson Education Asia Publisher
2	Measurement Systems	6th edition (2007)	Beckwith and Buck	Pearson Education India,
3	Mechanical Measurements–Applications and Design	6 Edition (2004)	Doebelin	McGraw-Hill.

Regular: - 4td Semester Practical

ME1211	Mechanical Measurement Laboratory	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 study the various measuring systems, principles and their characteristics. To study the applications of measurements method, instrumentation technique. To evaluate mechanical parameters of different system. **[a,b,e,k,m]**	The Students will be able to – (1) Demonstrate the basic knowledge of measuring instruments and Evaluate various Static Characteristics. (2) Use mathematical models to Evaluate various Dynamic Characteristics of Instruments. (3) Differentiate between various Inputs and Explain Signal processing. (4) Select proper measuring instrument and Use it for measuring various mechanical parameters.

List of Practical

A set of 10 Experiments from following list to be performed. **[b,m]**

1. Measurement of strain by using a basic strain gauge and hence verify the stress induced. **[b,m]**
2. Speed Measurement by using Stroboscope. **[b,m]**
3. Speed Measurement by using Magnetic Pick Up **[b,m]**
4. Speed Measurement by using Photo-electric Pick Up **[b,m]**
5. Measurement of flow by using Rota meter. **[b,m]**
6. Displacement measurement by inductive transducer. **[b,m]**
7. Temperature control using Thermal Reed switch & Bimetal switch. **[b,m]**
8. Calibration of Thermocouple. **[b,m]**
9. Calibration of RTD. **[b,m]**
10. Calibration of LVDT **[b,m]**
11. Determination of negative temperature coefficient and calibration of a thermister. **[b,m]**
12. Measurement of force & weight by using a load cell. **[b,m]**
13. Liquid Level Measurement by using Capacitive Transducer system. **[b,m]**
14. Verify characteristics of photo transducer. **[b,m]**
15. Measurement of Sound level using SLM. **[b,m]**
16. Measurement of Air velocity using Hot wire anemometer. **[b,m]**
17. Measurement of Air velocity using turbine type anemometer **[b,m]**

Regular: - 4td Semester Theory

ME1212	Engineering Thermodynamics	L=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 achieve an understanding of thermodynamics systems To provide in-depth study of laws of Thermodynamics, thermodynamic state, basic thermodynamic relations and properties of pure substance. To enlighten the basic concepts of vapour power cycles **[a,e,k,l,m]**	(***On completion of this course, the student will be able to:*** 1) Apply the laws of thermodynamics for the analysis of thermodynamic systems to evaluateenergy interactionin various processes s. a. (Analyzing, Applying, Evaluate) b. (ProgrammeOutcome: 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) Examine various thermodynamic parameters in the processes with phase change using steam tables, charts and relations applying the laws of thermodynamics. a. (Evaluating, Analyzing, Applying) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13) 4) Create various thermodynamic property relations using the concepts in thermodynamics. a. (Evaluating, Analyzing, Applying) **b.** (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13)

Syllabus

Unit 1 [8 hrs]
Introduction To Thermodynamics: Basic concepts of Thermodynamics, Closed & Open Systems, Forms of energy, Properties of a system, State and Equilibrium, Processes and Cycles, Temperature and Zeroth Law of Thermodynamics. The Ideal Gas equation of state, Difference between Gas and Vapor, Compressibility Factor, Internal energy and specific heats of gases, Universal Gas Constants. **[a,e,k,m]**

Unit 2 [8 hrs]
First Law of Thermodynamics : Heat and Work, Mechanical forms of work, Non-Mechanical Forms of Work, applied to closed systems flow work and enthalpy, The Steady flow process and its applications. Introduction to Unsteady Flow process. **[a,e,k,m]**

Unit 3 [8 hrs]
Second Law Of Thermodynamics: Introduction (Law of degradation of energy), Thermal energy reservoirs, Kelvin-Plank & Clausius statements, Heat engines, Refrigerator and Heat pump, Perpetual motion machines, Reversible and Irreversible processes, Carnot cycle, Thermodynamic temperature scale. **[a,e,k,m]**

Unit 4 **[7hrs]** **Entropy:** The Clausius inequality, Entropy, Principle of increase of entropy, Change in entropy for Closed and Steady flow open systems. Second law analysis of engineering systems: Availability, Reversible work and Irreversibility. **[a,e,k,m]**
Unit 5 **[7 hrs]** **Properties of Steam:** Critical state, Sensible heat, Latent heat, Super heat, Wet steam, Dryness fraction, Internal energy of steam, External work done during evaporation , T-S diagram, Mollier chart. Work and Heat transfer during various thermodynamics processes with steam as working fluid. Determination of dryness fraction using various calorimeters.. **[a,e,k,l,m]**
Unit6 **[7hrs]** Introduction to Power Plant Cycle, Vapour Cycles: Simple Rankine cycle , Thermodynamic Relations, T-ds relations, Enthalpy and internal energy as a function of independent variables, Specific heat relations, Maxwell's equation, Claperyon Equation, **[a,e,k,l,m]**

Reference books:				
1	Thermodynamics- An Engineering approach	5 Edition (2006)	Yunus A. Cengel, Michael A. Boles	McGraw-Hill
2	Thermodynamics	3 Edition (2007)	C.P. Arora	Tata Mc-Graw Hill publication
3	Fundamentals of Classical Thermodynamics	1st edition 2007	Gorden J.Van Wylen, Richard E.Sonntag	John Wiley
4	Engineering Thermodynamics	4th edition 2008	P. K. Nag	Tata McGraw-Hill
5	Basic Engineering Thermodynamics	3rd edition 2009	Reiner Joel	Longman

Regular: - 4th Semester Theory

ME1213	Design of Machine Elements	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
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. **[a,c,e,f,k,l,m]**	Students will be able to: 1. Describe the design process, material selection, calculations of stresses and sress concentrations under static and dynamic loading. 2. Design the various joints such as Riveted joints, welded joints & bolted joints and finding its failure criteria in eccentric loading. 3. Summerize the knowledge in design of helical and leaf springs, Brakes and clutches, presure vessels and power screws. 4. Dsign the solid and hollow shafts on the basis of strength, rigidity and critical speed.

Syllabus

Unit1 **[6 hrs]**

Definition of design, types of design, design process, need, defining the problem, feasibility, preliminary design alternatives, final design selection, preliminary and final plant drawings.

Failure criterion & manufacturing considerations in design, basis of good design, failure of machine parts, deformations, wear, corrosion, manufacturing methods, machining tolerance, surface finish, cost design consideration in casting & forging.

Mechanical properties , application and designing as per ISI and their equivalence with other standards of engineering materials, selection of material ,temperature effect on properties of material such as cast iron ,plain carbon steel& its application. **[a,c,e,f]**

Unit2 **[9 hrs]**

Design of Joints: Design of cotter and knuckle joint.

Riveted joints: Riveted joints for boilers, structural works (Uniform strength joint),and eccentric loaded riveted joint.

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 lever: Hand lever, foot lever ,and bell crank lever. **[a,c,e,l,m,k]**

Unit3 **[8 hrs]**

Power screw and Leaf spring: Design of power screw
Design of Helical and Leaf Springs. **[a,c,e,l,m,k]**

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. **[a,c,e,l,m,k]**

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. **[a,c,e,l,m,k]**

Unit 6 **[8 hrs]**

Design of Shafts: Design of transmission Shafts on the Basis of Strength, rigidity and critical speed. ASME Code for shaft Design, Design of Stepped shaft Axle splined Shaft, Keys. **[a,c,e,l,m,k]**

Text books:				
1	Machine Design	3rd. Edition. 1982	Black P. H	McGraw-Hill
2	Mechanical Engg. Design	5th Edition. 1989.	Shigley J. E	McGraw-Hill,
3	Design of Machine Element	3rd Edition (2008)	Shiwalkar B. D	Denett & Co.
4	Design of Data for Machine Elements	3rd Edition (2008)	Shiwalkar B. D	Denett & Co.
5	Design of machine elements	5th Edition	Bhandari V.B.	
Reference books:				
1	Mechanical Design of Machine	5th Edition. 2010	Maleev hartman	Cbs Publishers & Distributors
2	Design Data Book	7th Edition (2007)		PSG Tech, Coimbatore, India

Regular: - 4td Semester Theory

ME1215	**Hydraulic Machines**	**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**
The content of the syllabus intends to understand basic principles and physical phenomenon of fluid mechanics and fluid machineries. The basic objective is to study hydraulic machines commonly used in industrial and commercial environment & to study mathematical analysis involving matching of hydraulics of systems and selection of machineries **[a,b,e,k,l,m]**	**(1) Students will be able to design and analyze fluid mechanics system like jet, impulse & reaction turbine for optimum performance.** **(2) Students will be able to design and analyze the hydrodynamic pumps for optimum performance.** **(3) Students will be able to explore the use of dimensional analysis for the turbine & pump applications.** **(4) Students will be able to construct and implement control valves, actuators, pumps in the circuit of hydraulic system.**

Syllabus

Unit 1 **[7 hrs]**

Effect and analysis of Impact of Jet. Principles Hydraulic Machines. Theory of Rotodynamic machines. Classification of hydraulic machines.

Classification of hydraulic turbines, General Layout of hydroelectric Power Plant

Pelton Turbine: Principle, Constructional features, Velocity diagram and analysis, working proportions, Design parameters, Performance characteristics. **[a,b,e,k,m]**

Unit 2 **[8 hrs]**

Reaction or Pressure turbine, Francis turbine, Propeller turbine, Kaplan turbine, Velocity diagram and analysis, Working proportions, Design parameters, Cavitation in turbines, Draft tubes, Performance characteristics, Governing of Turbines. **[a,b,e,k,m]**

Unit 3 **[7 hrs]**

Hydrodynamic pumps: Classification and Applications.

Centrifugal Pumps: Components and Principles of operation, Classification, Priming, Fundamental equation, Various heads, Velocity triangles and their analysis, Effect of outlet blade angle, Vane shapes, Losses & efficiencies of pumps, Multi staging of pumps, Design considerations, Working proportions, N.P.S.H , Cavitations in pumps, Performance characteristics, Pump and system matching. **[a,b,e,k,l]**

Unit 4 **[8 hrs]**

Classification of Positive displacement Pumps: Reciprocating pumps: Basic principle, types, Main components, Slip, Work done. Indicator diagrams, Separation, Air vessels, Hand pumps. **[a,b,e,k,l]**

Unit 5 **[7 hrs]**

Dimensional analysis, dimensional homogeneity, Buckingham's π& Rayleigh method. Types of similarities, Dimensionless number and their significance, Unit and specific quantities.Model Testing: Application to hydraulic turbines and hydrodynamic pumps. **[a,e,k,l]**

Unit 6 **[8 hrs]**

Essential Elements Of Hydraulic System, Reservoir, Pumps : Introduction to gear pumps, Vane pumps, Screw pumps, Linear and rotary actuator, control valves, Hydraulic accumulator and intensifier, Basic hydraulic circuits. **[a,k,m]**

Reference books:

1	Fluid Mechanics with Engineering Applications	Eight Edition	Daugherty R.L. & Franizini J.B.	McGraw-Hill
2	Hydraulic Machines- Theory & Design	Second Edition (1988)	V. P. Vasandani	Khanna Publishers
3	Fluid Mechanics & Fluid Power Engineering	17th Edition (2007)	D. S. Kumar	S. K. Kataria Publication
4	Theory of Turbo-Machines	(1990)	A. T. Sayers	McGraw-Hill
5	Industrial Hydraulics	Third Edition (1979)	J. J. Pippenger	Gregg Division McGraw-Hill
6	Hydraulic Machines	Sixth Edition (1977)	Jagdish Lal	Metropolitan Book Co.
7	Fluid Power with applications	Sixth Edition	**Anthony Esposito**	Pearson education India
8	Hydraulic Machines	Third Edition (2008)	**Rajput R.K.**	S Chand and Company Ltd

Regular: - 4td Semester Practical PTDC: - 4th Semester

ME1216	Hydraulic Machines Laboratory	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
The content of the syllabus intends to understand basic principles and physical phenomenon of fluid mechanics and hydraulic machineries. The basic objective is to study hydraulic machines commonly used in industrial and commercial environment & to study mathematical analysis involving matching of hydraulic machines with the system.	**(1) Students will be able to design and analyze fluid mechanics system like jet, impulse & reaction turbine for optimum performance.** **(2) Students will be able to design and analyze the hydrodynamic pumps for optimum performance.** **(3) Students will be able to explore the use of dimensional analysis for the turbine & pump applications.** **(4)Students will be able to construct and implement control valves, actuators, pumps in the circuit of hydraulic system.**

List of Practical

A set of 8 Experiments from following list to be performed.

1. To verify Bernoulli's theorem. (N A) **[a,m]**
2. To find the value of coefficient of a given venturi meter fitted in a pipe. **[a,m]**
3. To find the value of coefficient of discharge for a given orifice meter. **[a,m]**
4. To find the value of friction factor for flow through pipe. **[a,m]**
5. Performance characteristics of Pelton Wheel. **[a,m]**
6. Performance characteristics of Francis Turbine. **[a,m]**
7. Performance characteristics of Kaplan Turbine. **[a,m]**
8. Performance characteristics of Reciprocating Pump. **[a,m]**
9. Performance characteristics of Centrifugal pump. **[a,m]**
10. Study experiment on basic hydraulic circuits **[a,k,m]**
11. Study of different types of rotary positive displacement pumps. **[a,k,m]**

Regular: - 4td Semester Theory

ME1217	Manufacturing Processes- 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

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. **[a,b,c,e]**	(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.

Syllabus

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 (Analytical treatment) Cleaning, inspection and casting defects.

Unit 2 [6 hrs]

Foundry mechanism: Special casting processes such as investment Casting, Centrifugal Casting, Shell Molding, CO Molding, Slush Casting, Die Casting, Cleaning, inspection & casting defects.

Unit 3 [5 hrs]

Mechanics of forming processes (including analytical treatment), Determination of forging forces, equipment (Hammer/Press) capacity required. Rolling, Forging, Extrusion & Wire Drawing. Melting furnaces – Types, Electric furnace, Induction furnace, Cupola-construction & operation.

Unit 4 [6 hrs]

Sheet metal working:- Introduction, Terminology, Types of operation, Classification of dies, Introduction to design parameters, Types of processes

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.

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.

Text books:				
1	Manufacturing Technology (Foundry Forming & Welding)	2nd Edition (2009)	P N Rao	The McGraw-Hill Companies
2	Manufacturing Science	2nd Edition (2010)	Ghosh & Malik	East West
3	Workshop Technology (Volume-I)	2nd Edition (2009)	Hajra Choudhary	The McGraw-Hill Companies
4	Manufacturing Engineering & Technology	1st Edition (2009)	S Kalpakjian & SR Schmid	Pearson Education Canada
5	Manufacturing Technology	3rd Edition (2003)	Adithan, Gupta	NEW AGE INTERNATIONAL
6	Modern Machining Processes	1st Edition (2008)	Pandey, Shah	The McGraw-Hill Companies

Reference books:				
1	Workshop Technology: Vol. I - III	2ndEdition (1961)	WAJ Chapman	St. Martin's Press
2	Manufacturing Processes	1st Edition (1974)	M Begman	Ballinger Pub. Co
3	Processes & Materials of Manufacture	1st Edition (1990)	R Lindberg	Allyn and Bacon Technology & Engineering
4	Workshop Technology (Volume I & II)	2nd Edition (2009)	Bawa	The McGraw-Hill Companies
5	Workshop Technology Vol. I & II	1st Edition (1979)	B.S. Raghuvanshi	Dhanpat Rai & Sons

ME1218	Manufacturing Processes- II Laboratory	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
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. **[a,b,c,e]**	(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

List of Practical

1. Study of Cupola Furnace **[a,e,k]**
2. Study of Moulding Processes **[a,b,e]**
3. Study of Casting Processes.**[a,e,l]**
4. Study of different types of pattern**[a,e,k]**
5. Practice on wood pattern making.**[a,b]**
6. Study of sand testing.**[a,b,k]**
7. Molding practical.**[a,b]**
8. Machining Work: At least two Mechanical assemblies using three or more parts involving machining on lathe, drill, shaper & milling machines.**[a,b,l]**

Note: It is expected that while planning practical for manufacturing process-I; the job should be designed, such that the job machined in MP-I could also be used for assembly (either few or all of them) in MP-II with little machining (if required).

A Visit: A visit to a foundry shop for more understanding of the casting practices. **[a,l]**

Regular: - 5th Semester Theory PTDC: - 3rd Semester

ME1301	**Metrology and Quality Control**	**L=3**	**T=0**	**P=0**	**Credits=3**

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. • .	• **Students will be able to** **1)** classify various operations and design of limit ,fit and tolerances.. **[a,e]** **2)** interpret principle of engg. Metrology and can evaluate quality by metrological equipments. **(a,b,e,k)** **3)** Apply statistical process control and acceptance sampling procedures in a manufacturing environment to improve quality of process.. **(a,b,e,k)** **4)** Illustrate different tools used in quality management.. **[a,e,]**
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

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

Regular: - 5th Semester Practical PTDC: - 3rd Semester

ME1302	**Metrology and Quality Control Laboratory laboratory**	**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]**	• Students will be able to 1) classify various operations and design of limit ,fit and tolerances.. [a,e] 2) interpret principle of engg. Metrology and can evaluate quality by metrological equipments. (a,b,e,k) 3) Apply statistical process control and acceptance sampling procedures in a manufacturing environment to improve quality of process.. (a,b,e,k) 4) Illustrate different tools used in quality management.. [a,**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]**

Regular: - 5th Semester Theory

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]**	(On completion of this course, the student will be able to: 1) Analyze and solve the problems of unidirectional steady state heat conduction and lumped heat capacitance systems. a. (Analyzing, Applying:(Solving)) b. (Programme Outcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 2) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient. a. (Analyzing:(Investigate), Applying, Evaluate:(estimating)) b. (Programme Outcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 3) Design & analyze the heat exchangers with LMTD & ϵ-NTU methods. a. (creating:(design), Analyzing) b. (Programme Outcome: PO-1, PO-2, PO-3, PO-5, PO-11,PO-12, PO-13) 4) Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships. a. (Analyzing:(examine), Evaluating, Applying(Using)) b. (Programme Outcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13)

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]

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

Regular: - 5th Semester

ME1304	Heat Transfer Laboratory	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)**	(On completion of this course, the student will be able to: 1) Analyze and solve the problems of unidirectional steady state heat conduction and lumped heat capacitance systems. a. (Analyzing, Applying:(Solving)) b. (Programme Outcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 2) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient. a. (Analyzing:(Investigate), Applying, Evaluate:(estimating)) b. (Programme Outcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 3) Design & analyze the heat exchangers with LMTD & ϵ-NTU methods. a. (creating:(design), Analyzing) b. (Programme Outcome: PO-1, PO-2, PO-3, PO-5, PO-11,PO-12, PO-13) 4) Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships. a. (Analyzing:(examine), Evaluating, Applying(Using)) (Programme Outcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13)

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]**

Regular: - 5td Semester Theory

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	Unit
Students should be enable to acquire the knowledge of applications of thermodynamics about compressible fluid flow, steam nozzle, steam turbine and steam condenser. 2.Students should understand the working of Gas turbine and Jet propulsion	**(1) Students shall be able to describe and analyze the basic principles of compressible fluid flow and apply those principles to its applications. [PO-1,PO-5,PO-12,PO-13]**	1
	(2) Students should illustrate and analyze Steam nozzle, steam turbine and condenser used in thermal power plants. [PO-1,PO-5,PO-12,PO-13]	2,3,4
	(3) Students should able to illustrate and evaluate gas turbine cycle, its classification, and its application in power plant. [PO-1,PO-5,PO-12]	5
	(4) Students should able to evaluate gas turbine cycle, and its application to jet propulsion.[PO-1,PO-5,PO-12]	6

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]**

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

Regular: - 5th Semester Theory

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]**	Students 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.

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

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

Regular: - 4td Semester Practical

ME1324	Dynamics of Machinery Laboratory	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 characteristics. 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]**	Students 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 **[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]**

Regular: - 6th Semester Practical

ME1308	Machine Drawing Laboratory	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.	Students will be able to: 1. Identify the National and International standards pertaining to machine drawing. 2. Apply limits & tolerances to assemblies and choose appropriate fits. 3. Recognize machining and surface finish symbols. 4. Explain the functional and manufacturing datum in selection to geometric tolerances.

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.

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

Regular: - 6th Semester Theory

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

Regular: - 6th Semester Practical PTDC: - 6th Semester

ME1311	Energy Conversion Laboratory	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]**

Regular: - 6td Semester Theory

ME1312	Computer Aided Design	L=4	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 educate students on -Main concepts of computer aided design -Graphics representation of curves. -Surface and solids. **[a,e, k]**	Students will be able to: 1. Distinguish the various CAD CAM tools and also evaluate criteria for CAD CAM systems 2. Design 2D and 3D Transformation matrices 3. Calculate and analyze the parametric equations for wire frame. surface and solid modeling entities. 4. Design the applications of modeling and evaluate data exchange formats

Unit 1 CAD TOOLS [a,e,k][6 hrs]
Definition ofCADTools, Types ofsystemCAD/CAM systemevaluation Criteria, functional areas of CAD,Modelingandviewing,efficientuseofCADsoftware.

Unit2 Two / Three Dimensional Transformations [a,e,k][8 hrs]
Two& Threedimensional geometricandco-ordinatetransformations likescaling,translation, rotation, reflection,shear.Conceptofhomogeneous representationandconcatenated transformations. Inverse transformations.(Enumeration ofentityongraphpaper).

Unit 3 Wire Frame Modeling [a,e,k] [7 Hrs]
Typesofmathematical representation ofcurves,wireframemodels,wireframeentities, parametric representation ofanalytical andsynthetic curves- Hermitecubic splines, Bezier curves, BSplines

Unit4 Surface Modeling [a,e,k][8 hrs]
Mathematical representationofsurfaces,Surfacemodel,Surfaceentities, surfacerepresentation, parametricrepresentation ofsurfaces,planesurface,ruledsurface,surfaceofrevolution, Tabulated surface.

Unit 5 Solid Modeling [a,e,k] **[8 hrs]**

Solid Representation - Boundary Representation (B-rep), Constructive Solid Geometry (CSG) and othermethods, DesignApplications: IntroductiontoFeaturebasedandAssembly modeling.

Unit 6 CAD CAM Data Exchange **[a,e,k][8 hrs]**

Evaluationofdata-exchange formats, IGESdatarepresentations andstructure, STEPArchitecture,implementation, ACIS&DXF.

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
5				

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

Regular: - 6th Semester Practical

ME1313	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:
To educate students on -Main concepts of computer aided design -Graphics representation of curves. -Surface and solids. **[a,e, k]**	Students will be able to: 1. Distinguish the various CAD CAM tools and also evaluate criteria for CAD CAM systems 2. Design 2D and 3D Transformation matrices 3. Calculate and analyse the parametric equations for wire frame. surface and solid modeling entities. 4. Design the applications of modeling and evaluate data exchange formats

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]**

Regular: - 6th Semester Theory

ME1320	Control Systems Engineering	L=3	T=1	P=0	Credits=3

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

Objective	CourseOutcome :- Students will be able to
• To develop an ability to define transfer function. • To analyze the performance of control system in time domain and frequency domain.	(I) Describe the mathematical representation of various control system components and determine the transfer function of mechanical, electrical, thermal and fluid system. **[a,e,m]**
	(II)Analyse the construction and working of various control system components and electrical motors.**[a,e,m]**
	(III) Evaluate theperformanceof control system using time response analysis and stability analysis. **[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

Regular: - 7th Semester Theory PTDC: - 4th Semester

ME1447	Production 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

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 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.

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

Regular: - 7th Semester Theory

ME1448	Design of Mechanical Drives	L=4	T=0	P=4	Credits=4

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.	Students will be able to: 1. Dscribe the design process, material selection & calculations of stresses in flat belt, V belt, chain drive and rope drive, and finding its ailure criteria. 2. Design the various gear drive such as spur, helical, worm & worm wheel and bevel gears, and finding its failure criteria. 3. Summarize the knowledge on shafts, coupling and flywheel and finding its failure criteria. 4. Evaluate the radial and thrust load for journal bearings, antifriction bearings and finding its failure criteria.

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]**

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

Regular: - 7th Semester Elective-I Theory

ME1401	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]**	Students will be able to: 1. Explain the fundamentals of tool design. 2. Design the various cutting tools, dies, jigs/fixtures and forging dies. 3. Evaluate the failure modes of tools and cost estimation. 4. Compose the planning for manufacturing of tools for various parts

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]**

.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

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

ME1402	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]	Students will be able to: 1. Explain the various typs of Material handling systems. 2. Design the various rope and chain assisted material handling systems. 3. Explin various attachments, drives and safety components of material handling system. 4. Analyze and select various material handling systems for different material handling situations.

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

Regular: - 7th Semester Elective-I Theory

ME1404	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]**	**1. Students will be able to identify the plastic materials for some specified applications based`on its property.** **.Students will be able to investigate suitable plastic Processing technique.** **.Students will be able to evaluate the suitable machining and joining of plastic materials.** **Students will be able to justify the suitable Solid State Fabrication Techniques**

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.

Regular: - 7th Semester Elective-I Theory

ME1405	**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]**	The students will be able 1. To apply the concepts of monitoring and evaluation, appraise 2. To analyze 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..

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 environmental & social aspects. .**[a,d,e,h,k]**

.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

Regular: - 7th Semester Elective I- Theory

ME 1449	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.	Students will be able to: 1. Dscribe the design process, material selection & calculations of stresses in flat belt, V belt, chain drive and rope drive, and finding its ailure criteria. 2. Design the various gear drive such as spur, helical, worm & worm wheel and bevel gears, and finding its failure criteria. 3. Summarize the knowledge on shafts, coupling and flywheel and finding its failure criteria. 4. Evaluate the radial and thrust load for journal bearings, antifriction bearings and finding its failure criteria.

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)

.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

ME1456	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)**	Upon successful completion of the course, the student will be able to: CO I: distinguish the various nontraditional manufacturing process based on energy sources. CO II: evaluate various advanced manufacturing process for new materials and the requirements of complex features on the basis of various parameters. CO III: justify the various advanced welding and bonding techniques as per the applications. CO IV: Evaluate the application of various advanced manufacturing techniques in industries.

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

Regular: - 7th Semester Elective – ITheory

ME1461	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,I]	(I) Student will learn basics of Rapid Prototyping.[d,I]
	(II)Student will learn the process of RP.[I]
	(III)Student will learn model slicing for RP [I]
	(IV)Student will learn Liquid and solid based RP systems [I]
	(V) Student will learn powder based RP system [I]
	(V) Student will learn RP tooling and manufacturing [d,I]

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,I]**

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,I]**

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,I]**

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,I]**

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]**

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.

Regular: - 7th Semester Elective- Theory

ME1462	Fuel Cells 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 Hrs	

Unit 1 : [7 hrs]

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. **(CO -1)**

Unit 2 : [6 hrs]

Fuel Cell Thermodynamics: Heat Potential (Enthalpy of Reaction), Work Potential (Gibbs free energy), Reversible fuel cell voltage (Nernst equation), Fuel Cell Efficiency.
(CO-2)

Unit 3: [7 hrs]

Fuel Cell Electrochemistry: Electrochemical Reaction basics, Faraday's law, Tafel equation, Butler- Volmer equation, Exchange current
(CO-2)

Unit 4: [6 hrs]

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.
(CO-3)

Unit 5: [7 hrs]

Fuel Cell Characterization: In Situ Versus Ex Situ Characterization, Polarization Test, Electrochemical Impedance Spectroscopy, Linear Sweep Voltammetry, Cyclic Voltammetry, Current Interrupt, High frequency resistance.
(CO-4)

Unit 6 : [6 hrs]

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)
(CO-4)

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 Elective Theory

ME 1463	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

OBJECTIVES

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.

Regular: - 7th Semester Elective–II Theory

ME1408	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]**	CO-I Describe the fundamentals of kinematic synthesis and its application. CO-II Formulate mathematical model of function generation, path generation and motion generation. CO-III Apply various graphical and analytical methods to design the mechanisms to meet kinematic needs. CO-IV Evaluate the various optimisations 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,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	

Regular: - 7th Semester Elective-II Theory

ME1409	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

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 evaluate 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]**

.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

Regular: - 7th Semester Elective-II Theory

ME1410	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]**

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,

Regular: - 7th Semester Elective-II Theory

ME1411	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]**

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]**

.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

Regular: - 7th Semester Elective-II Theory

ME1412	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]**

.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

Regular: - 7th Semester Elective – I Theory

ME1466	Design For Manufacturing & Assembly	L=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 NO	DETAILS	Hours/Marks
UNIT 1	**Kinds of failure** : Yielding, Buckling, Fatigue, Creep, Environmental Degradation, Vibrational modes, Impact, Wear	[7 H/08M]
UNIT 2	**Different Theories of failure**	[7 hrs/10M]
UNIT 3	**Types of fracture** : Brittle fracture and ductile fracture , Theoretical cohesive strength , Stress concentration, Griffith's theory of brittle fracture , Orwan's theory , Irwin's theory: Energy release rate , Stress analysis of cracks: Stress intensity factor , Modes of crack surface displacement, plane stress and plane strain conditions , K1C	[8 hrs/10M]
UNIT 4	**Fracture toughness measurement**: Impact testing , Effect of temperature: transition temperature , Plane strain toughness and plane stress toughness testing , Indentation technique for measuring K1C , Crack opening displacement (COD) , J-Integral and J1C , R-Curve phenomenon	[8 hrs/12M]
UNIT 5	**Metallographic aspects of fracture**: Cleavage fracture-dislocation pile-up, crack nitiation, crack propagation, Ductile fracture: Coalescence of voids	[8 hrs/12M]
UNIT 6	**Fatigue fracture**: S-N curve , Fatigue crack growth , Fracture modes in fatigue , Microscopic fracture mechanisms , Toughening mechanisms	[7 hrs/08M]

Text Books:

QUANTITATIVE TECHNIQUES (7th sem Elective)

ME1467	**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:-** Integer 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 Elective Theory

ME 1468	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

OBJECTIVES

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

Regular: - 7th Semester Elective-III Theory

ME1406	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]
	(Iv)The students will be able to analyze structure.. [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]**

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

Regular: - 7th Semester Elective-III Theory

ME1417	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]**	**CO1 : The Students will have ability to design and evaluate experimentation on CNC machines.** **CO2: Designing of GT cell layouts for transforming into flexible manufacturing system.** **CO3: The students will be able to compose and transform robot programs various industrial applications.** **CO4: The students will have ability to justify CAPP and CAQC to design computer integrated manufacturing**

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]**

.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

Regular: - 7th Semester Elective-III Theory

ME1419	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 construct the engine systems & explore their coordination...**[a,b,h,m]** (II)Students will be able to determine design & development of fuel supply system **[a,b,h,m]** (III)Students will be able to analyze SI & CI engine combustions **[a,b,h,m]** (IV) Students will be able to perform & analyze the engine parameters **[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]**

.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.

Regular: - 7th Semester Elective-III Theory

ME1421	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	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]
	(3) The student will be able to study miscellaneous refrigeration devices of vapour compression refrigeration systems.[[a,b,k,m]
	(4)The student will be able to carry out performance analysis of air conditioning systems. [a,b,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]

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

Regular: - 7th Semester Elective-III Theory

ME1445	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]

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]**

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.

Regular: - 7th Semester Theory

ME 1469	**Refrigeration & Cryogenic**	L=3	T=0	P=2	Credit=3

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

Objectives	Course Outcome
• To study and analyse Vapour Compression Refrigeration Systems. • To study vapour absorption and other refrigeration systems. • To study and analyse Air Cycle Refrigeration Systems. • To study cryogenic technology	1. The student will be able to describe, analyze and evaluate Vapour Compression Refrigeration System.
	2. The student will be able to describe and analyze other refrigeration system such as Vapour Absorption Refrigeration System, Electrolux refrigeration system, steam jet refrigeration systems, thermoelectric refrigeration and vortex tube refrigeration
	3. The student will be able to describe, analyze and evaluate Air Cycle Refrigeration Systems.
	4. The student will be able to describe and analyze Cryogenic Systems.

UNIT I Air refrigeration systems **[7 Hrs]**

Gas cycle refrigeration, reversed Brayton /Joules/Bell Coleman cycle, aircraft refrigeration, simple cycle, boot strap cycle, reduced ambient air cycle, regenerative cycle. **[CO3]**

UNIT II Vapor Compression Refrigeration system **[5 Hrs]**

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. **[CO:1]**

UNIT III Multistage Refrigeration systems **[6 Hrs]**

Working and analysis of multistage systems multiple evaporator and multiple compressor systems. **[CO:I]**

UNIT IV Components of Vapour compression system **[6 Hrs]**

Various components used in refrigeration system like compressors, condensers, evaporators, expansion devices and its types, cooling towers, various control use in refrigeration system

Refrigerants

Types and classification, properties and nomenclature, environment friendly refrigerants. **[CO:1]**

UNIT V Other refrigeration systems **[5 Hrs]**

Vapor absorption systems (NH3- H20, LiBr- H2O) , Electrolux refrigeration system, Steam jet refrigeration systems, Thermoelectric refrigeration, Vortex tube refrigeration. **[CO:2]**

UNIT VI Cryogenics **[6 Hrs]**

Introduction and applications of cryogenics, Cascade refrigeration, Joules Thomson effect, methods of air liquefaction, Linde's and Claude's cycle .Liquefaction of hydrogen, Liquefaction of helium, cryogenic insulation. Hazards and safety, production of dry ice. **[CO:4]**

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
VII	ME1469	Refrigeration & Cryogenic	1	The student will be able to describe, analyze and evaluate Vapour Compression Refrigeration System.	3		3		3							3	3	3
			2	The student will be able to describe and analyze other refrigeration system such as Vapour Absorption Refrigeration System, Electrolux refrigeration system, steam jet refrigeration systems, thermoelectric refrigeration and vortex tube refrigeration	3		3		3							3	3	3
			3	The student will be able to describe, analyze and evaluate Air Cycle Refrigeration Systems.	3		3		3							3	3	3
			4	The student will be able to describe and analyze Cryogenic Systems.	3		3		3							3	3	3

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.

Regular: - 7th Semester Elective-III Theory

ME1476	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 : The student will be able to:-
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. **[PO1,5,6,11]**	(I) Explain the drives and mechanisms of machine tools (II) Design Gear boxes of machine tools (III) Design machine tool structures, guide ways and power screws, spindles and supports of machine tools. (IV) Test the machine tools and examine the 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. **[PO1,5,6,11] CO I**

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 . **[PO1,5,6,11] CO II**

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. **[PO1,5,6,11] CO III**

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. **[PO1,5,6,11] CO III**

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. **[PO1,5,6,11] CO III**

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. **[PO1,5,6,11] CO IV**

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
VII	ME 1476	EL III: Machine Tool Design	I.	Explain the drives and mechanisms of machine tools	3				3	3					3			
			II.	Design Gear boxes of machine tools	3				3	3					3			
			III.	Design machine tool structures, guide ways and power screws, spindles and supports of machine tools.	3				3	3					3			
			IV.	Test the machine tools and examine the control system of machine tools.	3				3	3					3			

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

Regular: - 8th Semester **Theory**

ME1435	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

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]	Students will have (I)Ability to design and evaluate product layout using line balancing.
	(II)Ability to compose and evaluate CNC programs.
	(III)Ability to examine the use of robot and automated material handling to design automated system.
	(IV)Ability design GT cells to build FMS.

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]**

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 PIll	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

Regular: - 8th Semester Practical

ME1436	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	

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]	Students will have (I)Ability to design and evaluate product layout using line balancing.
	(II)Ability to compose and evaluate CNC programs.
	(III)Ability to examine the use of robot and automated material handling to design automated system.
	(IV)Ability design GT cells to build FMS.

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]**

Regular: - 8th Semester Theory

ME1475	Operation Research 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:-

CO-I: - Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.

CO-II: -To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.

CO-III:-Analyze projects for minimum total cost and smooth level of resources.

CO-IV:-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

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]**

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.

Chairperson		Date of Release		Applicable for AY 2016-17 Onwards
Dean (Acad. Matters)		Version	1.01	

7th semester Elective

ME 1407	PE- : Lab: FINITE ELEMENT METHOD	L=0	T=0	P=1	Credits=1

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

Objectives:	Course outcomes:
• To develop an ability to analyze simple mechanical engineering problems using analysis software • To examine and build the solutions using the commercial softwares for simple machine elements **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**	*After completion of the course students would be able to* **1. Study, analyse and develop the fundamentals of Finite Elements Method for mechanical engineering problems.** **2. Evaluate the stresses, strains and deformation in simple machine elements and design solutions for simple problems.** **3. Build the solutions using the commercial softwares for simple machine elements.**

List of Practical:-

1. To study about Finite Element Methods **[PO-1,3,5,6,7,8,9,10,11,PSO-1,2]**
2. To determine stress and strain in 1-D bar element **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
3. To determine stress and strain in Composite element **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
4. To determine principle stress and strain in CST element **[PO-1,2,3,5,6,7,8,9,10,11,PSO-1,2]**
5. To determine stress and strain in CST element **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
6. To study the performance of structural tutorial **[PO-1,3,5,6,7,8,9,10,11,PSO-1,2]**
7. Deflection of Beam (Simply Supported Beam) **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
8. Tutorial of 2D truss analysis in Mechanical APDL (Ansys). **[PO-1,2,3,5,6,7,8,9,10,11,2,PSO-1,2]**

Regular: - 7th Semester Elective-III Practical

ME1418	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	

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]**	**CO1 : The Students will have ability to design and evaluate experimentation on CNC machines.** **CO2: Designing of GT cell layouts for transforming into flexible manufacturing system.** **CO3: The students will be able to compose and transform robot programs various industrial applications.** **CO4: The students will have ability to justify CAPP and CAQC to design computer integrated manufacturing**

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]**

Regular: - 7th Semester Elective-III Practical

ME1420	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	

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 construct the engine systems & explore their coordination...**[a,b,h,m]**
	(II)Students will be able to determine design & development of fuel supply system **[a,b,h,m]**
	(III)Students will be able to analyze SI & CI engine combustions **[a,b,h,m]**
	(IV) Students will be able to perform & analyze the engine parameters **[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]**

Regular: - 7th Semester Elective-III Practical

ME1422	REFRIGERATION & AIR CONDITIONING 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	

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]
	(3) The student will be able to study miscellaneous refrigeration devices of vapour compression refrigeration systems.[[a,b,k,m]
	(4)The student will be able to carry out performance analysis of air conditioning 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]

Regular: - 7th Semester Elective-IIII Practical

ME1446	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		

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]

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]

Regular :- 6th semester Practical

ME1470	**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
1 To study and analyse Vapour Compression Refrigeration Systems. 2 To study vapour absorption and other refrigeration systems. 3 To study various components used in Refrigeration Systems. 4 To study the refrigeration system and components used in Industry.	1. The student will be able to describe and analyse Vapour Compression Refrigeration System. 2. Student will be able to describe various components and controls used in vapour compression refrigeration system 3. The student will be able to describe Vapour Absorption Refrigeration System. 4. Student will be able to describe refrigeration system and other components used in Industry.

List of experiment

1. Experiment on Determination of COP of Refrigeration trainer [CO:1]
2. Trial on ice-plant test rig [CO:1]
3. Study of expansion devices used in vapour compression refrigeration system [CO:2]
4. Study of condensers and cooling towers used in vapour compression refrigeration system [CO:2]
5. Study of Evaporators used in vapour compression refrigeration system [CO:2]
6. Study of vapour absorption refrigeration system [CO:3]
7. Study of Electrolux refrigeration system [CO:3]
8. Study of controls used in refrigeration system [CO:2]
9. Visit to air liquefaction plant [CO:4]
10. Visit to cold storage [CO:4]
11. Visit to Industrial cooling tower [CO:4]
12. Visit to ice plant [CO:4]

Sem	Course code	Course title	CO	CO contain	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2			

7	ME1 470	Refrigeration and cryogenics	1	. The student will be able to describe, analyse and evaluate Vapour Compression Refrigeration System.	3		3		3			3				3	3	3			
			2	Student will be able to describe various components and control used in vapour compression refrigeration system	3		3		3			3				3	3	3			
			3	The student will be able to describe Vapour Absorption Refrige	3		3		3			3				3	3	3			

				ration System																
			4	Student will be able to describe refrigeration system and other components used in Industry.	3		3		3			3				3	3	3			

Regular: - 7th Semester Elective-IV Practical

ME1477	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 :** The student will be able to:-
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. . **[PO1,5,6,11]**	(I) describe the drives and mechanisms of machine tools (II) design Gear boxes of machine tools (III) design machine tool structures, guide ways and power screws, spindles and supports of machine tools. (IV) describe testing and control system of machine tools

List of Practical (Minimum 10 Experiments)

1. Introduction to Machine Tool Design **CO I** . **[PO1,5,6,11]**
2. Gear box design **CO II** . **[PO1,5,6,11]**
3. Design of Beds, Column, housings, Bases & Tables **CO III** . **[PO1,5,6,11]**
4. Design of, Cross Rails, Arms, Saddles, Carriages, Rams **CO III** . **[PO1,5,6,11]**
5. Design of Guide ways **CO III** . **[PO1,5,6,11]**
6. Design of Power Screws. **CO III** . **[PO1,5,6,11]**
7. Design of Spindles **CO III** . **[PO1,5,6,11]**
8. Design of Spindle Supports. **CO III [a, e,k,l]**

9. Testing of Machine Tools. **CO IV** . **[PO1,5,6,11]**
10. Study of Machine Tool controls. **CO IV** . **[PO1,5,6,11]**

Regular: - 8th Semester Elective–III Theory

ME1415	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]	Students will be able to: 1. Analyze the various types of vibrations. 2. Evaluate vibrations and carry out its analysis. 3. Predict/judge vibration parameters and evaluate through different approaches for multidegree freedom system. 4. Form and work on transformation of matrices for vibration for evaluating frequencies..

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	

Regular: - 8th Semester Elective-IV Theory

ME1437	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]**	1) To **investigate** the hydraulic fluids and **apply** the fluid power laws and principals for **analysis** of simple fluid power system. a. (Analyzing(Investigate), Applying) b. (ProgrammeOutcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 2) To **identify**, **analyze**, and **justify** selection of suitable components of fluid power system for specific applications based on its function, performance and working characteristics. a. (Remembering(identify), Analyzing, Evaluating:(Justify)) b. (ProgrammeOutcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 3) To **design** and **examine** the fluid power system and to **compose** and **interpret** its circuit diagrams **using** standard symbols. a. (Creating(Design, Compose), Analysing(Examine), Understanding:(Interpret) Applying(Using)) b. (ProgrammeOutcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-

	12, PO-13) 4) To **examine** the fluid piping and fittings, safety measures, maintenance, and trouble shooting for fluid power systems. a. (Analysing(Examine)) b. (ProgrammeOutcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13)

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]**
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

Regular: - 8th Semester Elective–IV Theory

ME1439	**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]	Students will be able to: 1. Explain the structure of NC, CNC and DNC 2. Design the tooling of CNC and compose program for CNC. 3. Explain the structure and kinematics of Robot. 4. Explain the various grippers and sensors, deign the applications and compose the program for Robot.

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
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

Regular: - 8th Semester Elective-IV Theory

ME1441	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	Unit
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular vehicle. 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. (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]**

- 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	

Regular: - 8th Semester Elective-IV Theory

ME1443	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]**	Upon successful completion of the course, the student will be able to: CO I: Differentiate the nature, scope and the role of MIS in an organization. CO II: Examining the system for processing the information. CO III: Compose the DSS to solve the managerial problems. CO IV: Justify the application using MIS tools.

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

Regular: - 7th Semester Elective - Theory

ME 1478	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

Unit 1 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.

Unit 2 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.

Unit 3 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.

Unit 5 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,

Regular: - 8th Semester Elective–III Practical

ME1416	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	

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]	Students will be able to: 1. Analyze the various types of vibrations. 2. Evaluate vibrations and carry out its analysis. 3. Predict/judge vibration parameters and evaluate through different approaches for multidegree freedom system. 4. Form and work on transformation of matrices for vibration for evaluating frequencies..

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]]**

Regular: - 8th Semester Elective-IV Practical

ME1438	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	

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]**	1) To **investigate** the hydraulic fluids and **apply** the fluid power laws and principals for **analysis** of simple fluid power system. a. (Analyzing(Investigate), Applying) b. (ProgrammeOutcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 2) To **identify**, **analyze**, and **justify** selection of suitable components of fluid power system for specific applications based on its function, performance and working characteristics. a. (Remembering(identify), Analyzing, Evaluating:(Justify)) b. (ProgrammeOutcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 3) To **design** and **examine** the fluid power system and to **compose** and **interpret** its circuit diagrams **using** standard symbols. a. (Creating(Design, Compose), Analysing(Examine), Understanding:(Interpret)

	Applying(Using)) b. (ProgrammeOutcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13) 4) To **examine** the fluid piping and fittings, safety measures, maintenance, and trouble shooting for fluid power systems. a. (Analysing(Examine)) b. (ProgrammeOutcome: PO-1, PO-2, PO-3, PO-5,PO-11, PO-12, PO-13)

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]

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

ME1440	**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**	

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]	Students will be able to: 1. Explain the structure of NC, CNC and DNC 2. Design the tooling of CNC and compose program for CNC. 3. Explain the structure and kinematics of Robot. 4. Explain the various grippers and sensors, deign the applications and compose the program for Robot.

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]**

Regular: - 8th Semester Elective-IV Practical

ME1442	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	

Objective	Course Outcome	Unit
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular vehicle. 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. (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

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]**

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

ME1444	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	

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]**	Upon successful completion of the course, the student will be able to: CO I: Differentiate the nature, scope and the role of MIS in an organization. CO II: Examining the system for processing the information. CO III: Compose the DSS to solve the managerial problems. CO IV: Justify the application using MIS tools.

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]

Regular: -7th Semester Elective - Practical

ME 1479	Solar Energy & Utilization lab	L=3	T=0	P=0	Credits= 2

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**

Regular: - 8th Semester Elective–V Theory

ME1451	STRESS 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	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]	(Students will be able to: 1. Analyze the stresses and strains in simple problems in Cartesian co-ordinate. 2. Analyze the stresses and strains in simple problems in Polar co-ordinate. 3. Analyze the stresses and strains using whole field method. 4. Analyze the stresses and strains using strain gauges, carryout of analysis for fracture and fatigue; design a proper stress analysis system for as per system requirements.

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]**

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

Regular: - 8th Semester Elective-V Theory

ME1452	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)	Students will be able to 1) Calculate and represent Frequency Distribution, Histograms and Probability distribution [a,e,l] 2) Design the experiments 3) Distinguish and analyze the different optimization techniques. [a,e,l] 4) Analyze the variance in observation data. [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

Regular: - 8th Semester Elective-V Theory

ME1453	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]**	Students will be able to: 1. Explain the various typs of Values and functions. 2. Evaluate the product life cycle. 3. Analyze the project selection and estimate life cycle costs. 4. Evaluate and improve value of product/system by designing and critically analyzing the VE job plans and othe VE/VA techniques.

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

Regular: - 8th Semester Elective-V Theory

ME1454	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) (IV)The students will be able to apply TRIZ technique.. [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
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			

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

ME1455	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]	Students will be able to: 1. Evaluate the product life cycle. 2. Analyze and select the materials and manufacturing processes for designed product. 3. Evaluate the product for different design criteria like robust design, benchmarking, DFX,etc and estimate the product costing. 4. Explain the various prototyping methods and its economics.

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
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

Regular: - 8th Semester Elective-V

ME1457	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]

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]**

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.

Regular: - 8th Semester Elective-V Theory

ME1458	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]**	Students will be able to: 1. Explain the drives and mechanisms of machine tools 2. Design Gear boxes of machine tools 3. Design machine tool structures, guide ways and power screws, spindles and supports of machine tools. 4. Test the machine tools and examine the 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]

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

Regular: - 8th Semester Elective-V Theory

ME1459	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. •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]**	(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]** (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,

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

1460	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 can be able to Justify the concept of advance welding processes applicable to industry. 2. Student can be able to examine the parameters needed for welding to increase the durability of product. 3. Student can be able to differentiate the concept of soldering and brazingand cutting process through welding. 4. Student can be able to evaluate welding defect through welding testing method.

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]**

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,

Regular: - 8th Semester Elective-V Theory

ME1482	AIR 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**	

Course Objectives	Course Outcome
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	1) The student will be able to understand and determine various psychrometric properties of air, analyze various psychrometric process and will be able to apply it to live problems 2) The students will be able to design air distribution system 3) The student will be able to analyze various types of VCRS refrigeration systems 4) The students will also have brief knowledge of non VCRS refrigeration systems & cryogenic systems

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. **[CO-1]**

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. **[CO-1]**

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. **[CO-2]**

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. **[CO-4]**

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 of above equipments to students.

REFEGERANTS:

Nomenclature of refrigerants, refrigerant properties, mixture refrigerants, global warming potential & Ozone depletion potential, Montreal & Kyoto protocol, alternate refrigerants. **[CO-4]**

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

[CO-4]

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
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

Regular: - 8th Semester Elective

ME1483	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	

Cryogenic Systems

Course 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

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.

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.

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, 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.

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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Department of Electrical Engineering

Semester VII (EL1437)

Name of Subject: - Electric Vehicles

Objectives	Outcomes
The course objective is to impart knowledge of • Laws of operation of electric vehicle and analyze the various methods of energy storage. • Topologies of power electronics and drive train. • Brief discussion on the hybrid electric vehicles. .	Students will be able to 1. Understand the history, vehicle mechanics, laws of motion, dynamics and propulsion power of electric vehicles. 2. Analyze energy storage methodologies used in electric vehicles. 3. Analyze the topologies of power electronics and drive-train used in electric vehicles. 4. Understand the types, size, capacity of hybrid electric vehicle. Comparison of HEV and EV.
Mapped program outcomes: 1,2,3,7,8	

Unit 1: - Introduction to Electric Vehicles & Vehicle mechanism
EV System, Components of an EV, History of EV, EV Advantages, EV Market, Vehicle Mechanics:- Roadway Fundamentals, laws of Motion, Dynamics of Vehicle motion, Propulsion power, Velocity and acceleration, Propulsion system design. (6)

Unit 2: - Battery and other alternative Energy Sources
Battery basics, lead acid battery, alternative batteries, battery parameters, technical characteristics of battery, targets and properties of batteries, battery modeling, fuel cells, super capacitors and ultra-capacitors, flywheels. (6)

Unit 3: - Electric Machines
Motor and engine ratings, EV and HEV motor requirements, dc and three phase ac machines, space vector representation, dq modeling, induction machine dq model, power and electromagnetic torque, permanent magnet machines, switched reluctance machines, BLDC machines. (6)

Unit 4: - Power Electronics and motor Drives
Electric drive components, dc drives, operating point analysis, ac drives, PM synchronous motor drives, Switched Reluctance motor drives. (6)

Unit 5: - Drive Train
EV transmission configuration, transmission components, gears, automobile differential, clutch, brakes, ideal gear box, EV motor sizing. (6)

Unit 6: - Hybrid Electric Vehicle

Types of Hybrids, series and parallel HEVs, IC engines, reciprocity engines, various air cycles, design of HEV, hybrid drive train, sizing of components, rated vehicle velocity, initial acceleration, maximum velocity and maximum gradeability.

Text Books:

S No	Title	Edition	Authors	Publisher
1	Electric and Hybrid Vehicles: Design Fundamentals	2nd edition 2005	Iqbal Husain	CRC Press

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

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.

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 :-

1) Load test on single phase transformer.
2) O.C. and S.C. tests on single phase transformer.
3) O.C. and S.C. tests on three phase transformer.
4) Polarity and phasing out test on three phase transformer.
5) Parallel operation of single phase transformers.
6) Load test on D. C. shunt motor.
7) Speed control of D. C. shunt motor.
8) Load test on three phase induction motor.(Generator as load)
9) Brake test on three phase induction motor.
10) No load and blocked rotor tests on three phase induction motor.
11) Speed control of slip ring induction motor using voltage control and rotor resistance method.

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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.

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

ET1330	Lab. : Microprocessors	L=0	T=0	P=2	Credits=1

Evaluation Scheme (% Weightage)	CA	ESE	Total	ESE Duration
	40	60	100	2 Hours

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.

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

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

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

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

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

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 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 Ybus by
   i. Inspection
   ii. Building algorithm
   iii. Singular Transformation for a given system
6. Write flow chart and program in C to plot swing curve by using step by step method
7. Write flow chart and program in C to plot swing curve by using Euler's method
8. To calculate the change in power handling capacity of transmission line with change in parameters or change in distance
1. To find I_f and V_t and other bus voltages for LG Fault
2. To find I_f and V_t and other bus voltages for LLG Fault

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	

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

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

Practicals 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 module.
6) To study the biogas plant model set up at SDMP College.
7) To study the box type solar cooker
8) To study Solar water heater
9) Study of Hydroelectric Power Plant

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

1. Relay setting and co-ordination of relay.
2. Secondary injection testing and setting of relays.
3. 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	

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	

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	

III 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

III 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	Outcomes
➢ The purpose of this course is to present a clear consistent picture of the internal physical behavior 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.	➢ Graduates will have a fair knowledge about the working of PN junction diodes and special purpose diodes. ➢ Graduates will understand the basic working physics of BJT, FET and MOSFET both in ideal and non-ideal conditions along with their biasing circuits. ➢ Graduates will understand the Working of transistors at low frequencies. ➢ Graduates will understand the fundamentals of power devices like rectifiers, uni-junction transistors etc..
Mapped Program Outcomes: a,b,c,k	

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, MillMan Halkias, 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.

III 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.	➢ Graduates will have a fair practical knowledge about the working of PN junction diodes and zener diodes. ➢ Graduates will understand the basic working rectifiers and biasing of transistors. ➢ Graduates will understand the Working of FET & MOSFET. ➢ Graduates will understand the fundamentals of amplifiers & power devices.
Mapped Program Outcomes: a,b,c,k	

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.

III 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

Objective	Outcomes
➢ 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 simplify combination logic circuits using Boolean algebra. ➢ Will be able to analyze and describe the function of different types of counters and registers. ➢ Will have understanding of different combination logic circuits which may be used in various digital systems. ➢ Will be able to demonstrate use of sequential logic and their applications.
Mapped Program Outcomes: a, b, c, d, e, k	

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, Quine McClauskey methods, incompletely specified functions, Static & Dynamic Hazards in combinational circuits.

(6 Hours)

Unit IV:
Design of Arithmetic 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 and Asynchronous sequential Circuits, Counters: Ring counter, Johnson counter, Ripple counter.

(6 Hours)

Unit VI:
Design of synchronous counter: single mode and multi-mode counters. Classification of synchronous machines, Design of synchronous sequential machines using Moore & Mealy circuits: Sequence detector, State diagram, State reduction (Method of Partitioning) and implementation.

(8 Hours)

Text Books:
1) Digital Circuits & Microprocessors, Hebert Taub, Mc Graw Hill, 1988.
2) Switching Theory & Finite Automata, Zvi Kohavi, Mc Graw Hill, 2nd edition, 2004.

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 of India 1993.
3) Digital Design, M. Morris Mano, Third Edition, Prentice Hall of India,4th edition 2008.

III 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.	➢ Students will be aware of Digital IC's and it's experimentation. ➢ Students will be able to design and evaluate circuit performance on breadboard. ➢ The student will be able to analyze and interpret more experiments relating to theoretical knowledge received during lecture hours.
Mapped Program Outcomes: a,b,c,k	

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.

III 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 identify the various methods for measurement of resistance, capacitance and inductance. ➢ Student will able to identify & apply specific electronics instrumentation and measurement system. ➢ Student will able to use the different types of meters like digital multimeter, LCR meter. ➢ Students will be able to define usage of transducers, sensors, DAC / ADC, signal generator systems ➢ Will able to understand the concept of virtual instrumentation.
Mapped Program Outcomes: a,b,c,k	

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, Dhanpat Rai & 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 , Mc Graw 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.

		1.00		Applicable for AY 2015-16 Onwards
Chairperson	Dean (Acad. Matters)	Version	Date of Release	

III 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
➢ To learn basic measurement concepts and related instrumentation requirement as vital ingredients of electronics.	➢ Students will be able to identify the various methods for measurement of R, L & C. ➢ Graduate will be able to use the different types of measuring instruments. ➢ Will able to demonstrate the practical based on virtual instrumentation.
Mapped Program Outcomes: a,b,c,k	

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.

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, 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.

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.

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

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

III 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.

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.

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

IV 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.	➢ Student will have understanding of Electromagnetic fields. ➢ Will be able to define gradient, curl & divergence and to verify both sides of divergence theorem. ➢ Will able to understand different laws applicable for electric & magnetic field. ➢ Will be able to understand the different principles of wave propagation theory.
Mapped Program Outcomes: a,e,i	

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, Ashutosh Pramanik, 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.

IV 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 various electronic device parameters and the small signal equivalent circuit of amplifiers employing devices like BJT, FET, MOS 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 able to know the high frequency parameters and analysis of BJT and MOSFET. ➢ Students will able to know the types of amplifier ➢ Students will able to know the feedback topology in amplifiers and to analyze them using bode plot and nyquist criterion. ➢ Students will able to know the types of power amplifier, distortion in amplifier and analyze them. ➢ Students will able to know the different voltage regulators, types, protection circuits etc.
Mapped Program Outcomes: a,b,c,k	

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, Millman Halkias, 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.

IV 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.	➢ Students will able to determine the h-parameter of transistors. ➢ Students will able to determine the frequency response of amplifier with and without feedback. ➢ Students will able to determine the distortions in amplifiers. ➢ Students will able to determine the voltage regulator using different regulator devices.
Mapped Program Outcomes: a,b,c,k	

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.

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 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.

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

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

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	➢ Graduates will understand architectural details of microprocessors ➢ Will be able to demonstrate the microprocessor based system design ➢ Will be able to interface various devices with microprocessor
Mapped program outcomes:- a, b, c, k	

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

IV 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
➢ To understand the concept and addressing modes of Intel 8085A ➢ To understand various interfacing concepts like 8255,8253,8259,ADC etc. for designing Microprocessor based applications	➢ Graduates will understand architectural details of microprocessors ➢ Will be able to demonstrate the microprocessor based system design ➢ Will be able to interface various devices with microprocessor
Mapped program outcomes:- a,b,c,k	

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

IV 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
➢ To acquaint student with various computing schemes using mathematical software tools.	➢ Graduates will be able to understand the concept of Mathematical modeling of systems. ➢ Will be able to apply concept of Mathematical modeling for various applications. ➢ Graduates will be able to understand the concept circuit analysis & designing using SPICE programming.
Mapped Program Outcomes :- b,k	

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

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

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	Outcome
1. To Study of amplitude, frequency & phase modulation. 2. To learn the concept of PPM, PAM, PWM & PCM & delta modulation. 3. To understand transmitter & receivers communication systems, Television working principles. 4. To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students 1. Will demonstrate different modulation techniques. 2. Will be able to describe various types of transmitters & receivers in communication system. 3. Will be able to define various types of noise in communication system 4. Will be able to explain digital modulation techniques for transmitting digital data. 5. Will be able to explain term multiplexing.

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 space Terms & 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	DhakeArvind 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	Outcome
➢ 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 1. Will be able to classify both continuous and discrete time signals and systems. 2. Will be able to analyze continuous signals in complex plain. 3. Will understand sampling process 4. Will be able to analyze discrete signals in time and 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	Hwei Hsu,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 primary 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 1. Will acquire knowledge of the fundamentals and internal structure of the operational amplifier. 2. Will have a fair knowledge about noise & the different Parameters of the operational amplifier. 3. Will understand the Linear and non-linear applications of the operational amplifier. 4. Will 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-Current Converter, 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

Objectives	Outcomes
➢ 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 1. Will be able to describe and model different electrical transducers. 2. Will understand basics of digital measurement 3. Will understand different liquid level measurement techniques 4. Will understand different networking standards 5. will be introduced to 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	Outcomes
➢ 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 1. Will be able to analyze specification & design Combinational & Sequential circuits. 2. Will able to analyze different faults models & can apply testing principles in Combinational & Sequential circuit. 3. Will able to analyze asynchronous, synchronous & finite state machine. 4. Will be able to formulate digital logical design methods and to develop algorithms that can be useful for wide range of applications.

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 1. Will be able to identify the hardware components of a computer system. 2. Will understand the operation of fixed- and floating-point arithmetic units. 3. Will able to understand the basic organization of the memory. 4. Will acquire the knowledge of the input/output mechanisms used to connect computers to their external environments. 5. Will 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.

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 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 1. Will be aware of the safety aspects in this field 2. Will understand the basics of Audio Video Engineering 3. Will know about current trends in electronics equipments 4. Will know about the recent trends in communication and computing equipments

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, WiFi Technology, 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, Vandana Singhal, "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

Course Objectives	Course outcomes:

Mapped Program Outcomes						

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.

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-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

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
6. To enable the students, to have a fair knowledge about the theory and problems of EM wave transmission through waveguides and transmission line. 7. To lay a strong foundation on the theory of transmission line. **8.** To avail deep knowledge and mathematical analysis of Radiation of EM wave, Classification of different types of waveguides and their characterization.	Students 1. Will understand radio wave propagation theory. 2. Will derive and understand Electromagnetic equations for TE, TM and TEM wave for parallel plane and waveguides. 3. Will derive and understand basic transmission line equation, characteristics of transmission lines and understand impedance matching devices. 4. Will understand use of smith chart to design transmission line system.

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.	Students will 1. Understand Discrete Fourier transform and FFT algorithms 2. Understand analysis and characterization of LTI system using Z Transform 3. Design and realization of finite impulse response filters and infinite impulse response filters 4. Understand fundamental concepts of DSP processor

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, Lowpass 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

Objectives	Outcomes
1. To develop ability to use a hardware description language, simulation, and a logic synthesis tool in the design of digital circuits 2. To design and model digital circuits with VHDL at behavioral, structural, and RTL levels . 3. To develop test benches to simulate combinational and sequential circuits.	Students 1. Will able to understand different modeling styles of VHDL 2. Will able to analyze and design combinational logic circuits. 3. Will able to incorporate different building blocks in the design of a digital system. 4. Will able to understand the basics of synchronous sequential logic and finite state machines. 5. 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	3rd Edition ,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

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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	Outcomes
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.	STUDENTS 1. Will understand architectural details of microcontrollers 8051. 2. Will be able to demonstrate the microcontroller based system design. 3. Will be able to interface various devices with microcontroller. 4. Will be able design Data acquisition system.

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 Mc Graw Hill, 2000.

Reference Book:
1) Intel or Atmel MCS 51 Family Microcontrollers Data Sheets.

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.	[CO1(S),CO2(S)]
2	Convert single digit Hex number to its ASCII equivalent.	[CO1(S),CO2(S)]
3	Find the maximum data byte in a block	[CO1(S),CO2(S)]
4	Data block transfer. .	[CO1(S),CO2(S)]
5	Find three number of negative data bytes in a block. .	[CO1(S),CO2(S)]
6	Convert BCD to its binary equivalent. .	[CO1(S),CO2(S)]
7	Generate a saw tooth waveform using DAC. .	[CO2(S),CO3(S)]
8	Read Analog signal from channel 2 of ADC and store it to internal RAM.	[CO2(S),CO3(S)]
9	Rotate stepper motor into clockwise and counter clockwise direction.	[CO2(S),CO3(S)]
10	Generate square waveform from pin no P 1.2 of 8051.	[CO2(S),CO3(S)]
11	Display character on LCD.	[CO2(S),CO3(S)]

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

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.

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

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.

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		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

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 ofbiomedical instrumentation. 2. Will learn measurement techniquesfor involved in processes such cardiovascular measurements. 3. Will also learn techniques in x-rays,EMG, etc.

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		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	

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 1. Will be familiar with ARM7 pipeline architecture, Memory organization. 2. Will be able to write Assembly language program, design different applications using ARM 7 3. Will be able to understand different protocols 4. Will be able to understand architecture of Real time operating system

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.

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

OBJECTIVES	OUTCOMES
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.	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.

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

Chairperson		Version	1.00	Applicable for AY 2016-17
Dean (Acad. Matters)		Date of Release	May 2016	Onwards

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. 2. Will learn the various MOS Process Technologies. 3. Are expected to design circuits using different CMOS styles and also to do analysis on CMOS structures. 4. Will learn the physical layout of standard and compound Gates. 5. Understand electrical Properties and modeling of Very Large Scale Integrated Circuits in order to design the large systems. 6. Will demonstrate the ability to design a system, component or process as per needs and specifications.

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.

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
To verify the fundamental data structures and algorithms, to have good command of algorithmic techniques, their applications and complexity.	Students 1. Will learn the basic concepts of Algorithms. 2. Will learn formation of Data Structures. 3. Will learn Searching and Sorting Algorithms.

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

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	Outcomes
➢ 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 amplifier and wave shaping circuit 3. Will have a fair knowledge of practical circuit analysis 4. Will understand practical circuit design

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, Bistable Multivibrators, Design of Square and Triangular Waveform using Astable Multivibrators, Design of Standardized Pulse, The Monostable Multivibrator, 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	Nashesky Boylestead	PHI
3	Microelectronics Circuit Analysis and Design	Fourth Edition 2010	Donald A. Naemen	McGraw Hill

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
1. This course provides compressive coverage of digital communication systems and understanding of the operation of digital modulation schemes/	Students 1. Will learn pulse modulation techniques, the process of sampling, quantization & coding that is fundamental to the digital transmission of analog signals. 2. Will understand fundamental concepts & limits in information theory in the context of digital communication theory/ 3. Will able to analyze mathematical model of digital communication systems. 4. Will able to apply error control coding techniques at the receiver.

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
➢ To analyze digital modulation techniques. ➢ To analyze keying techniques.	Students 1. Will be able to apply suitable modulation schemes and coding for various applications. 2. 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. Will be able analyze Performance of spread spectrum communication system.

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.

7th Semester

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
The purpose of this course is to introduce the basic concept of microwave power generators. Study of scattering matrices of transmission lines and the design of microwave filters, microwave network analysis and measurement	Students 1. Will be able to know Causes of failure of conventional tubes at high frequency and the detail concept of cavity klystron amplifier, Reflex klystron. 2. Will be able to differentiate Slow wave structure, various types of microwave power generatorslike Magnetron. Microwave component, junction and various tees. 3. Will able to apply scattering matrices for various tees and microwave junction, 4. Will able to study 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)

7th Semester

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

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.	Students 1. Will have understanding of reference mode for data communication & functions of all layers of OSI reference model. 2. Will able to differentiate between various protocols of different layers & standards on data communication. 3. Will acquire knowledge of the network layer routing 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.
(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
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

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 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.	Student's 1. Will learn the basic concepts Operating System. 2. Will learn Processes, Threads, and Memory Management. 3. Will also learn Security Issues in Operating System.

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,

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

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.Sasi Bhushana Rao, "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
1. 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 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

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

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.

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 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 various analysis of differential amplifiers. ➢ To give basic understanding of non linear circuits such as comparator design.	Students 1. Will able to design an electrical component or system to meet desired needs. 2. Will able to design and analyze basic analog functional module designs such as current mirrors, active load, biasing circuits. 3. Will able to demonstrate the ability to design a system, component or process as per needs and specifications. 4. Will able to simulate MOS devices and CMOS circuits with AC, DC, Transients analysis.

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	Behzad Razavi	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

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. 7. Will demonstrate the ability to design a system, component or process as per needs and specifications.

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

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.	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.

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. ➢ Demonstrate mastery of pointers, iterators, memory management including object creation and destruction.	Students 1. Will learn the basic concepts of Object Oriented Programming. 2. Will design program using the concept of Inheritance, Polymorphism, Overloading 3. Will learn Files and Stream Operations. 4. Can Choose the appropriate data structure and algorithm design method for a specified application.

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

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 learn measurement techniques for involved in processes such cardiovascular measurements. 3. Will also learn techniques in x-rays,EMG, etc.

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:
Electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments, Methods of accident prevention. Telemedicine, Telemedicine applications, telemedicine concept, essential parameters of telemedicine, telemedicine technology, video conferencing, digital communication in telemedicine, use of internet resource for telemedicine

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 guides & other signal degradation factors. 3. Will able to classify various optical source materials, LED structures, LASER diodes. 4. Will learn the fiber optic receivers such as PIN, APD diodes, receiver operation & performance. 5. Will understand the operational principal of WDM, SONET, measurement of attenuation, dispersion, refractive index profile in optical fibers.

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.

(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	1.00	Applicable for AY 2016-17
Dean (Acad. Matters)		Date of Release	May 2016	Onwards

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 1. Will be able to know the evolution of mobile communication. 2. Will be able to understand the need and different methods for enhancing the quality of communication. 3. Will also develop a detailed technical knowledge of current practice in wireless systems and networks.

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 signaling, Signaling 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.	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

Chairperson		Version	1.00	Applicable for AY 2016-17
Dean (Acad. Matters)		Date of Release	May 2016	Onwards

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
1. Design, analyze, and test products and processes that incorporate appropriate computing tools, sensors, and actuators. 2. Practice professional and ethical responsibility and be aware of the impact of their designs on human-kind and the environment. 3. Apply mechanical engineering and electrical engineering knowledge and skills to problems and Challenges in the areas of mechatronic engineering. 4. Integrate and use systems or devices incorporating modern microelectronics, information technologies and modern engineering tools for product design, development and manufacturing.	Students: 1. Will demonstrate the ability to employ the knowledge of mathematics, science, and engineering. 2. Will able to design and conduct experiments to evaluate ,analyze, interpret data and performance of a mechatronics system 3. Will able to Design mechatronics component, system or process to meet desired needs. 4. Will able to Demonstrate knowledge of statics, dynamics and solid mechanics relevant to 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

Signal, system and controls: Introduction to signal, system and controls, system representation, linearization of nonlinear system, time delay, measure of system, performance, root locus and bode plots, Real-time interfacing i.e. I/O cards

UNIT-V

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-VI

Advanced application in Mechatronics: Case studies in mechatronics system design.

TEXT BOOKS:

1. Devdas Shetty 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	

5th Semester

ET1307	PE I : Algorithm & Data 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 Hrs

Course Objective
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.

Course Outcome
Students will be able to
1. Use the fundamental concepts of Object Oriented Programming for Solving different problems
2. Design, Develop and Implement programs for inheritance and polymorphism
3. Construct different formats of outputs
4. Design, Develop and Implement programs for Various types of data structures
5. Evaluate Skip-list and hashing data structures
6. Evaluate different types of 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.

06 Hrs

UNIT-3 :
Streams basics, Stream classes hierarchy, console i/o, formatted I/O, manipulators, file streams, opening and closing of files, exception handling mechanism.

06 Hrs

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.

06 Hrs

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

Text books:				
1	Data structures, Algorithms and Applications in C++	2nd edition August 2004	S. Sahni	University press (India) pvt ltd , 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

ET1309	PEI : Object Oriented Programming		L= 3	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

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. Define, compare and contrast the fundamental concepts of object-oriented programming: data abstraction, encapsulation, inheritance and polymorphism.
2. Use the concept of Control Structures, Pointers and Functions effectively to build the C++ program.
3. Design and develop programs to implement the concepts of data abstraction, encapsulation, inheritance, and polymorphism using C++ language.
4. Design and develop programs for implementing data structures using array.
5. Design and develop programs for implementing data structures using linked List.
6. 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.

06 Hrs

UNIT-2:

Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Recursion, Classes and Objects, Constructors and Destructors.

06 Hrs

UNIT-3:

Operator overloading, Function Overloading, Inheritance, Types of Inheritance , Polymorphism, Friend and Virtual Functions.

06 Hrs

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.

06 Hrs

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. Edition Year: 2008	E. Balagurusamy	TMH.
2	Object Oriented Programming in Microsoft C++	4th Edition Date: 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 Edition 1998	Horowitz, S.Shani and S.Rajasekaran	Galgotia Pub. Pvt Ltd

5th Semester

ET1311	PE I : Discrete 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 Hrs

Course Objective
Students should be able to
1. Learn algorithms related to discrete mathematics.
2. Study encryption and decryption security algorithm.
3. Understand basic concepts of permutations and combinations.
4. Understand basic concepts of graphs.
5. Understand basic concepts of various tree traversal methods.
6. Study the fundamentals of network models.

Course Outcome
Students will be able to
1. Apply mathematical knowledge to develop algorithms.
2. Design encryption and decryption security algorithm.
3. Solve various problems of discrete probability theory.
4. Analyze various graphs.
5. Analyze various tree traversal methods.
6. Design 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 .

06 Hrs

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

6th Semester

ET1319	PE II : Embedded 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

Students should be able to

1.To study & understand the difference between microprocessor & microcontroller, CISC & RISC controllers also,to learn the detailed architectural features of ARM processor

2. To study instruction set of ARM processor and apply the same for programming

3. To explore the details about ARM9TDMI,ARM co-processors & memory buses

4. To understand interfacing of various peripherals with ARM controller.

5. To understand the details about memory management in ARM

6. To Obtain a broad understanding about real time systems

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 various versions of ARM processor and memory buses associated.
4. Develop programs in interfacing of different peripherals with ARM processors
5. Acquire knowledge about memory management in ARM.
6. Elaborate the 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.

06 Hrs

UNIT-3 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 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.

06 Hrs

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 Edition 2002	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

6th Semester

ET1321	PE II : 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

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. Compare and evaluate different architectures like ROM, PLA, PAL, CPLD and FPGA.
2. Acquire the knowledge of different design units & compare concurrent and sequential statements.
3. Construct the subprograms applied in various digital domains.
4. Design and Implement finite state machines.
5. Develop HDL Codes for combinational logic circuits.
6. Design synchronous and asynchronous 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.

06 Hrs

UNIT-2 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.

06 Hrs

UNIT-3 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.

06 Hrs

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,

06 Hrs

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

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

ET1323	PE II : TV & Video 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

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. Analyze and comprehend basic concept of monochrome and color TV.
2. Compare various television systems and standards.
3. Do trouble shooting of Video Amplifier circuits.
4. Analyze and compare PAL, NTSC and SECAM decoder.
5. Comprehend basic concepts of cable television.
6. 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 .

06 Hrs

UNIT-3 VIDEO 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

06 Hrs

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.

06 Hrs

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.

06 Hrs

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,

5th Semester

ET1331	OE I : Microcontroller & Embedded 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
Students should be able to
1. Understand the architecture of 8051 microcontroller.
2. Learn assembly language programming of microcontroller.
3. Understand concepts of Embedded C and operation of timers .
4. Study serial communication and concept of interrupt programming.
5. Understand the interfacing of LCD, RTC and EPROM with microcontroller.
6. Understand the interfacing of ADC, DAC and Stepper Motor with microcontroller.

Course Outcomes
Students will be able to
1.Explore the architecture of 8051
2. Develop assembly -language programs for embedded systems.
3. Apply the basics of Embedded C to develop programs and interface TIMERS with 8051 microcontroller.
4. Apply the concept of interrupts and establish serial communication with various peripherals.
5. Interface off chip peripherals like LCD, RTC & EPROM.
6. Interface off chip peripherals like stepper motor, ADC & DAC.

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, 7 segment display, keyboard matrix programming
06 Hrs

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.
06 Hrs

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.
06 Hrs

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 Mc Graw Hill

5th Semester

ET1333	OE I : Principles of 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

Course Objective

Students should be able to

1. Study fundamentals of EM waves and types of noise.
2. Understand continuous and discrete modulation schemes.
3. To explore various types of angle modulation
4. To introduce the concept of demodulation or detector
5. Learn AM and FM transmitters & receivers.
6. To analyze different continuous as well as Pulse modulation schemes.

Course Outcome

Students will be able to

1. Utilize the concept of radiation and propogation of signals in varios applications. Analyze different types of noise.
2. Analyze various modulation schemes & apply the concepts of modulation for the design of communication systems.
3. Know the fundamental of various types of angle modulation
4. Understand the types of detector
5. Describe the working of Transmitter and Receiver in communication systems.
6. Analyze various Pulse modulation schemes

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.

06 Hrs

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 of FM 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.

06 **Hrs**

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	Satya Prakashan, New Delhi

5th Semester

ET1335	OE I : Fundamentals of 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

Course Objective
Students should be able to
1. Understand the principles of image formation, sampling and quantization.
2. Learn the algorithms of intensity transformation and 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. Analyze the image sampling, quantization
2. Apply basic intensity transformation techniques for image enhancement
3. Apply filtering techniques in spatial and frequency domain.
4. Interpret the digital images in frequency domain by using various transform techniques.
5. Implement and evaluate the methodologies for image segmentation.
6. Implement the algorithms for image compression.

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

ET1340	OE II : 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

Course Objective

Students should be able to

1. Familiarize with soft computing concepts.
2. Introduce the concepts of Genetic algorithm
3. Introduce the ideas of Neural networks.
4. Introduce the concepts of Fuzzy Logic.
5. Describe the basics of Soft computing and its application areas particularly to intelligent systems

Course Outcome

Students will be able to

1. Identify and describe genetic operators and genetic algorithms in problem solving
2. Apply supervised multilayer NN algorithm in pattern classification
3. Apply unsupervised multilayer NN algorithm in pattern classification
4. Apply fuzzy logic to handle uncertainty and solve engineering problems
5. Apply fuzzy arithmetic and reasoning in problem solving
6. Define fuzzy rule base and design fuzzy controller for a given problem.

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

06 Hrs

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,

06 Hrs

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, Vijayalaxmi Pai	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	Mc Graw Hill

6th Semester

ET1341	OE II : Industrial 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

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 passive temperature transducers.
4. Learn the working principle of various active temperature transducers.
5. Learn the working principle of various flow transducers.
6. Learn the working principle of various transducers like level , thickness speed, ph value etc.

Course Outcome

Students will be able to

1. Design instrumentation system using various transducers and its calibration process.
2. Analyze pressure using pressure measuring instruments and its calibration process.
3. Measure and analyze the temperature using passive temperature transducers.
4. Measure and analyze the temperature using active temperature transducers.
5. Measure and analyze flow using flow transducers.
6. Measure and analyze various parameters like level , thickness speed, ph value etc.

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,

06 Hrs

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.

06 Hrs

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.

06 Hrs

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.

06 Hrs

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

06 Hrs

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.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.

6th Semester

ET1342	OE II : Medical 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

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. Analyze various parameters using ECG,EEG and EMG
2. Analyze various physical measurements such as blood pressure, heart rate, temperature etc.
3. Measure and analyze various parameters using ECG, EEG EMG and phonocardiograph.
4. Measure and analyze various parameters such as - Blood Pressure, Blood flow rate, Pulse rate, Heart rate, respiration rate and temperature and hearing ability.
5. Interpret the working principle of X-ray equipments
6. 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,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	New Delhi, 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	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Objective	Course Outcome
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 3. To understand properties of Luminescence materials 4. To understand different displays 5. To learn backplane technology and driver integration 6. To understand properties of materials modes	Students will be able to 1. Identify different display technologies, manufacturing process. 2. Characterized and analyzed specifications of display technology. 3. Analyze properties of Luminescence materials and analyze matrix addressing. 4. Explore design parameters of displays. 5. Understand the fundaments of backlight unit technologies. 6. Elaborated 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

7th Semester

ET1405	PE III: 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 Objective
Students should be able to
1. Learn the principles of step index and graded index optical fiber.
2. Know the types of losses in optical fiber.
3. Understand Transceiver systems in optical communication.
4. Learn concept of active, passive devices and measurements in optical communication.

Course Outcome
Students will be able to
1. Design and analyze an Optical Communication System.
2. Differentiate the types of losses in optical system.
3. Explore different types of sources in fiber optics.
4. Analyze different types of receivers in fiber optics
5. Use different splicing techniques and connectors
6. Explore different methods of loss measurement 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 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

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	Third Edition	Govind Agrawal	John Willy & Sons

7th Semester

ET1407	PE III: 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 Objective
Students should be able to
1. Understand, design and analyze Planar Transmission Lines.
2. Design Passive MIC components.
3. Study the concepts of microstrip patch antenna.
4. Design & understand active MIC components.
5. Study the Hybrid MIC fabrication processes.
6. Study the Monolithic MIC fabrication processes.

Course Outcome
Students will be able to
1. Analyze different types of planar transmission lines.
2. Use the concept of Microstrip lines for designing different passive RF components.
3. Design and analyze Microstrip circuits.
4. Understand the designing of active MIC components.
5. Understand the Hybrid MIC fabrication processes.
6. Understand the Monolithic MIC fabrication processes.

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	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.	**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		Bharti Bhat, 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		Bharti Bhat, S. K. Koul	New Age International

7th Semester

ET1409	PE III: 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

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. Compare different LAN Topologies.
2. Apply the knowledge of LAN structure to design autonomous system.
3. Detect Data transmission errors.
4. Compare data transmission protocols.
5. Describe the applications of communication network.
6. Solve network security issues.

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.
06 Hrs

UNIT VI: Network Security:
Network security cryptography, secrete key, public key, digital signature, e-mail security, web security, communication security.
06 Hrs

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

8th Semester

ET1419	PE IV: 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
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.

Course Outcome
Students will be able to
1. Analyze and design an AC/DC rectifier circuit.
2. Analyze characteristics of different devices.
3. Design of AC voltage converters and Cycloconverters
4. Analyze and design DC/DC converter circuits.
5. Analyze and design inverter circuits.
6. Demonstrate the application of power electronics to solve real life problems.

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, step down, thyrister Choppers, design of choppers

06Hrs

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

ET 1420	PE IV : 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 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. Explain cellular system standards.
2. Describe capacity improvement in cellular systems.
3. Quantify causes and effects of path loss and signal fading on received signal characteristic
4. Describe concept of equalization, diversity & its techniques.
5. Analyze GSM & CDMA systems.
6. 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 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	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	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective

Students should be able to

1. To become familiar with satellites and satellite services.
2. To understand the satellite Propagation on satellite
3. To understand earth station technology
4. To make the student understand the principles of Radar and its use in military and civilian environment
5. To make the RADAR antennas, Lens antenns & RADAR, Receiver
6. To explain Effects of weather on RADAR

Course Outcome

Students will be able to

1. Analyze satellite services and satellite system
2. Work with Propagation on satellite
3. Describe the Earth station technology
4. Analyze the RADAR range equation and Doppler principle to radars and hence detect moving targets and cluster
5. Analyze RADAR antennas and Reflectors
6. Analyze the effects of satellite on weather

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		Varsha Agrawal 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	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

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. Analyze various parameters using ECG ,EEG and EMG
2. Analyze various physical measurements such as blood pressure, heart rate, temperature etc.
3. Measure and analyze various parameters using ECG ,EEG EMG and phonocardiograph.
4. Measure and analyze various parameters such as - Blood Pressure, Blood flow rate, Pulse rate, Heart rate, respiration rate and temperature and hearing ability.
5. Interpret the working principle of X-ray equipments
6. 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	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs.

Course Objective	Course Outcome
Students should be able 1. To learn fundamental concepts of different display technologies related to manufacturing techniques and materials selection. 2. To explore specifications required for display technologies 3. To understand properties of Luminescence materials 4. To understand different displays and addressing of displays 5. To learn backplane technology and driver integration 6. To understand properties of materials and its modes	Students will be able to 1. Identify different display technologies and manufacturing processes. 2. Characterize and analyze specifications of display technology. 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. 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	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Course Objective
Students should be able to
1. Learn the concepts of Neural network.
2. Understand the supervised and unsupervised algorithms in neural networks.
3. Learn the concepts of Fuzzy sets and logic.
4. Understand fuzzy logic and reasoning, operations and relations.
5. Learn design parameters for fuzzy logic controller.

Course Outcome
Students will be able to
1. Describe neural network architecture and apply single layer supervised algorithms for pattern classification problems.
2. Extract learning rules and apply multilayer supervised algorithms for problems solving.
3. Apply unsupervised algorithms for pattern classification, association problems.
4. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
5. Prove and Apply fuzzy arithmetic operations and relations for problem solving.
6. 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	Mc Graw Hill
4	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, Vijayalaxmi Pai	PHI Timothy Ross

8th Semester

ET1424	PE V : 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 Objective
Students should be able to
1. Learn fundamentals of RF circuits.
2. Understand the use of HF component in design the RF circuit.
3. Study the bandwidth estimation techniques.
4. Learn the design of high frequency amplifier
5. Understand the concept of CMOS technology in RF circuits.
6. Study the PLL, phase detector principle at high frequency.

Course Outcome
Students will be able to
1. Apply the fundamentals for design of RF circuits.
2. Analyze the HF circuit design and its behavior.
3. Compare the behavior of series and parallel RLC circuit at HF.
4. Distinguish the different bandwidth estimation techniques.
5. Apply the knowledge of CMOS technology for design of supply independent bias circuit.
6. Compare the power amplifier parameters with HF amplifier.

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

ET1426	PE V : 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 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 audio
3. Get acquainted with various algorithms used for multimedia data compression
4. Understand basic concepts of video compression
5. Learn basic concepts of multimedia communication networks.
6. Understand basic concepts of Content-Based Retrieval in Digital Libraries

Course Outcome
Students will be able to
1. 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. Compare different compression scheme used for image.
4. Compare different compression standards used for video.
5. Describe the multimedia networks communication protocols.
6. Comprehend different steps used in content based image retrieval.

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,SIP-Transport 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

ET 1417	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 Objective
Students should be able to
1. Understand the current trends in CMOS VLSI technologies.
2. Study analysis of the MOS transistor with first order and second order effects.
3. Study the static and dynamic operating principles of inverter circuit.
4. Understand the different CMOS implementation process.
5. Learn the basic structure and operation of combinational and sequential logic circuits.
6. Study dynamic circuits using domino and dynamic logic.

Course Outcome
Students will be able to
1. Apply mathematical methods to analyze CMOS VLSI circuits
2. Design SSI, MSI and LSI CMOS circuits to realize specified digital functions.
3. Apply Lambda design rules to design optimized CMOS layout.
4. Apply various steps for the fabrication of various CMOS circuits
5. Design digital logic circuit using CMOS Technology and verify the functionality, timing, power, area and parasitic effects.
6. Design and analyze BICMOS, dynamic and domino 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.

08 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.

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.

08 Hrs

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.

08 Hrs

8th Semester

ET 1417	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

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	TataMc Graw Hill
3	Design of Analog CMOS Integrated Circuits	2001	Razavi, Behzod	McGraw Hill

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-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.

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

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

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)

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

Students should be able to

1. Learn an object oriented way of solving problems.
2. Develop C++ classes for simple applications
3. Strengthen the ability to identify and apply the suitable data structure for the given real world problem
4. Gain knowledge in practical applications of data structures.

Course Outcome

Students will be able to

1. Apply object-oriented programming features to program, design and implementation.
2. Analyze, use, and create functions, classes, to overload operators.
3. Have practical knowledge on the application of data structures.
4. Understand various data structure such as stacks, queues, etc. to solve various computing problems
5. Decide a suitable data structure and algorithm to solve a real world problem.

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

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. To understand the basic concepts object oriented programming.
2. Understand the concept of Control Structures, Pointers and Functions.
3. Understand the concept of data structure
4. Understand different concepts of file handling and commandline arguments.

Course Outcome

Students will be able to

1. Write C++ program using concepts object oriented programming.
2. Use the concept of Control Structures, Pointers and Functions effectively to build the C++ program.
3. Implement concept of stack and queue using array and linked list.
4. Implement concepts of File handling, template and commandline arguments using C++.

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

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. Design different algorithms based on recursion for various application.
3. Design various discrete probability problems.
4. Identify the processing of roots by various tree traversal methods.

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.

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) Learn assembly language programming of ARM microcontroller.
2) Learn Embedded C-language language programming of ARM microcontroller.
3) Understand the interfacing of UART, ADC, DAC with ARM microcontroller
4) Understand the interfacing of LEDs, LCD, TIMERS with ARM microcontroller.

Course Outcome

Students will be able to

1) Develop assembly language programs for embedded systems.
2) Develop Embedded C language programs for embedded systems.
3) Apply the basics of Embedded C to develop programs for interfacing of on chip peripherals like DAC,ADC,UART etc. with ARM microcontroller .
4) Interface off chip peripherals like LCD, LEDs, TIMERs etc.

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

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. Study Data flow, behavioral and structural modeling for design and verify truth table of logic gates
2. Learn signal and variable assignment statements of combinational and sequential logic design.
3. Study basics of generic, generate and assignment statements to design digital systems.
4. Learn behavior of Moore and Mealy state machines to design FSM.

Course Outcome

Students will be able to

1. Develop VHDL programs for combinational and sequential logic circuits.
2. Analyze waveforms of signal assignment and variable assignment statements.
3. Design digital systems using generic, generate and assignment statements.
4. Design and analyze FSM for sequence generators and detectors.

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

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. Understand the concept of monochrome and color TV receiver
2. Provide hands on experience in the analysis & testing of various blocks of TV Receiver.
3. Learn fault creation and rectification at various stages of T.V
4. Understand various components of chrominance signals.

Course Outcome

Students will be able to

1. Detect and rectify faults in RF tuner section
2. Analyze various components of colourplexed composite video signals.
3. Test and analyze various blocks of TV Receiver through hands on experience.
4. Detect fault in TV using pattern generator.

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.

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. Observe and analyze various fiber optic data links when used for both digital and analog transmission.
2. know the measurement of NA of an optical fiber.
3. know data transmission using modulation techniques such as PAM, PWM.
4. understand the use of OTDR in Optical fiber.

Course outcomes
Students will be able to
1. explore both analog and digital optical fiber communication.
2. analyze the NA measurements in different optical fibers.
3. use different modulation techniques in optical fiber.
4. explore the OTDR in Optical Fiber.

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

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. To 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 Outcomes
Students will be able to
1. Identify the different MIC components.
2. Set up the Test bench of MIC.
3. Analyze the components.
4. Use the spectrum analyzer for the analysis of MIC components.

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

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 the design parameters of LAN topology.
2. Learn design specifications of stop and wait, go back –n, selective repeat ARQ data link and transport layer protocols.
3. Study communication network securities issues.
4. Study methods of error free communication.

Course outcomes
Students will be able to
1. Design autonomous system using LAN topologies.
2. Develop algorithms for stop and wait, go back –n, selective repeat ARQ data link layer and transport protocols.
3. Develop algorithms for data encryption and decryption
4. Compare systems with single and burst error.

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

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. Acquaint student with various computing algorithms in FLNN using software tools.
2. Understand operation of basic elements in fuzzy logic and neural network through simulation.
3. Learn development of algorithms to solve real life applications.

Course Outcome
Students will be able to
1. Demonstrate basic concepts fuzzy logic and neural network through simulation.
2. Develop the logic given in problem statement using algorithms in NN and basics of toolbox studied.
3. Develop the logic given in problem statement using operations in fuzzy logic and basics of toolbox studied.
4. Develop real life applications using NN and Fuzzy Logic.

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

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. Understand the concept of RF circuit behavior at different HF.
2. Learn various bandwidth estimation techniques
3. Study various plots to analyze results of HF circuits.
4. Study amplifier design and its analysis.

Course Outcomes
Students will be able to
1. Design and simulate the circuit at different frequency levels
2. Analyze different output at various plots
3. Reduce the power requirement and bandwidth of HF circuits.
4. Apply the different concept for designing of HF amplifiers.

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

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. Study different color models.
2. Understand transmission of audio using Delta and ADPC modulation technique
3. Understand the concept of dithering.
4. Learn the SPIHT and EZW algorithm.
5. Understand different steps of DCT compression.
6. Study the concept of motion vector.

Course Outcomes
Students will be able to
1. Write program MALTLAB to implement the concept of multimedia.
2. Implement SPIHT, EZW algorithm for image compression technique.
3. Implement DCT for image compression technique.
4. Utilize the concept of motion vector for video compression.

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.

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

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

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, 2'd 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, 2'd 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, j 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: **[6 hrs]**
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: **[8 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: **[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.

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

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: **[7 Hrs]**

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: **[8 Hrs]**

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: **[8 Hrs]**

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: **[7 Hrs]**

Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.

UNIT V: **[8 Hrs]**

Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen"s problem, graph colouring, Hamiltonian cycles etc.

UNIT VI: **[7 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", 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 **[7 Hrs]**
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

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

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

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

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

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

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

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 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).

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

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			

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

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	

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

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IT1204	**Algorithms & Data Structures**		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. To identify data structuring strategies that is appropriate to a given contextual problem and able to design and implement them, also be able to perform algorithmic analysis. 2. Illustrate and implement how stack, queue can be implemented to manage the memory allocations in various applications 3. Compare and contrast the benefits of dynamic and static data structures implementation, and implements various operations on linked list. 4. Discuss and distinguish the conceptual and applicative differences in trees, binary trees, and binary search trees. Implement binary tree traversals and operations on binary search trees to design applications . 5. Implement operations on graph and get familiar with some graph algorithms. 6. Describe how, records, fields, files are store in memory and Design and implement an appropriate hashing function for an application.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1204.1	To identify data structuring strategies that is appropriate to a given contextual problem and able to design and implement them, also be able to perform algorithmic analysis.	H	M		L	L							H	M	
IT1204.2	Illustrate and implement how stack, queue can be implemented to manage the memory allocations in various applications	M	H		M	M							H	M	
IT1204.3	Compare and contrast the benefits of dynamic and static data structures implementation, and implements various operations on linked list.	H	H		M	L							M	M	
IT1204.4	Discuss and distinguish the conceptual and applicative differences in trees, binary trees, and binary search trees. Implement binary tree traversals and operations on binary search trees to design applications	H	M		H	H							M	M	
IT1204.5	Implement operations on graph and get familiar with some graph algorithms	H	L		M	M							M	M	
IT1204.6	Describe how, records, fields, files are store in memory and Design and implement an appropriate hashing function for an application	H	M		M	M							M	M	
IT1204		H	M		M	M							M	M	

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.

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

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Information Technology

III Semester

IT 1205	**Lab: Algorithms &Data Structure**	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
• To develop skills to design and analyze simple linear and non linear data structures • To Strengthen the ability to identify and apply the suitable data structure for the given real world problem • To Gain knowledge in practical applications of data structures	1. Be able to design and analyze the time and space efficiency of the data structure 2. Be capable to identity the appropriate data structure for given problem 3. Have practical knowledge on the application of data structures

Course Outcomes	Mapped PO										
	a	b	c	d	e	f	g	h	i	j	k
Be able to design and analyze the time and space efficiency of the data structure	√	√	√		√				√		
Be capable to identity the appropriate data structure for given problem	√	√			√						
Have practical knowledge on the application of data structures	√	√	√		√						

Sr. No	Experiments Base On
1	Implementation of Data Searching using divide and conquer technique
2	Implementation of Sorting Algorithms(simple Algorithms)
3	Implementation of Sorting Algorithms(divide and conquer Algorithms)
4	Implementation of 2D Array
5	Implementation of Stack data structure
6	Implementation of Queue data structure
7	Implementation of Singly linked list.
8	Implementation of Doubly linked list.
9	Implementation of Binary Search trees
10	Implementation of Breadth First Search Techniques
11	Implementation of Depth First Search Techniques.

III Semester

12	Implementation of shortest path algorithm

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IV Semester

IT 1208	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 Objectives: -	Course Outcomes:-
• Students will learn the fundamentals of computer organization and its relevance to classical and modern problems of computer Architecture. • Students will be able to identify where, when and how enhancements of computer performance can be accomplished • To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division. • To study the different ways of communicating with I/O devices and standard I/O interfaces. • To study the hierarchical memory system including cache memories and virtual memory	After Completion of this course students will be able to 1. Identify various parts, various types of buses in computer system. 2. List the steps of instruction execution 3. List the types of memories and understand their working. 4. Solve the problems using various arithmetic techniques. 5. Distinguish between various processor architectures, their speed and their applications.

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, Assembly language, Design of Assembler, Stacks, Subroutine, Linkers and loaders.

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.]**

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, Macro Processor.

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.]**

Computer Peripherals: I/O Devices, DMA, Interrupt handling, Online storage, File services. Processors: Families of microprocessors Chips, Introduction to RISC and CISC Processors, Introduction to Pipelining.

Information Technology

IV Semester

Textbooks:

Computer Organization	4th Edition, 2001	V. Carl Hamacher	McGrawHill
Computer Organization and Design(The Hardware/Software Interfaces)	4th Edition	David A. Patterson & John L. Hennessy	Morgan Kaufmann

Reference Books:

Computer Organization	5th Edition,2000	William Stalling	McGraw Hill
System Programming*		John Donovan	TATA McGraw Hill

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IT1202	**Object Oriented Programming**		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. Understand basic features of JAVA as an object oriented-programming language. 2. Write, compile, test and run simple Java programs 3. Write object based programs with object oriented features 4. Demonstrate the ability to use simple data structures like arrays in a Java program. Use and explain the difference between a String and a StringBuffer object 5. Demonstrate exceptions that can be recognized and handled by the Java programming language, Understand stream classes, Use it to save and read the data in a file. 6. Be able Use Java programming language features to design and create Java applets.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1202.1	Understand basic features of JAVA as an object oriented-programming language.	L	M										M	L	
IT1202.2	Write, compile, test and run simple Java programs	M	H										M	M	
IT1202.3	Write object based programs with object oriented features	H	L										M	L	
IT1202.4	Demonstrate the ability to use simple data structures like arrays in a Java program. Use and explain the difference between a String and a String Buffer	H	M										M	M	

	object														
IT1202.5	Demonstrate exceptions that can be recognized and handled by the Java programming language, Understand stream classes, Use it to save and read the data in a file.	M	M										M	L	
IT1202.6	Be able Use Java programming language features to design and create Java applets.	M	L										M	M	
IT1202		M	M										M	M	

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

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IV 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

Lab Course Learning Objective	Course Outcomes
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	1. Demonstrate the understanding of Object oriented concepts and design object oriented program using JAVA 2. Design, develop, test, and debug programs using object oriented principles using java. 3. Understand class relationships and implement common data structures. 4. Design and implement a full-scale Java solution in the form of an Application.

Course Outcomes	Mapped PO										
	a	b	c	d	e	f	g	h	i	j	k
Demonstrate the understanding of Object oriented concepts and design object oriented program using JAVA			√								
Design, develop, test, and debug programs using object oriented principles using java.		√									
Understand class relationships and implement common data structures.											√
Design and implement a full-scale Java solution in the form of an Application.											√

Sr. No	Experiments Base On
1.	Introduction of JAVA Programming Environment
2.	Data Types and Control Structures
3.	Class and constructor
4.	Overloading
5.	Overriding
6.	Interface
7.	Arrays and String
8.	Exception
9.	Collection

IV Semester

10.	Applet

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
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(Academic Year : 2016-17)

IT1303	**Operating System**		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. a. Describe the main components of a computer and understand how these are managed by the operating system; b. Identify the services provided by operating systems; 2. 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. Understand and solve problems involving process control, mutual exclusion, deadlock and synchronization; 4. List and differentiate various memory management techniques and Understand the need for virtual memory management 5. Understand the internal structure of an operating system and organization of file system **6.** Become familiar with protection and security mechanisms.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1303.1	Describe the main components of a computer and understand how these are managed by the operating system; Identify the services provided by operating systems;	H	M											H	
IT1303.2	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;	M	H				M							H	
IT1303.3	Understand and solve problems involving process control, mutual exclusion, deadlock and synchronization;			H			H							H	
IT1303.4	List and differentiate various memory management techniques and Understand the need for virtual memory management		H	H	M									H	
IT1303.5	Understand the internal structure of an operating system and organization of file system				H									H	
IT1303.6	Become familiar with protection and security mechanisms.							H						H	
IT1303		M	H	H	M		M	H						H	

UNIT I **[05 Hrs.]**

Introduction, 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.

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. Deadlocks: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.

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.]**

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.

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

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Information Technology

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	Students will be able to: 1. Understand the working of task practically. 2. Describe OS support for processes and threads. 3. Implement a program that illustrates the creation of child process using fork system call for various tasks. Also able to Recognize CPU Scheduling, synchronization, and deadlock. 4. Use C / C++ and Unix commands, and develop various system programs under Linux to make use of OS concepts related to process synchronization, shared memory, file systems etc

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1304.1	Understand the working of task practically.	H		H											H
IT1304.2	Describe OS support for processes and threads	M		M											H
IT1304.3	Implement a program that illustrates the creation of child process using fork system call for various tasks. Also able to Recognize CPU Scheduling, synchronization, and deadlock			M											H
IT1304.4	Use C / C++ and Unix commands, and develop various system programs under Linux to make use of OS concepts related to process synchronization, shared memory, file systems etc			H		M									M
IT1304		M		M		M									H

Sr. No	Experiments Base On
1	Linux Commands
2	Windows Task Manager
3	Linux Process Control : Program 1
4	Linux Process Control : Program 2
5	CPU scheduling Algorithm
6	Deadlocks

7	Semaphores
8	Inter-process Communication
9	Memory Allocation algorithms
10	Page Replacement Algorithms

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IT1328	**Data Analysis & Statistics**		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1328.1	Demonstrate the ability to apply fundamental concepts in exploratory data analysis and concepts of probability distribution.	H	M												
IT1328.2	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.	H	M		M										
IT1328.3	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.	H	M		M										M
IT1328.4	Perform Chi-Square test for Independence as well as Goodness of Fit.	H	M												M
IT1328.5	Compute and interpret the results of Regression and Correlation Analysis, for forecasting.	H	M		M										
IT1328.6	Identify components of time series and perform time series analysis and discuss how indices are used in practical applications.	H	M		M										
IT1328		H	M		M										M

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., 328 Delhi, 2001
Business forecasting	8th Edition	John Hanke, Dean W. Wichern	Prentice Hall India

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IT1327	**Web Programming**		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. Understand the internet communication technologies & design dynamic web sites 2. Design & develop database-driven web sites 3. Design & develop to design dynamic websites 4. Develop to design JavaScript WebPages. 5. Use the concept of xml, CSS and DHTML 6. Develop a static and dynamic websites.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1327.1	Understand the internet communication technologies & design dynamic web sites		H	H			L	L		L					
IT1327.2	Design & develop database-driven web sites		H	H			L	L		L					
IT1327.3	Design & develop to design dynamic websites		H	H			M	L		L					
IT1327.4	Develop to design JavaScript WebPages.		M	H			M	L		M					
IT1327.5	To be able to use the concept of xml, CSS and DHTML		M	M			H	L		L					
IT1327.6	To be able to develop a static and dynamic websites.		H	M			M	L		M					
IT1327			H	H			M	L		L					

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

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IT1325	**Object Oriented Programming (JAVA)**		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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	After completion of the course students will be able to: 1. To understand basic features of JAVA as an object oriented-programming language. 2. Be able to write, compile, test and run simple Java programs 3. Be able to think write object based programs with object oriented features 4. 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. Demonstrate exceptions that can be recognized and handled by the Java

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT325.1	To understand basic features of JAVA as an object oriented-programming language	L	M										M	L	
IT3252	Be able to write, compile, test and run simple Java programs	M	H										M	M	
IT325.3	Demonstrate exceptions that can be recognized and handled by the Java programming language	H	L										M	L	
IT325.4	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	H	M										M	M	
IT325.5	Demonstrate exceptions that	M	M										M	L	

	can be recognized and handled by the Java programming language														
IT325.6	Understand stream classes, Use it to save and read the data in a file	M	L										M	M	
IT325		M	L										M	M	

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

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IT1322	**Web Technology**		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. Understand the internet communication technologies & design dynamic web sites 2. Design & develop database-driven web sites 3. Design & develop to design dynamic websites 4. Develop to design JavaScript WebPages. 5. To be able to use the concept of xml, CSS and DHTML 6. To be able to develop a static and dynamic websites.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1322.1	Understand the internet communication technologies & design dynamic web sites		H	H			L	L		L					
IT1322.2	Design & develop database-driven web sites		H	H			L	L		L					
IT1322.3	Design & develop to design dynamic websites		H	H			M	L		L					
IT1322.4	Develop to design JavaScript WebPages.		M	H			M	L		M					
IT1322.5	To be able to use the concept of xml, CSS and DHTML		M	M			H	L		L					
IT1322.6	To be able to develop a static and dynamic websites.		H	M			M	L		M					
IT1322			H	H			M	L		L					

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

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IT1334	**Internet of Things**		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	15	15	10	60	100	3 Hrs.

Course Learning Objective	**Course Outcomes**
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 students will be able to: 1. Describe ToT as a Process, its architecture and Management, compare and contrast old and new challenges. 2. Describe various communication protocol and its building blocks. 3. Identify the various building blogs of architecture. 4. Describe relevance of IoT with cloud 5. Identify the security challenges and describe various control strategies. 6. Describe use of IoT in various applications

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1334.1	Describe ToT as a Process, its architecture and Management, compare and contrast old and new challenges	L											M		
IT1334.2	Describe various communication protocol and its building blocks	M	H										M		
IT1334.3	Identify the various building blogs of architecture	H	H										M		
IT1334.4	Describe relevance of IoT with cloud	M	L								M		H		
IT1334.5	5. Identify the security challenges and describe various control strategies	L	L										H		
IT1334.6	Describe use of IoT in various applications	H									H		H		
IT1334		M	H								M		H		

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

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IT1305	**Software Engineering**		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. To differentiate between various process models and its utility in real world. Able to write proper SRS document. 2. Able to create better designs for various levels and to identify concurrency in given system & to decide the allocation of sub-systems. 3. Able to test, assess and use various test tools for testing and writing good test cases. 4. Able to use proper methods for measuring software 5. Able to draw the various UML diagram. 6. Apply the knowledge of latest trends to manage and control the development process of a software.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1305.1	To differentiate between various process models and its utility in real world. Able to write proper SRS document	H	H	M											
IT1305.2	Able to create better designs for various levels and to identify concurrency in given system & to decide the allocation of sub-systems	H		H	H										
IT1305.3	Able to test, assess and use various test tools for testing and writing good test cases	H	H		M	M									
IT1305.4	Able to use proper methods for measuring software	H	H	M		M									
IT1305.5	Able to draw the various UML diagram	H				H									M
IT1305.6	Apply the knowledge of latest trends to manage and control the development process of a software			M		H									
IT1305		H	H	M	M	M									M

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

UNIT III **[06 Hrs.]**

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

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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.	Students will be able to demonstrated: 1. Be able to analyze the process models to be used for a problem definition. 2. Be able to write proper SRS document by identifying the requirements. 3. Be able to create designs for the software. 4. Have practical knowledge on the application of Software engineering.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1306.1	Be able to analyze the process models to be used for a problem definition	H	H										M	M	
IT1306.2	Be able to write proper SRS document by identifying the requirements		M	M									M		
IT1306.3	Be able to create designs for the software	M		M									M		
IT1306.4	Have practical knowledge on the application of Software engineering	M	M	M									M		
IT1306		M	M	M									M		

Sr. No	Experiments Base On
1	Study of various SDLC phases and process models.
2	Identify the requirements of your problem definition.
3	Prepare SRS document of your problem definition.
4	Study the Rational Rose tool.
5	Draw a class diagram for your problem definition.
6	Draw a use case diagram for your problem definition.
7	Draw DFDs for your problem definition.
8	Draw a sequence diagram for your problem definition.
9	Design various test cases for your problem statement.

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5th Semester

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IT 1316	**Database Management System**		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. To be Able understand the different issues involved in the design and implementation of a database system 2. To be Able to understand the concept of physical and logical database designs, database modelling. Also can populate a database query using DML commands. 3. To be able to store & process large amount of data efficiently. 4. To be able to take the desired steps when there is a system failure 5. Able to understand the implementation of Concurrency Control Protocol. 6. Can implement secure and robust database and able to take the desired steps when there is a system failure.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1316.1	To be Able understand the different issues involved in the design and implementation of a database system	M												H	
IT1316.2	To be Able to understand the concept of physical and logical database designs, database modelling. Also can populate a database query using DML commands	L		H		H								M	
IT1316.3	To be able to store & process large amount of data efficiently	L				L								H	
IT1316.4	To be able to take the desired steps when there is a system failure	M												M	
IT1316.5	Able to understand the implementation of Concurrency Control Protocol	M		H										H	
IT1316.6	Can implement secure and robust database and able to take the desired steps when there is a system failure	H				M								M	
IT1316		M		H		M								H	

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

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Information Technology

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.	Students will be able to: 1. Perform practical on theory concepts. 2. Learn to use the database software: oracle to create table and enforce integrity constraints on a database. 3. Populate a database query using DML commands. 4. Perform practical's using DCL commands and can create a secure and protected database.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1317.1	Perform practical on theory concepts.				H										
IT1317.2	Learn to use the database software: oracle to create table and enforce integrity constraints on a database					M									
IT1317.3	Populate a database query using DML commands					H									
IT1317.4	Perform practical's using DCL commands and can create a secure and protected database					M									
IT1317					H	M									

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. (covers all types of Join)

5th Semester

9	Implementation of VIEWS.
10	Implementation of Grant and Revoke Command

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IT1318	**Design And Analysis Of Algorithms**		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. To formulate and solve recurrence relation. 2. Analyze asymptotic run time complexity of algorithm. 3. Ability to understand, compare advantages and disadvantages of different type of algorithms like Divide and conquer, greedy method. 4. To design, analyze and implement algorithms using dynamic programming. 5. To explain and implement major graph and searching algorithms and their analysis. 6. Apply different algorithm design techniques to solve certain NP- problems.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1318.1	To formulate and solve recurrence relation.	H				M									
IT1318.2	Analyze asymptotic run time complexity of algorithm.	H	M										L		
IT1318.3	Ability to understand, compare advantages and disadvantages of different type of algorithms like Divide and conquer, greedy method.	H		M									M		
IT1318.4	To design, analyze and implement algorithms using dynamic programming.	H			M										
IT1318.5	To explain and implement major graph and searching algorithms and their analysis.		M			H									
IT1318.6	Apply different algorithm design techniques to solve certain NP-problems.	H				M							H		
IT1318		H	M	M	M	M							M		

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

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Information Technology

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.	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
IT1332.1	Understand different analysis method and analyze it	H													
IT1332.2	Understand different techniques and apply it		H												
IT1332		H	H												

Sr. No	Experiments Base On
1	Practical Based on Amortized Analysis
2	Practical Based on Minimum Cost Spanning Tree
3	Practical Based on An Activity Scheduling Problem
4	Practical Based on Single Source Shortest Path
5	Practical Based on Dynamic Programming

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IT1330	**Business Intelligence**		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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, 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												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1330.1	Describe BI as a Process, its application in various domains and functional area , compare and contrast OLTP vs. OLAP	M					H								H
IT1330.2	Apply multi-dimensional modeling techniques for designing fact based decision making systems , identify various dimensions , metrics, aggregation strategies.	M	H												M
IT1330.3	Describe the basic building blocks along with their functions in N_tier BI system, and describe BI ecosystem.	M				M									
IT1330.4	Identify and Apply different stages in the lifecycle of a BI project. .	M	H												
IT1330.5	Apply SQL as a universal language for BI.	H	H												
IT1330.6	Recognize the different levels of abstraction in data warehouse, build schema objects, and generate different reports using BI tool.		H			H									
IT1330		M	H			M	H								M

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:				
3	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

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Information Technology

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	Students will be able to: 1. Obtain hands on experience with some popular BI software. 2. Demonstrate the ability to use BI tool for analysis

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT 1331.1	Obtain hands on experience with some popular BI software				H	H									M
IT 1331.2	Demonstrate the ability to use BI tool for analysis					H									M
IT1412					H	H									M

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

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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
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 students will be able to: 1. Understanding 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. To analyze and understand the human, technological and business environment associated with e-commerce 3. Defining and analyzing the concept of electronic data interchange and its legal, social and technical aspects 4. evaluate the key aspects of B2C e-commerce 5. discuss the trends in e-Commerce and the use of the Internet 6. 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												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1336.1	Understanding 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	M	L				H				L	L			
IT1336.2	To analyze and understand the human, technological and business environment associated with e-commerce	H	H				M				L	L			
IT1336.3	Defining and analyzing the concept of electronic data interchange and its legal, social and technical aspects	H	H				M				H	L			
IT1336.4	evaluate the key aspects of B2C e-commerce	M	L				L				H	H			
IT1336.5	Discuss the trends in e-Commerce and the use of the Internet.	L	L				L				L	H			
IT1336.6	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.	M	H				M				H	L			
IT1336		M	H				M				H	L			

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. *[CO1-H, CO4 –H]*

Information Technology

6th Semester

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:				
	E-Commerce	2001	David Whiteley	McGrew Hill Pub
	Electronic Commerce	2nd Edition	Schneider & James T. Perry	Course Technology
Reference books:				
	Teach Yourself Web Technologies - Part 1	2003	Ivan Bayross	BPB Publications
	Technologies TCP/IP Architecture, and Java Programming	2nd Edition	S. Godbole and Atul Kahate	v-Hill Education (India)

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IT1338	**Computer Networks**		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 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 no adaptive routing algorithms 5. Understand the concept of Quality of Service provided by the transport layer 6. Apply basic knowledge cryptography techniques for network security.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1338.1	Distinguish between various types of computer networks	M												M	
IT1338.2	Demonstrate basic understanding of hardware, software and types of transmission media used in computer networks		M											M	
IT1338.3	.Describe the concept of various protocols used in data link layer	M	M											M	
IT1338.4	Demonstrate the knowledge of adaptive and no adaptive routing algorithms		M												M
IT1338.5	Understand the concept of Quality of Service provided by the transport layer		M											M	
IT1338.6	Apply basic knowledge cryptography techniques for network security.	H											H		M
IT1338		M	M										H	M	M

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

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IT1311	**Artificial Intelligence**		L=3	T=1	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE
	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 students will be able to: 1. Demonstrate understanding of AI and its task domains 2. Understand, apply and choose proper state space search algorithm for the given problem. 3. Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets conceptual dependency) inference and theorem proving. 4. Demonstrate working knowledge of reasoning techniques in the presence of incomplete and/or uncertain information. 5. Demonstrate and understand the various learning methods and Know how to build simple knowledge-based systems 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.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1311.1	Demonstrate understanding of AI and its task domains	M													
IT1311.2	Understand, apply and choose proper state space search algorithm for the given problem		M												
IT1311.3	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets conceptual dependency) inference and theorem proving		H												
IT1311.4	Demonstrate working knowledge of reasoning techniques in the presence of incomplete and/or uncertain information														
IT1311.5	Demonstrate and understand the various learning methods and Know how to build simple knowledge-based systems			M											
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					L									
IT1311		M	M	M		L									

UNIT I **[08 Hrs.]**

Introduction to AI: Definition of AI, early work in AI, Approaches to AI, the importance of AI, AI and related fields, distributed AI, task domain of AI, physical symbol system and its hypothesis, AI technique, Turing test, knowledge and knowledge based systems. Problems, problem spaces and searches: defining the problem on a state space search.

UNIT II **[09 Hrs.]**

Production systems and control strategies: 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, constraint satisfaction, means-ends analysis

UNIT III **[09 Hrs.]**

Knowledge representation: issues, representation and mapping approaches, introduction to proposition logic, knowledge representation using predicated logic, unification and resolution algorithms. Representation knowledge using rules, procedural Vs declarative knowledge, logic programming, forward Vs backward reasoning, matching, control knowledge.

UNIT IV **[08 Hrs.]**

Knowledge representation using semantic nets, frames, conceptual dependency and scripts.

Introduction to non-monotonic reasoning: logics for non-monotonic reasoning Statistical reasoning: probability and Baye's theorem, certainty factors and rule based system.

UNIT V **[07 Hrs.]**

Learning: general learning model, types of learning, rote learning, learning by taking advice, learning by analogy, induction learning, l earning by observation and discovery. Expert System: Rule based system architectures, expert system shell, knowledge acquisition and validation, knowledge system building tools.

UNIT VI **[08 Hrs.]**

Natural languages processing: overview of linguistics, syntactic processing, semantic analysis, discourse and processing. Game Playing: the min-max search procedure, adding alpha-beta cut-offs. Introduction to Fuzzy Logic, Neural networks & Genetic Algorithm.

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

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Information Technology

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

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

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7th Semester

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
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	Students will be able to: 1. Demonstrate the ability to conduct dimensional modeling. 2. Demonstrate the ability to conduct Online analytical processing (OLAP) 3. Obtain hands on experience with some popular data mining software. 4. Implement the algorithm for prediction 5. Perform visualization on data to identify whether it is linear or not.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT 1428.1	Demonstrate the ability to conduct dimensional modeling	H		H										M	
IT 1428.2	Demonstrate the ability to conduct Online analytical processing (OLAP)				H										
IT 1428.3	Obtain hands on experience with some popular data mining software				H	H									
IT 1428.4	Implement the algorithm for prediction	M	H												
IT 1428.5	Perform visualization on data to identify whether it is linear or not					H									
IT 1428		M	H	H	H	H								M	

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

7th Semester

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

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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													

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 similaritymeasures, 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 setsDefuzzification 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

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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	

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

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7th Semester

IT 1418	Lab: TCP/IP	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 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	Students will be able to: 1. Be capable to identity the appropriate data structure for given problem network 2. Be able to configure real time environment 3. Have practical knowledge on the application of packets and segments data and formats

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1418.1	Be capable to identity the appropriate data structure for given problem network		M	H	-	-	-	-	L	M	-	-	L	H	
IT1418.2	Be able to configure real time environment		M	H	-	-	-	-	M	M	-	-	L	H	
IT1418.3	Have practical knowledge on the application of packets and segments data and formats		H	H	-	-	-	-	L	L	-	-	L	H	
IT1418			M	H	-		-	-	L	M	-	-	L	H	

Sr. No	Experiments Base On
1	Implementation of configuring wired TCP/IP Properties
2	Implementation of configuring wireless TCP/IP Properties
3	Analysis of the real time network with various tools
4	Analysis of IP packet, and identifying types of packet
5	Analysis of TCP,UDP segment
6	Implementation a program for identifying IP address

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Information Technology

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	

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 theGoods, 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)

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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												PSPO	
		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

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

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III 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 OBJECTIVES: -	Course Outcomes:-
Understanding the basic Concepts of Information Technology Study of Computer Systems and Program Development 3) Study of basic Database Concepts 4) Study of Internet Technology Learn different Applications of Information Technology	. Students are expected to learn variety of concepts of Information Technology, computer system. . Understand the background of OS, Databases & Networking . Students are expected to learn various basic concepts of Internet Technology. 4. Choose and apply appropriate application of IT

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 **[06 Hrs.]**

Evolution of Computing Machines, Computer Generations, Era of Personal Computing, Digital Computers, Micro Computers, I/O Devices, Auxiliary Storage Devices, Programming Language, Application Program Vs System Program, Memory Hierarchy, File Organization, File Types.

UNIT III **[06 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 **[10 Hrs.]**

Introduction to operating systems features of modern operating systems, LINUX: Introduction to LINUX, Shell Programming, Basic database concepts and SQL.

UNIT V **[10 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 **[05 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.

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III Semester

Text books:				
1	Foundations of Information Technology	Third Edition,	D.S. Yadav	New Age Publications

Reference books:				
1	Information Technology Principles and Applications	2004	Ajoy Kumar Ray, TinkuAcharya	PHI

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III Semester

IT 1206	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 OBJECTIVES: -	Course Outcomes:-
• **Understand** how the hardware and software components of a microprocessor-based system work together to **implement** system-level features; • Become **familiar** to both hardware and software aspects of integrating digital devices (such as memory and I/O interfaces) into microprocessor-based systems; • Know the operating principles of, and gain hands-on experience with, common microprocessor peripherals. • Get practical **experience** in Interfacing and assembly-language programming. • Be **exposed** to the tools and techniques used by practicing engineers to design, implement, and debug microprocessor-based systems (during the *Lab).*	1. Solve basic binary math operations using the microprocessor. 2. Demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor 3. Program using the capabilities of the stack, the program counter, and the status register and show how these are used to execute a machine code program 4. Apply knowledge of the microprocessor's internal registers and operations by use of a PC based microprocessor simulator. 5. Design circuitry to the Microprocessor I/O ports in order to interface the processor to external devices. 6. Write assembly language programs that will provide solutions to real-world control problems such as fluid level control, temperature control etc.

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.]**

Interrupt Structure: 8086 interrupt structure, 8259 priority interrupt controller, Interfacing & programming.

UNIT IV [07 Hrs.]

Interfacing with 8086/8088: Memory interfacing, Programmable parallel ports, Intel 8255 PPI, Block diagram & interfacing, Modes & initialization.

UNIT V **[07 Hrs.]**

Serial communication: Asynchronous & synchronous communication, RS-232C protocol, 8251 USART Interfacing & programming, 8237 Direct Memory Access (DMA) Interfacing & Programming

III Semester

UNIT VI **[07 Hrs.]**

8253/8254 PIT, Interfacing & programming. Keyboard/Display controller 8279; block diagram, system connections & programming.

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,

Reference books:				
1	An introduction to the Intel family of microprocessors	1996	James L. Antonakos	Prentice Hall
2	80x86 Family: Design, Programming & Interface		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

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III 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
• Understand how the hardware and software components of a microprocessor-based system work together to implement system-level features; • Become familiar to both hardware and software aspects of integrating digital devices (such as memory and I/O interfaces) into microprocessor-based systems; • Know the operating principles of, and gain hands-on experience with, common microprocessor peripherals. • Get practical experience in Interfacing and assembly-language programming. • Be **exposed** to the tools and techniques used by practicing engineers to design, implement, and debug microprocessor-based systems	1. Solve basic binary math operations using the microprocessor. 2. Demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor 3. Program using the capabilities of the stack, the program counter, and the status register and show how these are used to execute a machine code program 4. Apply knowledge of the microprocessor's internal registers and operations by use of a PC based microprocessor simulator. 5. Design circuitry to the Microprocessor I/O ports in order to interface the processor to external devices. 6. Write assembly language programs that will provide solutions to real-world control problems such as fluid level control, temperature control etc.

Course Outcomes	Mapped PO						
	a	b	c	d	e	f	g
Solve basic binary math operations using the microprocessor.	√	√		√			
Demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor					√		
Program using the capabilities of the stack, the program counter, and the status register and show how these are used to execute a machine code program		√			√		
Apply knowledge of the microprocessor's internal registers and operations by use of a PC based microprocessor simulator.		√			√		
Design circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.	√	√			√		
Write assembly language programs that will provide solutions to real-world control problems such as fluid level control, temperature control etc.	√	√			√		

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III Semester

Sr. No	Experiments Base On
1	Awareness about the simulator or Any Software and 8086 Kit used for performing practicals. (Study Experiments with basic Math operations using µP)
2	Microprocessor BASIC Instruction Set
3	Different Addressing Modes
4	Interfacing with I/O Devices (Timer IC, Interrupt Generation,LED,LCD) with 8086 µP
5	Memory related opeartions
6	8255, 8253,8279, 8251

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IV Semester

IT 1209	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 Objectives: -	Course Outcomes:- After Completion of this course students will be able to:
1. To Study of abstract computing models. 2. To Study Automata Theory and kinds of formal grammars, and learn how to apply them in computing. 3. To learn about the theory of computability and design complexity	1. Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars 2. Demonstrate their understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving. 3. Prove the basic results of the Theory of Computation 4. State and explain the relevance of the Church-Turing thesis.

Syllabus:

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:

IV Semester

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 Books:

Theory of Computation	2nd edition, 2005	Sipser	Course Technology
Theory of Computation	2008	O.G. Kakde	USP

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IV 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
• To study fundamentals of computer hardware, architecture and assembly of computer • To study of basic networking components • To study basic components of Linux/Unix operating system • Study of open source tools like Latex, My SQL	Students is able to: 1. Assembled Personal Computer. 2. Configuration of Computer Networks. 3. Write a program and execution of Different command in Linux/Unix O.S. 4. Learn Open Source Tool.

Course Outcomes	Mapped PO										
	a	b	c	d	e	f	g	h	i	j	k
Students is able to Assembled Personal Computer	√				√				√		
Students is able to Configuration of Computer Networks	√	√			√				√		
Students is able to Write a program and execution of Different command in Linux/Unix O.S	√				√				√		
Students is able to Learn Open Source Tool.	√				√	√			√		√

Sr. No	Experiments Base 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

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V 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.

V Semester

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.

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V 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 comphend 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 students will be able to: 1. Understand basics of computer graphics. 2. Apply basic algorithms for line, circle and to solve, apply and list geometric transformation matrices including rotation, translation, scaling and reflection to transform a 2D object. 3. Apply basic algorithms and methods for segments, clipping and viewing transformation. 4. Understand and implement 3D graphics algorithms. 5. To solve and plot curve and splines. 6. Understand various tools and apply to design the animation.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1307.1	Understand basics of computer graphics.	H		M						L		L	M		
IT1307.2	Apply basic algorithms for line, circle and to solve, apply and list geometric transformation matrices including rotation, translation, scaling and reflection to transform a 2D object.	M		H						L		L	M		
IT1307.3	Apply basic algorithms and methods for segments, clipping and viewing transformation.	M		H						L		L	L		
IT1307.4	Understand and implement 3D graphics algorithms.	H		M						L		L	H		
IT1307.5	To solve and plot curve and splines.	H		M						L		L	L		
IT1307.6	Understand various tools and apply to design the animation.	L		L						H		H	L		
IT1307		M		M						L		L	L		

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.

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

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

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V 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. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded system 2. Understand and design of embedded systems and real time systems 3. Design, implement and test an embedded system 4. Apply real time systems design techniques to various software programs. 5. Describe and compare the various types of peripherals used in embedded systems. 6. Define the unique design problems and challenges of real time systems

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1309.1	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.	H	L	M	L	L									
IT1309.2	Understand and design of embedded systems and real time systems	M	H	M	M	M									
IT1309.3	Design, implement and test an embedded system	L	M	H	M	M									
IT1309.4	Apply real time systems design techniques to various software programs.	M	H	M	H	L									
IT1309.5	Describe and compare the various types of peripherals used in embedded systems.	M	L	L	M	H									
IT1309.6	Define the unique design problems and challenges of real time systems	M	M	H	M	M									
IT1309		M	H	M	M	M									

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

IT1326	PE I : Digital Signal Processing		5th Semester	L=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 students will be able to: 1. 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. Apply DSP techniques to real-world signal acquisition, spectral analysis and signal filtering. 3. Analyze and characterize the signals and system through Z-transform. 4. Understand system characterization and able to classify and design it. 5. Design digital IIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation. 6. Understand Discrete Fourier Transform and improved algorithms for fast DFT calculation.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1326.1	Understand digital to analog (D/A) and analog to digital (A/D) conversion and to operate on a signal and model these operations mathematically.	H	M												
IT1326.2	Apply DSP techniques to real-world signal acquisition, spectral analysis and signal filtering.	H	M												
IT1326.3	Analyze and characterize the signals and system through Z-transform.	H	M												
IT1326.4	Understand system characterization and able to classify and design it.	H	M												
IT1326.5	Design digital IIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation.	H	M	H											
IT1326.6	Understand Discrete Fourier Transform and improved algorithms for fast DFT calculation.	H	M												
IT1326		H	M	H											

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 **[07Hrs.]**

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

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.

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)

Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2014

Information Technology

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
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 students will be able to: 1. To differentiate between wired and wireless communication and understand the basic issues related wireless & cellular communication. 2. To understand Cellular system architecture and channels, based on different medium access mechanisms. 3. To understand the basic modulation techniques to overcome the different fading effects 4. To distinguish between basic types of satellite communications and understand the current and proposed cellular technologies. 5. To analyze how the traditional networks can be extended for mobility support. 6. To understand WAP and identify different mobile application issues.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1308.1	To differentiate between wired and wireless communication and understand the basic issues related wireless & cellular communication.	H													
IT1308.2	To understand Cellular system architecture and channels based on different medium access mechanisms.						M								M
IT1308.3	To understand the basic modulation techniques to overcome the different fading effects		M												
IT1308.4	To distinguish between basic types of satellite communications and understand the current and proposed cellular technologies.						M								
IT1308.5	To analyze how the traditional networks can be extended for mobility support.												M		
IT1308.6	To understand WAP and identify different mobile application issues.		M												M
IT1308		H	M				M						M		M

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

Nagar Yuwak Shikshan Sanstha's

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Information Technology

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. Understand basics of image processing and IP systems. 2. understand and apply image enhancement and filtering techniques in spatial domain 3. Understand basics of image processing in frequency domain using transforms like DFT & DCT. 4. Apply frequency domain techniques for image filtering and enhancement. 5. Understand and apply different image segmentation techniques to image. 6. Understand internal and external representation of an image region and differentiate between them.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1320.1	Understand basics of image processing and IP systems	M	M												
IT1320.2	Understand and apply image enhancement and filtering techniques in spatial domain	H	M												
IT1320.3	Understand basics of image processing in frequency domain using transforms like DFT & DCT.	H	M												
IT1320.4	Apply frequency domain techniques for image filtering and enhancement.	H	M												
IT1320.5	Understand image segmentation and explain different techniques of it.	H	M												
IT1320.6	Understand internal and external representation of an image region and differentiate between them.	H	M												
IT1320		H	M												

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.

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 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	Tinku Acharya & Ajoy K. Ray	Willey Inter-Science

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BE SoE and Syllabus 2014

Information Technology

7th Semester

IT1407	PE III : 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 Learning Objective	Course Outcomes
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 students 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. Analyze real-time systems designs; 3. Apply formal methods for scheduling real-time systems; 4. Know the various task assignment and scheduling methods. For example RM and DM scheduling; 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; 6. Implement real-time programs on real-time operating systems and use real-time concepts for clear and concise presentation of problems and solutions.

Course Outcomes	Statement	Mapped PO												PSPO	
		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;	H	M												M
IT1407.2	Analyze real-time systems designs;	H	H	M	M										M
IT1407.3	Apply formal methods for scheduling real-time systems;	M	H	M	M										M
IT1407.4	Know the various task assignment and scheduling methods. For example RM and DM scheduling;	H	H	M	M										M
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;	H	H	H	M										M
IT1407.6	Implement real-time programs on real-time operating systems and use real-time concepts for clear and concise presentation of problems and solutions.	H	H	H	M										M
IT1407		H	H	M	M										M

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.

IT1407	PE III : 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.

[07 Hrs.]

UNIT III

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.

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Accredited 'A' Grade by NAAC
Hingna Road, Wanadongri, Nagpur-441110

Department of Applied Mathematics & Humanities

COMMUNICATION SKILLS (GE-1107)

Assignment- 2017-18

SHADOW TEACHING

Objective: The concept of shadow teaching benefits learners, motivates them to learn and to enhance and enrich learning environment, enhancing their confidence.

Task: All the students have to prepare certain topics from unit-I to unit IV .They can select any method to explain the topics. The time duration for each group will be 10 minutes. Students of sections-**A,B,C,D,E,F,G,P** are **divided in groups** and have to present the topics as per the groups.

Submission: 1. Use charts, PPTs, Blackboard etc.to present the task
2 Date: 20th - 24th November 2017

GROUPS	Topic:	ROLL NO.
1.	SHADOW TEACHING	1,11,21,31,41,51,61,71
2		2,12,22,32,42,52,62,72
3		3,13,23,33,43,53,63,73
4		4,14,24,34,44,54,64,74
5		5,15,25,35,45,55,65,75
6		6,16,26,3646,56,66,76
7		7,17,27,37,47,57,67,77
8		8,18,28,38,48,58,68,78
9		9,19,29,39,49,59,69,79
10		10,20,30,40,50,60,70,80

Course Faculty: Prof.Meenal R Kale -
Prof.N.K.Thakre-

KINESICS

SHADOW TEACHING

BODY'S PHYSICAL MOVEMENT

BY-

ROHIT RAMTEKE(51)

RUGVED TEKADE(52)

SAINATH MATTE(54)

SAMIR SHERKI(55)

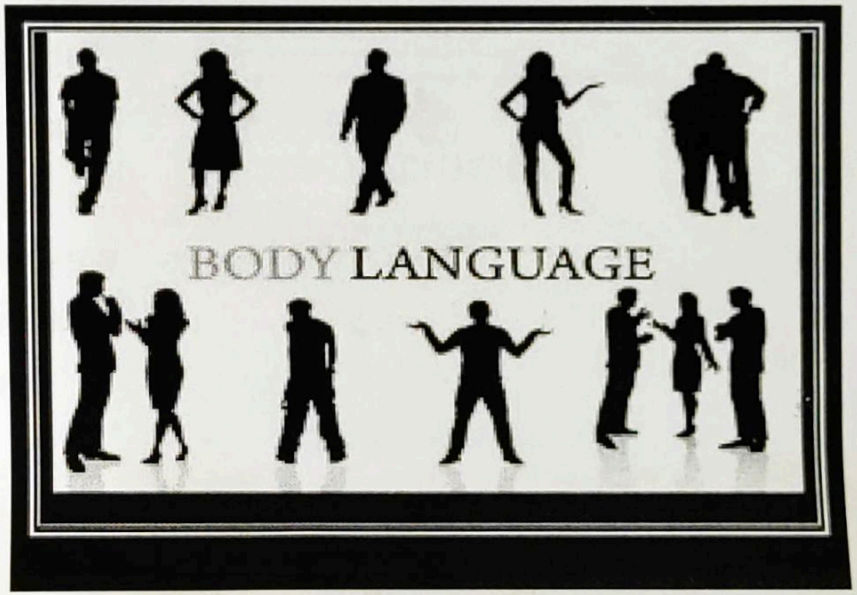
SANJYOT DAFALE(56)

SHREY UTTARWAR(57)

SHRIKANT KUMBHARE(58)

SPANDAN WASNIK(59)

SRAJAN RAGHUWANSHI(60)



WHAT IS KINESICS ?

- *Kinesics is the interpretation of body motion communication such as facial expressions and gestures, nonverbal behavior related to movement of any part of the body or the body as a whole. The equivalent popular culture term is body language. Kinesics is used to study how people communicate through posture, gesture, stance and movement. Understanding non-verbal cues will develop your ability to use them more effectively during your presentations.*

Types of Non-verbal communication

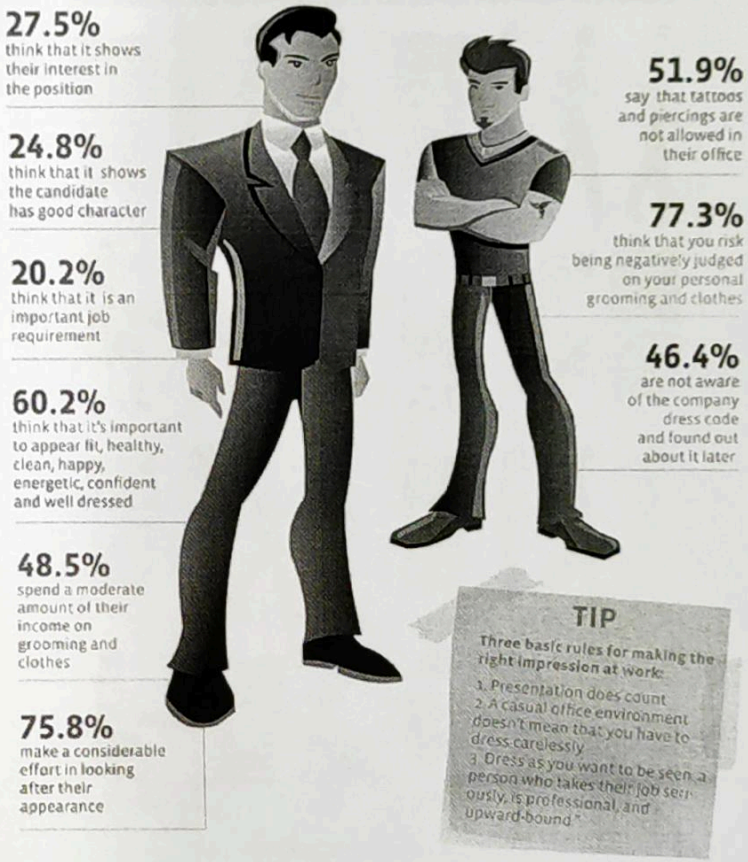
- KINESICS (BODY LANGUAGE)
  - FACIAL EXPRESSION
  - HEAD
  - EYE GAZE
  - GESTURES
  - POSTURES
  - SHAPE OF BODY
  - PERSONAL APPEARANCE ADORNMENT

Personal Appearance

- ***Personal appearance plays an important role; people see you before they hear you. Appearance include clothes, hair, jewelry, cosmetics and so on. Clothes accept the body's movement.***

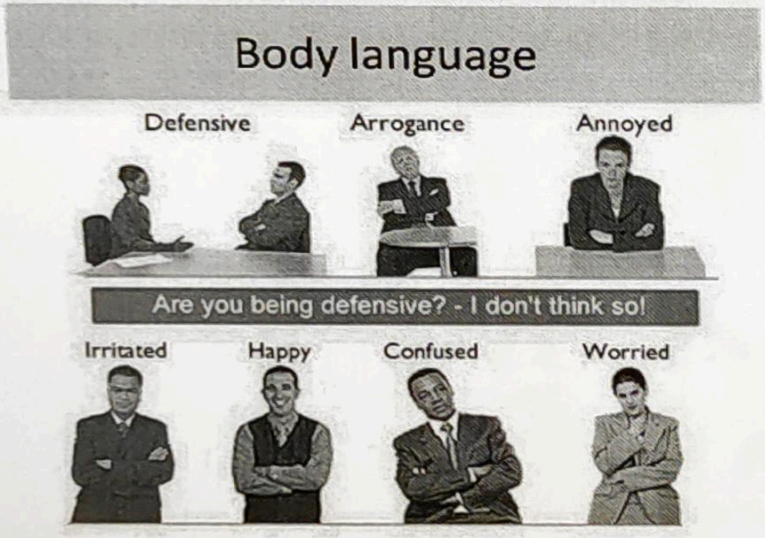


Good Grooming vs. Bad Grooming



Posture

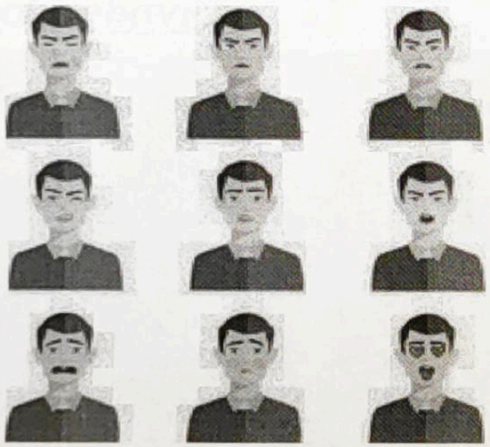
What is posture? Posture is a term used to describe a position of the body or the arrangements of body parts relative to one another.

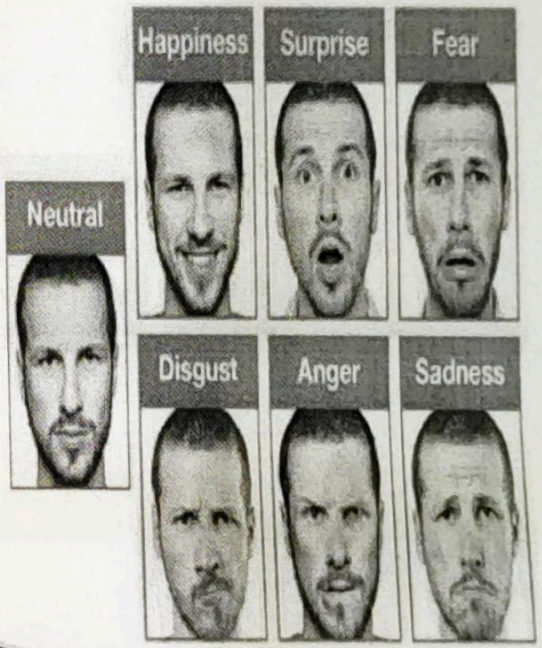




Facial Expressions

- ***Facial expression** is integral when expressing emotions through the body. Combinations of eyes, eyebrow, lips, nose, and cheek movements help form different moods of an individual.*





REFERENCES

- WIKIPEDIA
- WWW.COMMUNICATION.COM
- TECHNICAL COMMUNICATION BY SANGEETA SHARMA AND MINAKSHEE RAMAN

Review :

Date:

Topic: Kinesics.

Name of participents: Rohit Ramteke (51), Rugved Tekade (52), Sainath Mattc (54), Samir Sherki (55) Sanjyot Dafale (56), Shrey Uttarwar (57), Shrikant Kumbhare (58), Spandan Wasnik (59), Srajan Raghuwanshi (60).

Parameters of evaluation:

1) Contents: [9/10]

The contents and the matter in the presentation provided a deep insight. Everything was placed properly in a sequence. Each part was supported with pictures and was explained properly.

2) Body Language: [7/10]

could have been presented in a better way.

3) Overall presentation: [8/10]

It was a treat ~~for~~ to view the slides. Each topic was covered and explained enthusiastically.

4) Suggestions:

Explaination should have been much audible. Some participents contributed their best. Good efforts were taken. I think it was good ~~as for~~ it was the first attempt.

N.K. Thakre

Name: Ankeeta Mitra

Signature: Ankt

Roll no: 4

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Board of Studies (General Engineering)

Communication Skills Syllabus
GE- 1107
Academic session 2017-18

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	3Hrs

Objectives	Outcomes
The objective of the syllabus is to enrich lives of student's across various vertical in their career →To introduce the basic concepts of language, different strategies of technical communication skills and four folds skills. →To prepare students to stretch beyond their comfort zones in order to become leaders in Industries. →To develop students' new management skills. Express themselves with confidence and clarity, contribute more productively and above all become a good team member.	**By the end of the course students will have ability** →To Face challenges in communication, primarily in technical and will achieve commendable tyle in writing →Students will be able to eliminate oad 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 1:- Basics of Communication (PO-10)

Process of Communication, Language as a tool, Levels , flows , Networks of communication and importance of communication

Classification of Barriers (Intrapersonal, Interpersonal, Organizational)

Unit 2- Effective Presentation (PO-10)

Defining purpose, analyzing audience and locale, organizing content, preparing an outline, visual aids, understanding nuances of delivery (Kinesis, proxemics, paralinguistics and chronemics)

Listening Skills- Introduction, types, Traits of listening, active verses passive listening and implications of listening.

Unit 3 – Interview Skills (PO-10)

Objectives, Types of Interviews on the bases of objective and nature, three basic types of interview

Face to Face Interview- Expectation of the employer, Preparation that a candidate has to do, Types of question, types of answering techniques, overcoming nervousness, follow up, Telephone Interview- Types , Guidelines and preparation.

Reading Skills- Definition, Fixation, reading rates, techniques of reading.

Unit 4- Group Skills (PO-10)

Purpose, types and difference between group and team

GD- Purpose, Organizational GD & GD as a past of selection process, approach to topic and case study

Meeting- Purpose, Preparation and procedure of meeting, follow up

Conference- Significance, planning, preparation and procedure.

Unit 5- Reports and Memo (PO-10)

Reports- Objectives, characteristics, types, importance, formats and different aspects of Prewriting

Memo- Definition, classification, purposes style and structure and layout.

Unit 6- Technical proposals & Letters (PO-4,10)

Proposals- Definition, purposes, types, Characteristics style and appearance and elements of structure.

Text Book-

1) Raman & Sharma," Technical communication", Oxford University Press.

Reference books :-

1) Asha Kaul, Effective Bussiness Communication", Prentice Hall India.
2) Barbara & Allen Pease, "Body Language"

Dr. M.P Gandhi,
BOS Chairman,
General Engineering
Yeshwantrao Chavan College of Engineering,
Nagpur,

Nagar Yuwak Shikshan Sanstha's

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Syllabus 2017-18

GE : 1311- Fundamentals of Management

5th Semester

GE 1311	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

Course Objectives:

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.

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:

- S.C.Saxena, Business Management and Administration, Sahitya Bhawan Publication
- P. Subba Rao, Management -- Theory and Practice (Text and Cases) (Himalaya Publication)
- Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
- P.S Rao , Essentials of Human Resource Managemen & IR, Himalaya , Mumbai
- Avraham Shtub and Jonathan F. Bard, Project Management: Processes, Methodologies, andEconomics (2nd Edition)
- Kotler, Keller, Koshy & Jha, Marketing Management, Pearson, New Delhi
- R.K. *Sharma*, Shashi K *Gupta*, Management Accounting,. *Kalyani Publishers*.

Manjusha P.Gandhi
Chairman- BOS-General Engineering

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(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110

Department of Applied Physics

Academic Year 2017-18

Course codes : GE1106 **Name of the courses : Engineering Physics Lab.**

Expt.No.	Course Outcomes	Statement of Course outcomes
		Students are able to
1,3, 11	CO1	To study characteristics of p-n junction diode , identify the semiconductor and determine the density of charge carrier using Hall effect .
2,5	CO2	To obtain appropriate wave forms using proper knobs on CRO and determine amplitude , frequency of sinusoidal signal.
4,10	CO3	To develop graphical skill to find energy gap of semiconductor.
7,8	CO4	To develop technical skill for obtaining sharp and bright interference fringes in wedge shaped film and Newton's rings and determine physical/optical parameters such as t, λ, μ .
9	CO5	To develop technical skill for obtaining spectrum using diffraction grating and determine the wavelength of sodium light .
6	CO6	To learn the method of determination of velocity of ultrasonic waves in liquid using ultrasonic interferometer .

GE1106 Engineering Physics Lab. : CO- PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	3	3										
CO3	2	2										
CO4	3	3										
CO5	3	2										
CO6	3	3										
Average:	2.83	2.66										

Nagar Yuwak Shikshan Sanstha's
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Department of Applied Physics

Course codes : GE1106 **Name of the courses : Engineering Physics Lab.**

List of Experiments

Expt.No.	Name of Experiment	CO	PO
1.	To study variation of Hall voltage with current and magnetic field; and to determine Hall coefficient, concentration and polarity of charge carriers.	CO1	PO1,PO2
2.	To measure the amplitude and frequency of sinusoidal voltage obtained from the secondary of a step down transformer using CRO.	CO 2	PO1,PO2
3.	To study the static characteristics of semiconductor diode; (Germanium and Silicon diode) in forward and reverse bias mode	CO 1	PO1,PO2
4.	To determine the forbidden energy gap of a semiconductor by studying the temperature variation of its receptivity using four probe method.	CO 3	PO1,PO2
5.	To measure the phase shift introduced by a phase shift network using dual beam CRO .	CO 2	PO1,PO2
6.	Determination of the velocity of ultrasonic waves in a non electrolytic liquid by ultrasonic interferometer.	CO 6	PO1,PO2
7.	To determine the radius of curvature of Plano-convex lens by using Newton's Rings apparatus.	CO 4	PO1,PO2
8.	To determine the thickness of thin paper using Air Wedge arrangement.	CO 4	PO1,PO2
9.	To determine the wavelength of sodium light using Plane Transmission Grating.	CO 5	PO1,PO2
10.	To determine the forbidden energy gap of a semiconductor by using PN junction diode in reverse biased mode.	CO 3	PO1,PO2
11.	To study the dependence of Hall coefficient on temperature.	CO 1	PO1,PO2

Dr. S. A. Fadnavis

HOD

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YCCE

First Year BE

DEPARTMENT OF CHEMISTRY

2017-18

Name of Course: Engineering Chemistry Practical **Course code: GE 1104**

EXPERIMENT NUMBER	TITLE OF THE EXPERIMENT	CO	PO
1	Estimation of hardness	CO1	PO1, PO2
2	Estimation of Nickel	CO2	PO1, PO2
3	Estimation of alkalinity	CO1	PO1, PO2
4	Estimation of copper	CO2	PO1, PO2
5	Estimation of iron	CO2	PO1, PO2
6	Determination of viscosity	CO3	PO1, PO2
7	Analysis of coal	CO3	PO1, PO2
8	Determination of Flash point by Pensky-Marten's apparatus	CO3	PO1, PO2
9	Determination of Flash point by Able's apparatus	CO3	PO1, PO2
10	Determination of ion exchange capacity of resin	CO3	PO1, PO2
11	Determination of conductivity	CO4	PO1, PO2
12	Determination of pH	CO4	PO1, PO2
13	Preparation of urea formaldehyde resin	CO5	PO1

Head
Department of Applied Chemistry
Y. C. College of Engineering
NAGPUR

300
350

COURSE OBJECTIVES FOR ENGINEERING CHEMISTRY PRACTICAL (GE 1104)

Experiment Number	CO	STATEMENT
		Students will be able :
1 & 3	CO1	To determine chemical parameters such as hardness and alkalinity
2,4 &5	CO2	To determine the quantity of some metals like iron and copper in solution of unknown concentration using various titrimetric and spectrophotometric methods
6,7,8 & 9,10	CO3	To determine physical parameters of non-metallic engineering materials like lubricating oils, coal and water and study the related significance.
11&12	CO4	To determine physical parameters such as pH and conductance of a water sample
13	CO5	To synthesize some polymers and study their properties

CO-PO Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	2										
CO3	2	2										
CO4	2	2										
CO5	2											

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

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Mapping of Courses to Employability/ Entrepreneurship/Skill Development

1.1.3 Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during the year 2017-18

Sr.No.	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
1	PE-IV : Advanced Survey	CV-1452	Employability
2	PE-V : Water Transmission & Distribution system	CV-1432	Employability
3	Industrial Training / CRT	EL1406	Employability
4	Project Phase I	EL1407	Employability
5	Project Phase II	EL1420	Employability
6	Engineering Mathematics III	GE1201	Employability
7	Electronic Devices	EE1201	Employability
8	Electronic Measurement & Instrumentation	EE1205	Employability
9	Numerical Methods & Statistical Techniques	GE1204	Employability
10	Electromagnetic Fields	EE1207	Employability
11	Electronic Circuit Analysis	EE1208	Employability
12	Control Systems	EL1217	Employability
13	Microprocessor & Interfacing	EE1210	Employability
14	Analog Communication	EE1301	Employability
15	Signals and Systems	EE1306	Employability
16	Analog Integrated Circuit & its Application	EE1308	Employability
17	Power Electronics	EE1304	Employability
18	Computer Organisation	EE1324	Employability
19	OE1:Data Acquisition & Signal Conditioning	EE1320	Employability
20	OE1:Microporcessor & Microcontroller	EE1322	Employability
21	Transmission Lines & Wave Guides	EE1303	Employability
22	Digital System Design	EE1316	Employability
23	Microcontroller & Interfacing	EE1326	Employability
24	OEII:Basics of Analog and Digital Communication	EE1329	Employability
25	OEII:Biomedical Instrumentation	EE1330	Employability
26	PEII:Digital CMOS Circuits	EE1403	Employability
27	PEII:Algorithm & Data Structures	EE1405	Employability
28	Electronics Circuit Design	EE1407	Employability
29	Digital Communication	EE1409	Employability
30	PE3:Computer Communication Network	EE1414	Employability
31	PE3: Micro Electro Mechanical Systems	EE1437	Employability
32	PE4:Soft Computing	EE1417	Employability
33	PE4:Analog VLSI Design	EE1419	Employability
34	PE5: Biomedical Instrumentation & its Applications	EE1425	Employability
35	PE5: Optical Communication	EE1426	Employability
36	PE5: Wireless Communication	EE1427	Employability
37	PE5: Mechatronics	EE1428	Employability
38	OE 1 : Principles of Communication Engineering	ET1333	Employability
39	OE 1 : Fundamentals of Image Processing	ET1335	Employability
40	OE II : Soft computing	ET1340	Employability
41	OE II : Industrial Instrumentation	ET1341	Employability
42	OE II : Medical Electronics	ET1342	Employability
43	OE II : Display Technology and Applications	ET1343	Employability
44	PE III : Optical Communication	ET1405	Employability
45	PE III : Microwave Integrated circuit	ET1407	Employability
46	PE V : RF Circuit Design	ET1424	Employability
47	PE II : Embedded System	ET1319	Employability
48	Object Oriented Programming	CT1221	Employability
49	Lab: Object Oriented Programming	CT1222	Employability
50	Data Structure	CT1203	Employability
51	Programming Language Concepts & Constructs	CT1205	Employability
52	Advanced Data Structures	CT1223	Employability
53	Theoretical Foundation of Computer Science	CT1301	Employability
54	Operating Systems	CT1302	Employability
55	Computer Networks	CT1340	Employability
56	OE I: Operating System Concepts	CT1343	Employability
57	OE I: Essentials of IT	CT1344	Employability
58	Design & Analysis of Algorithm	CT1314	Employability
59	Language Processors	CT1318	Employability
60	PE1 : Privacy and Security in Online Social netwoks	CT1355	Employability
61	Network Security	CT403	Employability
62	PE2: Neural Network & Fuzzy Logic	CT405	Employability
63	PE3: Artificial Intelligence	CT409	Employability
64	Cyber laws	GE405	Employability
65	PE4: Digital Image Processing	CT414	Employability
66	PE4: Digital Image Processing Lab	CT415	Employability
67	Computer Architecture & Organization.	IT1208	Employability
68	Operating Systems	IT1303	Employability

Sr.No.	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
69	Software Engineering	IT1305	Employability
70	Microprocessor Based System Design	IT1206	Employability
71	Theory of Computation	IT1209	Employability
72	Digital Signal Processing	IT1326	Employability
73	Mobile Communication	IT1308	Employability
74	Digital Image Processing	IT1320	Employability
75	Real Time Systems	IT1407	Employability
76	Material Science & Metallurgy	ME1201	Employability
77	Fluid Mechanics	ME1205	Employability
78	Manufacturing Processes-I	ME1207	Employability
79	Lab: Manufacturing Processes-I	ME1208	Employability
80	Engineering Thermodynamics	ME1212	Employability
81	Optimisation Techniques	ME1475	Employability
82	PE I : Algorithm & Data Structure	ET1307	Employability
83	PE I :Object Oriented Programming	ET1309	Employability
84	PE I :Discrete Structures	ET1311	Employability
85	PEII :TV and Video Engineering	ET1323	Employability
86	OE 1 : Microcontroller & Embedded Systems	ET1331	Employability
87	PE IV : Power Electronics	ET1419	Employability
88	PE IV : Wireless Mobile Communication Systems	ET1420	Employability
89	PE IV : Satellite Communication & RADAR Engineering	ET1433	Employability
90	PE IV: Biomedical Instrumentation	ET1434	Employability
91	PE V : Multimedia Communications	ET1426	Employability
92	CMOS VLSI Design	ET1417	Employability
93	PE III : Communication Networks	ET1409	Employability
94	PE IV: : Display Technology	ET1437	Employability
95	PE V : Fuzzy Logic & Neural Networks	ET1422	Employability
96	PE I: Mobile Operating System	CT1347	Employability & Skill Development
97	Lab. :PE I: Mobile Operating System	CT1348	Employability & Skill Development
98	Student Training & Report	CT412	Employability & Skill Development
99	PE2: Probabilistic Statistical Data Analysis	CT1453	Employability & Skill Development
100	PE4: Mobile Operating Systems	CT418	Employability & Skill Development
101	PE4: Mobile Operating Systems Lab	CT419	Employability & Skill Development
102	Algorithms & Data Structures	IT1204	Employability , Skill Development
103	Object Oriented Programming	IT1202	Employability , Skill Development
104	PE:Data Analysis & Statistics	IT1328	Employability , Skill Development
105	PE:Web Programming	IT1327	Employability , Skill Development
106	OE: Object Oriented Programming	IT1325	Employability , Skill Development
107	OE:Web Technology	IT1322	Employability , Skill Development
108	Internet of Things	IT1334	Employability , Skill Development
109	Data Base Management Systems	IT1316	Employability , Skill Development
110	Design & Analysis of Algorithms	IT1318	Employability , Skill Development
111	Computer Networks	IT1338	Employability , Skill Development
112	Artificial Intelligence	IT1311	Employability , Skill Development
113	Data Mining	IT1427	Employability , Skill Development
114	Neural Networks & Fuzzy Logic	IT1415	Employability , Skill Development
115	Network Programming	IT1417	Employability , Skill Development
116	PE III: Cloud Computing	IT1432	Employability , Skill Development
117	Computer Graphics	IT1307	Employability , Skill Development
118	Computer Architecture & Organization	CT1207	Employability and Skill Development
119	PE I: : Introduction to Geographical Information System	CT1353	Employability, Entrepreneurship and Skill development
120	Electronics workshop Laboratory	EE1310	Employability/ Entrepreneurship/ Skill development
121	Seminar	EE1311	Employability/ Entrepreneurship/ Skill development
122	Industrial Training	EE1413	Employability/ Entrepreneurship/ Skill development
123	Comprehensive Viva-voce	EE1430	Employability/ Entrepreneurship/ Skill development
124	Extra Curricular / Competitive Exam	EE1431	Employability/ Entrepreneurship/ Skill development
125	Project Phase 2	EE1432	Employability/ Entrepreneurship/ Skill development
126	PE3:Operating System Concepts	EE1415	Employability/ Entrepreneurship/ Skill development
127	Business Intelligence	IT1330	Employbility and Entreprenurship
128	Introduction to Information Technology	IT1201	Employbility and Entreprenurship
129	Embedded System	IT1309	Employbility and Entreprenurship
130	PE I : Pavement Design	CV-1323	Employbility and Entreprenurship
131	PE-III : Advanced RCC	CV-1447	Employbility and Entreprenurship
132	PE-IV : Matrix Analysis of Structures	CV-1429	Employbility and Entreprenurship
133	PE-V : Advanced Steel Design	CV-1433	Employbility and Entreprenurship
134	PEII:Embedded System	EE1401	Employbility and Entreprenurship
135	PE3:Display Technology	EE1436	Employbility and Entreprenurship
136	PE4:Object Oriented Programming	EE1423	Employbility and Entreprenurship
137	Digital Circuits	EE1203	Employbility and Entreprenurship
138	Network Theory	EL1215	Employbility and Entreprenurship
139	Advanced Instrumentation	EE1305	Employbility and Entreprenurship
140	Switching Theory & Finite Automata	EE1307	Employbility and Entreprenurship

Sr.No.	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
141	Lab: Mechanical Measurement	ME1211	Employbility and Entreprenurship
142	Hydraulic Machines	ME1215	Employbility and Entreprenurship
143	Manufacturing Processes - II	ME1217	Employbility and Entreprenurship
144	Metrology & Quality Control	ME1301	Employbility and Entreprenurship
145	Heat Transfer	ME1303	Employbility and Entreprenurship
146	Applied Thermodynamics	ME1307	Employbility and Entreprenurship
147	Dynamics Of Machinery	ME1323	Employbility and Entreprenurship
148	Energy Conversion	ME1310	Employobility and Enterprenurship
149	Computer Aided Design	ME1312	Employobility and Enterprenurship
150	Control System Engineering	ME1320	Employobility and Enterprenurship
151	Production Management	ME1447	Employobility and Enterprenurship
152	Design Of Mechanical Drives	ME1448	Employobility and Enterprenurship
153	PE-I: Tool Design	ME1401	Employobility and Enterprenurship
154	PE-I: Material Handling Systems	ME1402	Employobility and Enterprenurship
155	PE-I: Engineering Of Plastics	ME1404	Employobility and Enterprenurship
156	PE-I: Project Evaluation & Management	ME1405	Employobility and Enterprenurship
157	PE-I: Computational Fluid Dynamics	ME1449	Employobility and Enterprenurship
158	PE-I: Advanced Manufacturing Techniques	ME1456	Employobility and Enterprenurship
159	PE-I: Rapid Prototyping	ME1461	Employobility and Enterprenurship
160	PE-I: Fuel Cells Technology	ME1462	Employobility and Enterprenurship
161	PE-I: Data Structure and Algorithm	ME1463	Employobility and Enterprenurship
162	Synthesis Of Mechanism	ME1408	Employobility and Enterprenurship
163	Finance & Cost Management	ME1409	Employobility and Enterprenurship
164	Renewable Energy System	ME1410	Employobility and Enterprenurship
165	Artificial Intelligence	ME1411	Employobility and Enterprenurship
166	Maintainance Management	ME1412	Employobility and Enterprenurship
167	Design For Manufacturing & Assembly	ME1466	Employobility and Enterprenurship
168	Quantitative Techniques	ME1467	Employobility and Enterprenurship
169	Database Management System	ME1468	Employobility and Enterprenurship
170	Finite Element Methods	ME1406	Employobility and Enterprenurship
171	CIM	ME1417	Employobility and Enterprenurship
172	I.C. Engines	ME1419	Employobility and Enterprenurship
173	Refrigeration & Air Conditioning	ME1421	Employobility and Enterprenurship
174	Mechatronics	ME1445	Employobility and Enterprenurship
175	Refrigeration & Cryogenics	ME1469	Employobility and Enterprenurship
176	Machine Tool Design	ME1476	Employobility and Enterprenurship
177	Automation In Production systems	ME1435	Employobility and Enterprenurship
178	PE-IV: Vibration	ME1415	Employobility and Enterprenurship
179	PE-IV: Industrial Fluid Power	ME1437	Employobility and Enterprenurship
180	PE-IV: Cnc & Robotics	ME1439	Employobility and Enterprenurship
181	PE-IV: Vehicle Engineering	ME1441	Employobility and Enterprenurship
182	PE-IV: MIS	ME1443	Employobility and Enterprenurship
183	PE-IV: Solar Energy and Utilization	ME1478	Employobility and Enterprenurship
184	PE-V: Stress Analysis	ME1451	Employobility and Enterprenurship
185	PE-V: Design Of Experiments And Taguchi Methods	ME1452	Employobility and Enterprenurship
186	PE-V: Value Engg.	ME1453	Employobility and Enterprenurship
187	PE-V: Lean Sigma	ME1454	Employobility and Enterprenurship
188	PE-V: Product Design And Development	ME1455	Employobility and Enterprenurship
189	PE-V: Power Plant Engineering	ME1457	Employobility and Enterprenurship
190	PE-V: Machine Tool Design	ME1458	Employobility and Enterprenurship
191	PE-V: Industrial Safety	ME1459	Employobility and Enterprenurship
192	PE-V: Advance Welding Techniques	ME1460	Employobility and Enterprenurship
193	PE-V: Air Conditioning	ME1482	Employobility and Enterprenurship
194	PE-V: Cryogenic Systems	ME1483	Employobility and Enterprenurship
195	Energy Conversion	ME1310	Employobility and Enterprenurship
196	Computer Aided Design	ME1312	Employobility and Enterprenurship
197	Control System Engineering	ME1320	Employobility and Enterprenurship
198	Production Management	ME1447	Employobility and Enterprenurship
199	Design Of Mechanical Drives	ME1448	Employobility and Enterprenurship
200	Extra Curricular Activities / Competitive Exam	EL1430	Enterprenership
201	FE2: Current Trends and Technologies	CT411	Enterprenership
202	OE II : Introduction to E-Commerce	IT1336	Enterprenurship
203	PE III: E-Commerce	IT1430	Enterprenurship
204	Fundamentals of Economics	GE1312	Enterprenurship
205	Fundamental of management	GE1311	Enterprenurship
206	OE1:Consumer Electronics	EE1323	Enterprenurship
207	PE II :Digital System Design	ET1321	Enterprenurship
208	OE II: Current Trends and Technologies	CT1352	Enterprenurship
209	Mechanics of Materials	ME1203	Entreprenurship and Emplobility
210	Structural Analysis-II : Lab	CV403	Skill Development
211	Comprehensive Viva-voce	CV424	Skill Development
212	Extra / Co-curricular / Competitive Examination	CV425	Skill Development

Sr.No.	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
213	Lab: Material Science & Metallurgy.	ME1202	Skill Development
214	Lab: Mechanics of Materials	ME1204	Skill Development
215	Kinematics of Machinery	ME1206	Skill Development
216	Mechanical Measurement	ME1210	Skill Development
217	Lab: Strength of Materials	CV1202	Skill Development
218	Lab: Geotechnical Engineering-I	CV1204	Skill Development
219	Lab: Fluid Mechanics-I	CV1206	Skill Development
220	Lab: Concrete Technology	CV1209	Skill Development
221	Lab: Surveying-I	CV1211	Skill Development
222	Lab: Environmental Engineering-I	CV1213	Skill Development
223	Lab: Computer Aided Building Drawing	CV1215	Skill Development
224	Lab: Surveying -II	CV1302	Skill Development
225	Lab: Structural Analysis-I	CV1308	Skill Development
226	Lab: Transportation Engineering –I	CV1305	Skill Development
227	Lab : Fluid Mechanics –II	CV1311	Skill Development
228	Seminar	CV1314	Skill Development
229	Lab : Structural Analysis-II	CV1403	Skill Development
230	Lab : Computer Applications in Civil Engineering	CV1442	Skill Development
231	Industrial Training / CRT	CV1406	Skill Development
232	Comprehensive Viva-voce	CV1424	Skill Development
233	Extra / Co-curricular / Competitive Examination	CV1426	Skill Development
234	Lab: Material Science & Metallurgy.	ME1202	Skill Development
235	Lab: Mechanics of Materials	ME1204	Skill Development
236	Kinematics of Machinery	ME1206	Skill Development
237	Mechanical Measurement	ME1210	Skill Development
238	Design of Machine Elements	ME1213	Skill Development
239	Lab: Hydraulic Machines	ME1216	Skill Development
240	Lab: Manufacturing Processes - II	ME1218	Skill Development
241	Lab. : Heat Transfer	ME1304	Skill Development
242	Lab. : Dynamics Of Machinery	ME1324	Skill Development
243	Lab. : Machine Drawing	ME1308	Skill Development
244	Lab.: Energy Conversion	ME1311	Skill Development
245	Lab.: Computer Aided Design	ME1313	Skill Development
246	Lab. : PE-IV: Vibration	ME1416	skill Development
247	Lab. : PE-IV: Industrial Fluid Power	ME1438	skill Development
248	Lab. : PE-IV: Cnc & Robotics	ME1440	skill Development
249	Lab. : PE-IV: Vehicle Engineering	ME1442	skill Development
250	Lab. : PE-IV: MIS	ME1444	skill Development
251	Lab. : PE-IV: Solar Energy And Utilization	ME1479	skill Development
252	PEI:Advance Power Electronics	EL1311	Skill development
253	PEII:Artificial Intelligence based system	EL1427	Skill development
254	PE III : Power System Operation and Control	EL1422	Skill development
255	PEIV:Fundamentals of Smart Grid	EL1436	Skill development
256	PEIV:Electric Vehicles	EL1437	Skill development
257	Lab: Analog Electronics	EE1216	Skill development
258	Lab: Network Analysis	EL1202	Skill development
259	Lab: Electrical Machines-I	EL1204	Skill development
260	Lab. : Power Electronics	EL1303	Skill development
261	Lab. : Microprocessors	ET1330	Skill development
262	Lab. : Electronics Engineering Workshop	EL1318	Skill development
263	Lab.: Control System	EL1307	Skill development
264	Lab.: Electrical Drives	EL1310	Skill development
265	Lab. : Simulation in Power Electronics & Drives	EL1312	Skill development
266	Lab. : High Voltage Engineering	EL1402	Skill development
267	Lab.: Computer Applications in Electrical Engg	EL1404	Skill development
268	Lab.: Simulations in Power System	EL1405	Skill development
269	Lab. :Renewable Energy Sources	EL1434	Skill development
270	Lab.: Switchgear and Protection	EL1417	Skill development
271	Lab.: Substation Design	EL1418	Skill development
272	Lab.: Comprehensive Viva-voce	EL1419	Skill development
273	Electronic Devices Laboratory	EE1202	Skill development
274	Digital Circuits Laboratory	EE1204	Skill development
275	Electronic Measurement & Instrumentation Laboratory	EE1206	Skill development
276	Network Theory Laboratory	EL1216	Skill development
277	Electronic Circuit Analysis Laboratory	EE1209	Skill development
278	Microprocessor & Interfacing Laboratory	EE1211	Skill development
279	Analog Communication Laboratory	EE1302	Skill development
280	Analog Integrated Circuit & its Application Laboratory	EE1309	Skill development
281	Digital Signal Processing	EE1314	Skill development
282	Digital System Design Laboratory	EE1317	Skill development
283	Microcontroller & Interfacing Laboratory	EE1327	Skill development
284	PEII:Embedded System Laboratory	EE1402	Skill development

Sr.No.	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
285	PEII:Digital CMOS Circuits Laboratory	EE1404	Skill development
286	PEII:Algorithm & Data Structures Laboratory	EE1406	Skill development
287	Electronics Circuit & Design Laboratory	EE1408	Skill development
288	Digital Communication Laboratory	EE1410	Skill development
289	PE4:Soft Computing Laboratory	EE1418	Skill development
290	PE4:Analog VLSI Design Laboratory	EE1420	Skill development
291	PE4:Object Oriented Programming Laboratory	EE1424	Skill development
292	Lab.: PE I: Algorithm & Data Structure	ET1308	skill development
293	Lab.: PE I: Object Oriented Programming	ET1310	Skill development
294	Lab.: PE I: Discrete Structures	ET1312	Skill development
295	Lab. : PE II : Embedded System	ET1320	Skill development
296	Lab. : PE II : Digital system Design	ET1322	Skill development
297	Lab. : PE II : TV & Video Engineering	ET1324	Skill development
298	Lab. :PE III : Optical Communication	ET1406	Skill development
299	Lab. :PE III : Microwave Integrated circuits	ET1408	Skill development
300	Lab. :PE III : Communication Networks	ET1410	Skill development
301	Lab.: PE V : Fuzzy Logic & Neural Networks	ET1423	Skill development
302	Lab.: PE V : RF Circuit Design	ET1425	Skill development
303	Lab.: PE V : Multimedia Communications	ET1427	Skill development
304	Lab: Data Structure	CT1204	Skill Development
305	Lab: Programming Language Concepts & Constructs	CT1206	Skill Development
306	Lab: Advanced Data Structures	CT1224	Skill Development
307	System Programming	CT1208	Skill Development
308	Lab: System Programming	CT1209	Skill Development
309	Lab. : Operating Systems	CT1303	Skill Development
310	Database Management Systems	CT1316	Skill Development
311	Lab. : Database Management Systems	CT1317	Skill Development
312	Lab. : Computer Networks	CT1341	Skill Development
313	OE I: Introduction to DBMS	CT1342	Skill Development
314	Lab. :Language Processors	CT1319	Skill Development
315	Lab. :PE I: : Introduction to Geographical Information System	CT1354	Skill Development
316	Lab. :PE1: Privacy and Security in Online Social netwoks	CT1356	Skill Development
317	OE II: Multimedia and Animation	CT1351	Skill Development
318	Software Lab (Mini Project)	CT1329	Skill Development
319	Numerical Computing	CT401	Skill Development
320	Numerical Computing Lab	CT402	Skill Development
321	Project Phase 1 (Analysis & Design)	CT413	Skill Development
322	FE2: Multimedia and Animation	CT410	Skill Development
323	Project Phase 2 (Implementation)	CT428	Skill Development
324	Extra/Co-curricular / Competitive exam	CT429	Skill Development
325	PE 5: Software Project Management	CT422	Skill Development
326	PE5: Software Project Management Lab.	CT423	Skill Development
327	Lab: Algorithms & Data Structures	IT1205	Skill Development
328	Lab: Object Oriented Programming	IT1203	Skill Development
329	Lab: Operating Systems	IT1304	Skill Development
330	Software Engineering-LAB	IT1306	Skill Development
331	Data Base Management Systems -LAB	IT1317	Skill Development
332	Lab:Design & Analysis of Algorithms	IT1332	Skill Development
333	Business Intelligence-lab	IT1331	Skill Development
334	Lab:Data Mining	IT1428	Skill Development
335	Lab: Network Programming	IT1418	Skill Development
336	Lab: Microprocessor Based System Design	IT1207	Skill Development
337	Lab: Computer Workshop	IT1210	Skill Development
338	Communication Skills	GE1107	Skill Development
339	Engineering Physics Lab.	GE1106	Skill Development
340	Engineering Chemistry Lab.	GE2104	Skill Development
341	Lab.: Metrology & Quality Control	ME1302	Skill Development
342	Automation In Production systems LAB	ME1436	Skill Development
343	PE-III: Finite Element Methods	ME1407	Skill Development
344	PE-III: CIM	ME1418	Skill Development
345	PE-III: I.C. Engines	ME1420	Skill Development
346	PE-III: Refrigeration & Air Conditioning	ME1422	Skill Development
347	PE-III: Mechatronics	ME1446	Skill Development
348	PE-III: Refrigeration & Cryogenics	ME1470	Skill Development
349	PE-III: Machine Tool Design	ME1477	Skill Development
350	Lab: Web Technology	CT1210	Skill Development & Entrepreneurship
351	PE1 : Computing with Python	CT1357	Skill Development & Entrepreneurship
352	(EDA)Electronics Design Automation Laboratory	EE1433	Skill Development and Employability
353	RF & Microwave	EE1434	Skill development and employablity
354	RF & Microwave Laboratory	EE1435	Skill development and employablity
355	Project Phase 1	EE1412	Skill development and employablity
356	Software Engineering	CT1345	Skill Development & Entrepreneurship

Sr.No.	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
357	Lab. : Software Engineering	CT1346	Skill Development & Entrepreneurship
358	PE I: Business Intelligence and its Applications	CT1349	Skill Development & Entrepreneurship
359	Lab. :PE I: Business Intelligence and its applications	CT1350	Skill Development & Entrepreneurship
360	PE6 :Object Oriented Modeling	CT427	Skill Development & Entrepreneurship
361	PE3: Cloud Computing	CT407	Skill Development, Employability And Entrepreneurship
362	Simulation Laboratory	EE1212	Skill development/Employability
363	Digital Signal Processing Laboratory	EE1315	Skill development/Employability
364	OEII:Fuzzy Logic & Neural Network	EE1328	Skill development/Employability

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