Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
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2019-20

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***

(Dr. U.P. Waghe)
Principal, Y.C.C.E.

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

Principal
Yeshwantrao Chavan
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Wanadongri Hingna Road,
NAGPUR-441110

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Sr. No.	Particulars	Page Nos.
	ighlighte Curri ulum/Syllabus of the Courses C	03
	ighlighte Curri ulum/Syllabus of the Courses ME	66
3	ighlighte Curri ulum/Syllabus of the Courses E	6 9
	ighlighte Curri ulum/Syllabus of the Courses EE	96 399
	ighlighte Curri ulum/Syllabus of the Courses E	00
6	ighlighte Curri ulum/Syllabus of the Courses C	3
	ighlighte Curri ulum/Syllabus of the Courses	
	ighlighte Curri ulum/Syllabus of the Courses E	3 60
9	Mapping of Courses to Employability/ Entrepreneurship/ Skill Development	603 610

III Semester
CV2202 - LAB : Strength of Materials

Objective	Course Outcome
1. To study suitability of various materials for civil engineering construction. 2. To study the resistance offered by various materials against the external forces	1. An ability to understand basic concepts & mechanical properties of material. 2. An Ability to understand behavior of various materials such as Steel, Aluminum, Wood etc. when subjected to various types of loading.
Mapped Program Outcomes : 1, 2	

PRACTICAL:
Minimum **Ten** practical to be performed from the list as below:-

S No	Name of practical
1.	To study the universal testing machine.
2.	To study the extensometer.
3.	To perform tension test on metal.
4.	To determine flexural strength of timber beam.
5.	To determine modulus of rigidity of M.S. bar by torsion test.
6.	To determine impact value of metal by Charpy Impact Test and Izod Impact Test.
7.	To determine Rockwell hardness number for M.S. and Aluminium bar.
8.	To determine Brinell hardness number for M.S. and Aluminium bar.
9.	To determine the stiffness of spring and modulus of rigidity.
10.	To perform shear test on metals.
11.	To determine the compressive strength of specimen.
12.	To determine water absorption of roofing tiles, flooring tiles and bricks.

III Semester
CV2204 - LAB : Geotechnical Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various Index properties of soil 2. To perform various test to determine engineering properties of soil	1. An ability to determine the Index properties of soil. 2. An ability to determine the Engineering properties of soil.
Mapped Program Outcomes : 1,2,3,4,9,11 **PSO** : ii	

S No	List of Practicals
1.	To determine Moisture content of given soil sample.
2.	To determine Specific gravity of soil.
3.	To perform Grain Size Analysis – (Dry Sieve Analysis)
4.	To determine Atterberg's Limits.
5.	To determine coefficient of Permeability by (i) Constant head, and (ii) Falling head.
6.	To perform Standard Proctor Compaction Test and to determine OMC.
7.	Field Density determination by sand replacement method.
8.	Field Density determination by core cutter method.
9.	To perform Unconfined compression test.
10.	To perform Direct shear Test.
11.	To perform Triaxial Compression test (Demonstration)
12.	To find F.S.W. and D.F.S. of soil. Identification of swelling Soil.
13.	To study the Consolidation characteristics of soil

Text Books:

S.N	Title	Authors	Edition	Publisher
1	Soil Testing for Engineers	Mittal S., Shukla J.P.		Khanna Publishers, New Delhi, 2006
2	Manual of Soil Laboratory Testing	Head K. H.,	3rd edition	Whittles Publishing, 2008

III Semester
CV2206 - LAB : Fluid Mechanics

COURSE OBJECTIVE	COURSE OUTCOME
1. To understand concept of equilibrium of floating bodies. 2. To understand various forms of energy of flowing fluid through pipe 3. To understand variousflow measuring devices in pipe, tank and channel. 4. To understand various concept of flow in open channel. 5. To understand the types of flow in pipe.	1. An ability to determine floating conditions of ship model. 2. An ability to verify Bernoulli's theorem. 3. An ability to measure velocity, discharge in pipe, tank, channel andto determine hydraulic coefficients of devices. 4. An ability to determine types of flow in pipes.
Mapped Program Outcomes : 1,2,3	

PRACTICAL

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	Determination of metacentric height of a given ship models.
2.	Verification of Bernoulli's theorem
3.	Velocity measurement by Pitot tube.
4.	Discharge measurement by Venturimeter- determination of coefficient discharge.
5.	Discharge measurement by pipe orifice, determination of Cd
6.	Determination of hydraulic coefficient of a sharp edged circular orifice.
7.	Determination of Cd of an external cylindrical mouth piece
8.	Determination of Cd of a rectangular notch:
9.	Determination of Cd of a triangular notch.
10.	Determination of types of flow in pipe using Reynold's apparatus.
11.	Study of micrometer contraction gauge

Reference Books:

S.N.	Title	Authors	Edition	Publisher
1	Laboratory work in Hydraulic Engineering	Asawa, G.L		New Age International Publishers

CV2208 – LAB : Water Supply Engineering

COURSE OBJECTIVE	COURSE OUTCOME
1. To study the water quality criteria & permissible standards. 2. To study the characteristics of water 3. To study the analysis of various parameters related to water quality.	1. To understand importance of water quality standards. 2. An ability to perform various physical and chemical tests on water sample. 3. An ability to understand various biological tests performed on water sample and to perform a few biological tests on water.
Mapped Program Outcomes : 1,2,4,	

PRACTICAL

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	Determination of pH.
2.	Determination of turbidity.
3.	To perform Jar test.
4.	Determination of available chlorine.
5.	Determination of residual chlorine.
6.	Determination of dissolved oxygen.
7.	Determination of Hardness.
8.	Determination of acidity
9.	Determination of alkalinity
10.	M.P.N. Test.
11.	Plate count test.
12.	B.O.D. test
13.	C.O.D. test

CV2252 – LAB : Concrete Technology

COURSE OBJECTIVE	COURSE OUTCOME
1. To understand the properties of various grades cement. 2. To study the behavior of concrete at its fresh and hardened state 3. To study about the concrete design mix 4. To know about the procedures in concreting 5. To understand special concrete and their use	1. An ability to conduct different tests on cement. 2. An ability to assess the different properties of coarse and fine aggregate. 3. An ability to conduct different workability tests on fresh concrete and various tests on hardened concrete. 4. An ability to understand working of various Non-destructive testing equipment.
Mapped Program Outcomes : 1,4,5,8,11	

PRACTICALS

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	To determine the normal consistency and initial setting time and final setting time by Vicat's apparatus.
2.	To determine the fineness of cement.
3.	To perform soundness test of cement.
4.	To determine fineness modulus for coarse and fine aggregates.
5.	To determine the bulking of sand & plotting bulking curve.
6.	To determine the compressive strength of cement.
7.	To design the concrete mix of required characteristic strength according to I.S .method.
8.	To determine the workability of concrete by slump cone, Vee bee apparatus, compaction factor and flow test.
9.	To prepare and test the concrete cubes for compressive strength by Indian standard method.
10.	Study of various Non-Destructive testing methods (NDT) in concrete Technology
11.	To determine workability of cement mortar.
12.	To determine the permeable voids of concrete.
13.	To determine the permeability of mortar.

CV2254 – LAB : Surveying

COURSE OBJECTIVE	COURSE OUTCOME
1. To understand the operation, principle, handling and uses of surveying equipment such as chain, compass, theodolite, level. 2. To recognize the role of the professional surveyor, and modern developments in surveying. 3. To study map interpretation and public land systems.	1. An ability to work in a team to carry out a survey of a small area using appropriate methods. 2. An ability to describe the observation, computation and adjustment of a Traverse to carry out basic survey computation and adjustment. 3. An ability to understand the angle and distance measurement; and differential, profile, cross-section, and topographic leveling procedures and apply them to field conditions.
Mapped Program Outcomes : 1,2,5,9,10	

PRACTICALS

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	Measurement of bearing of sides of traverse with prismatic compass and computation of correct included angles.
2.	Locating given building by chain and compass traversing (1 full size drawing sheet)
3.	Determination of elevation of various points with dumpy level by collimation plane method and rise and fall method.
4.	Fixing the bench mark with respect to temporary bench mark with dumpy level by fly leveling and check leveling.
5.	Measurement of horizontal angle with theodolite by method of repetition.
6.	Measurement of vertical angle with theodolite.
7.	Determination of horizontal distance between two inaccessible point with theodolite.
8.	Locating given building by theodolite traversing. (One full size drawing sheet)
9.	Determination of elevation of point by trigonometric leveling.
10.	Determination of constants of Tacheometer.
11.	Determination of elevation of points by Tacheometric surveying.
12.	Determination of elevation of points and horizontal distance between them by Tacheometrical survey.
13.	Determination of gradient of given length of road by Tacheometric survey.

CV2256 – LAB : Structural Analysis

COURSE OBJECTIVE	COURSE OUTCOME
1. To study the basic concept of strain measurements. 2. To study the various methods for finding deflection in truss analytically and graphically. 3. To study the analysis of the aches 4. To study various properties of beam like flexural rigidity, slope, deflection, bending moment etc. 5. To study the behavior of column curved member and portal frame.	1. An ability to understand various types of strain gauges and to measure the strain in beam. 2. An ability to find the defections in truss analytically and graphically. 3. An ability to determine the horizontal thrust of different types of arches. 4. An ability to understand the various properties of beam. 5. An ability to understand the behavior of the column, curved member and portal frame.
Mapped Program Outcomes : 1,2,4 **PSO :** i,	

Any TEN experiments from the following are required to be conducted:

S No	List of Practical
1.	To study various types of electrical resistance strain gauges.
2.	To measure the strain in the cantilever beam subjected to point load at tip and to check this value with theoretical value.
3.	To determine slope and deflection at center of each span for a two span continuous beam subjected to point load W at center of each span and to check these values with theoretical values.
4.	To verify Maxwell's Reciprocal Theorem for simply supported beam.
5.	To determine the value of flexural rigidity of given beam and to compare it with theoretical value.
6.	To determine the elastic displacements of the curved members experimentally and to check these values with theoretical values.
7.	To study the behavior of different types of struts and to calculate the Euler's buckling load for each case.
8.	To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of two hinged parabolic arch.
9.	To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of three hinged parabolic arch.
10.	To determine deflection of cantilever end of cantilever truss by Willot Mohr's diagram and to check this value with theoretical value.
11.	To study the behavior of a portal frame under different end conditions.
12.	To find the deflection of a pin-connected truss experimentally and to verify the result theoretically.
13.	To obtain the influence line for bending moment of prismatic fixed beam for cases (a) one end hinged (b) both ends fixed.
14.	To determine experimentally and analytically the reactions in the three suspension rods supporting an elastic beam with a concentrated load hung midway between two of the suspension rods when the suspension rods are attached at their upper end to rigid support.
15.	To verify Castigliano's Theorem for simply supported beam

CV2258 – LAB : Transportation Engineering

COURSE OBJECTIVE	COURSE OUTCOMES
1. To determine various properties of aggregates. 2. To determine various properties of bitumen. 3. To perform the CBR test on soil. 4. To determine the Marshall stability of bituminous mixture. 5. To conduct traffic volume survey. 6. To know about bridges and its various components.	1. An ability to conduct various tests on aggregates and soil. 2. An ability to conduct various tests on aggregates, bitumen and bitumen mix.
Mapped Program Outcomes : 1,2,3,4,11	

Any TEN experiments from the following are required to be conducted:

S No	List of Practical
1.	To determine specific gravity of aggregates.
2.	To determine impact value of given aggregate sample.
3.	To determine crushing value of given aggregate sample.
4.	To determine flakiness index of given aggregate sample.
5.	To determine abrasion value by Los Angeles test.
6.	To perform water absorption test on given aggregate sample.
7.	To find softening point of given bitumen sample.
8.	To perform penetration test for given bitumen sample.
9.	To perform flash and fire point for given bitumen sample.
10.	To perform ductility test on given bitumen sample.
11.	To perform viscosity test on bitumen.
12.	To perform CBR test on given soil sample.
13.	To perform Marshall Stability Test on bituminous concrete.
14.	Bridge site visit.

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.

VII SEMESTER

CV1459	Computer Application in Civil Engineering	L=3	T=0	P=0	CREDITS = 3

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

COURSE OBJECTIVES	COURSE OUTCOMES
1.To impart the knowledge of C programming language 2.To develop computer programs for the solution of Civil Engineering problems. 3.To provide the knowledge of various numerical with their applicability and accuracy to specific mathematical problems 4.To translate numerical methods into simple, reusable program modules.	1. An ability to understand the basic concepts of C Programming language 2. An ability to develop computer programs for the solution of Civil Engineering problems . 3. An ability to translate numerical methods into simple, reusable program modules 4. An ability to develop good technical understanding & application with good presentation skills.
Mapped Program Outcomes: 1,2,3,5,10	

UNIT –I

Introduction : C-Fundamentals , character set data type constant and variables , Declaration of constants & variables , Expression, Statements , Symbolic constants.Operator and Expression , Arthmetic operator , Unary operator , Relation and Logical operator , Assignment operators,the conditional operator,Library functions.Data input & output.

[6Hrs]

UNIT -II

Control Statements :-Control statement , the WHILE statements , do-while , for nested loop , if –else , switch break, continue , goto statement .

[07 Hrs.]

UNIT –III

Advance Topics :-Functions , Storage class , Arrays , Pointers , structures and Unions, Data files, File Handling .

[06 Hrs.]

UNIT-IV

Fundamental of Numerical Methods, Interpolation & extrapolation. Numerical Integration (Simpsons method , Trapezoidal method , Newtons Gauss Quadrature method) , Interactive Computer Program Development.

[07 Hrs.]

UNIT-V:

Computer programme based on Transportation Engineering,Geotechnical Engineering, Hydraulic Engineering, Irrigation Engineering, Surveying, Estimating & costing.

[06 Hrs.]

UNIT-VI

Computer programme based on Structural analysis, Structural Design,Environmental Engineering, Matrix algebra , Solution techniques.

[07 Hrs.]

Text books:

SN	Title	Edition	Authors
1	LET US C, BPB Publications.	15th Edition 2016	Yeshwant Kanetkar,
2	Computer Applications in Civil Engineering	1th Edition 2012	V.K.Singhal
3	Numerical Methods, New Age International.	2th Edition 1996	M. K. Jain

Reference books:-

SN	Title	Edition	Authors	Publications
1	C programming language	2th Edition 1996	Dennis Ritchie	Pearson
2	C: The Complete Reference	4th Edititon 2017	Herbert Schildt	Mc Graw Hill

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

VIII SEMESTER

CV1448	PE III: Remote Sensing & GIS			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hours

COURSE OBJECTIVES	COURSE OUTCOME
1. To provide exposure to students in gaining knowledge on concepts of Geoinformatics. 2. To provide the knowledge of Geoinformatics for various surveys ,information extraction, and its application.	The students will be able to 1. Explain the principles of Geoinformatics. 2. Describe the process of data acquisition of satellite images and their characteristics. 3.Illustrate knowledge of remote sensing and GIS in different civil engineering applications.
Mapped Program Outcomes: 1,2,5,10	

UNIT – I :
Definition and scope of remote sensing: electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and rdar scanners, radiometers spectral response curve and spectral signatures

[06 Hrs.]

UNIT – II :
Elements of sensing system: Terrestrial, airborne and space borne platforms, Sun-synchronous and geostationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote-sensing data products and their types: analogues and digital data formats, Thermal and radar imageries.

[07 Hrs.]

UNIT – III :
Interpretation techniques: Elements of interpretation and methods, interpretation key, interpretation instruments. Relief displacement, image parallax and vertical exaggeration, Determination and calculation of elevation from RS data

[07 Hrs.]

UNIT – IV :
Digital image processing: image rectification and restoration, image enhancement-contrast manipulations, spatial feature manipulation, multi-image manipulation, image classification supervised and unsupervised classification, accuracy assessments and data merging.

[07 Hrs.]

UNIT – V :
Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

[06 Hrs.]

UNIT – VI :
Applications: Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects damns and bridges, site investigations, landslide studies.

[06 Hrs.]

Text Books:
1. Remote sensing Geology: Ravi P Gupta, Springer publication
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Remote Sensing: Sabins, Floyd F
4. Higher surveying volume III: Dr B C Punmia

Reference Books:-
1. Concepts and Techniques of GIS 2005 C.P. Lo Albert PHI Learning
2. Remote Sensing Of the Environment – An Earth Resource Perspective 2004 John R. Jensen Pearson Education.

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

III Semester
CV2202 - LAB : Strength of Materials

Objective	Course Outcome
1. To study suitability of various materials for civil engineering construction. 2. To study the resistance offered by various materials against the external forces	1. An ability to understand basic concepts & mechanical properties of material. 2. An Ability to understand behavior of various materials such as Steel, Aluminum, Wood etc. when subjected to various types of loading.
Mapped Program Outcomes : 1, 2	

PRACTICAL:
Minimum **Ten** practical to be performed from the list as below:-

S No	Name of practical
1.	To study the universal testing machine.
2.	To study the extensometer.
3.	To perform tension test on metal.
4.	To determine flexural strength of timber beam.
5.	To determine modulus of rigidity of M.S. bar by torsion test.
6.	To determine impact value of metal by Charpy Impact Test and Izod Impact Test.
7.	To determine Rockwell hardness number for M.S. and Aluminium bar.
8.	To determine Brinell hardness number for M.S. and Aluminium bar.
9.	To determine the stiffness of spring and modulus of rigidity.
10.	To perform shear test on metals.
11.	To determine the compressive strength of specimen.
12.	To determine water absorption of roofing tiles, flooring tiles and bricks.

III Semester
CV2204 - LAB : Geotechnical Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various Index properties of soil 2. To perform various test to determine engineering properties of soil	1. An ability to determine the Index properties of soil. 2. An ability to determine the Engineering properties of soil.
Mapped Program Outcomes : 1,2,3,4,9,11 **PSO** : ii	

S No	List of Practicals
1.	To determine Moisture content of given soil sample.
2.	To determine Specific gravity of soil.
3.	To perform Grain Size Analysis – (Dry Sieve Analysis)
4.	To determine Atterberg's Limits.
5.	To determine coefficient of Permeability by (i) Constant head, and (ii) Falling head.
6.	To perform Standard Proctor Compaction Test and to determine OMC.
7.	Field Density determination by sand replacement method.
8.	Field Density determination by core cutter method.
9.	To perform Unconfined compression test.
10.	To perform Direct shear Test.
11.	To perform Triaxial Compression test (Demonstration)
12.	To find F.S.W. and D.F.S. of soil. Identification of swelling Soil.
13.	To study the Consolidation characteristics of soil

Text Books:

S.N	Title	Authors	Edition	Publisher
1	Soil Testing for Engineers	Mittal S., Shukla J.P.		Khanna Publishers, New Delhi, 2006
2	Manual of Soil Laboratory Testing	Head K. H.,	3rd edition	Whittles Publishing, 2008

III Semester
CV2206 - LAB : Fluid Mechanics

COURSE OBJECTIVE	COURSE OUTCOME
1. To understand concept of equilibrium of floating bodies. 2. To understand various forms of energy of flowing fluid through pipe 3. To understand variousflow measuring devices in pipe, tank and channel. 4. To understand various concept of flow in open channel. 5. To understand the types of flow in pipe.	1. An ability to determine floating conditions of ship model. 2. An ability to verify Bernoulli's theorem. 3. An ability to measure velocity, discharge in pipe, tank, channel andto determine hydraulic coefficients of devices. 4. An ability to determine types of flow in pipes.
Mapped Program Outcomes : 1,2,3	

PRACTICAL

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	Determination of metacentric height of a given ship models.
2.	Verification of Bernoulli's theorem
3.	Velocity measurement by Pitot tube.
4.	Discharge measurement by Venturimeter- determination of coefficient discharge.
5.	Discharge measurement by pipe orifice, determination of Cd
6.	Determination of hydraulic coefficient of a sharp edged circular orifice.
7.	Determination of Cd of an external cylindrical mouth piece
8.	Determination of Cd of a rectangular notch:
9.	Determination of Cd of a triangular notch.
10.	Determination of types of flow in pipe using Reynold's apparatus.
11.	Study of micrometer contraction gauge

Reference Books:

S.N.	Title	Authors	Edition	Publisher
1	Laboratory work in Hydraulic Engineering	Asawa, G.L		New Age International Publishers

CV2208 – LAB : Water Supply Engineering

COURSE OBJECTIVE	COURSE OUTCOME
1. To study the water quality criteria & permissible standards. 2. To study the characteristics of water 3. To study the analysis of various parameters related to water quality.	1. To understand importance of water quality standards. 2. An ability to perform various physical and chemical tests on water sample. 3. An ability to understand various biological tests performed on water sample and to perform a few biological tests on water.
Mapped Program Outcomes : 1,2,4,	

PRACTICAL

Minimum of **Ten** practical from the list given below shall be performed.

S No	List of Practical
1.	Determination of pH.
2.	Determination of turbidity.
3.	To perform Jar test.
4.	Determination of available chlorine.
5.	Determination of residual chlorine.
6.	Determination of dissolved oxygen.
7.	Determination of Hardness.
8.	Determination of acidity
9.	Determination of alkalinity
10.	M.P.N. Test.
11.	Plate count test.
12.	B.O.D. test
13.	C.O.D. test

V Semester
CV2311 - PE-I : Advance Surveying

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Different types horizontal and vertical curve. 2. Basic principle and application of different types survey such as geodetic, photographic surveying. 3. Basic principle of electronic surveying	Students will be able to 1. Discuss the modern technique of surveying. 2. Operate the modern Surveying equipment's 3. Discuss basic concepts of electronic surveying 4. Understand the rectangular coordinate system of surveying.
Mapped Program Outcomes: 1,2,4,5	

UNIT–1 : **Simple and Compound Curves** a) **Simple Curves**: Elements of simple curves, Types of Horizontal curve Methods of Curve ranging. b) **Compound Curves**: Elements of compound Curves, setting out the curve.	**[06 Hrs.]**
UNIT–2 : **Transition and vertical curve** a) Transition Curves: Elements of transition curves, Super elevation, Length of transition curve, setting out the transition curve. b) Vertical Curves: Elements of vertical curves, Types, Tangent Correction, Location of highest or lowest point.	**[07 Hrs.]**
UNIT–3 **Geodetic Surveying and Triangulation Adjustment (a,b,d)** a) Geodetic Surveying: Classification of triangulation survey, Station marks, Signal and tower, Inter visibility of stations b) Triangulation Adjustment: Definitions, , Laws of weights, Station adjustment.	**[07 Hrs.]**
UNIT–4 : **ELECTRONIC SURVEYING** Introduction, electromagnetic wave theory – electromagnetic application, Modulation, types of EDM instrument, distance measuring system-Principle of working and EDM instrument, distomat, errors in EDM.	**[06 Hrs.]**
UNIT–5 : **TOTAL STATION SURVEYING** Introduction, basic principle, types of total station, characteristics, feature of total station, component of total station, working of total station, sources of error, care and maintenance of total station instrument, advantages of total station over conventional instrument.	**[06 Hrs.]**
UNIT–6 : **Advanced surveying techniques** **Photographic Surveying:** Basic definitions, Terrestrial and aerial photography, Scale of vertical photograph, ground coordinate flight planning, study of photo theodolite and stereoscope, Displacement due to ground relief.	**[07 Hrs.]**

Text Books:

1. Punmia B.C., Jain A.K., Jain A.K, Surveying, (Vol. 2 & Vol. 3), Laxmi Publication, New Delhi. 1, 15th Edition.
2. Kanetkar T.P. & Kulkarni S. V, Surveying & Levelling (Vol.2 & Vol. 3), Pune Vidhyarthi Gruha Prakashan, Pune.
3. Reddy M. A., Remote sensing & GIS, B. S. Publication, Hyderabad.
4. Dr. A.M. Chandra, Higher Surveying, New age international publishers , New Delhi

Reference Books:

1. Thomas M. L., Ralph W. K., Jonathan W., Remote Sensing and Image Interpretation, Chipman Wiley & Sons, 5th Edition (2010).

		June 2019	1.00	Applicable for AY 2019-20 Onwards
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V Semester
CV2319 – PE-I : Advanced Concrete Technology

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand To develop systematic knowledge of concrete constituents 2. To familiarize with the fundamentals of concrete 3. Principals involved for high performance concrete 4. To understand the basic concepts of special concretes 5. To introduce fundamentals of concreting methods	1. An ability to understand the properties of the constituent materials of concrete. 2. An ability to understand the properties of fresh and hardened concrete and tests to determine these properties. 3. An ability to design concrete mixes and apply statistical quality control techniques 4. An ability to understand importance of Non-destructive testing and various equipment used. 5. An ability to understand the durability of concrete.
Mapped Program Outcomes : 1,3,7,11,12	

UNIT–1 : Review of properties of cement, their physical and chemical properties, special purpose cements, Classification and properties of aggregates, soundness of aggregates, alkali aggregate reaction, thermal properties of aggregates, Importance of shape and Surface area and grading, gap graded and aggregates.	**[07 Hrs.]**
UNIT–2 : Rheological behaviour of concrete, requirements of workability of concrete, Effect of environmental conditions, Strength properties of hardened concrete, Impact, Dynamic and fatigue behaviour of concrete, shrinkage and creep of concrete, behaviour of concrete under fire.	**[06 Hrs.]**
UNIT–3 : Permeability and Durability of concrete, Parameters of durability of concrete, chemical attack on concrete, Production of concrete; batching mixing, transportation, placing, compaction of concrete. Special methods of concreting and curing of concrete, Hot weather and cold weather concreting, Guniting (Shotcreting).	**[06 Hrs.]**
UNIT–4 : Concrete mix design, Basic considerations and choice a mix proportions, various methods of mix designs including IS Code method. Quality control and quality assurance of concrete, Acceptance criteria.	**[07 Hrs.]**
UNIT–5 : Quality management in concrete construction, Inspection and testing of concrete. Non-destructive testing of concrete, core test and load test. Admixtures & construction chemicals, Use of Fly Ash, Silica Fumes, Metakaolin & GGBS in concrete.	**[07 Hrs.]**
UNIT–6 : Special concrete such as high strength, Lightweight, heavy weight, vacuum processed concrete. Mass concrete, high performance concrete, Pumpable concrete, Self Compacting concrete, Air entrained concrete, Ferro cement, fiber reinforced concrete, Polymer impregnated concrete. Jet concrete. Deterioration and repair technology of concrete, Distress and type of repairs, crack sealing techniques.	**[06 Hrs.]**

V Semester
CV2319 – PE-I : Advanced Concrete Technology

Text Books :

1. Gambhir M.L: Concrete Technology Tata McGraw Hill (Second Edition) 1995.
2. M.S. Shetty, Concrete Technology S. Chand & Company New Delhi 2005.

Reference Books:

1. P.Kumar Mehata, Paulo & J.M. Monteiro, Concrete microstructure, properties & materials, Prentice Hall INC & Mcgraw Hill USA.
2. Short & Kenniburg, Light Weight Concrete, Asia Publishing House, Bombay 1963.
3. Chen Orchard D.F.; Concrete Technology-Vol I. & II Applied Science Publishers (Fourth Edition) 1979.
4. Neville A.M., J.J. Brook Properties of Concrete Addison Wesley 1999.

V Semester
CV2327– PE-I : Geographical Information Systems

COURSE OBJECTIVES	COURSE OUTCOMES
1. To introduce the fundamentals and components of Geographic Information System 2. To provide details of spatial data structures and input, management and output processes.	The students will be able to understand; 1. The basic concepts and components of GIS. 2. Concepts of spatial and non spatial data, map projections and operations.
Mapped Program Outcomes : 1,2,12	

UNIT–1 : Introduction - A Brief History of GIS - Geographical concepts and terminology - Essential components of GIS -utility of GIS- Hardware, Software, Data, People, Methods – Proprietary and open source Software Various GIS packages.	**[06 Hrs.]**
UNIT–2 : Data: Spatial and Non-Spatial Data Spatial Data: Points, Lines, Polygons/Area and Surface - Non-Spatial Data - Scales/Levels of Measurement. Data Base: Data sources, Data Base Structure models.	**[07 Hrs.]**
UNIT–3 : Data acquisition: Vector Data Models, Raster data model, Data Compression, arc-node data structure - Raster to vector conversion - Topology and spatial relationships - Data storage verification and editing.	**[07 Hrs.]**
UNIT–4 : Coordinate systems, Datums- Map projections - Coordinate transformation, Georeferencing, Digitization- Methods of digitization, Common errors in digitization.	**[06 Hrs.]**
UNIT–5 : Discrete and continuous surfaces- Digital elevation models, sources of DEM, TIN structure, Extraction of topographic parameters: slope, aspect, delineation of watershed and drainage network - DEM applications.	**[06 Hrs.]**
UNIT–6 : Operations in GIS - Overlay, Buffers, Spatial analysis, Network analysis, Application of GIS to various natural resources mapping and monitoring and other civil engineering related problems.	**[07 Hrs.]**

Text Books :

1. Lo C.P. and Yeung
2. A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice-Hall, Inc., NJ, 2002.
3. An Introduction to Geographical Information Systems (4th Edition) by Ian Heywood, Sarah Cornelius and Steve Carver, 2012
4. Burrough, P.A. and McDonnell, R.A. (1998) Principles of Geographical Information Systems. Oxford University Press, Oxford.
5. Introduction to Geographic Information Systems by Chang Kang-tsung (Karl), 2006
6. Geographic Information Systems: An Introduction by Tor Bernhardsen, 2005

Reference Books :

1. M. Anji Reddy BS Publications Remote Sensing and Geographical Information Systems Third Edition
2. Geographic Information System and Environment Modeling Keith C. Clerk, Bradely O Parks, Michel P Crane Pritince Hall of India 2002.

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VII SEMESTER

CV1459	Computer Application in Civil Engineering	L=3	T=0	P=0	CREDITS = 3

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

COURSE OBJECTIVES	COURSE OUTCOMES
1.To impart the knowledge of C programming language 2.To develop computer programs for the solution of Civil Engineering problems. 3.To provide the knowledge of various numerical with their applicability and accuracy to specific mathematical problems 4.To translate numerical methods into simple, reusable program modules.	1. An ability to understand the basic concepts of C Programming language 2. An ability to develop computer programs for the solution of Civil Engineering problems . 3. An ability to translate numerical methods into simple, reusable program modules 4. An ability to develop good technical understanding & application with good presentation skills.
Mapped Program Outcomes: 1,2,3,5,10	

UNIT –I

Introduction : C-Fundamentals , character set data type constant and variables , Declaration of constants & variables , Expression, Statements , Symbolic constants.Operator and Expression , Arthmetic operator , Unary operator , Relation and Logical operator , Assignment operators,the conditional operator,Library functions.Data input & output.

[6Hrs]

UNIT -II

Control Statements :-Control statement , the WHILE statements , do-while , for nested loop , if –else , switch break, continue , goto statement .

[07 Hrs.]

UNIT –III

Advance Topics :-Functions , Storage class , Arrays , Pointers , structures and Unions, Data files, File Handling .

[06 Hrs.]

UNIT-IV

Fundamental of Numerical Methods, Interpolation & extrapolation. Numerical Integration (Simpsons method , Trapezoidal method , Newtons Gauss Quadrature method) , Interactive Computer Program Development.

[07 Hrs.]

UNIT-V:

Computer programme based on Transportation Engineering,Geotechnical Engineering, Hydraulic Engineering, Irrigation Engineering, Surveying, Estimating & costing.

[06 Hrs.]

UNIT-VI

Computer programme based on Structural analysis, Structural Design,Environmental Engineering, Matrix algebra , Solution techniques.

[07 Hrs.]

Text books:

SN	Title	Edition	Authors
1	LET US C, BPB Publications.	15th Edition 2016	Yeshwant Kanetkar,
2	Computer Applications in Civil Engineering	1th Edition 2012	V.K.Singhal
3	Numerical Methods, New Age International.	2th Edition 1996	M. K. Jain

Reference books:-

SN	Title	Edition	Authors	Publications
1	C programming language	2th Edition 1996	Dennis Ritchie	Pearson
2	C: The Complete Reference	4th Edititon 2017	Herbert Schildt	Mc Graw Hill

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

Regular: - 3rd Semester Theory

ME2201	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 the classification of materials and Crystalline nature of metals and there effect on property of metals. (2) Student Should be able to understand the effective use of Equilibrium diagrams and Micro Structural changes occurring due to heating and cooling cycles. (3) Student will be able to understand the Classification , general properties ,application and heat treatment practices of plain carbon steels stainless steel, Tool Steel and HSS. (4) Student will be able to understand the and Effect of heat treatment on properties of metals and TTT diagram. (5) Student will be able to understand of Structure, production, properties and utilizations and treatments cast irons (6) Student will be able to understand importance of Powder Metallurgical technique	(1) Student will be able to demonstrate the knowledge of various engineering materials and Crystalline nature of metals and there effect on property of metals. (2) Student will be able to demonstrate the knowledge Iron-Iron carbon equilibrium diagram (3) Student will be able to demonstrate the knowledge of general properties , application and heat treatment practices of plain carbon steels stainless steel, Tool Steel and HSS. (4) Student will be able to demonstrate the knowledge of effect of heat treatment on properties of metals and TTT diagram. (5) Student will be able to demonstrate the knowledge of Structure, production, properties and utilizations and treatments cast irons. (6) Student will be able to demonstrate the knowledge of Powder Metallurgical technique , composite materials and polymers for production of Engineering Component,

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. **[COI]**

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

Alloys and solid solutions, types and their formations, modified Gibbs's phase rule, Lever rule for phase mixtures and their application in system. Study of equilibrium diagrams and invariant reactions. Iron-Iron carbide equilibrium diagram, critical temperatures. Microstructure of slowly cooled steels. Estimation of carbon from microstructures; structure property relationship.Classification and applications of steels. Effect of alloying elements. **[CO II]**

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

Classification and application of plain carbon steels. Examples of alloy steel such as Hadfield Manganese Steel, ball Bearing Steels, etc.

Tool Steels – Classification, composition, application and commercial heat treatment practice for HSS, Secondary hardening.
Stainless Steels - Classification, composition, application and general heat treatment practice for Stainless Steels.
[CO III]

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

Heat treatment and its importance. Annealing, Normalizing, Hardening, Quench Cracks, Hardenability test.
TTT diagram and its construction and related Heat Treatment Processes such as Austempering, Martempering, Patenting etc.
Retention of Austenite, Effects and elimination of retained austenite, Tempering.
Case / Surface hardening treatments such as Carburising, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening. **[CO IV]**

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

Cast Iron – Classification, White cast Iron, Gray Cast Iron, Nodular Cast Iron, Malleable Cast Iron, Chilled and alloy Cast Iron. (Production route, Composition, Microstructure and applications) Effects of various parameters on structure and properties of Cast Iron, Alloy cast Iron such as Ni-resist, Ni-hard.
Non-Ferrous Alloys – Study of non-ferrous alloys such as brasses (Cu-Zn diagram), Bronzes (Cu-Sn diagram), Aluminum Alloys (e.g. Al-Si & Al-Cu diagram), Bearing materials. **[CO V]**

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.
Introduction to Composites: Basic concepts, Processing, advantages over metallic materials, types and their applications.
Polymers: Basic concepts, Processing techniques, advantages and disadvantages over metallic materials, basic types and applications.
[CO VI]

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,
5	Material Science and Metallurgy	10th revised edition, 2003	V. D. Kodgire	Everest Publication, Pune

Regular: - 3rd Semester Practical

ME2202	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.	(1)Students will be able to prepare specimen for metallographic examination. (2)) Students will be able to analyze the microstructure of ferrous and non-ferrous Materials (3) Students will be acquainted with the different testing of Materials

List of Practical

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

1) Study of Metallurgical Microscope. **[CO I, II,III]**
2) Preparation of Specimen for metallographic examinations. **[CO I, II,III]**
3) Study and drawing of microstructures of Steels. **[CO I, II,III]**
4) Study and drawing of microstructures of Cast Iron. . **[CO I, II,III]**
5) Study and drawing of microstructures of Non Ferrous Metals. . **[CO I, II,III]**
6) Study of the effect of annealing and normalizing on properties of steels. **[CO I, II,III]**
7) Determination of hardenability of steels by Jominy End Quench test. . **[CO I, II,III]**
8) Tensile test on Mild Steel and Aluminum test specimen. . **[CO I, II,III]**
9) Measurement of hardness of ferrous and non-ferrous materials with the help of Brinell hardness tester. **[CO I, II,III]**
10) Measurement of hardness of ferrous and non-ferrous materials with the help of Vicker hardness tester. **[CO I, II,III]**
11) Measurement of hardness of ferrous and non-ferrous materials with the help of Rockwell hardness tester. . **[CO I, II,III]**
12) Study the heat treatment of high speed steels. . **[CO I, II,III]**
13) Study the heat treatment of stainless steel. . **[CO I, II,III]**
14) Study of effect of alloying elements on properties of steels. **[CO I, II,III]**
15) Study of macroscopic examinations. . **[CO I, II,III]**
16) Study of mechanisms of quenching. . **[CO I, II,III]**
17) Study of Pack carburizing of steel samples. . **[CO I, II,III]]**
18) Observation of microstructures using image analyzer. **[CO I, II,III]**

Regular: - 3rd Semester Theory

ME2203	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
i. Understand the basic tool geometry of cutting tool and basic machining parameters. ii. Analyze the various machining processes. iii. Identify and explain basic components and function of different machine tools. iv. Understand the application and limitations of various machining processes with regard to shape formation and surface quality. v.	(Upon successful completion of the course, the student will be able to: I. Select cutting tool materials and tool geometries for different metals. II. Demonstrate the fundamentals of machining processes and machine tools for cylindrical surface machining. III. Select appropriate machining processes and conditions for flat surface machining using SPCT and gear manufacturing. IV. Learn machine tool structures and processes for flat surfaces marching using MPCT. V. Analyze the various finishing and super finishing processes. VI. Learn machine tool structures and processes for internal surfaces machining and application of jigs and fixtures.

Syllabus:

Unit I

Mechanics of metal cutting And Machinability: Introduction to machining, Mechanism of chip formation, geometry of SPCT., Orthogonal and Oblique cutting, Use of chip breaker in machining, Merchant Circle (Analytical treatment expected), thermal aspects of machining, cutting temperature measurement during machining, Cutting Fluids, Machinability, Estimation of Tool life, Tool materials. **[CO I]**

Unit II

Lathe: Kinematic systems and operations of lathes, attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, time estimation for turning operations. Capstan and Turret Lathe and special purpose Machines: Construction, Operation and selection of Machining Parameters, Machining Centers, Tool Heads and indexers. **[CO I CO II]**

Unit III

Shaper: Introduction, type, specification, description of machines, hydraulic drives in shapers, cutting parameters, attachments for shaper, work holding devices, shaper operations.

Planer: Introduction, specifications, description, type of planner, Mechanism for planner: Driving mechanism, feeding mechanism, planner cutting tools, cutting parameters

Slotter: Introduction, specifications, description, type of drives for slotter, types of slotting. **[CO I,III]**

Unit IV

Milling: Kinematic systems and operations of milling machines, attachments for Milling. Cutting parameters, Types of milling cutters, Tool geometry and their specifications. Indexing- simple, compound and differential. Screw threads and Gear Manufacturing Methods. **[CO I ,IV]**

Unit V

Grinding operations, grinding wheel, specifications, selection and performance, cylindrical and centre less grinding operation, surface grinding, tool & cutter grinding, time estimation for grinding operations.

Super finishing process: Honing, Lapping, super finishing, polishing, buffing, metal spraying, galvanizing and electroplating. Process parameters and attainable grades of surface finish, surface roughness measurement. **[CO I,V]**

Unit VI

Drilling, boring and reaming: Drilling, tools for drilling, classification of drills, twist drill nomenclature, drill size and specifications, carbide tipped drills, type of drilling machines, Drilling machines operations, time estimation for drilling. Reamers, types and nomenclature, Boring machines, types ,mechanism and operations. Broaching, type of broaches, and nomenclature of broaches, type of broaching machines. Jigs and Fixtures for Machine shops. **[CO I,VI]**

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 publication
3	Workshop Technology (Volume-II)	2nd Edition (2009	Hajra Choudhary	MPP LTD.
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	McGraw- Hill
4	Processes & Materials of Manufacture	1st Edition (1990)	R Lindberg	Allyn and Bacon Technology & Engineering
5	Production Technology	1st Edition (2008)	Karunakaran	HMT
6	Workshop Technology (Volume I & II)	2nd Edition (2009)	Bawa	McGraw-Hill Companies

Manufacturing Process –I **Regular: - 3rd Semester** **Practical**

ME2204	**Manufacturing processes-I**	**L=0**	**T=0**	**P=2**	**Credits=1**

Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	--	---	**40**	**60**	**100**	**3 Hrs**

Objective	**Course Outcome**
i. Understand the basic tool geometry of cutting tool and Identify basic components and function of different machine tools. ii. Understand the application and limitations of various machining processes with regard to shape formation and surface quality.	Upon successful completion of the course, the student will be able to: I. Select cutting tool materials and tool geometries for different metals. II. Demonstrate and apply the fundamentals of machining processes and machine tools using cylindrical surface machining for fabricating basic parts. III. Select appropriate machining processes and conditions for flat surface machining using SPCT fabricating basic parts. IV. Learn machine tool structures and processes for flat surfaces marching using MPCT fabricating basic parts. V. Analyze the various finishing and super finishing processes. VI. Learn machine tool structures and processes for internal surfaces machining.

S No Name of Experiment

1 Demonstration of single point cutting tools, their nomenclature, geometry materials and applications. CO I

2 Demonstration of multi point cutting tools, their nomenclature, geometry materials and applications. CO I

3 Demonstration of working of Lathe Machine and study of its mechanism. CO II

4 Demonstration of working of Shaper Machine and study of its mechanism CO III

5 Demonstration of working of Milling machine and study of its mechanism. CO IV

6 Demonstration of working of Drilling machine and study of its mechanism. CO VI

7 Practical on lathe for turning , facing , step turning , taper turning and threading. CO II

8 Practical on Shaper with exposure to auto feed. CO III

9 Practical on milling machine for slot cutting. CO IV

10 Practical on Drilling machine for drilling. CO VI

11 Demonstration of boring operations. CO VI

12 Study of Grinding machine and super finishing processes. CO V

13 Introduction to NC and CNC machines. CO II

Regular: - 3rd Semester Theory

ME2205	Mechanics of Material	L=4	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 should be able to acquire elementary knowledge of stress, strains and material properties. • To impart the knowledge on shear force and bending moment calculations for beams. • To impart the knowledge about bending and shear stress and its importance. • To impart basic knowledge on strain energy calculations due to various types of loads and to estimate the load carrying capacity of columns. • To impart basic knowledge to calculate deflection of beams. • To impart knowledge on the principal stresses and planes in three dimensional stress systems.	**I.** Student will be able to compute stress strain and deformation in an axis member of mechanical system. **II.** Student will be able to analyze the beam and construct SFD & BMD. **III.** The student will able to determine and analyze the bending stress & she as stress in beam **IV.** The student will able to interpret the behaviors & analysis of column and apply the concept of strain energy. **V.** Student will learn the method of calculation of definition beams & torsional shear stress for circular section **VI.** The student will be able to so his two dimensional stress problem using analytical and graphical method

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]**

Combined Stresses: Definition of principal planes & principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of stresses. Derivation of maximum and minimum principal stresses & maximum shear stresses when the member is subjected to different types of stresses simultaneously (i.e. combined stress) **[a,b,e,l]**

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)	Shiwalkar B. D	PSG Tech, Coimbatore, India
3	Design of Machine Elements	3rd Edition (2007)	Shiwalkar B. D	Denett & Co.
4	Strength of Materials	Seventh Edition1984	Timoshenko and Young	CSB Publisher
5	Strength of Materials	4th (February 1987)	Singer F. L	Harper and Row Publications
6	Introduction to Mechanics of	2nd (June 1998)	Popov E.P	Prentice Hall Publication

Regular: - 3rd Semester Practical

ME2206	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 **[a,b,c,d,e,l,m]**	(1) The students will be able to gain practical knowledge of stress, strain and relations based on linear elasticity and also will be able to understand the material behaviour due to different types of loading. (2) Students will be able to understand beam types and loading, buckling and torsion phenomena.

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 Theory

ME2207	Kinematics 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

Objective	Course Outcome
• To provide a study of understanding the concept of kinematics in Mechanisms and machines to students of mechanical engineering though the theoretical principles involved have immediate application to practical problems • To provides the foundation for the study of displacements, velocities, accelerations and static and dynamic forces. Required for the proper design of mechanical linkages, cams and geared systems.	CO-I Students should be able to understand the mechanical system, mechanism its components, relative between them. CO-II Students should be able to determine the relative velocity & Acceleration of a kinematic link of a given mechanism. CO-III Students should be able to identify the motion as per the application & draw the profile of a cam followers mechanism. CO-IV Students should be able to understand various types of Gears used in Machine terminologies. CO-V Students should be able to determine the exact Velocity Ratio using various Gear & trains. CO-VI Students should be able to determine the various forces coming on the links because of the externally applied force in a static condition.

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

ME2208	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 and momentum equation to Fluid flow systems. Study various flow measuring devices. Understand the concept of viscosity as applied in real flows. Learn to use equations in combination with experimental data to determine losses in flow systems. **[a,e,k,m]**	**(**1) Students will be able to understand the various 4 bar mechanisms and their inversions (2) Students will be able to select the proper dimensions and size of cams ,gear and, gear trains for specific applications (3)The students will be able to establish Eulers equation of motion; obtain Bernoulli's Equation and apply it to various flow systems. [**a,e,k,m**] (4) The students will be able to apply momentum equation for simple engineering flows and determine the force exerted by the fluid flow on the passage confining it. The students will be able to describe the different techniques of flow measurement; obtain the discharge through pipes, orifices etc. [**a,e,k,m**] (5) The students will able to describe the conditions under which the flow is laminar or turbulent; establish and apply the Hagen Poiseullie equation for Laminar flow in a pipe; solve simple laminar flow problems; explain the development of boundary layers in external and internal flow; explain the origin of lift and drag forces for flow around an immersed bodies. [**a,e,k,m**] (6) The students will able to derive and expression for the frictional head losses in a pipe flow, estimate minor losses, draw energy and hydraulic gradient lines; calculate the flow characteristics through pipes connected in series and in parallels; and work out power transmission in a pipe. [**a,e,k,m**]

Prerequisites: Nil, but basic knowledge of various subjects studied earlier, is expected.

Unit1 **[8 hrs]**

Introduction to Fluid Mechanics: Properties of fluids, Newton's law of viscosity and its applicationPascal's law, Basic equation of fluid static, Fluid pressure & its measurement

(Manometers & Bourdon's pressure gauge) Hydrostatics: Pressure variations in compressible & incompressible fluids **[a,e,k,m]**

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

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

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

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

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

Reference books:

1	Fluid Mechanics: Fundamentals and Applications	Yunus A. Cengel and John M. Cimbala	McGraw-Hill
2	Engineering Fluid Mechanics	K. L. Kumar	S. Chand & Company Ltd.
3	Basic Fluid Mechanics	C.P. Kothandaraman & R. Rudramoorthy	New Age Publication
4	Fluid Mechanics	J.F.Douglas, J.M.Gasiorek & J.A. Swaffield	ELBS Publication
5	Fluid Mechanics	A.K.Mohanty	Prentice Hall Publication
6	Fluid Mechanics & Fluid Power Engineering	D. S. Kumar	S. K. Kataria Publication
6	Fluid Mechanics	A.K.Jain	Khanna Publishers

Regular: - 3rd Semester Practical

ME2209	Fluid Mechanics Practical	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	---	---	40	60	100	3 Hrs

Objective	Course Outcome
Develop an understanding of fluid statics, kinematics and dynamics in Mechanical. Learn to apply Bernoulli's Equation and momentum equation to Fluid flow systems. Study various flow measuring devices. Understand the concept of viscosity as applied in real flows. Learn to use equations in combination with experimental data to determine losses in flow systems. **[a,e,k,m]**	(1) Students will be able to understand the various 4 bar mechanisms and their inversions (2) Students will be able to select the proper dimensions and size of cams ,gear and, gear trains for specific applications (3)The students will be able to establish Eulers equation of motion; obtain Bernoulli's Equation and apply it to various flow systems. [**a,e,k,m**] (4) The students will be able to apply momentum equation for simple engineering flows and determine the force exerted by the fluid flow on the passage confining it. The students will be able to describe the different techniques of flow measurement; obtain the discharge through pipes, orifices etc. [**a,e,k,m**]

LIST OF PRACTICALS

1) Study of Pressure Measuring Devices
2) To determine hydrostatic Force on vertical Surface
3) To determine hydrostatic Force on horizontal Surface
4) Verification of Bernoulli's Equation
5) To Determine Coefficient of Discharge of Venturimeter
6) To Determine Coefficient of Discharge of Open Orifice
7) To Determine Coefficient of Discharge of Orifice for compressible fluids
8) To Determine Coefficient of Discharge of Triangular notch
9) To Determine Coefficient of Discharge of Rectangular Notch
10) To Determine friction factor of fluid flowing through pipe
11) Performance on pipes in series
12) Performance on pipes in parallel
13) To Determine Minor losses and Coefficients of Minor Losses
14) To Determine Force exerted by Jet
15) Study of fluid flow over immersed bodies
16) Any other practical based on Fluid Mechanics syllabus

Regular: - 4th Semester Theory

ME 2251	Design of Machine Elements	L=3	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
This subject occupies a predominant position in the curriculum of Mechanical Engineering. It consists of application of scientific principles, technical information & creative thinking for the development of a new or improved machine or mechanical system, to perform desired function with maximum efficiency.	Student will be able to I) Apply the knowledge of design principal in machine components. II) Design and analyze Welded joints, Bolted joints and Riveted joints. III) Apply design principles and analyze through design of power screw & springs. IV) Learn positive governing principles and analyze brakes and clutches. V) Apply principal of thick and thin cylinders, & analyze and design of pressure vessels. VI) Analyze and design of power transmission shaft.

Syllabus

Unit1
[8 hrs]
Definition of design, types of design, design process, need, defining the problem, feasibility, design alternatives, final design selection, preliminary and final plant drawings.

Theories of failure, Design for Fatigue & manufacturing considerations in design, basis of good design, failure of machine parts, deformations, wear, corrosion, machining tolerance, surface finish, cost design consideration in casting & forging.
Mechanical properties, Design considerations and selection of materials. **[CO – I]**

Unit2
[7 hrs]
Design of Joints:
Welded joint: design of single transverse, double transverse, parallel fillet, combination fillet butt joint, Eccentrically loaded welded joints.
Bolted joint: Design of bolted fasteners, bolt of uniform strength, bolted joints under eccentric loading.
Design of riveted joints. **[CO – II]**

Unit3
[7 hrs]
Power screw and Leaf spring: Design of power screw
Design of Helical and Leaf Springs. **[CO – III]**

Unit4
[7 hrs]
Brakes and clutches: Kinematics of Friction Drives such as Brakes, Clutches Design of Friction Clutch, Single Plate, Multiple Plate, Cone, Centrifugal Clutch, Design of Brake, Shoe Brake, Band

Brake,, Internal Expanding brake. **[CO – IV]**
Unit5 **[7 hrs]** **Pressure Vessel:** Classification of Thick and Thin Cylindrical Pressure Vessel, Stresses in Thin and Thick Cylindrical Pressure Vessels when it is subjected to internal pressure, Expression for Circumferential and Longitudinal stresses, Design of pressure vessel, Heads and Cover Plate. **[CO – V]**
Unit 6 **[8 hrs]** **Design of Shafts:** Design of transmission Shafts on the Basis of Strength and rigidity, ASME Code for shaft Design, Design of Stepped shaft Axle splined Shaft, Keys. **[CO – VI]**

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: - 4th Semester Theory

ME2252	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 develop the understanding of thermodynamic principles/laws for ideal gas/pure substance and to use it for evaluation of the energy interaction with the thermodynamic systems undergoing process.	***On completion of this course, the student will be able to:*** i. ***Analyze the*** concepts and parameters involved in thermodynamics and the Zeroth law of thermodynamics. **Evaluate** the work and heat interactions associated with a various processes. **a. (Analyzing, Applying, Evaluation)** b. **(Outcome:)** ii. **Apply** first law of thermodynamics for the **Analysis** of closed and open systems for **evaluation** of energy interaction. **a. (Analyzing, Applying, Evaluation)** b. **(Outcome:)** iii. **Evaluate** the performance of heat engines and other engineering cyclic devices and **determine** the reversibility or irreversibility for various processes **applying** thermodynamic laws. **a. (Analyzing, Applying, Evaluation)** b. **(Outcome:)** iv. **Evaluate** entropy changes and availability in various processes **applying** First & Second Law of thermodynamics. **a. (Analyzing, Applying, Evaluation)** b. **(Outcome:)** v. **Evaluate** various thermodynamic parameters in various *processes with phase change* **using** phase change diagrams, relations and steam tables/ charts **applying** Law of thermodynamics. **a. (Analyzing, Applying, Evaluation)**

	b. **(Outcome:)** vi. **Analyze** the performance of various Thermodynamic cycles **applying** Law of thermodynamics for **evaluation** of energy interaction. **a. (Analyzing, Applying, Evaluation)** b. **(Outcome:)**

Syllabus

UNIT I:
Introduction To Thermodynamics: Basic concepts of Thermodynamics, Continuum and macroscopic approach; thermodynamic system, Concept of energy and various forms of energy; internal energy, enthalpy; specific heats;, thermodynamic properties and equilibrium; state of a system, state postulate, state diagrams, paths / processes and cycles on state diagrams . The Ideal Gas equation of state. The concepts of heat and work interactions. Evaluation of different modes of work. Zeroth Law of Thermodynamics, concept of temperature.
UNIT II
First Law of Thermodynamics applied to the various processes in Closed Systems, Various Steady flow systems, Steady-Flow Engineering Devices and Unsteady Flow process such as: charging and discharging of gas cylinder.
UNIT III
Second Law of Thermodynamics : Limitations of the Zeroth and First law of thermodynamics, concepts of Thermal energy reservoirs, heat engines and heat pumps/refrigerators, Kelvin-Planck and Clausius statements and their equivalence; reversible and irreversible processes; Carnot cycle and Carnot principles/theorems; thermodynamic temperature scale;
UNIT IV
Entropy: Clausius inequality and concept of entropy; microscopic interpretation of entropy, the principle of increase of entropy, T-s diagrams, Change in entropy for processes in Closed and Steady flow systems. Introduction to concept of Availability.
UNIT V
Properties of Pure Substances (Steam) : Thermodynamic properties of pure substances in solid, liquid and vapor phases; P-v-T behavior of simple compressible substances, phase rule, thermodynamic property tables (Steam Tables) and charts. Calculations of work and heat interactions in non- flow and steady flow processes. Determination of dryness fraction using various calorimeters.
UNIT VI:
Thermodynamic Cycles **Vapor Power Cycles**: Carnot vapor cycle, Rankine cycle: ideal and the reheat, the analysis of vapor power cycle. **Air-standard cycles:** air standard assumptions, basic considerations and the analysis of power cycles: Otto cycle, Diesel engine cycle, and Brayton cycle. **Refrigeration Cycle:** Introduction to Vapor-compression Refrigeration Cycle
Text/ Reference Books:
1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi. 2. Cengel, „Thermodynamics – An Engineering Approach" Tata McGraw Hill, New Delhi. 3. Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.

4. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of Engineering Thermodynamics: John Wiley & Sons.
5. Reiner Joel., Basic Engineering Thermodynamics, Longman Publications.

Regular: - 4th Semester Practical

ME2253	Machine Drawing 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 familiarize the students with- 1) To gain knowledge of different types of line and its application, conventional representation of various machining and mechanical details as per IS 2) To visualize an object and convert it into a drawing. 3) To become conversant with 2D and 3D.	(i) The student will able to apply standards practices and conventions in machine drawing. (ii) The will be capable of visualizing and preparing detailed drawing of given objects. (iii) The student will able to create to 2D and 3D using any standard CAD software with due manufacturing consideration.**[d,k]**

Unit1 **[8 hrs]**
Drawing Standards for following- Drawing Sheets, Name Blocks, Lines, Dimensioning of Tolerances, Standard features, Machining Symbols, Welding Symbols, Heat Treatment, manufacturing Instructions, Allowances, and Materials. .**[d,k]**

Unit2 **[6 hrs]**
Orthographic Projection of Elements, section, dimensioning, Dimensioning of tolerances, Orthographic Projections, Sectional Views, Missing Views, conventional representation of machine elements. .**[d,k]**

Unit3 **[6 hrs]**
Preparation of drawing of machine Elements such as - threads, Bolts, Nuts, Washers, Rivets, Welds, Keys and Keyways, splines, Couplings, shaft..**[d,k]**

Unit4 **[8 hrs]**
Assembly and Dismantling Principles : Fits and Tolerances (Standards, Types Application and Selection) , Tolerance Charting, Surfaces Finishing Requirement for Assembly, Geometry suitable for Assembly, Assembly / Dismantling Tools, Bearing Assemblies, Assemblies by Fastening. .**[d,k]**

Unit5 **[9 hrs]**
Study of some Standard Assemblies.
Assembly Drawings: Principles, Techniques and standards for Preparing Component Drawings, Subassembly Drawing, Full Assembly Drawing, Exploded Views.
Assembly drawings of :- Lathe machine tail stock and tool post , radial engine sub assembly, plummer block, steam stop valve or safety valve, etc. .**[d,k]**

Unit 6 **[8 hrs]**
Production Drawing : Name Plates, Part List, Revisions Etc., Essential Parts/ Formats Required for Production Drawings, Process Sheet, blue print reading. .**[d,k]**

Practical:

1. Drawing of some Standard Components. (Two Sheets).
2. Drawings of two Standard Assemblies with Components. (Two Sheets).
3. Computer printout of a small Assembly with Components.
4. Pencil Drawing / Computer printout of a Large Assembly with components Drawings, subassembly drawings and assembly drawings using all standard formats.
5. Computer Printout of Production Drawing and process Sheets for One Component having maximum five Operations. Pencil Drawing should be in full imperial sheet folded to quarter Imperial size, Computer printouts should be on a plotter in A3 size. All drawings should be submitted in one folder.
6. To parts and assembly drawing using suitable CAD software.

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: - 4th Semester Theory

ME2254	Manufacturing Process-II	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	40	60	100	--

Objectives:	Course outcomes:
1. Understand the basics of mold making processes. 2. Study the special casting processes along with the various defects arising in casting. 3. Study the working of various rolling and forging processes. Study the different furnaces. 4. Study the introductory concepts of Press working. 5. Study the different welding processes. 6. Study the different non-conventional mach and similar processes.	1. Upon successful completion of the course, the student will be able to: 2. CO I: The basics of mold making processes. 3. CO II: The special casting processes along with the various defects arising in casting. 4. CO III: The working of various rolling and forging processes and to Study the different furnaces. 5. CO IV: The introductory concepts of Press working. 6. CO V: The working principle & applications of welding and other joining processes. 7. CO VI: The working principle & applications of different non-conventional machining & similar processes.

Syllabus:

UNIT – I

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). **(8hr) [CO I]**

UNIT – II

Special casting processes: Investment Casting, Centrifugal Casting, Shell Molding, CO Molding, Slush Casting, Die Casting, inspection & casting defects. **(6hr) [CO II]**

UNIT – III

Mechanics of forming processes: Rolling (including analytical treatment), Forging equipment (Hammer/Press), Extrusion & Wire Drawing. Melting furnaces – Types, Electric-arc furnace, Induction furnace, Cupola-construction & operation. **(7hr) [CO III]**

UNIT – IV

Sheet Metal Working: Terminologies, Types of Operations, Classification of Dies and Presses, Introduction to Design Parameters and Types of Processes (including analytical treatment). **(6hr) [CO IV]**

UNIT – V

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. **(9hr) [CO V]**

UNIT – VI

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. **(6hr) [CO VI]**

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)	HajraChoudhary	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 BaconTechnology & 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

Regular: - 4td Semester Practical

ME2255	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]**	(Upon successful completion of the course, the student will be able to: CO I – Understand the application of different molding processes **[a, b, e]** CO II – Understand practicability of various processes like casting and press work. **[a, b, e]**

List of Practical:-

1. Preamble about Foundry Practices used in Industries. **[I]**
2. Preparation of Mold Sand. **[I]**
3. Study of various Molding Processes. **[I]**
   a) According to the Method used.
   b) According to the Mold material.
4. Study of various types of melting furnaces and Cupola in detail. **[II]**
5. Study of different types of wooden pattern. **[I]**
6. Grain Fineness test of molding sand. **[I]**
7. Study of Foundry tools and Mold materials with demonstration of mold making. **[I]**
   a) Types of Gates.
   b) Defects of casting.
8. Preparation of mold making. **[I]**
9. Study of different casting processes. **[II]**
10. Preparation of wooden pattern in pattern making shop. **[II]**
11. Study of Press Working – Dies and accessories. **[II]**
12. Report of Foundry visit. **[I, II]**

Regular: - 4th Semester Theory

ME2256	MECHANICAL MEASUREMENT AND METROLOGY	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	40	60	100	--

UNIT 1

Interchangeability, standards of measurements, simple gauging instruments for linear and angular measurements, form measurement, surface finish measurement, comparators, measurement of straightness and flatness, measurement thread , interferometers, calibration of equipment, CMM.

UNIT 2

Tolerance analysis of limit and fits, Design of limit gauges(analytical treatment), types of fits, shaft basis system ,hole basis system, selective assembly ,allowances, process planning sheet, preparation of tolerance chart (analytical treatment).

Unit 3

Purpose, Structure, and elements of a general measurement system. Static characteristics of measurement system, measurement error, Type of inputs, methods of corrections. Dynamic characteristics of measurements system, Mathematical modeling, transfer function, order of system, Standard input signals. Response of Zero, First and second order instruments.(no analytical treatment)

Unit 4

Study of instruments for measurements of linear & angular displacement, speed, acceleration, force, torque, power and Strain..

Unit 5

Study of instruments for measurement of temperature, level, pressure and flow.

UNIT 6

Acceptance sampling techniques, O.C. Curve, sampling plans, (analytical treatment), inspection types and objective. Introduction to control charts.

Text books:				
	Name of the book	Edition	Author	Publisher
1	Principles of measurements system	4thedition (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.

A TEXT BOOK OF METROLOGY	R K JAIN	KHANNA PUB DELHI
A TEXT BOOK OF METROLOGY	I C GUPTA	DHANPAT RAI PUB. DELHI
SQC	E L GRANT	McGRAW HILL
SQC	M MAHAJAN	DHANPAT RAI PUB. DELHI

Regular: - 4td Semester Practical

ME2257	MECHANICAL MEASUREMENT AND METROLOGY	L=0	T=0	P=2	Credits=1

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

List of Practical:-

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

1. Measurement of strain by using a basic strain gauge and hence verify the stress induced.
2. Speed Measurement by using Stroboscope.
3. Speed Measurement by using Magnetic Pick Up
4. Speed Measurement by using Photo-electric Pick Up
5. Measurement of flow by using Rota meter.
6. Displacement measurement by inductive transducer.
7. Calibration of Thermocouple.
8. Calibration of RTD.
9. Calibration of LVDT
10. Determination of negative temperature coefficient and calibration of a thermistor.
11. Measurement of force & weight by using a load cell.
12. Liquid Level Measurement by using Capacitive Transducer system.
13. Measurement of Air velocity using Hot wire anemometer.
14. Measurement of Air velocity using turbine type anemometer
15. Scope of metrology lab and study of all metrological instruments.
16. Study of slip gauges and its uses.
17. To find half taper angle of a w/p using sine bar
18. To find various parameters of screw thread using TMM.
19. To find effective diameter of a threaded plug by two wire method using floating carriage machine.
20. Study of flatness of surface using monochromatic light with the help of fringe pattern.
21. To measure the surface roughness of a given w/p using Stylus probe.
22. To study the profile of given w/p using optical profile projector.
23. Design of limit gauge.
24. Preparation of process planning sheet and tolerance chart.
25. Problems on acceptance sampling.

Regular: - 5th Semester Theory

Regular: - 5th Semester Theory

ME2301	Heat Transfer	L=3	T=0	P=0	Credits=3

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

Objective

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]**

Course Outcome

On completion of this course, the student will be able to:

1) Analyze and solve the problems of unidirectional steady state heat conduction systems.
2) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient.
3) Design & analyze the heat exchangers with LMTD & ϵ-NTU methods.
4) Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.

	CO-PO Weightage details 2020													
	V SEMESTER B.E.	MECHANICAL												
	COURSE CODE: ME2303	COURSE NAME: HEAT TRANSFER												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	CO-1) Analyze and solve the problems of unidirectional steady state heat conduction and lumped heat capacitance systems.	3	3	3	2	3	1	2	1	1	1	2	2	3	3

CO2	CO-2) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient.	**3**	**3**	**3**	**2**	**3**	**1**	**2**	**1**	**1**	**1**	**2**	**2**	**3**	**3**
CO3	**CO-3)** Design & analyze the heat exchangers with LMTD & ϵ-NTU methods.	**3**	**3**	**3**	**2**	**3**	**1**	**2**	**1**	**1**	**1**	**2**	**2**	**3**	**3**
CO4	**CO- 4)** Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.	**3**	**3**	**3**	**2**	**3**	**1**	**2**	**1**	**1**	**1**	**2**	**2**	**3**	**3**

Syllabus:

Unit 1 : **[6 hrs]**

Introduction: Modes of Heat Transfer, Basic Laws of Heat Transfer and Conservation of Energy requirement.

Derivation of **general Heat conduction equation** in Cartesian, Cylindrical and Spherical Co-ordinates, Thermal conductivity and Thermal diffusivity.

One dimensional steady state conduction equation for the plane wall, Cylinder and Sphere, Thermal resistance of composite structures, Contact resistance, and overall heat transfer coefficient.

Unit 2 : **[5 hrs]**

Conduction with uniform internal heat generation: within plane wall, solid Cylinder and solid sphere,

Extended Surfaces with uniform cross section area, temperature distribution and their heat transfer rate, Fin efficiency and effectiveness,

Unit 3: **[5 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, **Using Empirical co-relation** (from heat transfer data book) for heat transfer during external and internal flow in laminar and turbulent regime for UHF and UWT condition, for determination of heat transfer coefficient.

Unit 4: **[5 hrs]**

Natural Convection:

Grashoff number, Rayleigh number, Hydrodynamic and Thermal Boundary Layer.

Using Empirical co-relation (from heat transfer data book) for heat transfer during external flow in laminar and turbulent regime for UHF and UWT condition (over plates & cylinders in Horizonal and vertical position, and over sphere).

Heat transfer with phase change (Theory only):

Pool boiling phenomenon, curve and regimes of pool boiling, Film and drop wise condensation, Film wise condensation on vertical surface (plate & cylinder), horizontal tube & bank of tubes, effect of superheated and non-condensable gasses on condensation heat transfer.

Unit 5: **[6 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

Unit 6 : **[6 hrs]**

Radiation

Basic Radiation Concepts:

Fundamentals, Basic ideas, spectrum, basic definitions, radiative properties of opaque surfaces, Spectral and directional variations, emissive power, radiosity, intensity of radiation and solid angle, Band Emission.

Black Body Radiation Laws: Planck's law, Stefan Boltzmann law, Wien's Displacement law, Kirchhoff's law, Lambert cosine law,

Radiation Energy Exchange:

Concept of black and gray bodies, Radiation exchange between black surfaces, Radiation exchange between gray surfaces

Shape Factor Concepts– Definition, relations and its properties.

Radiation network for radiative exchange.

Radiation between parallel plates, concentric Cylinders and concentric spheres & simple enclosures.

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

ME2302	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.	(On completion of this course, the student will be able to: 1) Analyze and solve the problems of unidirectional steady state heat conduction systems. 2) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient. 3) Design & analyze the heat exchangers with LMTD & ϵ-NTU methods. 4) Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.

List of Practical

A set of 9 Experiments from following list to be performed.

List of Practical: Minimum eight experiments from the following:

1D steady state Conduction:

1) Determination of **thermal conductivity of metal bar**.

2) Determination of **thermal conductivity of insulating material** in the powder form (Lagged Pipe).

3) Determination of thermal conductance of a **composite wall**.

4) Heat Transfer through **FINs**.

Steady State convection:

5) Determination of **forced convection heat transfer coefficient** for fluid flow through a closed conduit.

6) Determination of **natural convection heat transfer coefficient** for a vertical surface.

Heat Exchanger:

7) Determination of **effectiveness and overall heat transfer coefficient** for parallel flow and counter flow concentric tube heat exchangers.

Steady State Radiation

8) Determination of **emissivity** of non black surfaces.

9) Determination of **Stefan-Boltzmann constant.**

Study:

1) Study of different methods of temperature measurements with special emphasis on thermocouples.

2) Study of **heat pipes**

3) Study of **pool boiling phenomenon** (Nukiyama Curve).

4) Study of **condensation heat transfer** in film wise & drop wise modes.

Regular: - 5th Semester Theory

ME2303	Dynamics of Machinery	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	MSE-II	TA	ESE	Total	ESE Duration
	15	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	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 **[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 **[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 **[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 **[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 **[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 **[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: - 5td Semester Practical

ME2304	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
2. Determination of Gyroscopic couple through motorized Gyroscope
3. Experiments on Governors - Pronell Governor, Hartnell Governor
4. Determination of Balancing of rotating mass, statically and dynamically.
5. Determination of natural frequency of longitudinal vibration
6. Determination of natural frequency of transverse vibration of beam.
7. Determination of natural frequency of simply supported beam using dunkerlays method.
8. Determination of natural frequency of torsional vibration of single rotor.
9. Determination of natural frequency of torsional vibration of double rotor.
10. Determination of whirling speed of shaft.

Regular: - 5th Semester Theory

ME2305	**Production Management**	**L=3**	**T=1**	**P=0**	**Credits=3**

Evaluation Scheme	**MSE-I**	**MSE-II**	**MSE-III**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**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.	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 .

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.

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.

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.

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.

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.

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: - 5th Semester Open Elective-I Theory

ME2331	Operation Research Techniques	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
The course aims to develop the engineering - analysis capability for engineering-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.	After completion of this course, Students will be able to 1. Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method. 2. To Solve Transportation and Assignment Models and analyze the concept of dynamic programming to Solve problems of discreet and continuous variables. 3. Analyze projects for minimum total cost and smooth level of resources. 4. Evaluation of different replacement policies and its application in operation research and analysis of the application of simulation, inventory control model and waiting line model.

Syllabus

Unit 1

Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR. Linear programming solutions (LPP) by graphical methods and simplex method. Sensitivity analysis. **(CO-1) [7 hrs]**

Unit 2

Assignment Model and Transportation Model. **(C0- 2) [7 hrs]**

Unit 3

Dynamic programming - characteristics, approach and its formulations. Application of Dynamic programming in Employment smoothening problem, Resource allocation, Inventory control & Linear programming. **(CO- 2) [6 hrs]**

Unit 4

Project Management: Network Scheduling by CPM & PERT, Cost considerations in PERT and CPM. **(CO- 3) [7 hrs]**

Unit 5

Replacement Models: Replacement of Models that deteriorate with time, Concept of equivalence , Interest Rate and Present worth. Replacement of items that fails suddenly considering Individual and Group replacement policy. **(CO- 4) [6 hrs]**

Unit 6

Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), Simulations, Monte- Carlo Simulation. Inventory Control with Deterministic models. **(CO- 4) [6 hrs]**

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
V	5ME1315	Operation Research Techniques	1.	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.	3				3	2			1				3	
			2.	To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.	3				2	3			3				3	
			3.	Analyze projects for minimum total cost and smooth level of resources.	3			2	2	2				2	3		3	
			4.	Evaluation of different replacement policies and its application in operation research and analyse of the application of simulation, inventory control model and waiting line mode.	3				2	2	1	1			2	3	3	

Text books:

Sr. No.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Introduction to Operation Research: Computer Oriented Algorithmic approach	2007	Billy E.Gillet	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2	Operations Research	Third edition 2008	Prem Kumar Gupta & D.S. Hira	S. Chand& Co.
3	Operations Research: Theory and Applications	Second edition 2002	J.K. Sharma	Mac Millan
4	Introductory 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	Hamdy A. Taha	Prentice Hall of India Pvt. Ltd., New Delhi.

Regular: - 5th Semester Open Elective-I

ME2332	AUTOMOBILE ENGINEERING	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	(1)Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.
	(2) Student will be able to describe various power transmission systems from clutch to wheel in vehicle.
	(3) Student will be able to evaluate and describe control systems like steering and brakes in vehicle.
	(4) Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.

Syllabus

UNIT-1: [7 hrs]

- Introduction, Automobile history and development and classification. Vehicles layout.
- Engine Classification, construction and working 2 stroke and 4-stroke cycle.
- Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic)
- Engine cooling and lubrication systems. [CO-1]

UNIT-2: [6 hrs]

Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch.

Gear box: Necessity of gear box with gear theory, working principle, Classification: Sliding mesh, constant mesh, synchromesh, and Transfer case gear box, Gear Selector mechanism, Defects and remedies in Gear box. Working of CVT (Continuous variable transmission) [CO-2]

UNIT-3: [7 hrs]

- Transmission system: Propeller shaft, Universal joint, Hotchkiss drive, torque tube drive.
- Differential - Need and working principle and Differential lock.
- Rear Axles and Front Axles
- Wheel and Tyres: Classification, various constituents of tyres with cross section, specification, factors affecting tyre performance. [CO-2]

UNIT-4: [6 hrs]

- Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types.
- Brakes - Need, types: Mechanical, hydraulic (Master and wheel cylinder), Air brakes. Drum and Disc brakes, Comparison
- Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber. [CO-3]

UNIT-5: [6 hrs]

- **Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries.**
- **Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator , wiper.(only basic)**
- **Automobile air-conditioning,**
- **Panel board instruments.** [CO-4]

UNIT-6: [6 hrs]

- **Resistance to vehicle motion: Air, Road and gradient resistance and power calculation.**
- **Advances in automobiles such as ABS, Power Steering.**
- **Safety aspect in Automobile.**
- **Overall Vehicle specifications**
- **Servicing, Overhauling and Engine tune up.** [CO-4]

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
5		OE-1/III: Automobile Engineering	I.	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.	3	2												3
			II.	Student will be able to describe various power transmission systems from clutch to wheel in vehicle.	3	2												3
			III.	Student will be able to evaluate and describe control systems like steering and brakes in vehicle.	3	2												3
			IV.	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.	3			2					2					3

Reference books:

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

ME2333	OEI: Robotics and Subtractive Manufacturing	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
• Gain knowledge of Robotics and automation. • Understand the working methodology of robotics and automation. • Write the program for robot for various applications • To understand subtractive manufacturing • To implement CNC programs	On completion of course students will be able to • Understand working of subtractive manufacturing • Implement CNC programs for various product manufacturing • have knowledge of Robotics, automation, robotics motion, sensors, robotic programming and roles of robots in industry • Understand the working methodology of robotics and automation, motion and control, machine vision and programming, application of robots in industry.

Unit 1 **[7 hrs]**

Unit 1

Concepts of NC, CNC, DNC. Classification of CNC machines, MCU architecture and functionality, Machine Configurations, Types of control, CNC controller's architecture and characteristics, Interpolators.

Unit 2 **[8 hrs]**

Positioning system, Cutter offset compensation, Word address format, Introduction to G and M codes Manual part programming for CNC turning, milling and drilling.

Unit 3 **[8 hrs]**

Tooling system for Machining center and Turning center, work holding devices, of CNC Machines. APT part programming, CAD/CAM programming, Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM.

Unit 4

FUNDAMENTALS OF ROBOT **[7 hrs]**

Robot – Definition – Robot anatomy – Co-ordinate systems, work envelope, types and classification – Specifications – Pitch, yaw, roll, joint notations, speed of motion and pay load – Robot parts and their functions – Need for robots – Different applications..

Unit 5 **[8 hrs]**

ROBOT KINEMATICS

Forward kinematics – Inverse kinematics – Differences: Forward kinematics and Reverse kinematics of manipulators with two and three degrees of freedom (In 2 dimensional), four degrees of freedom (In 3 dimensional) – Deviations and problems ,Introduction to DH notations

Unit 6 **[7 hrs]**

ROBOT PROGRAMMING

Teach pendant programming – Lead through programming – Robot programming languages – VAL programming – Motion commands – Sensor commands – End effecter commands – Simple programs.

IMPLEMENTATION

Implementation of robots in industries – Various steps - Safety considerations for robot operations.

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
2	Industrial Robotics: Technology, Programming and Applications,	2012	Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta	2nd Edition, Tata McGraw Hill, 2012.
3	Automation in Production system	2002	Mikell P. Groover	Prentice-Hall of India Pvt. Ltd., New Delhi, 2002

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

1.

Regular: - 5th Semester **Open Elective - I Theory**

ME2334	Control Systems Engineering	L=3	T=1	P=0	Credits=3

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

Objective	Course Outcome :- 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.
	(II)Analyse the construction and working of various control system components and electrical motors.
	(III) Evaluate the performance of control system using time response analysis and stability analysis.
	(IV) Analyze the performance of control system on the basis of frequency response and design suitable compensation for the control system

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.

Unit 2 **[7 hrs]**
Representation of Control components: Mechanical and Electrical components; Analogous systems; Thermal and Fluid systems.

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.

Unit 4 **[8 hrs]**
Transient and steady state response of first and second order systems Concept of stability; relative stability; Routh stability criteria.

Unit5 **[8 hrs]**
Frequency response and its characteristics; Bode plots; Nyquist plots. Gain margin and phase margin. Identification of system transfer function.

Unit6 **[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.

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: - 5th Semester Open Elective-II Theory

ME2341	Total Quality Management	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

COURSE OBJECTIVES	COURSE OUTCOMES
• The course aims to build an overall capability to understand Quality and its relevance in today's dynamic market. • Various Quality Improvement tools and technique shall be introduced and practiced so as to develop skills and knowledge to function as a good quality professional in the Engineering Profession.	1. Develop an understanding on quality management philosophies and frameworks. 2. Develop in-depth knowledge on various tools and techniques of quality management. 3. To Evaluate the applications of quality tools and techniques in both manufacturing and service industry 4. Ability to use quality management methods analyzing and solving problems of organization.

Unit 1 **[7 hrs]** Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering
Unit 2 **[7 hrs]** Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards.
Unit3 **[8 hrs]** Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA -YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design
Unit4 **[8 hrs]** Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes
Unit5 **[8 hrs]** Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling.]
Unit6 **[7 hrs]** Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing

.Reference books:

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

Regular: - 5th Semester Open Elective-II Theory

ME2342	Reliability Engineering	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

Objective	Course Outcome
1.To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution. **2.**Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.	(I) Student will be able to use reliability modeling as a tool for evaluating system performance. (II) Student will be able to analyze the failure of a machine, determine the failure rate of systems or components. (III) Student will able to understand importance of the maintenance of engineering systems and factors affecting maintainability. (IV) Student will be able to prepare the production & maintenance schedule of particular engineering system.

Unit 1 **[7hrs]**

Fundamental concepts:-

Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability,

Unit 2 **[8hrs]**

Probability theory:-

Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications.

Unit 3 **[7hrs]**

System reliability and modeling:

Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation.

Unit 4 **[8hrs]**

Maintainability and Availability:

Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation.

Unit 5 **[7hrs]**

System reliability Analysis:
Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing.

Unit 6 **[8hrs]**

Strength based reliability:
Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads.

. .Reference books:

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

Regular: - 5th Semester Open Elective-II Theory

ME2343	POWER GENERATION ENGINEERING	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	**(1) Student will be able to describe basics of power generations systems.**
	(2) Student will be able to analyze various conventional & non-conventional power plants.
	(3) Student will be able to analyze and examine combined operations of different power plants.
	(4) Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant

Syllabus

Unit 1 **[7 Hrs]**

THERMAL POWER PLANT- I

Introduction to thermal power plants and power plant layouts. Site selection.

Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling.

- Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers **[CO-1]**

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. (visit to nearby power plant shall be arrange for the students) **[CO-2]**

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.Governing.

- Comparison with other power plant. **[CO-2]**

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 **[CO-3]**

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.

- Comparison with other power plant. **[CO-4]**

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. **[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
6	ME1333	OE-II: Power Plant Engineering	I.	Student will be able to describe basics of power generations systems.	3	2												3
			II.	Student will be able to analyze various conventional & non-conventional power plants.	3	2												3
			III.	Student will be able to analyze and examine combined operations of different power plants.	3	2												3
			IV.	Student will be able to evaluate and describe_Hydroelectric power plant nuclear power plant	3			2					2					3

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1	Power Plant Engineering	2002	Domkundwar.	Dhanpat Rai & Co.
2	Power Plant Engineering	2007	Vopal & Slortzki	
3	Power Plant Engineering	2010	P K Nag	

Regular: - 5th Semester Open Elective-II Theory

ME2344	Project Evaluation & Management	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	ISE-III	TA	ESE	Total	ESE Duration
	15	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 economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	The students will be able 1. To apply the concepts of monitoring and evaluation, appraise 2. To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 3. to perform problem analysis, determine relevant indicators and data necessary for evaluation, 4. Implement a monitoring and evaluation process, establish baselines and targets..

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
Unit2 **[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:
Unit3 **[9 hrs]** **Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.
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
Unit 5 **[7 hrs]** **Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital
Unit6 **[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.				
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: - 6th Semester Theory

ME2351	Fluid Machines	L=4	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
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]**	**CO:1** The student will be able to describe and analyze the working of Positive Displacemnt Pumps .[a,e,k]
	CO:2 The student will be able to describe and analyze the working Centrifugal Pumps .[a,e,k]
	CO:3 The student will be able to define evaluate Static and Stagnation properties and; describe and analyze the compressible flow.[a,e,k]
	CO:4 The student will be able to describe and analyze the working of compressors.[a,e,k]

Unit 1
[8 hrs]
Classification of Positive displacement Pumps: Study of Rotary pumps such as vane pump, Gear pump and Screw pump.
Reciprocating pumps: Basic principle, types, Main components, Slip, Work done. Indicator diagrams, Separation, Air vessels **[CO:1]**

Unit 2
[7 hrs]
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, N.P.S.H , Cavitations in pumps, Performance characteristics [**CO:1]**

Unit 3
[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. Multistaging in reciprocating compressor, condition for minimum work input, capacity control, Actual indicator diagram [**CO:1]**

Unit 4
[7 hrs]
Compressible Flow: Stagnation properties, speed of sound wave, Mach number, one dimensional isentropic flow, Stagnation properties, 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, [**CO:2]**

Unit 5
[7 hrs]
Centrifugal compressor:-Principle, operation, parts, velocity diagram, static & stagnation quantities, work done by impeller, isentropic efficiency of compressor. Slip factor, pressure coefficient and power input factor. [**CO:3]**

Unit 6
[8 hrs]
Axial flow compressor:-Principle, operation, parts. Velocity diagram, work done, degree of reaction stage efficiency compressor characteristics, surging & chocking. [**CO:4]**

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

ME2352	Fluid Machines Lab	L=0	T=0	P=2	Credits=1

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

List of Practical

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

1) Study of Positive Displacement Rotary Pumps
2) **Trial on Reciprocating Pump**
3) **Trial on Centrifugal Pump**
4) Trial on reciprocating compressor **[CO:1]**
5) Trial on rotary Blower. **[CO:1]**
6) **Trial on Pelton wheel [CO:2]**
7) **Trial on Francis Turbine**
8) **Trial on Kaplan Turbine**
9) Performance testing of a single cylinder I.C. Engine. **[CO:2]**
10) Trial on Petrol Engine with energy balance sheet. **[CO:2]**
11) Heat balance on Multicylinder Diesel Engine. **[CO:2]**
12) Performance on Vapor Compression Refrigeration System (VCRS). **[CO:3]**
13) Performance on air-conditioning system. **[CO:4]**

Regular: - 6th Semester Practical

ME2353	Computer Aided Design LAB	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.	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.
2. Simple examples of two dimensional transformations
3. Simple examples on three dimensional transformations.
4. Programs on 2-D transformations- scaling, rotation, reflection and translation
5. 3-D Wireframe object modeling using any CAD software.
6. Generation of analytical curves using any CAD software
7. Generation of synthetic curves using any CAD software
8. Basics of surface modeling using Extrude, Revolve, fill, sweep, variable section sweep commands using any CAD software.
9. Creating fill surfaces, lofted multi-section surfaces, blended surfaces using any CAD software.
10. Analyzing the curve and surface quality using any CAD software.

11. Generation of at least two simple solid models showing geometric properties using any CAD software.
12. To generate at least two simple assembly model using any CAD software.
13. Solid model generation using feature based modeling using any CAD software
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

ME2354	Design of Mechanical Drives	L=3	T=0	P=3	Credits=3

Evaluation Scheme	MSE-I	MSE-II	MSE-II	TA	ESE	Total	ESE Duration
	15	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.

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.

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.

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.

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.

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.

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: - 6th Semester Open Elective-III Theory

ME2381	Operation Research Techniques	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
The course aims to develop the engineering - analysis capability for engineering-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.	After completion of this course, Students will be able to 1. Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method. 2. To Solve Transportation and Assignment Models and analyze the concept of dynamic programming to Solve problems of discreet and continuous variables. 3. Analyze projects for minimum total cost and smooth level of resources. 4. Evaluation of different replacement policies and its application in operation research and analysis of the application of simulation, inventory control model and waiting line model.

Syllabus

Unit 1

Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR. Linear programming solutions (LPP) by graphical methods and simplex method. Sensitivity analysis. **(CO-1) [7 hrs]**

Unit 2

Assignment Model and Transportation Model. **(C0- 2)** **[7 hrs]**

Unit 3

Dynamic programming - characteristics, approach and its formulations. Application of Dynamic programming

in Employment smoothening problem, Resource allocation, Inventory control & Linear programming. **(CO- 2)** **[6 hrs]**
Unit 4 Project Management: Network Scheduling by CPM & PERT, Cost considerations in PERT and CPM. **(CO- 3)** **[7 hrs]**
Unit 5 Replacement Models: Replacement of Models that deteriorate with time, Concept of equivalence , Interest Rate and Present worth. Replacement of items that fails suddenly considering Individual and Group replacement policy. **(CO- 4)** **[6 hrs]**
Unit 6 Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), Simulations, Monte- Carlo Simulation. Inventory Control with Deterministic models. **(CO- 4)** **[6 hrs]**

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
V	5ME1315	Operation Research Techniques	1.	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.	3				3	2			1				3	
			2.	To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.	3				2	3			3				3	
			3.	Analyze projects for minimum total cost and smooth level of resources.	3			2	2	2				2	3		3	
			4.	Evaluation of different replacement policies and its application in operation research and analyse of the application of simulation, inventory control model and waiting line mode.	3				2	2	1	1			2	3	3	

Text books:				
Sr. No.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Introduction to Operation Research: Computer Oriented Algorithmic approach	2007	Billy E.Gillet	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2	Operations Research	Third edition 2008	Prem Kumar Gupta & D.S. Hira	S. Chand& Co.
3	Operations Research: Theory and Applications	Second edition 2002	J.K. Sharma	Mac Millan
4	Introductory 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	Hamdy A. Taha	Prentice Hall of India Pvt. Ltd., New Delhi.

Regular: - 6h Semester Open Elective-III

ME2382	AUTOMOBILE ENGINEERING	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	(1)Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.
	(2) Student will be able to describe various power transmission systems from clutch to wheel in vehicle.
	(3) Student will be able to evaluate and describe control systems like steering and brakes in vehicle.
	(4) Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.

Syllabus

UNIT-1: [7 hrs]

- Introduction, Automobile history and development and classification. Vehicles layout.
- Engine Classification, construction and working 2 stroke and 4-stroke cycle.
- Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic)
- Engine cooling and lubrication systems. [CO-1]

UNIT-2: [6 hrs]

Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch.

Gear box: Necessity of gear box with gear theory, working principle, Classification: Sliding mesh, constant mesh, synchromesh, and Transfer case gear box, Gear Selector mechanism, Defects and remedies in Gear box. Working of CVT (Continuous variable transmission) [CO-2]

UNIT-3: [7 hrs]

- Transmission system: Propeller shaft, Universal joint, Hotchkiss drive, torque tube drive.
- Differential - Need and working principle and Differential lock.
- Rear Axles and Front Axles
- Wheel and Tyres: Classification, various constituents of tyres with cross section, specification, factors affecting tyre performance. [CO-2]

UNIT-4: [6 hrs]

- Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types.
- Brakes - Need, types: Mechanical, hydraulic (Master and wheel cylinder), Air brakes. Drum and Disc brakes, Comparison

- **Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber.** [CO-3]

UNIT-5: [6 hrs]

- **Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries.**
- **Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator , wiper.(only basic)**
- **Automobile air-conditioning,**
- **Panel board instruments.** [CO-4]

UNIT-6: [6 hrs]

- **Resistance to vehicle motion: Air, Road and gradient resistance and power calculation.**
- **Advances in automobiles such as ABS, Power Steering.**
- **Safety aspect in Automobile.**
- **Overall Vehicle specifications**
- **Servicing, Overhauling and Engine tune up.** [CO-4]

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
5		OE-1/III: Automobile Engineering	I.	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.	3	2												3
			II.	Student will be able to describe various power transmission systems from clutch to wheel in vehicle.	3	2												3
			III.	Student will be able to evaluate and describe control systems like steering and brakes in vehicle.	3	2												3
			IV.	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.	3			2					2					3

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

ME2383	OEI: Robotics and Subtractive Manufacturing	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
• Gain knowledge of Robotics and automation. • Understand the working methodology of robotics and automation. • Write the program for robot for various applications • To understand subtractive manufacturing • To implement CNC programs	On completion of course students will be able to • Understand working of subtractive manufacturing • Implement CNC programs for various product manufacturing • have knowledge of Robotics, automation, robotics motion, sensors, robotic programming and roles of robots in industry • Understand the working methodology of robotics and automation, motion and control, machine vision and programming, application of robots in industry.

Unit 1 **[7 hrs]**

Unit 1

Concepts of NC, CNC, DNC. Classification of CNC machines, MCU architecture and functionality, Machine Configurations, Types of control, CNC controller's architecture and characteristics, Interpolators.

Unit 2 **[8 hrs]**

Positioning system, Cutter offset compensation, Word address format, Introduction to G and M codes Manual part programming for CNC turning, milling and drilling.

Unit 3 **[8 hrs]**

Tooling system for Machining center and Turning center, work holding devices, of CNC Machines. APT part programming, CAD/CAM programming, Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM.

Unit 4

FUNDAMENTALS OF ROBOT **[7 hrs]**

Robot – Definition – Robot anatomy – Co-ordinate systems, work envelope, types and classification – Specifications – Pitch, yaw, roll, joint notations, speed of motion and pay load – Robot parts and their functions – Need for robots – Different applications..

Unit 5 **[8 hrs]**

ROBOT KINEMATICS

Forward kinematics – Inverse kinematics – Differences: Forward kinematics and Reverse kinematics of manipulators with two and three degrees of freedom (In 2 dimensional), four degrees of freedom (In 3 dimensional) – Deviations and problems ,Introduction to DH notations

Unit 6 **[7 hrs]**

ROBOT PROGRAMMING

Teach pendant programming – Lead through programming – Robot programming languages – VAL programming – Motion commands – Sensor commands – End effecter commands – Simple programs.

IMPLEMENTATION

Implementation of robots in industries – Various steps - Safety considerations for robot operations.

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
2	Industrial Robotics: Technology, Programming and Applications,	2012	Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta	2nd Edition, Tata McGraw Hill, 2012.
3	Automation in Production system	2002	Mikell P. Groover	Prentice-Hall of India Pvt. Ltd., New Delhi, 2002

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

1.

Regular: - 6th Semester **Open Elective - III Theory**

ME2384	Control Systems Engineering	L=3	T=1	P=0	Credits=3

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

Objective	Course Outcome :- 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.
	(II)Analyse the construction and working of various control system components and electrical motors.
	(III) Evaluate the performance of control system using time response analysis and stability analysis.
	(IV) Analyze the performance of control system on the basis of frequency response and design

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.

Unit 2 **[7 hrs]**

Representation of Control components: Mechanical and Electrical components; Analogous systems; Thermal and Fluid systems.

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.

Unit 4 **[8 hrs]**

Transient and steady state response of first and second order systems Concept of stability; relative stability; Routh stability criteria.

Unit5 **[8 hrs]**

Frequency response and its characteristics; Bode plots; Nyquist plots. Gain margin and phase margin. Identification of system transfer function.
Unit6 **[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.

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: - 6th Semester Open Elective-IV Theory

ME2391	Total Quality Management	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

COURSE OBJECTIVES	COURSE OUTCOMES
• The course aims to build an overall capability to understand Quality and its relevance in today's dynamic market. • Various Quality Improvement tools and technique shall be introduced and practiced so as to develop skills and knowledge to function as a good quality professional in the Engineering Profession.	1. Develop an understanding on quality management philosophies and frameworks. 2. Develop in-depth knowledge on various tools and techniques of quality management. 3. To Evaluate the applications of quality tools and techniques in both manufacturing and service industry 4. Ability to use quality management methods analyzing and solving problems of organization.

Unit 1 **[7 hrs]** Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering
Unit 2 **[7 hrs]** Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards.
Unit3 **[8 hrs]** Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA - YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design
Unit4 **[8 hrs]** Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes
Unit5 **[8 hrs]**

Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling,]
Unit6 **[7 hrs]** Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing

.Reference books:

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

6	Statistical Quality Control	1984	Grant E.L and Leavensworth	McGraw-Hill, 1984.

Regular: - 6th Semester Open Elective-IV Theory

ME2392	Reliability Engineering	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

Objective	Course Outcome
1.To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution. 2.Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.	(I) Student will be able to use reliability modeling as a tool for evaluating system performance.
	(II) Student will be able to analyze the failure of a machine, determine the failure rate of systems or components.
	(III) Student will able to understand importance of the maintenance of engineering systems and factors affecting maintainability.
	(IV) Student will be able to prepare the production & maintenance schedule of particular engineering system.

Unit 1 **[7hrs]**

Fundamental concepts:-
Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability,

Unit 2 **[8hrs]**

Probability theory:-
Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications.

Unit 3 **[7hrs]**

System reliability and modeling:
Series and parallel components, mixed configuration, complex systems. Redundancy, element

redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation.

Unit 4 **[8hrs]**

Maintainability and Availability:
Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation.

Unit 5 **[7hrs]**

System reliability Analysis:
Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing.

Unit 6 **[8hrs]**

Strength based reliability:
Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads.

. .Reference books:

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

Regular: - 6th Semester Open Elective-IV Theory

ME2393	POWER GENERATION ENGINEERING	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	**(1) Student will be able to describe basics of power generations systems.**
	(2) Student will be able to analyze various conventional & non-conventional power plants.
	(3) Student will be able to analyze and examine combined operations of different power plants.
	(4) Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant

Syllabus

Unit 1 **[7 Hrs]**

THERMAL POWER PLANT- I

Introduction to thermal power plants and power plant layouts. Site selection.

Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling.

- Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers **[CO-1]**

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. (visit to nearby power plant shall be arrange for the students) **[CO-2]**

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.Governing.

- Comparison with other power plant. **[CO-2]**

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 **[CO-3]**

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.

- Comparison with other power plant. **[CO-4]**

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. **[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
6	ME1333	OE-II: Power Plant	I.	Student will be able to describe basics of power generations systems.	**3**	**2**												**3**

		Engineering	II.	Student will be able to analyze various conventional & non-conventional power plants.	3	2											3
			III.	Student will be able to analyze and examine combined operations of different power plants.	3	2											3
			IV.	Student will be able to evaluate and describe_Hydroelectric power plant nuclear power plant	3			2					2				3

Reference books:				
S.N.	**Title of Book**	**Edition**	**Authors**	**Publication**
1	Power Plant Engineering	**2002**	Domkundwar.	Dhanpat Rai & Co.
2	Power Plant Engineering	**2007**	Vopal & Slortzki	
3	Power Plant Engineering	**2010**	P K Nag	

Regular: - 6th Semester Open Elective-IV Theory

ME2394	Project Evaluation & Management	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	MSE-III	TA	ESE	Total	ESE Duration
	15	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 economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	The students will be able 1. To apply the concepts of monitoring and evaluation, appraise 2. To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 3. to perform problem analysis, determine relevant indicators and data necessary for evaluation, 4. Implement a monitoring and evaluation process, establish baselines and targets..

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

Unit2 **[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:

Unit3 **[9 hrs]**

Economic feasibility: Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.

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

Unit 5 **[7 hrs]**

Project report: Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital

Unit6 **[8 hrs]**

Initial review, performance analysis, ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects.

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: - 6th Semester Professional Elective-I Theory

ME2361	FINITE ELEMENT METHOD	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	MSE-III	TA	ESE	Total	ESE Duration
	15	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.

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

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.

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.

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.

Unit 6 **[8 hrs]**

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

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

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	ME1 407	PE-III: Lab: FINITE ELEMENT METHOD	I.	**Study, analyse and develop the fundamentals of Finite Elements Method for mechanical engineering problems.**	3	3			3	2	1	1	2	1	1		3	1
			II.	**Evaluate the stresses, strains and deformation in simple machine elements and design solutions for simple problems.**	3	3	3		3	3	1	1		1	1	1	3	3
			III.	**Build the solutions using the commercial softwares for simple machine elements.**	3	3			3	2	1	1	2	1	2	1	3	3

ME 2362	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: - 6th Semester Professional Elective-I Theory

ME2363	INDUSTRIAL FLUID POWER	L=3	T=0	P=0	Credits=3

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

Objective	Course Outcome
• To understand the working principle of hydraulic and pneumatic components and its selection. • To design hydraulic and pneumatic circuits for different applications.	1) To **investigate** the hydraulic fluids and **apply** the fluid power laws and principals for **analysis** of simple fluid power system. 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. 3) To **design** and **examine** the fluid power system and to **compose** and **interpret** its circuit diagrams **using** standard symbols. 4) To **examine** the safety measures, maintenance, and trouble shooting for fluid power systems.

1. SYLLABUS:

Unit 1 **[5 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 and its application to hydraulics, Bernoulli's principle , continuity equation, analysis of simple hydraulic jack .

Types of Hydraulic fluid, petroleum based, synthetic & water based. Properties of fluids. Selection of fluids, additives, effect of temperature & pressure on hydraulic fluids, SAE grades and ISO viscosity numbers.

Filters, strainers, types and sources of contamination of fluid & its control, effects, ISO contaminant code.

JIC symbols/ISO Symbols for hydraulic & pneumatic circuits.

Hydraulic Reservoirs and Power Pack : functions and its elements, standard designs.

Unit 2 **[6 hrs]**

Pumps: Types, classification, principle of working & constructional details of pumps used in Hydraulic system such as 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.

Unit 3 **[5 hrs]**

Control Of Fluid Power: Necessity of pressure control, directional control and flow control valves, **methods of actuation of valves.**

Pressure Control Valves: Principle of pressure control valves, types, constructional features, direct operated, pilot operated, relief valves, pressure reducing valve, sequence valve.

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

Direction Control Valves: constructional features , types, 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

Unit 4 **[5 hrs]**

Actuators: Classification, constructional features and working, 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, cushioning, calculations of force, velocity and power from a cylinder. Design consideration for cylinders.

Unit 5 **[6 hrs]**

Design and analysis of Hydraulic Circuit such as:

1) Control of single and Double -acting hydraulic cylinder,
2) regenerative circuit,
3) pump unloading circuit,
4) double pump hydraulic system,
5) counter balance valve application,
6) hydraulic cylinder sequencing circuits,
7) cylinder synchronizing circuit using different methods,
8) hydraulic circuit for force multiplication;
9) speed control of hydraulic cylinder metering in, metering out and bleed off circuits.
10) Pilot pressure operated circuits.
11) Hydraulic circuit examples with accumulator /intensifier.

12) circuit to lift and hold heavy load,
13) Pressure control for cylinders,
14) Flow divider circuits

Safety precautions, maintenance and trouble shooting of Hydraulic Circuits.

Unit 6 **[6 hrs]**

Pneumatics:

Introduction to pneumatic power sources, Characteristics of compressed air , air compressors used and Components of pneumatic system.

Air preparation units, filters, regulators & lubricators and silencer. compressed air distribution system in a plant;

Actuators, linear, single & double acting, rotary actuators, air motors,

Pressure Regulating Valves, Directional Control Valves, Flow Control Valves.

methods of actuation, , use of memory valve, Quick exhaust valve, time delay valve, shuttle valve,

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical examples involving the use of logic gates.

Pneumatic circuits for industrial applications & automation.

3. Books recommended :

1. Introduction to Hydraulics and Pneumatics, 2nd. ed. by **Ilango** and Soundararajan, PHI.
2. Fluid Power with Applications by A. **Esposito**, 6th Ed, Pearson Prentice Hall.
3. Pneumatic Systems : Principles and Maintenance by S.R. **Majumdar**, Tata McGraw Hill.
4. Fluid Power and Control Systems by E. C. **Fitch**, Jr, Mc Graw Hill Book Co.
5. Industrial Hydraulics by Banks and Banks, Prentice Hall.
6. Oil Hydraulic Systems, Principle and Maintenance by S R **Majumdar**, McGraw-Hill.
7. **Srinivasan**. R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints Private Limited, 2011.
8. Fluid Power: Generation, Transmission and Control, **Jagadeesha** T., Thammaiah Gowda, Wiley.
9. Product Manuals and books from Vickers/ Eaton, FESTO, SMC pneumatics can be referred.

4. Reference Books:

1. Industrial Hydraulics by John **Pippenger** and Tyler Hicks, McGraw Hill.
2. William W.Reaves, "Technology of Fluid Power", Delmer Publishers, 1997.
3. Petor Rohner, "Fluid Power Logic circuit", Design Macmillon Press Ltd., 1990.
4. FESTO, "Fundamentals of Pneumatics", Vol I, II and III.
5. The Analysis & Design of Pneumatic Systems by B. W. **Anderson**, John Wiley.
6. Control of Fluid Power Analysis and Design by Mc Clay **Donaldson**, Ellis Horwood Ltd.
7. Hydraulic and Pneumatic Controls: Understanding made Easy, K.**Shanmuga** Sundaram, S.Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009)
8. Basic Pneumatic Systems, Principle and Maintenance by S R Majumdar, McGraw-Hill.
9. Basic fluid power Dudley, A. Pease and John J. Pippenger, , Prentice Hall, 1987
10. Thomson, "Introduction to Fluid power", Prentice Hall, 2004.
11. Pinches, Industrial Fluid Power, Prentice hall

Regular: - 6th Semester Professional Elective-I

ME 2364	PE- : Lab: INDUSTRIAL FLUID POWER	L=0	T=0	P=1	Credits=1

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

Objective	Course Outcome
• To understand the working principle of hydraulic and pneumatic components and its selection. • To design hydraulic and pneumatic circuits for different applications.	1. To **investigate** the hydraulic fluids and **apply** the fluid power laws and principals for **analysis** of simple fluid power system. 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. 3. To **design** and **examine** the fluid power system and to **compose** and **interpret** its circuit diagrams **using** standard symbols. 4. To **examine** the safety measures, maintenance, and troubleshooting for fluid power systems.

List of Experiments: Minimum Eight out of the following areas shall be performed:

A. Experiments on Hydraulics Circuits:

1. Extend-Retract and Stop system of a linear actuator.

2. Regenerative circuit.

3. Speed Control circuits: meter-in, meter-out and bleed off.

4. Sequencing circuit

5. Use of solenoid operated DCV.

6. Traverse and Feed circuit.

B. Experiments on Pneumatic Circuits:

7. Study of Compressor, FRL unit and 5/3 DCV.

8. Reciprocating motion of a single and a double acting actuators.

9. Speed control circuits.

10. Automatic to & fro motion of a pneumatic linear actuator.

11. Sequencing circuit.

12. Logical circuits.

Other practical work:

13. Design **report** of a hydraulic or pneumatic system using **manufacturer's catalogue**.

14. Study of accumulators and intensifiers.

15. **Industrial visit** to study automation by means of hydraulic and pneumatics such as LPG bottling plant etc

16. Study of **compressed air generation and distribution** systems.

17. Study of **simple hydraulic systems** used in practice such as hydraulic clamps, jack, dumper, forklift etc.

18. **Other circuits possible on the trainer kit, relevant to the syllabus**

C. Students should build up the above circuits on computer using software and simulate the flow of fluid during the operation if possible. Afterwards, they themselves can physically connect the circuit on the hydraulic/pneumatic trainer and run the circuit.

Major Equipment:

1. A hydraulic trainer

2. A pneumatic trainer

3. Simulation Software (not mandatory)

List of Open Source Software/learning website:

1. Autosim Premium

2. Hydrosym

ACTIVE LEARNING ASSIGNMENTS:

Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered.

Regular: - 6th Semester Professional Elective -1 Theory

ME2365	PE I : I.C.Engines	L=3	T=0	P=2	Credits=3

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

Objectives:	Course Outcome
To understand basic working cycles, types and development of I.C. Engines. To study the various systems related to I.C. Engines. To understand testing and performance of Engines. To study fuels, combustion, pollution and its control of engines..	***On completion of this course, the student will be able :*** Student should able to analyze basic working cycles, construction and and systems of I.C. Engines. Student should able to analyze fuels, combustion process, pollution and its control of engines. Student should able conduct a trial for Engine performance evaluation.

Syllabus:

UNIT 1 **[7 HRS]**

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 Lubrication systems, cooling systems and their importance.

UNIT 2 **[8 HRS]**

I.C.Engines fuel and its desirable properties. Requirements of S.I and C.I. Engine fuel

Other fuel like CNG, LPG, Alcohols Rating of I.C. engine fuels

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 .

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.

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.

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.

Air pollution from I.C.Engines and their control using EGR, Catalytic converters, particulate traps.

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
VI		PE I : I.C.Engines PE I : I.C.Engines	1															
			2															
			3															
			4															

.**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: - 6th Semester Lab.

ME2366	PE I : I.C. Engines LAB	L=0	T=0	P=2	Credits=1

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

List of Practical

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

Regular: - 6th Semester Theory

ME 2367	Refrigeration & Cryogenic	L=3	T=0	P=0	Credit=3

Evaluation Scheme	MSE-I	MSE-II	MSE-III	TA	ESE	Total	ESE Duration
	15	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** **[8 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** **[7 Hrs]**

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

UNIT IV **Components of Vapour compression system** **[8Hrs]**

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** **[7 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 **[8 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: - 6th semester **Practical**

ME2368	**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]

Regular: - 6th Semester Elective-I Theory

ME2369	Computer Integrated Manufacturing	L=4	T=0	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	MSE-III	TA	ESE	Total	ESE Duration
	15	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.	**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.

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

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

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.

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

Unit 6 **[5 hrs]**

Totally integrated process planning systems, Integration of CNC robotics for CIM, Agile manufacturing, Nano Manufacturing. Simulation

.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: - 6th Semester Elective-I Practical

ME2370	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.	**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.
2. Study of CAD systems
3. Numerical control – Fundamental & Application
4. CNC- Lathe – Features, Specification, & Part Program.
5. CNC- Milling – Features, Specification, & Part Program.
6. Group Technology.
7. FMS & CIM.
8. Computer Aided Process Planning.

9. Manual Part Programming.
10. APT Part Programming.
11. Robots Fundamental and Applications
12. AGVS- Fundamental and applications
13. CNC Lathe – Programming, Simulation & Actual Machining of Part.(Thread Cutting , Facing , Turning , Grooving etc.)
14. CNC Milling – Programming , Simulation & Actual Machining of Part. (Profile Cutting , Various Interpolation , Pocketing , Mirroring etc.)
15. Programming , Simulation of Robot.

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

ME1483	Cryogenic 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 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

1. Introduction to Cryogenics and its applications.

2. Properties of cryogenic fluids.
3. Properties of materials at cryogenic temperature.
4. Gas-Liquefaction and Refrigeration Systems.
5. Gas Separation.
6. Cryocoolers.
7. Cryogenic Insulations.
8. Vacuum Technology.
9. Instrumentation in Cryogenics.
10. Cryostat design.

COURSE OUTLINE

This course assumes that the students have undergone UG courses in Engineering Mathematics, Thermodynamics, Heat Transfer and Refrigeration. The purpose of this course is to give introductory knowledge of cryogenic Engineering. The course also gives detailed knowledge of cryocoolers, on which research is going on world wide. The treatment is both theoretical and mathematical. The course will interest students wishing to embark on a research career in Cryogenic Engineering.

6th Semester

EL1311	PE-I: Advanced Power Electronics	L= 3	T=0	P=0	Credits=3

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

Course Objective	Course Outcomes
To study soft switching and various soft switched converters, Multilevel inverters, Pulse Width modulation with different modulation strategies are covered.	1) To gain the knowledge of semi conductor devices regarding their structure and operation. 2) Concept of converters which uses the special switching techniques. 3) Operation of different multilevel and hybrid multilevel inverter topologies. 4) Various types of modulation techniques, their significance, implementation and applications. 5) Causes, effects and remedies of different power quality problems. 6) Various types of harmonics, their measuring indices and elimination methods.
Mapped Program Outcomes: a,b,c,d,f,j	

UNIT-1: Power Semiconductor Devices

Power Semiconductor Devices: Metal Oxide Turn off thyristor (MTO), Metal oxide Controlled Thyristor (MCT), Emitter Turn off Thyristor (ETO), Static Induction Thyristor (SIT). Injection enhanced gate transistors (IEGT), integrated gate commutated thyristor (IGCT).

UNIT-2: Hard Switched and Soft Switched Converters

Hard Switched and Soft Switched Converters: Load Resonant Converters, Series, Parallel & Hybrid Loaded Converters, Resonant Switch Converter, Zero Current, Zero Voltage switched Resonant Converter, DC-DC Resonant link inverters, Hybrid resonant link inverters.
AC Voltage Controller: Single phase and three phase controllers, Voltage Regulators.

UNIT-3: Multilevel Inverters

Multilevel Inverters: Diode Clamped Inverters, Flying Capacitor Inverters, Cascaded multilevel Inverters and Hybrid Cascaded Inverter. Introduction to latest multilevel inverter topologies.

UNIT-4: Modulation Techniques

Modulation Techniques: Pulse Width Modulation, Selective Harmonic Elimination (SHM), Space Vector Pulse Width Modulation (SVPWM), Random PWM.

UNIT-5: Power Quality

Power Quality: Overview, Definition, Sources of Pollution, Power quality Problems, Rapid Voltage Fluctuations, Voltage Unbalance, Voltage Dips and Voltage Swells and Short Duration Outages.

UNIT-6: Harmonics

Harmonics: Effects within power system, Interference with Communication Harmonic Measurements and Elimination of Harmonics.

Text Books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics	1989	Ned Mohan, T.M. Undeland and W.P. Robbins	John Wiley and Sons,Inc
2	**Power Electronics Circuit's** Devices and Applications	3rd Edition 2004	M.H. Rashid	Prentice Hall India
3	Power Electronics and AC Drives	2003	B.K. Bose	Pearson Education

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Semiconductor Circuits	1984	S.B. Dewan and Straughen	John Wiley and Sons, Inc.

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Department of Electrical Engineering

Semester VI (EL1327)

Name of Subject: - Illumination Engineering

Unit I: -
Radiation & Color (2 Lectures)
Eye & Vision (2 Lectures)
Different entities of illuminating systems (2 Lectures)

Unit II:
Light sources: daylight, incandescent, electric discharge, fluorescent, arc lamps and lasers – 4 Lectures
Luminaries, wiring, switching & control circuits – 3 Lectures

Unit III:
Laws of illumination; illumination from point, line and surface sources – 2 Lectures
Photometry and spectrophotometry; photocells – 2 Lectures
Environment and glare – 2 Lectures.

Unit IV:
General illumination design – 2 Lectures.
Interior lighting – industrial, residential, office departmental stores, indoor stadium, theatre and hospitals – 4 Lectures.

Unit V:
Exterior lighting- flood, street, aviation and transport lighting, lighting for displays and signaling-neon signs, LED-LCD displays beacons and lighting for surveillance - 4 Lectures.
Utility services for large building/office complex & layout of different meters and protection units – 3 Lectures.

Unit VI:
Different type of loads and their individual protections – 2 Lecture.
Selection of cable/wire sizes; potential sources of fire hazards and precautions. Emergency supply – standby & UPS – 4 Lectures.
A specific design problem on this aspect - 2 Lectures
Reference: NPTEL (MOOCS Course)

		June 2020	1.02	Applicable for AY 19-20 Onwards
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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

III SEMESTER

EL2202	Lab. : Electronics Engineering Workshop		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total		ESE Duration
	--	40	60	100		---

Course Objective	Course Outcomes
To expose printed circuit board (PCB) design, fixing of components on PCB, testing of components and circuits	1. This course gives the basic introduction of electronic hardware systems. 2. It provides hands-on training with familiarization, identification, testing, assembling, dismantling of various components. 3. Student can identify the active and passive electronic components 4. Testing of electronics components like Resistor, Capacitor, Diode, Transistor, UJT and JFET using multimeter. 5. PCB fabrication and repairing such systems by making use of the various tools and instruments available in the Electronics Workshop.

Mapped program outcomes							

Practical based on following topics :-

Minimum eight practical based on following are to be set up :-

Expt. No.	Experiments based on
01	Design and fabrication of PCB
02	Design of voltage regulators
03	Design of different timers using operational amplifiers.
04	Study and testing of diodes
05	Study and testing of transistors
06	Study and testing of MOSFET, IGBT
07	Study and testing of Thyristor, power diodes
08	Study and testing of power transistors
09	Study and testing of operational amplifiers, LEDs.ICs etc

III SEMESTER

EL2204	Lab. : Electrical Machines		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total		ESE Duration
	--	40	60	100		---

Course Objective	Course Outcomes
	The student will be able to understand the 1. Circuit connections, selections of measuring instruments and their 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 :-

Expt. No.	Experiments based on
01	To perform load test on 1-phase transformer to determine its efficiency and voltage regulation.
02	To perform Open Circuit and Short Circuit tests on a 1-phase transformer to evaluate efficiency and voltage regulation.
03	To perform back to back test on two identical 1-phase transformers.
04	To study conversion of a 2-winding transformer into an autotransformer.
05	To study phasing out and polarity marking of a 3-phase transformer.
06	To study voltage and current relations in a 3-phase, Delta-Star connected transformer.
07	To perform Open Circuit and Short Circuit test on a 3-phase transformer.
08	To plot magnetization characteristic of a DC generator.
09	To study speed control of a DC shunt motor by varying – (a) field excitation and (b) armature voltage
10	To perform load test on a DC shunt motor.
11	To study measurement of slip of a 3-phase induction motor by different method.
12	To study control of a 3-phase slip-ring induction motor by – (a) variation of a rotor resistance and (b) varying supply voltage
13	To perform load test on a 3-phase induction motor by indirect loading.
14	To perform load test on a 3-phase induction motor by direct loading.
15	To perform No-Load and Blocked rotor tests on a 3-phase induction motor.
16	To perform No-Load and Blocked rotor tests on a 1-phase induction motor.
17	To study Induction generator operation.

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BE SoE and Syllabus 2018

ELECTRICAL ENGINEERING

III SEMESTER

EL2206	Lab.: Computer Programming		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total		ESE Duration
	--	40	60	100		---

Course Objective	Course Outcomes
To make the student familiar with the application of MATLAB using programming and simulink.	1) The inbuilt functions, keywords, concepts of drawing and using the various toolbars in SCILAB programming. 2) To design the matrix operation and mesh analysis which generally using in mathematical operation. 3) The various conditions like for loop, while loop and if else loop which are used in decision making statement. 4) The RL series circuit which is the basic concept in basic engineering. 5) The differential equations used in mathematical operation. 6) The design of 2-D and 3-D plots.

Mapped program outcomes								

Minimum Eight Practical are to be performed from the following :-

Expt. No.	List of Experiments
01	Program to demonstrate the script file and elementary matrix manipulations
02	Program to demonstrate indexing of matrices.
03	Program to create function and calling functions
04	Program to solve linear differential equations
05	Write a function that returns the two roots of a quadratic equation, given the three arguments a, b and c. Test the function from the command line
06	Write a function that returns the mean and standard deviation of a vector of numbers (input vector). While Matlab supplies the mean() and std() functions, try just using the sum() and length() functions.
07	Write a function that reverses the order of letters in a string, and returns the new string.
08	Use the eval() Matlab function to evaluate strings such as: exp1 = „5*6 + 7"; Note this, and feval(), is very useful for dynamic programming
09	Use a cell array to store a list of expressions, stored as strings. Then use eval() and a for loop to iterate over the expressions and evaluate them.
10	Create the vector 0:pi/20:2*pi and use it to sample the sin() function. Plot the results and edit the figure window to put labels on the figure. Save the figure (.fig) and export a .jpg file.
11	Use the meshgrid() function to sample a 2 dimensional input space between 0 and 2p, then use the data to sample the function $\sin(x_1)*\cos(x_2)$. Plot the results using the mesh() function.
12	Create a GUI that prompts the user for a number and then displays double that number next to the entered value.
13	Start Simulink and using a sin() **source** and a **scope sink**, view the signal over 10 seconds.
14	Change the frequency of the sin() source and again compare the results. Next change the simulation length.
15	Build the first order system H(s) = 1/(1+3s) in the model and pass a sin() signal through the system. Make sure you run the simulation for a long enough time for the transients to die down and the system to settle. Replace the first order system with the second order system, what is the difference when the system settles down H(s) = 1/(1+2s+s^2).
16	We need to simulate the resonant circuit and display the current waveform as we change the frequency dynamically

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ELECTRICAL ENGINEERING

III SEMESTER

EL2208	Lab: Electrical Measurement & Instrumentation	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration
	-	40	60	100	--

Course Objective	Course Outcomes
	The student will be able to understand 1) Measure resistance, capacitance, and inductance using AC and DC bridges 2) Calibrate single phase energy meter 3) Determined the characteristics of RTD,themistor,pressure and transducer 4) Measure the active and reactive power using different types of method

Mapped program outcomes	a	b	c	f	g	h	j

Minimum Eight Practical are to be performed out of the following :-

Expt. No.	Experiments based on
01	To measure high resistance using loss of charge method.
02	To measure low resistance using Kelvins" double bridge.
03	To measure inductance using Maxwell"s inductance capacitance bridge.
04	To measure inductance using Anderson"s bridge.
05	To measure three phase power using two wattmeter method
06	To measure electrical energy using electromechanical energy meter.
07	Determination of self inductance using Owen"s bridge.
08	Testing of single phase induction type energy meter.
09	Measurement of reactive power in balanced three phase ac circuit using single wattmeter.
10	Study of Pressure gauge.
11	Study of Strain gauge.
12	To measure Torque using sensors.
13	To study first order response of filters- (i) High pass filters (ii) Low pass filters (iii) Notch filter.
14	Study of an instrumentation amplifier.
15	Study of Cathode Ray Oscilloscope.
16	Draw the characteristics of LVDT.
17	Measurement of distance by ultrasonic transducers.
18	Draw the characteristics of RTD, Thermo couple and Thermistor.

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
GE2201 - Engineering Mathematics III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform, Z transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	The student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

Unit I: Finite Differences
Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients. **(6 hours)**

Unit II: Laplace Transform
Laplace Transforms: Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations . **(7 hours)**

Unit III: Z-transform
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient. **(6 hours)**

Unit IV: Fourier Series
Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions **(7 hours)**

Unit V: Partial Differential Equation
Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(7 hours)**

Unit VI : Fourier Transform : Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem. **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	Laxmi Prakashan

3rd SEMESTER

EE2201	Electronic Devices		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes
1. The purpose of this course is to present a clear consistent picture of the internal physical behaviour of many electronic devices so that their studies of electronic circuit and system will be meaningful. 2. The purpose of this course is to introduce to the students, the basics of biasing of transistor circuits, feedback amplifiers & analyzing different two port devices.	Students will be able 1. To understand the concepts of Energy Bands, Charge Carriers and various semiconductor devices like diodes and BJT 2. Be familiarized with semiconductor device fabrication processes. 3. To understand various configurations and their characteristics for BJT and MOSFET amplifiers 4. To understand the concepts of Stabilization and operating points of BJT and MOSFET amplifiers

Unit I: Energy Bands and Charge carriers in Semiconductors
Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations.

Unit II: Diode and its applications
PN junction diode, diode equation, The Volt-Ampere Characteristics, The Temperature Dependence of the Characteristics, Diode Resistance, Diode Circuits: DC Analysis and Models, AC Equivalent Circuit, Zener breakdown, avalanche breakdown, Clipping, Clamping, Rectifier circuits, Basic Design of DC Power Supply ,Tunnel Diode, Schottky Barrier Diodes, Varactor Diodes, LED, photo diode and solar cell.

Unit III: Device Fabrication Process
Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

Unit IV: Bipolar Junction Transistor and its Configurations
Bipolar Junction Transistor Construction, Operation, The Common-Base Configuration and its Characteristics, The Common-Emitter Configuration and its Characteristics, Common-Collector Configuration and its Characteristics, Transistor as an Amplifier and Switch.

Unit V: MOSFET and its Configurations
MOS Field-Effect Transistor, Two-Terminal MOS Structure, n-Channel Enhancement-Mode MOSFET, Ideal MOSFET Current–Voltage Characteristics—NMOS Device, p-Channel Enhancement-Mode MOSFET, Ideal MOSFET Current–Voltage Characteristics—PMOS Device.

Unit VI: BJT and MOSFET Amplifier Configurations
Common Emitter, Common Base, Common Collector Common-Source Circuit, Common-Drain Circuit, Common-Gate Circuit, Biasing.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Devices and Circuits Theory	BoyleSted, Nashelsky,	10th Edition.	Pearson
2	Microelectronics Circuit Analysis and Design	Donald Neaman	4th Edition	McGraw Hills, 2010
3	Op-amps and linear integrated circuits,	R. A. Gayakwad	3rd edition	PHI, 1995

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Integrated Electronics,	MillManHalkias	3rd reprint, 2007.	Tata McGraw Hil
2	Microelectronics Circuits	Sedra Smith	6th Edition	Oxford Uni. Press

3rd SEMESTER

EE2202	Lab : Electronic Devices	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Course Objective	Course Outcomes
↗ 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 of transistor circuits, feedback amplifiers & analyzing different two port devices.	Students will be able 1. To understand the concepts of Energy Bands, Charge Carriers and various semiconductor devices like diodes and BJT 2. Be familiarized with semiconductor device fabrication processes. 3. To understand various configurations and their characteristics for BJT and MOSFET amplifiers 4. To understand the concepts of Stabilization and operating points of BJT and MOSFET amplifiers

Expt. No.	Name of Experiment
1	To plot the V- I characteristics of PN junction diode (Silicon and Germanium) and perform simulation in LT-Spice.
2	To plot the V- I characteristics of Zener shunt regulator.
3	To determine the Ripple factor and efficiency of Half wave and full wave rectifier with and without capacitive filter and perform simulation in LT-Spice.
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	Analysis of Fixed Bias circuit of transistor.
7	Analysis of Self Bias circuit of transistor
8	To plot the Drain and Transfer characteristics of Field Effect Transistor (FET) in CS mode.
9	To plot the Drain and Transfer characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET) in CS mode.
10	Mini Project

3rd SEMESTER

EE2203	Signals & Systems	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

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

Course Objective	Course Outcomes
↙ 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. ↙ To enable the students, their time and Frequency characteristics.	Students will be able to 1. Classify continuous time signals and systems, transformation of independent variable. 2. Analyze Fourier series, Fourier transform representation of continuous-time periodic and aperiodic signals. 3. Determine and evaluate Laplace Transform of continuous time signals. 4. Analyze time & frequency characterization of Signals and Systems & Sampling Theorem

Unit I: Continuous and Discrete time signals **[6 hr]**
Signal representation, Transformation of the independent variable, classification of signals, Signal Energy and Power, Periodic, Even & Odd, Real and Exponential Signals

Unit II: Continuous and Discrete time System [6 hr]
Continuous-Time Systems, system properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, convolution

Unit III: Fourier Series Representation of Periodic Signals [6 hr]
Fourier Series Representation of Continuous-Time Periodic Signals, convergence of the Fourier Series.

Unit IV: Fourier Transform [6 hr]
Convergence of Fourier Transform and its Properties, Representation of Aperiodic Signals, The Fourier Transform for Periodic Signals. Analysis and Characterization of LTI Systems using the Fourier Transform.

Unit V: The Laplace Transform [6 hr]
The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. The Unilateral Laplace Transform

Unit VI: Z transform [6 hr]
The Z Transform. The Region of Convergence for Z Transforms. The Inverse Z Transform. Properties of the Z Transform. Analysis and Characterization of LTI Systems Using the Z Transform

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Signals and Systems	Alan V. Oppenheim, Alan S. Willsky, with S. Hamid	2nd Edition, 1996	Prentice Hall
2	Digital signal processing –Principles, algorithms and applications	J. G. Proakis, D. G. Manolakis	3rd Edition, 1996	PHI

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Outline of Signals and Systems	Hwei Hsu,Schaum's	1st Ed 1995	McGraw-Hill
2	Signals & Systems	Simon Haykin and Van Veen	2nd Edition, 2002	Wiley
3	Signals & Systems Analysis Using Transformation Methods & MAT Lab	Robert	2003	TMH
4	Signals, Systems and Transforms	C. L. Philips, J.M.Parr and Eve A.Riskin	3rd Edition, 2004.	
5	Signals & Systems	I.J.Nagrath, S.N.Sharan, R.Ranjan, S.Kumar	2001	Pearson education

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

3rd SEMESTER

EE2204	Lab : Programming Language		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	10	60	100	---	

Course Objective	Course Outcomes
1. To understand Python is a useful scripting language for developers. 2. To learn how to design and program Python applications.	1. To understand syntax and semantics of language 2. To understand and apply the basics of the programming language 3. To understand and apply special language features 4. To develop any application

Expt. No.	Name of Experiment
1	Write, test, and debug simple Python programs
2	Implement Python programs with conditionals and loops
3	Develop Python programs step-wise by defining functions and calling them.
4	Develop Python programs step-wise by Python lists
5	Develop Python programs step-wise by Python tuples
6	Develop Python programs step-wise by Python dictionaries for representing compound data.
7	Read and write data from/to files in Python.
8	Application Development

EE2205	Digital Logic Design		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes
⇗ Develop a strong foundation of digital electronics. ⇗ Understand concepts of combinational and sequential circuits. ⇗ Develop and design synchronous circuits and sequential machines.	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods. 2. Understand and apply the concept of combinational logic circuits in various digital systems. 3. Understand and demonstrate the various codes and illustrate concept of logic family with their characteristics. 4. Understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

Unit I: **(7 Hr)**

Number Systems and IEEE Floating point representations, 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.

Unit II: **(6 Hr)**

Combinational Circuits: Minimization methods: Incompletely specified functions, Karnaugh map, Quine McClauskey methods.

Unit III: **(7 Hr)**

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, Functions & its implementation using Multiplexer, Demultiplexer, Encoder, Decoder,

Unit IV: **(6 hr)**

Combinational circuits design using MSI and LSI chips, PLA's ,Parity Checkers and generators, Introduction to Logic families & their characteristics such as Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin.

Unit V: **(7 Hr)**

Sequential circuits: Latches and flip-flops: RS-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF's, Excitation & Truth Table, Flip-flop conversions, Shift registers. Introduction to Synchronous, Counters: Ring counter, Johnson counter, Ripple counter, Design of synchronous counter.

Unit VI: **(7 Hr)**

Classification of synchronous machines, Design of synchronous sequential machines using Moore & Mealy circuits: Sequence detector, State diagram, State reduction (Method of Partitioning) and implementation.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Digital Circuits & Microprocessors	Hebert Taub	1988.	Mc Graw Hill
2	Switching Theory & Finite Automata	Zvi Kohavi	2nd edition 2004	Mc Graw Hill

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Fundamentals of Logic Design	C.H.Roth	7th edition 2014.	Public Work & Services
2	Modern Digital Electronics	RP Jain	3rd Edition	Tata McGraw Hill
3	Digital Design	M. Morris Mano	4th edition 2008	Prentice Hall of India

Chairperson	Dean (Acad. Matters)	June 2019	1.00	Applicable for AY 2019-20 Onwards
		Date of Release	Version	

3rd SEMESTER

EE2206	Lab : Digital Logic Design	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Course Objective	Course Outcomes
↗ Develop a strong foundation of digital electronics. ↗ Understand concepts of combinational and sequential circuits. ↗ Develop and design synchronous circuits and sequential machines.	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods. 2. Understand and apply the concept of combinational logic circuits in various digital systems. 3. Understand and demonstrate the various codes and illustrate concept of logic family with their characteristics. 4. Understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

Expt. No.	Name of Experiment
1	Introduction to SPICE Digital model and commands.
2	Finding out Vohmin, Volmax, Vihmin, Vilmax,Delay Td, Power Supply Range (using SPICE)
3	Finding out Vohmin, Volmax, Vihmin, Vilmax, Delay Td, Power Supply Range (using Hardware)
4	Verify basic Logic gates, MUX, DeMUX, Truth Tables(using SPICE and using Hardware)
5	To Implement Coder decoder (using SPICE and using Hardware)
6	To Implement & verify adder circuits.
7	To Implement & Verify parity checkers circuit (using SPICE and using Hardware)
8	To verify the truth table of all flip-flops. (using SPICE and using Hardware)
9	To Design binary synchronous/asynchronous counter. (using SPICE and using Hardware)
10	To Design Finite State Machine (using SPICE and using Hardware)

EE2207	Network Analysis		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes
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: ↙ To understand basic of circuits elements and energy sources ↙ To know the fundamental theory and Mathematics for the analysis of electrical circuits.	On successful completion of this course, students should be able to: 1. Apply and analyze nodal and mesh analysis on circuits 1. Apply network theorems initial and final conditions to analyze circuits 2. Understand, apply and analyze circuits in transform domain 3. Apply the concept of two – port networks to find different two-port parameters.

UNIT-1: **Nodal Analysis of Electric Circuits**

Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources - their types and characteristics, concept of equivalent sources, source transformation and duality, 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 super mesh 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, behaviour 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 behaviour from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-6: Two Port Parameters

Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, 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:

SNo	Title	Authors	Edition	Publisher
1	Network Analysis	M. E. Van Valkenburg	3rd Edition	PHI Learning Private Limited.
2	Circuits and Network	Sudhakar, A., Shyammohan, S. P.;		Tata McGraw-Hill New Delhi
3	–Engineering Circuit Analysisll	A William Hayt	8th Edition	McGraw-Hill Education.

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

3rd SEMESTER

EE2208	Lab : Network Analysis		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	10	60	100	---	

Course Objective	Course Outcomes
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: ↗ To understand basic of circuits elements and energy sources ↗ To know the fundamental theory and Mathematics for the analysis of electrical circuits.	On successful completion of this course, students should be able to: 1. Apply and analyze nodal and mesh analysis on circuits 2. Apply network theorems, initial and final conditions to analyze circuits 3. Understand, apply and analyze circuits in transform domain 4. Apply the concept of two – port networks to find different two-port parameters.

Expt. No.	Name of Experiment
1	Introduction To PSPICE Software.
2	SPICE Models for various components. Verification of Kirchhoff's law.
3	SPICE Models for various sources. Perform nodal analysis on complex electrical circuits
4	Perform mesh analysis on complex electrical circuits.
5	Verification of Superposition Theorem.
6	SPICE Analysis Methods. Verification of Thevenin's Theorem.
7	SPICE Analysis Methods. Verification of Norton's theorem.
8	SPICE Analysis Methods .Verification of Maximum power transfer theorem.
9	SPICE Analysis Methods .Determinations of Transfer function of Two port network.
10	Determination of Z & Y parameters of Two Port Network.

IV Semester

GE2204 - Advanced Mathematical Techniques

Objective	Outcomes Students will be able to
• To introduce various Numerical Methods to solve algebraic and differential equations • To understand the concept of Probability distribution • To introduce the concept of Fuzzy Set theory and functions • To make aware of different optimization techniques	• Utilize numerical techniques to obtain approximate solutions of mathematical equations • Measure the Statistical parameters for random variables • Explain the basic concept of fuzzy sets, Relations and fuzzy logic. • Design and determine the solution of linear programming problems

Unit I:

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 Raphson method and their convergence **Numerical Methods System of Algebraic Equations**: Solution of System of linear equations, Gauss- Seidel method, Crouts method. **(7 hours)**

Unit II:

Numerical Methods for Differential 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. **(6 hours)**

Unit III:

Random Variables and Probability Distribution: Discrete and continuous random variables, probability density function of one and two variables, Probability distribution function of one and two variables, Joint distributions and conditional distributions. **(6 hours)**

UNIT IV:

Mathematical Expectation: Definition of mathematical expectation, functions of one and two random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis. **(7 hours)**

UNIT V:

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. **(7 hours)**

Unit VI:

OPTIMIZATION TECHNIQUES: Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method. **(6 hours)**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition (2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
GE2204 - Advanced Mathematical Techniques

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers
6	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	LaxmiPrakashan

4th SEMESTER

EE2251	Electronic Circuits		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Objective	Outcomes
The purpose of this course is to present a clear consistent picture of the high frequency behavior of BJT and MOSFET based amplifiers and classification based on different modes of working so that their studies of electronic circuit and system will be meaningful.	1. Students will be able to know the low frequency parameters and analysis of BJT, MOSFET and its configuration. 2. Students will be able to know the high frequency parameters and analysis of BJT, MOSFET and its configuration. 3. Students will be able to analyze amplifiers with and without feedback. 4. Students will be able to analyze Power amplifier and Oscillators.

Unit I: BJT Amplifiers (Low frequency: (Single and Multi-stage)
The Bipolar Linear Amplifier, Graphical Analysis and ac Equivalent Circuit, Small-Signal Hybrid-π Equivalent Circuit of the Bipolar Transistor, Small-Signal Voltage Gain, Hybrid-π Equivalent Circuit, Including the Early Effect, Other Small-Signal Parameters and Equivalent Circuits, Basic Transistor Amplifier Configurations, Common-Emitter Amplifiers, Ac Load Line Analysis, Common-Collector (Emitter-Follower) Amplifier, Common-Base Amplifier, Multistage Amplifiers.

Unit II: MOSFET Amplifiers (Low frequency: Single-Stage)
The MOSFET Amplifier, Graphical Analysis, Load Lines And Small-Signal Parameters, Small-Signal Equivalent Circuit, The Common-Source Amplifier, The Common-Drain (Source-Follower) Amplifier, The Common-Gate Configuration, Multistage Amplifiers

UNIT III: Transistor Amplifiers at High-frequency
Amplifier Frequency Response, System Transfer Functions, Transistor Amplifiers With Circuit Capacitors, Frequency Response: Bipolar Transistor, Expanded Hybrid- π Equivalent Circuit, Short-Circuit Current Gain, Cut-off Frequency, Miller Effect.

UNIT III: MOSFET Amplifiers at High-frequency
The MOSFET Amplifiers: Common Source Amplifier, Common Drain Amplifier, High-Frequency Equivalent Circuit, High-Frequency Response of MOSFET Circuits, Multistage MOSFET Amplifiers.

UNIT V: Feedback Configurations
Basic Feedback Concepts, Feedback Topologies, Analysis of Voltage-Series, Voltage-Shunt, Current- series and Current Shunt feedback amplifiers, Oscillators: Barkhausen's criterion, RC phase shift oscillators, Wien bridge, Tuned Oscillators: Hartley, colpitts, crystal Oscillators

UNIT VI: Power Amplifiers
Power Amplifiers, Power Transistors, Power MOSFETS, Heat Sinks, Classes Of Amplifiers, Class-A Operation, Class-B Operation, Class-AB Operation, Class-C Operation, Class-A Power Amplifiers, Inductively Coupled Amplifier, Transformer-Coupled Amplifiers, Class-AB Output Stage.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Devices and Circuits Theory	BoyleSted, Nashelsky,	10th Edition.	Pearson
2	Microelectronics Circuit Analysis and Desig	Donald Neaman	4th Edition	McGraw Hills, 2010
3	Op-amps and linear integrated circuits,	R. A. Gayakwad	3rd edition	PHI, 1995

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Integrated Electronics,	MillManHalkias	3rd reprint, 2007.	Tata McGraw Hil
2	Microelectronics Circuits	Sedra Smith	6th Edition	Oxford Uni. Press

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

4th SEMESTER

EE2252	Lab : Electronic Circuits	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	--	10	60	100	---

Objective	Outcomes
The purpose of this course is to present a clear consistent picture of the high frequency behavior of BJT and MOSFET based amplifiers and classification based on different modes of working so that their studies of electronic circuit and system will be meaningful.	1. Students will be able to know the low frequency parameters and analysis of BJT, MOSFET and its configuration. 2. Students will be able to know the high frequency parameters and analysis of BJT, MOSFET and its configuration. 3. Students will be able to analyze amplifiers with and without feedback. 4. Students will be able to analyze Power amplifier and Oscillators.

Exp No	Name of Experiment
1.	Evaluation of small signal h and π-parameter using BJT.
2.	To Plot the Frequency Response of single stage RC coupled CE amplifier with feedback
3.	To Plot the Frequency Response of single stage RC coupled CE amplifier without feedback
4.	To simulate the Frequency Response of single stage RC coupled CE amplifier on LT-spice.
5.	To Plot the Two stages RC coupled amplifier with voltage series feedback.
6.	To simulate the Frequency Response of Two stage RC coupled CE amplifier on LT-spice.
7.	To simulate the Frequency Response of Common Source MOSFET Amplifier on LT-spice.
8.	To determine the efficiency of Class B push pull power amplifier and to study cross over distortion.
9.	To determine the phase shift in RC phase shift oscillator.
10.	Mini project

4th SEMESTER

EE2253	Microcontroller & its Applications		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Objective	Outcomes
To provide the acquaintance with concepts of inbuilt memory, I/O Ports ,timer, serial communication using 8051 To develop the 8051 based projects	A student who completes this course will be able to: 1. Understand & Learn concept of Architecture of 8051 µc 2. Apply the concept of programming language to interface I/O Devices 3. Establish the serial communication between the I/O Devices. 4. Design Data Acquisition System related to Industries

Unit I: (8 Hrs)
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.

Unit II: (7 Hrs)
Loop, Jump and Call instructions, Bit manipulation, 8051 I/O programming, Delay Programs. I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming.

Unit III: (8 Hrs)
8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access, Timer programming in assembly and C: Various modes of operation, SFR related to timer operation.

Unit IV: (7 Hrs)
Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs. 8051 interrupts, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt.

Unit V: (7 Hrs)
Interfacing and programming for LCD, Interfacing RTC, EEPROM using I2C Bus and programming.

Unit VI: (8 Hrs)
Interfacing of ADC, DAC, stepper motor and PS2 keyboard and programming

Text Books:
1) The 8051 Microcontroller and Embedded systems , Muhammad Ali Mazidi , J.G. Mazidi, 2nd edition Pearson Education, Prentice Hall of India.
2) 8051 Microcontrollers programming and practice By Mike Predcko.
3) The 8051 Microcontroller Architecture, programming and Applications By Kenneth Ayala, Penram India publication.
4) Advanced Microprocessors and Peripherals , A. K. Ray, K. M. Bhurchandi, Second edition, Tata McGraw Hill, 2000.

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

4th SEMESTER

EE2254	Lab. Microcontroller & its Applications		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	10	60	100	---	

Objective	Outcomes
↙ To provide the acquaintance with concepts of inbuilt memory, I/O Ports ,timer, serial communication using 8051 ↙ To develop the 8051 based projects	A student who completes this course will be able to: 1. Understand & Learn concept of Architecture of 8051 µc 2. Apply the concept of programming language to interface I/O Devices 3. Establish the serial communication between the I/O Devices. 4. Design Data Acquisition System related to Industries

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

4th SEMESTER

EE2255	Analog Communication		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Objective	Outcome
To Study different modulation techniques. To understand transmitter &receivers communication systems. To learn the concept of PPM, PAM, PWM & PCM. To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students will be able to 1. Demonstrate and analyze various amplitude, angle modulation techniques. 2. Understand various types of receivers & noise in communication system and investigate noise parameters. 3. Understand pulse modulation & multiplexing techniques. 4. Apply the concept of Radiation & Propagation of waves to design communication system

UNIT-1: **(7 Hrs)**

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.

UNIT-2: **(8 Hrs)**

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.

UNIT-3: **(8 Hrs)**

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.

UNIT-4: **(8 Hrs)**

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.

UNIT-5: **(8 Hrs)**

Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Pulse code modulation.

UNIT-6: **(8 Hrs)**

Radiation & Propagation of waves:-Fundamental of electromagnetic waves, propagation of waves- Ground wave, space wave and sky wave propagation, tropospheric scatter propagation, extraterrestrial communications.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Communication System	Gorge Kennedy	4th Edition, 1999	Tata McGraw-Hill
2	Digital and analog communication systems	K. Sam Shanmugam	5th Edition, 2003	John Wiley & Sons

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Communication Systems	Frank R. Dungan	Second Edition, 1993	Delmar Publishers
2	Communication Electronics	Louis Frenzel	Third Edition, 2007	McGraw-Hill

4th SEMESTER

EE2256	Lab : Analog Communication		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	10	60	100	---	

Objective	Outcome
To Study different modulation techniques. To understand transmitter &receivers communication systems. To learn the concept of PPM, PAM, PWM & PCM. To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students will be able to 1. Demonstrate and analyze various amplitude, angle modulation techniques. 2. Understand various types of receivers & noise in communication system and investigate noise parameters. 3. Understand pulse modulation & multiplexing techniques. 4. Apply the concept of Radiation & Propagation of waves to design communication system

Exp No	Name of Experiment
1	To study the Generation of Amplitude Modulation using transistor. Calculate modulation index for value of modulating amplitude.
2	To study the Generation of Amplitude Demodulation using Envelop Detector.
3	To study the Generation of Frequency Modulation using IC 8038 function generator.
4	To perform Frequency Demodulation using Foster Seeley Detector.
5	To perform DSB-SC using Ring Modulator.
6	Generation of Pulse Amplitude Modulation using IC 555 & IC 4016.
7	Generation of PWM signal using IC 555.
8	Generation of PPM signal using IC 555.
9	To perform Time Division Multiplexing (TDM).
10	To perform Amplitude Modulation using Simulink tool in MATLAB
11	To perform Frequency Modulation using Simulink tool in MATLAB

4th SEMESTER

EE2257	Electromagnetic Fields	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours

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

Objective	Outcome
To introduce students with different coordinate systems. To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems. To understand the basic laws applicable to electric and magnetic field. To expose the students to the ideas of electromagnetic waves.	After study through lectures and assignments, students will able to: 1. Define and recognize different co-ordinate systems, apply different techniques of vector calculus to understand concepts of electromagnetic field theory. 2. Determine the electromagnetic force exerted on charged particles, current elements, working principle of various electric and magnetic fields. 3. Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields in different media using the fundamental laws. 4. Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information, in the form of radio waves.

Unit I: **(7 Hours)**
Orthogonal coordinate systems: Cartesian, Cylindrical, Spherical and Transformations, differential lengths, surfaces and volumes.

Unit II: **(7 Hours)**
Coulomb's law, Electric field Intensity for different charge distribution: Point, Line, Surface & Volume, Electric flux, Gauss's law and Application, Divergence, Maxwell's First equation (Electrostatics), The Divergence Theorem.

Unit III: **(7 Hours)**
Energy & Potential: Energy Expended in Moving a Point charge in an Electric Field, 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, Poisson's and Laplace's equation, Uniqueness Of Electrostatic solution.

Unit IV: **(8 Hours)**
Biot-Savart's law and its applications, Ampere's Circuital law and its applications, Curl, Stoke's Theorem, Magnetic flux and magnetic flux density, Faraday's law, displacement current, Maxwell's equations for static and time varying fields with physical significance.

Unit IV: **(7 Hours)**
Uniform plane wave, wave propagation in free space & dielectric, Poynting's Theorem and Wave Power, Propagation in Good Conductors: Skin Effect.

Unit VI: **(7 Hours)**
Reflection of uniform plane waves at Normal incidence, standing wave ratio, plane wave propagation in general directions, plane wave reflection at oblique incidence angles, Brewsters angle.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Engineering Electromagnetic	William H. Hayt,	7th Edition	Tata McGraw – Hill, 2006 reprint.
2	Electromagnetics	J D Kraus	3rd edition 1984	McGraw – Hill

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Electromagnetism: Theory and application	Ashutosh Pramanik	2nd edition august 2009	Prentice Hall
2	Elements of Electromagnetics	M. N. O. Sadiku	4th edition 2007	Oxford Press
3	Field and Wave Electromagnetics	David K. Cheng	Second Edition	Addison Wesley

4th SEMESTER

EE2258	Lab:Electronics Workshop		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration	
	--	10	60	100	---	

Objective	Outcome
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 Will able to 1. Identify different Electronics Components. 2. Do mini project to enhance their practical Knowledge. 3. Artwork, printing, Etching & drilling of PCB 4. Work in a teamwork

Exp 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).

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

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

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

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

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

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

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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Dean (Acad. Matters)		Date of Release	May 2016	Onwards

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	

ET-1344	PE-Fundamentals of Computung	L= 3	T = 0	P = 2	Credits = 3

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

Objectives	Outcomes
➢ To understand the use of Python as a scripting language for programmers. ➢ To learn Python programming and to design applications	➢ Students will be able to 1. To learn and understand basic Python programming, data types, operators, control structures, algorithm development, and program design with functions of python 2. To write loops and decision statements in Python. 3. To use strings, lists, tuples, Numpy and dictionaries in Python programs. 4. To learn how to write functions in Python.

UNIT-1:

Introduction to Python ,Python syntax ,comments variables, basic programming [CO1]

UNIT-2:

Data types, numbers, Casting strings Booleans, python operators: basic, membership and bitwise [CO1]

UNIT-3:

Conditions, Control statements: if-else, loops, Use of while loops in python Loop manipulation using pass, continue, break and else [CO1,CO2]

UNIT-4:

_Python String Defining list and list slicing, Use of Tuple data Types [CO3]

UNIT-5

List and Dictionary Manipulations Building blocks of python programs [CO3]

UNIT-6:

Numpy, Functions, recursion and advanced programming [CO4]

Text books:				
1	NPTEL material			
2	Online resources			
3	Complete Refernce	Martin C Brown	Tata McGraw Hill Publications	
Reference books: Core Python Programing, Wesley Chun, Prentice Hall Publications				

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

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

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

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

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

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Department of Electronics and Telecommunication Engineering

Session:-2019-20 **Semester: - VI**

Fundamentals of Computing Lab

ET 1344	**Fundamentals of Computing Lab**	L = 0	T = 0	P = 2	Credits= 1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	2 Hrs

Course Objective Student will be able to	Course outcomes Student will be able to
1. To understand Python is a useful scripting language for developers. **2.** To learn how to design and program Python applications.	**1.** To understand syntax and semantics of language **2.** To understand and apply the basics of the programming **3.** To understand and apply special language features **4.** To develop any application

List of Experiments

Sr.No	Name of experiment	co
1	Write, test, and debug simple Python programs	1,2
2	Develop Python programs using different data types and understand their use	1,2
3	Implement Python programs with conditionals and loops	1,2
4	Develop Python programs for Python lists and understand their use	1,2
5	Develop Python programs for Python tuples and understand their use	1,2,3
6	Develop Python programs step-wise by Python dictionaries for representing compound data.	1,2,3
7	Develop Python programs step-wise by defining functions and calling them	1,2,3
8	Read and write data from/to files in Python.	1,2,3
9	Mini Project	1,2,3,4

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.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. Scheme of Examination & Syllabus 2019

Communication Engineering

I Semester

ET3909	**PE I: Embedded Systems & DSP Processor**	L= 3	T = 0	P = 0	Credits = 3

Evaluation Scheme	MSEs *	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hrs

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

Objectives:

The course introduces us with the basics of embedded systems, familiarity with the Optimizing Design Metrics, processor technology, IC technology, design technology, hardware, the software, peripherals, memory and interfacing and tradeoffs.

UNIT-1:

Embedded Systems, Introduction, Design Metrics, Processor Technology, IC Technology, Design Technology, Design Productivity Gap, Custom Single purpose Processor Design, RT level design, FSMD, Data-paths, Optimization, Instruction set simulators for simple processors.

06 Hrs

UNIT-2:

Architectural Features Of ARM: Processor modes, Register organization, Exceptions and its handling,Memory, Memory-mapped I/Os, ARM and THUMB instruction sets, Addressing modes, DSP extensions, ARM sample codes

06 Hrs

UNIT-3

ARM7/9 Core: H/W architecture, Timing diagrams for Memory access, Co-processor interface, Debug support, Scan chains, Embedded Real Time ICE, Hardware and software breakpoints. Buses: AMBA, ASB, APB, Development tool like Compilers, Debuggers, IDE etc.

06 Hrs

UNIT-4:

DSP Architecture: MAC, Modified bus structures and Memory access schemes, Multiple access Memory , Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes, On chip peripherals.

06 Hrs

UNIT-5

TMS320C3X -32 bit floating point DSP Processor: Introduction, features, Applications, Block diagram, Internal architecture, CPU & data paths, Functional units, Addressing modes, Memory architecture, External memory accesses, Pipeline operation, Peripherals **06 Hrs**

UNIT-6:

Assembly language programming. Hardware tools: DSP and other DSP boards Software tools: Assembly language tools.

06 Hrs

Text books:

1	ARM System Developer's Guide: Designing and Optimizing	2004	Sloss Andrew N, Symes Dominic, Wright Chris	The Morgan Kaufmann Publication
2	Digital signal processors	2002, 1st Edition	Venkataramani, M Bhaskar	Tata McGraw Hill

Reference books:

1	ARM System-on-Chip Architecture	2nd Edition, 2002	Steve furber	Pearson Education
2	Embedded System Design	2002, 1st Edition	Frank Vahid and Tony Givargis	Wiely Publication
3	Embedded System Design	2003	Raj Kamal	Tata McGraw Hill

		June 2019	1.00	Applicable for Sem 1 & 2 AY 2019-20 & Sem 3 & 4 AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III Semester
CT2201 - Computer Architecture and Organization

Course Objective	Course Outcomes
Student will be able: 1. To Understand Internal working of Computer System, its basic principles & execution of machine instructions 2. To Understand basic processor design using Hardwired and microprogrammed control unit. 3. To Know Organization of main memory, cache memory. 4. To Know Various ways in which I/O operations are performed.	Upon successful completion of the course, the student will be able to: 1. Relate & Identify the function and design of the various units of computers that process data and store the information. 2. Analyze and write control signal for executing machine instructions for different processors. 3. Explain & Design the organization of memory, memory hierarchy, other peripheral devices, and estimate the cost of computation. 4. Compare among different types of I/O operation

UNIT-1: **[6 hrs]**
Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, Bus Structures, Software, addressing methods and machine program sequencing: Memory Locations, addressing and encoding of information, Instructions and Instruction sequencing,

UNIT-2: **[7 hrs]**
Addressing modes, Assembly language, Stacks, Subroutine. Instruction set : SimpleRISC
Processing Unit: Some fundamental concepts, Execution of a complete instruction, Single, two, three bus organization, Sequencing of control Signals.

UNIT-3: **[7 hrs]**
Processor Design, hard wired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, perfecting microinstruction.

UNIT-4: **[7 hrs]**
Arithmetic (Fixed and Floating point): 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.

UNIT-5: **[7 hrs]**
Integer Division, Floating point numbers and operations. The Main Memory: Basic concepts, Memory Hierarchy, semiconductor RAM memories, Memory system consideration, semiconductor ROM memories, Speed Size and Cost, Cache Memory, Performance Considerations.

UNIT-6 : **[6 hrs]**
Mapping techniques, Pipelining: Basic Concepts, Data Hazards, Instruction Hazards Computer Peripherals: I/O Devices, I/O transfers – program controlled, interrupt driven and DMA, Interrupt handling.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer Organization	5thedition	V.Carl Hamacher, Zvonko Vranesic,	McGraw Hill Publications.

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Computer Organization and Architecture	6th edition	WillaiamStaliing	Pearson Education
2	Computer Architecture & Organization	3rd edition	J.P. Hayes	McGraw Hill Publications.

III Semester
CT2202 - Object Oriented Programming

Course Objective	Course Outcomes
1. To introduce object oriented programming features and its diagrammatic representation of its model components. 2. To understand concept of class, handling its features and the reusability concept in object oriented language. 3. To understand the mechanism to make use of files and standard libraries. 4. To introduce the exception handling mechanism and the MVC architecture along with web components to design the software solution. 5. To introduce how to perform the event driven programming.	1. Able to analyze the problem and can proposed the solution in OO approach. 2. Able to implement the solution using suitable reusability technique provided in OOP language. 3. Able to implement the solution using files and standard template library. 4. Able to design the error free software solution using the standard architecture patterns. 5. Able to design and implement the event driven solution for the problem.

UNIT I: **[06 Hrs]**
Introduction to object oriented programming paradigm, procedure oriented programming vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class. UML diagrams to represent class, objects and various relationships.

UNIT II **[06 Hrs]**
Functions in OOP, function overloading, friendly functions, Passing & returning Objects, pointers to members, constructors and destructors, copy constructor, operator overloading. Access specifiers and packages.

UNIT III **[06 Hrs]**
Inheritance, types of inheritance, virtual base classes, abstract classes, virtual function, late binding. Interface, collection interface.

UNIT IV **[06 Hrs]**
Streams, stream classes, file handling, command line arguments, class templates, function templates, standard template library.

UNIT V **[06 Hrs]**
Basics of exception handling, exception handling mechanism, MVC architecture, Java web components and its architecture

UNIT VI **[06 Hrs]**
Event driven programming using AWT components and various listener interfaces.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Object Oriented Programming with C++	6th	E. Balguruswamy	TMH
2	Thinking in Java	4th	Bruce Eckel	Prentice Hall

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Java Complete Reference	7th	Herbert Schildt	McGraw-Hill
2	Mastering C++	4th	Ravishankar, Venugopal	TMH

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III Semester
CT2203 - Lab. : Object Oriented Programming

Course Objective	Course Outcomes
1. To introduce object oriented programming features and its diagrammatic representation of its model components. 2. To understand concept of class, handling its features and the reusability concept in object oriented language. 3. To understand the mechanism to make use of files and standard libraries. 4. To introduce the exception handling mechanism and the MVC architecture along with web components to design the software solution. 5. To introduce how to perform the event driven programming.	1. Able to analyze the problem and can proposed the solution in OO approach. 2. Able to implement the solution using suitable reusability technique provided in OOP language. 3. Able to implement the solution using files and standard template library. 4. Able to design the error free software solution using the standard architecture patterns. 5. Able to design and implement the event driven solution for the problem.

Expt. No.	Experiments based on
01	Implement the concept of Class and its data members and member functions in Java/C++
02	Implement the concept of function and operator overloading in Java/C++
03	Implement the concept of friend function
04	Implement the concept of class constructor and its type in Java/C++
05	Implement the concept of Abstraction in Java/C++
06	Implement the concept of all types of inheritance in Java/C++
07	Implement he collection listener to solve the problem in Java
08	Implement the concept of run time polymorphism in Java/C++
09	Implement the concept of Files using command line arguments in Java/C++
10	Implement the concept of function templates and class template in C++
11	Implement the concept of exception in Java/C++
12	Implement the concept of applet to prepare a web application in Java
13	Implement the event driven approach to prepare the web application in Java

III Semester
CT2204 - Data Structures

Course Objective	Course Outcomes
1. To make students familiar with syntaxes and usages of various programming constructs of C language. 2. To make student understand concept of abstract data types like stacks and queues. 3. To make student understand file handling operations. 4. To create thinking ability needed for implementation of programming logic with proper use of memory.	Upon successful completion of the course, the student will be able to: 1. To Identify programming constructs needed to solve real world problems. 2. To Implement various abstract data types 3. To Write program for file handling by using various access modes and operations needed as per the requirement of given problem. 4. To Implement programming logic needed for solving given problem.

UNIT-I: **[7 Hrs]**
Types and operations, Iterative constructs and loop invariants, Quantifiers and loops, Structured programming and modular design, parameter passing mechanisms, recursion, program stack and function invocations including recursion

UNIT-II: **[7 Hrs]**
Overview of arrays and array-based algorithms - searching and sorting: merge sort, quick sort, Sparse matrices.

UNIT-III: **[5 Hrs]**
Structures (Records) and array of structures (records). Database implementation using array of records. Pointers- pointer variable, pointer-to-pointer, pointer arithmetic, function pointer, structure using pointers.

UNIT-IV: **[6 Hrs]**
Dynamic memory allocation and deallocation. Dynamically allocated single and multi-dimensional arrays, polynomial representation. Concept of an Abstract Data Type (ADT), Lists as dynamic structures, operations on lists.

UNIT V: **[7 Hrs]**
Stack, Queues and its operations. Implementation of stacks and queues using array-based. Applications of stacks and queues.

UNIT VI: **[4 Hrs]**
Files, operations on them, examples of using file.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Data Structures in C++	2nd 2009	Ellis Horowitz, Sartaj Sahani, Dinesh Mehta	University Press
2	Data Structures and Program Design in C	2nd 2009	Robert Kruse, Cl Tondo	Pearson Education
3	The C programming Language	2nd Edition	Brian Kernighan , Dennis Ritchie	Prentice Hall

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Data Structures with C	Latest	Seymour Lipschutz	TMH
2	Data structures using C	Latest	Reema Thareja	Oxford
3	Algorithms and Data Structures	First	M.M.Raghuwanshi	Narosa

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III Semester
CT2205 - Lab: Data Structures

Course Objective	Course Outcomes
1. To make students familiar with syntaxes and usages of various programming constructs of C language 2. To make student understand concept of abstract data types like stacks and queues 3. To make student understand file handling operations 4. To create thinking ability needed for implementation of programming logic with proper use of memory	Upon successful completion of the course, the student will be able to: 1. To Identify programming constructs needed to solve real world problems. 2. To Implement various abstract data types. 3. To Write program for file handling by using various access modes and operations needed as per the requirement of given problem. 4. To Implement programming logic needed for solving given problem.

List of Programs

1. Program for counting number of digits in a random number
2. Program for generating list of random numerals and print them in words
3. Program to print Pascal's triangle

```
          1
        1   1
      1   2   1
    1   3   3   1
  1   4   6   4   1
1   5   10  10  5   1
```

4. Program for finding GCD of two numbers using factorial method
5. Program for finding GCD of two numbers using recursion. Also, print number of recursive calls.
6. Program for allocating memory dynamically for single dimensional array and sort it using quick sort and merge sort
7. Program for allocating memory dynamically for two-dimensional array printing it in spiral manner.
8. Program to create linked list of cell phone with any 3 attributes as data fields and print it
9. Program to create file for storing details of all the items needed for playing any game of your choice also perform display, insertion of new record at any location, deletion of any record
10. Program to implement stack and print MAX data item from it

III Semester
CT2206 - Lab: Python Programming

Course Objective	Course Outcomes
1. To make student aware about various programming frameworks of Python 2. To make student familiar with syntax of various data structures and their operation along with control statements in Python 3. To make students comprehend concepts of file handling,classes and objects 4. To make student aware about various packages inbuilt in Python along with their usages	1. To select any framework for python programming as per their understanding 2. To write any python program using various data structures and control statements 3. To write program where file handling and concepts of classes and objects are needed 4. To develop advanced applications using functionalities provided under various packages of python

Unit I: **[04Hrs]**
Python frameworks : Basic syntax, variables and expressions, basic operators, decision making

Unit II : **[06 Hrs]**
Control flow statements: continue, break, Loops: while, for and Functions

Unit III: **[06 Hrs]**
Data structures: list, dictionary, arrays, tuples, sets, strings

Unit IV: **[06Hrs]**
File handling, Classes and objects

Unit V: **[06 Hrs]**
Introduction to Various Libraries:
NumPy: Fundamental package for scientific computing
NLTK- Natural language toolkit

Unit VI: **[06 Hrs]**
Python patterns- Implementing Graphs NetworkX- A package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.

Expt.No.	Experiments based on
01	Informal introduction to programming IDEs Downloading and installing Python
02	Python: variables, operations, control flow - assignments, condition-als, loops, functions
03	Python: types, expressions, strings, lists, tuples, dictionaries
04	Python memory model: names, mutable and immutable values Operations pertaining to various data structures
05	More on Python functions: optional arguments, default values Passing functions as arguments Higher order functions on lists: map, list comprehension
06	Exception handling, Basic input/output, Handling files
07	Classes and Objects
08	Various packages in Python

Text Books:

SN	Title	Edition	Authors	Publisher
1	Introduction to Programming Using Python	1st	Y. Daniel Liang	Pearson
2	Python: The Complete Reference	1st	Martin C Brown	McGraw Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Data Structures and Algorithms Using Python	1st	Rance D. Necaise	Willey

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III Semester
CT2207 - Lab: Web Technology

Course Objective	Course Outcomes
1. To introduce with the internet technology 2. To study the basic of web page designing 3. To introduce the validations in the web page 4. To introduce the concepts of data storage using XML 5. To learn the advance technique for designing the interactive web page	After successful completion of the course students will be able to: 1. Understand various internet technologies 2. To design the web pages using some basic techniques 3. To design and implement the interactive web pages 4. To use the XML technology to store the data 5. To design and develop the interactive web pages using the advanced technique

Expt. No.	List of Experiments
01	Introduction to Internet (overview of Internet, email, www, broad band, FTP)
02	Study and implement basic html tags.
03	Create Web Form by using FORMS in HTML (use any example)
04	Program to demonstrate the use of JavaScript in while and for loops.
05	Program to demonstrate the use of JavaScript conditional statements and functions.
06	Demonstrate validation of form controls using simple functions written in JavaScript.
07	Introduction to XML. Program to demonstrate use of External and Internal DTD.
08	To create a web form to demonstrate use of ASP.net web controls – Radio Button Control, Image Control and Link Button Control.
09	Create a web form which will accept two numbers as input and perform an operation depending on value selected from dropdown list control.
10	To demonstrate use of validation controls including required field validator, range validator, compare validator, regular expression validator and summary validator.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Learn to code HTML & CSS: develop & style websites	2014	Shay Howe	[Berkeley]: New Riders, cop.
2	The definitive guide to Netbeans Platform	2009	HeikoBöck	Berkeley, CA :Apress

Reference Books:

SN	Title	Edition	Authors	Publisher
1	The book of Inkscape	2008	Dmitry Kirsanov	San Francisco, Calif.:No Starch; Farnham: O'Reilly [distributor]
	The sed&awk Pocket Reference	2009	Arnold Robbins	Arnold Robbins

Web Resources:

SN	Title	Web link
1	W3 schools for HTML and CSS	https://www.w3schools.com

IV Semester
CT2251 – Operating Systems

Course Objective	Course Outcomes
1. To learn different types of OS & services provided by OS. 2. To understand process management and inter-process communication. 3. To know the deadlock concepts & deadlock avoidance algorithms. 4. To understand the need of memory management. 5. To learn different file system organization.	Upon successful completion of the course, the student will be able to: 1. Analyze & compare different OS & its services. 2. Apply & analyze CPU scheduling algorithm & also find different ways to synchronize the process. 3. Use different methods to handle deadlock. 4. Apply various memory management techniques. 5. Compare various disk scheduling algorithms based on their performances.

UNIT I **[06 Hrs]**
Introduction, services provided by OS, functions of OS, system calls.
Process management-introduction, process control block, process states, process context switch, threads: user level and kernel level.

UNIT II **[08 Hrs]**
CPU scheduling, goals of scheduling, CPU scheduling algorithms: FCFS, SJF, SRTF, RR, Priority based.
Inter-process communication: process cooperation and synchronization, race condition, critical section, mutual exclusion and implementation, semaphores, classical inter-process communication problems.

UNIT III **[07 Hrs]**
Deadlocks: System Model, deadlock characterization-necessary conditions, resource allocation graph (RAG), methods for handling deadlock-deadlock avoidance, deadlock detection, deadlock prevention, recovery from deadlock.

UNIT IV **[06 Hrs]**
Memory management techniques-contiguous and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads.

UNIT V **[06 Hrs]**
Virtual memory and demand paging, page faults, page replacement algorithms, thrashing and working set model.

UNIT VI **[06 Hrs]**
File systems-introduction, disk space management and space allocation strategies, directory structures, disk caching, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, FileOrganization: Sequential, Index, IndexSequential

Text Books:

SN	Title	Authors	Edition	Publisher
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:

SN	Title	Authors	Edition	Publisher
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		Prentice Hall publication.
6	Operating Systems	Achyut Godbole	3rd Edition	McGraw Hill Education

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
CT2252– Lab: Operating Systems

Course Objective	Course Outcomes
1. To learn different types of OS & services provided by OS. 2. To understand process management and inter-process communication. 3. To know the deadlock concepts & deadlock avoidance algorithms. 4. To understand the need of memory management. 5. To learn different file system organization.	Upon successful completion of the course, the student will be able to: 1. Analyze & compare different OS & its services. 2. Apply & analyze CPU scheduling algorithm & also find different ways to synchronize the process. 3. Use different methods to handle deadlock. 4. Apply various memory management techniques. 5. Compare various disk scheduling algorithms based on their performances.

Expt. No.	Experiments based on
01	Basics of Linux commands and its use.
02	(i) rite a shell script to find maximum of 3 numbers. (ii)rite a shell script to check whether entered number even or odd
03	(i) rite a shell script to find factorial of a number (ii)rite a shell script to find the sum of all the digits of a number
04	Write a program to create a process using fork( ) system call.
05	Write a program to implement Non-Preemptive Priority scheduling algorithm.
06	Write a program to implement FIFO page replacement algorithm.
07	Write a program to implement First-Fit/Worst-Fit strategies
08	Installation of Linux Operating System.
09	Case study on Advanced Operating System (Ameoba).

IV Semester
CT2253- Advanced Data Structures

Course Objective	Course Outcomes
• To understand various types of linked lists, their structures and operations performed on them. • To understand structures and working of advanced data structures like skip list, disjoint set, hash table etc. • To understand various types of tree like multidimensional trees, tries etc • To understand graph data structures along with its representation methods and various terminologies	• Implement different types of linked list with various operations on them • Implement various operations on skip list, disjoint set and hash table • Identify and Implement various operations on different types of trees • Write program for finding shortest path between pair of entities

UNIT 1: **[8Hrs]**
Lists - Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list etc. Applications of lists in polynomial representation, multi-precision arithmetic. Multi linked structures.

UNIT 2: **[5Hrs]**
Introduction to Skip lists, data structures for disjoint set representation, hash table

UNIT 3: **[8 Hrs]**
Trees, binary trees, binary trees- basic algorithms and various traversals. Binary Search Trees (BSTs) and insertion, deletion in BSTs. Heaps and heap sort

UNIT 4: **[9Hrs]**
Height-balanced (AVL) trees, Splay tree, Red-black trees, Multi-way trees-B and B+ and applications

UNIT 5: **[5Hrs]**
Multidimensional trees, Tries and Pattern matching algorithms

UNIT 6: **[7Hrs]**
Graphs – their representation & traversals. Spanning trees, topological sort, shortest path algorithm, all-pairs shortest paths

Text Books:

SN	Title	Authors	Edition	Publisher
1	Data Structures with C	Seymour Lipschutz	Latest	TMH
2	Data structures using C	Reema Thareja	Latest	Oxford

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Introduction to Algorithms	Thomas Cormen, Charles Leiserson, Ronal Rivest, Clifford Stein	3rd 2015	PHI
2	Fundamentals of Data Structures in C++	Ellis Horowitz, Sartaj Sahani, Dinesh Mehta	2nd, 2009	University Press
3	Data Structures and Program Design in C	Robert Kruse, Cl Tondo	2nd, 2009	Pearson Education

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester

CT2254- Lab: Advanced Data Structures

Course Objective	Course Outcomes
• To understand various types of linked lists, their structures and operations performed on them. • To understand structures and working of advanced data structures like skip list, disjoint set, hash table etc. • To understand various types of tree like multidimensional trees, tries etc • To understand graph data structures along with its representation methods and various terminologies	• Implement different types of linked list with various operations on them • Implement various operations on skip list, disjoint set and hash table • Identify and Implement various operations on different types of trees • Write program for finding shortest path between pair of entities

Expt. No.	List of Programs
01	Program based on Linked list
02	Program based on implementing one data structure using another data structure
03	Program to Print the Alternate Nodes in a Linked List using Recursion
04	Program based on Binary tree
05	Program based on Binary search tree
06	Program for Heap sort
07	Program based on Tries
08	Program based on graph
09	Program for detecting presence of cycle in given graph G
10	Program for printing topological sort of given graph

IV Semester

CT2255- Mathematical Foundations for Data Analysis

Course Objective	Course Outcomes
1. To introduce the basic statistical formulae and visualization techniques 2. To comprehend the concepts of probability and probability distribution 3. To understand the concepts of sampling, sampling distribution and estimation 4. To understand the concept of hypothesis testing	1. Able to analyze and find the hidden meaning from the given data and visualize the results 2. Able to solve the real-life problem using the probability theory and use it for decision making 3. Able to analyze the samples from the population and solve the problem to get predictive solution using the estimation theory 4. Able to analyze the sample data and use it to test the assumptions made for the population parameter

UNIT I **[06 Hrs]**

Introduction: The role of statistics. Numerical and graphical methods for describing and summarizing data.

UNIT II **[06 Hrs]**

Probability: Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence.

UNIT III **[06 Hrs]**

Probability distribution: What is probability distribution, random variables, use of expected value in decision making, and various probability distributions.

UNIT IV **[06 Hrs]**

Sampling and Sampling Distribution: introduction to sampling, random sampling, Introduction to sampling distribution. Design of experiment

UNIT V **[06 Hrs]**

Estimation: Introduction, Point estimates, Interval estimates and confidence interval, interval estimates using t distribution, determining the sample size in estimations

UNIT VI **[06 Hrs]**

Testing Hypothesis: Introduction, testing hypothesis, One sample test

Text Books:

SN	Title	Authors	Edition	Publisher
1	Introduction to probability and statistics for engineers and scientist	Sheldon M. Ross	3rd Edition	Elsevier
2	Statistics for Management	Richard I. Levin & David S. Rubin	7th Edition	Pearson Education

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Practical Statistics for Data Scientists, 50 Essential Concepts.	Peter Bruce & Andrew Bruce		
2	An Introduction to Statistical Learning with Applications in R	Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani		

		June 2019	1.00	Applicable for AY 2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
CT2256- Lab: Mathematical Foundations for Data Analysis

Course Objective	Course Outcomes
1. To introduce the basic statistical formulae and visualization techniques 2. To comprehend the concepts of probability and probability distribution 3. To understand the concepts of sampling, sampling distribution and estimation 4. To understand the concept of hypothesis testing	1. Able to analyze and find the hidden meaning from the given data and visualize the results 2. Able to solve the real-life problem using the probability theory and use it for decision making 3. Able to analyze the samples from the population and solve the problem to get predictive solution using the estimation theory 4. Able to analyze the sample data and use it to test the assumptions made for the population parameter

Expt. No.	List of Experiments
01	Implement basic functionality of R
02	Implement data import and export functionality in R
03	Implement R functions to calculate basic statistics of data source
04	Apply the basic visualization techniques in R to understand data
05	Apply some advanced visualization techniques in R to analyze the data
06	Solve the problems using probability distributions in R
07	Using a case study compare various probability distributions
08	Analyze the data using sampling technique
09	Analyze the data to find out estimated value
10	Analyze the data using hypothesis testing

IV Semester
CT2257- Database Management Systems

OBJECTIVES	OUTCOMES
1. To learn different database system concepts 2. To learn the designing of Entity Relationship Diagram. 3. To know relational data model, relational algebra& SQL Queries. 4. To understand relational database design. 5. To know about data integrity issues.	Upon successful completion of the course, the student will b e able to: 1. Analyze & compare different levels of abstraction & data independence. 2. Design Entity Relationship Diagram for any scenario. 3. Solve queries based on relational algebra & SQL. 4. Identify functional dependencies & normalise the database andapply ACID properties. 5. Analysetransaction management,variousconcurrency control protocols and crash recovery methods.

[05 Hrs]

UNIT I

Introduction to Database Management System: General File System and Database system Concepts and Architecture, Data Models, Schemas and Instances, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence.

UNIT II **[06 Hrs]**

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 III **[06 Hrs]**

SQL: Data definition language (DDL), Data Manipulation Language (DML), Basic structure of SQL Queries, Set operations, Null Values, Nested subqueries, views, modification of database, transaction, Joins.

Advanced SQL: SQL data types & schemas, Integrity Constraints, Domain Constraints, Assertions, triggers, Advanced SQL Features.

UNIT IV **[07 Hrs]**

Relational Data Model: Structure of Relational Databases

Relational Algebra: Structure of relational databases, Fundamental Relational-Algebra Operations, Additional relational algebra operations, extended relational algebra operations, modification of the databases.

IV Semester
CT2257- Database Management Systems

UNIT V **[06 Hrs]**

Relational Database Design: Pitfalls in Relational Database Design, Functional Dependencies, Normalization using Functional Dependencies, Alternative Approaches to Database design.

Transaction Management: ACID Properties, Implementation of ACID Properties, Database processes to support ACID Properties, Schedules, and Testing of Serializability.

UNIT VI **[06Hrs]**

Concurrency Control: Lock-based Protocols, Timestamp Based Protocols, Validation Techniques, Multiple Granularity, Multi version Timestamp Protocol, Transaction isolation levels, Read consistency.

Crash Recovery: Failure Classification, Log Based Recovery, Buffer Management, Checkpoints, Shadow Paging.

TEXT BOOKS:

1. "Database System Concepts" Korth, Silberschatz: McGraw-Hill publication.
2. "Fundamentals of Database Systems ", Elmasri, Navathe& Gupta, Pearson Education.

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.

IV Semester
CT2258- Lab: Database Management Systems

Course Objective	Course Outcomes
Student will be able: 1. To Understand fundamental database concepts and the different database systems, methodologies to conceptualize systems. 2. To model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model. 3. To understand, advanced develop applications involving advanced database systems. 4. To Know Various database concepts, Identify the key issues in developing database systems and applications.	Upon successful completion of the course, the student will be able to: 1. Design relational database for any given problem, write appropriate queries for accessing database. 2. design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs. 3. Examine the different operation of Transaction to design efficient system. 4. Compare among different types of database and its different concept.

Expt. No.	List of Programs
01	Design an ER Diagram.
02	Study and implement DDL Command.
03	Study and Implement Entity Constraints, Referential Constraints, Domain Constraints
04	Study and Implement DML Commands (select, Insert).
05	Study and Implement Update and Delete Command.
06	Study and Implement Aggregate function.
07	Study and Implement Inner join.
08	Study and Implement Outer Join.
09	To Design a full database system and queries for given topic

6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

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

Objective	Outcome
Principle of Management	To familiarize the students with the basic concepts and principles of management. The students should clearly understand the definitions of different areas of management. This course will facilitate students to understand and describe specific theories related to perception, motivation, leadership. This will help the students to demonstrate effective management skill by knowing the various functions of management like planning, organising, directing, coordinating and controlling.
Legal Aspects of Management	The present course aims at familiarizing the students with various legal aspects of business, contract, partnership and companies. It aims at providing a rich fund of contemporary knowledge, time tested principles, basic concepts, emerging ideas and practices in the field of law in a comprehensive way.
Human Resource Management	The objective of this course is to endow the student with a broad perspective on themes and issues of Human Resource Management, Human Resource Development, Training and Development activities, Job Analysis, Performance Appraisal, disciplinary and grievance procedure. It will help the students to build up and refine decision making skills so that they can help organizations effectively manage employee relations.
Project Management	The course is intended to develop the knowledge of the students in the management of projects, special emphasis will be provided on project formulation as also on various tools and techniques for project appraisal and control so that they are able to draft the project proposal in any area of management and evaluate the projects.
Marketing Management	This course intends to provide an experienced-based approach to marketing concept and its practical application. The course is designed to enable the students to learn the basic of marketing, customer behaviour, marketing research & sales promotion. Topics of the syllabus shall be addressed and discussed from an application oriented perspective
Financial Management	The present course aims at familiarizing the participants with the skills related to basic principles, tools and techniques of financial management. This will help the students to demonstrate their skill in understanding the budgets and budgetary control, balance sheet, and profit and loss statement.

Mapped Program Outcomes:

6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

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

UNIT-1: Principles of Management
Evolution of Management Thought : Scientific, Classical, Neo Classical and Modern Theory of Management, Defintion Meaning and Concept of Management, Functions of Managment : Planning, Organizing, Directing Coordinating and Controlling. Motivation Theory, Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, Types of Partners, Right and Duties of Partners, Registration and Dissolution of firm, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Directors : Powers and duties, Winding up of the Company

UNIT-3: Human Resource Management
Human Resource Management-Meaning, Nature and Scope, Principles of HRD, Human Resource Planning, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Discipline and Grievance Procedure.

UNIT-4 Project management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Project Management, Tools and Techniques of Project Management, SWOT Analysis, Project Risk Analysis, Project cost, Project Planning, Project Control, Network techniques - Introduction and Use of CPM &PERT for planning.

UNIT-5 Marketing Management:-
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Rural Marketing, Marketing Environment, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

UNIT-6 Financial Management:-
Definition & Functions of Finance department, Sources of finance , Financing organizations, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

TEXT BOOKS:

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

6th Semester

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

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

TEXT BOOKS FOR REFERENCE:

1) Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2) Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3) Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4) C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,

5) Lock, Gower - Project Management Handbook
6) Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7) Rajan Saxena: Marketing Management, Tata McGraw Hill.
8) Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9) Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10) Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11) Khan M Y - Financial Services (Tata Mc Graw Hill, 1998)

V Semester

CT 2303- Theoretical Foundation of Computer Science

Objective	Course Outcome
1. To introduce students to the mathematical foundations of computation including automata theory, regular languages. 2. To understand of different types of grammars and the properties of Context Free Grammar 3. To study the concepts of Push Down Automata and Turing machine. 4. To understand decidable and undecidable problems.	On completion of this course, the student will be able to: 1. Construct automata, regular expression for any pattern. 2. Write context free grammar for various languages. 3. Design push down automata and Turing Machine for a language. 4. Derive whether a problem is decidable or not.

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non-Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	8
2	Regular Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets (Proofs not required), Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church"s hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machin	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function unbounded minimization and recursive function	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Automata Theory, Languages, and computation	3rd Edition	Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman	Pearson Education
2	Introduction to languages and the Theory of Computation	3rd Edition	John C. Martin	Mc Graw Hill

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

CT 2303- Theoretical Foundation of Computer Science

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation	2nd Edition	Michael Sipser	GALE CENGAGE Learning
2	Theory of Computation	1st Edition	Dr. O. G. Kakde	Laxmi Publication

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

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

CT1348	Lab. : PE I: Mobile Operating Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Sr.No.	Practical Name
1	Introduction to Android Basics
2	Create and application having login functionality.
3	Create and application using View and View Groups
4	Create and application Using Layouts
5	Create and application Using Adapter, Spinner, Toast and Notification
6	Create and application that provides the functionality of Calculator.
7	Create and application using Shared preferences.
8	Create and application using SQLite data storage.
9	Create and application using Launch Modes.
10	Create and application using Content Provider.
Beyond Syllabus Practical List:	
11	Create an application that reads contacts from the native address book and supports edit/add new contact information

6th Semester

CT1349	PE I : Business Intelligence and Its Applications	L=4	T=0	P=0	Credits=4

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

OBJECTIVES	OUTCOMES
1.The proposed elective course exposes students to Business Intelligence domain. The objectives of this course include introduction to BI terminologies and framework, basics of data integration (Extraction Transformation Loading), introduction to multi-dimensional data modeling, basics of enterprise reporting and application of the concepts using open source/Microsoft tools.	Extract and transform data from an operational database to a data warehouse. 1.Map operational data to a data warehouse. 2.Design multidimensional data models. 3.Design reports using various reporting tools and methods. 4.Use BI tools to identify trends. 5.Exploit business analytics and performance measurement tools. 6.Design a BI solution for a business problem.

PO, PSO MAPPING :- a,b,c,d,e,f,g,i,j,k,l,m

UNIT I
Introduction to Business Intelligence: Introduction to digital data and its types – structured, semi-structured and unstructured, BI Definitions & Concepts, BI Framework, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.

Unit II
Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP) Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, **Data Warehousing concepts and its role in BI**

Unit III
Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data – types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle).

UNIT IV
Identifying Dimension tables and fact table, designing of dimension and fact tables" schema, design of snowflake schema, query redirection. Aggregations: Why aggregate? , designing Summary tables, which summaries to create.

UNIT V
Introduction to business metrics and KPIs, creating cubes using Microsoft Excel ,Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards.

UNIT VI
Case study: Overview and use of products from Pentaho and other open software. BI road Ahead: BI and mobility, BI and cloud computing, BI for ERP systems, Social CRM and BI.

6th Semester

CT1349	PE I : Business Intelligence and Its Applications			L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

TEXT BOOKS:

1. Fundamentals of Business Analytics by R. N. Prasad, Seema Acharya Wiley India
2. Data Warehousing in the real world A practical guide for building Decision Support System by Sam Anahory, Dennis Murray, PEARSON

Reference Books:

1. Business Intelligence by David Loshin.
2. Business intelligence for the enterprise by Mike Biere.
3. Business intelligence roadmap by Larissa Terpeluk Moss, Shaku Atre.
4. An introduction to Building the Data Warehouse, IBM.
5. Business Intelligence For Dummies, Swain Scheps.
6. Successful Business Intelligence: Secrets to making Killer BI Applications by Cindi Howson Information dashboard design by Stephen Few

6th Semester

CT1350	Lab. : PE I: Business Intelligence and Its Applications	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Sr. No.	Practical Name
1	Design a conceptual multidimensional model for the given data.
2	Implement the algorithm to extract the data from various sources.
3	Implement the algorithm to clean the data according to business requirement.
4	Transform the data into final „ready to load" form.
5	Implement the algorithm to load the data in the multidimensional format.
6	Solve the given business queries from the multidimensional model (Phase I).
7	Solve the given business queries from the multidimensional model (Phase II).
8	Design the report for output of Phase I.
9	Design the report for output of Phase II.
Beyond Syllabus Practical List:	
1.	Download and install any one free open source tool for reporting
2.	Take the reports from the system for the given data.

6th Semester

CT1353	PE I : Introduction to Geographical Information System			L=4	T=0	P=0	Credits=4

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

OBJECTIVES	OUTCOMES
1. Get overview of GIS applications and study fundamental concepts of GIS. 2. Explore the Coordinate Systems and Map Projections. 3. Study the fundamentals of Spatial Data that include creation, organization and displaying special data. 4. Comprehend the Making Sharing Maps. 5. Study the Metadata. 6. Understand the fundamentals of Spatial Analysis	1. To know the various GIS applications used by industries and government organization and also understand fundamental concepts of GIS. 2. To understand Coordinate Systems and Map Projections 3. To understand Fundamentals of Spatial data. 4. To create Sharing Maps 5. To understand metadata and special data standards. 6. To do special analysis using tools and techniques

Unit I [7 hrs]

Introduction to GIS Applications currently used by Industry & Government and their common usages. Fundamental concepts of GIS: GIS terminologies, various components of GIS software and types of GIS applications. The GIS Software Market.

Unit II [7 hrs]

Fundamentals of Coordinate Systems and Map Projections: History of Coordinate Systems, Geographic Coordinate Systems, Map Projections and Geo referencing.

Unit III [7 hrs]

Fundamentals of Spatial Data: Introduction to Spatial Data Formats, Creation of Vector data, Organization of Spatial Data and Displaying Spatial Data.

Unit IV [7 hrs]

Making Sharing Maps: Map Creation and Design, Sharing Maps as Services, Sharing Spatial Data and using shared Spatial Data.

Unit V [7 hrs]

Metadata: Metadata and Spatial Data Standards.

Unit VI [7 hrs]

Fundamentals of Spatial Analysis: Spatial Analysis, analyzing Vector and Raster data, overview of analysis tools, analyzing Spatial Relationships and sharing Analysis Results

Text Books:

1. "An Introduction to Geographical Information Systems", D. Ian Heywood, Sarah Cornelius & Steve Carver, 3rd edition, Pearson Prentice Hall, 2006

Reference Books:

1. "An Introduction to Geographical Information Systems", Heywood/Raju, Heywood Ian, Pearson Education India, 2009
2. "Getting to Know ArcGIS", Michael Law & Amy Collins, fourth edition, Esri Press
3. "Mathematical Modeling in Geographical Information System global Positioning System and Digital Cartography", H. S. Shrama, D. R. Ram, Rama Prasad & P. R. Binda, 4th Edition, Concept Publishing Company, 2006.

6th Semester

CT1354	Lab : PE I : Introduction to Geographical Information System	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
1. Get overview of GIS applications and study fundamental concepts of GIS. 2. Explore the Coordinate Systems and Map Projections. 3. Study the fundamentals of Spatial Data that include creation, organization and displaying special data. 4. Comprehend the Making Sharing Maps. 5. Study the Metadata. 6. Understand the fundamentals of Spatial Analysis	1. To know the various GIS applications used by industries and government organization and also understand fundamental concepts of GIS. 2. To understand Coordinate Systems and Map Projections 3. To understand Fundamentals of Spatial data. 4. To create Sharing Maps 5. To understand metadata and special data standards. 6. To do special analysis using tools and techniques

List of Practical:

1. To explore applications mentioned in the lecture on your own, understand the needs they meet and problems they solve.
2. To study GIS applications of various types and explore GIS resources, and Installation of GIS Desktop Software.
3. To explore various components of the GIS Desktop Software and study the GIS resources.
4. To understand and analyze Coordinate Systems and Projections.
5. To explore data formats using GIS Desktop Software, Creating data from scratch, Importing and exporting GIS data.
6. To create Geo databases, data conversion, introduction to making maps using GIS Desktop Software.
7. To make maps using GIS Desktop Software.
8. To install GIS Server, creating web services out of GIS maps or data, Sharing maps, Using GIS web services.
9. To manage metadata of Vector and Raster datasets, using metadata.
10. To use basic GIS analysis tools, Applications of GIS analysis tools, GIS Models, Creating web services from Analysis tools

6th Semester

CT1352	OE II: Current Trends and Technologies				L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. The objective of this course is to make the students aware of the basic fundamentals of communication. 2. Growth of technologies in Internet, E- Technologies & E-Learning. 3. Students should know about the Green Computing and its implementation.	1. Using the Basics of Internet for deployment of various servers and recourses. 2. Designing and implementation of Etechnologies 3. Design E-Learning Resources. 4. Choose appropriate processors and Real Time System for Green Computing 5. Develop the Social Networking for next generation.
PO,PSO MAPPING :- a,b,c,d,e,f,g,h,i,j,k,l,m	

UNIT I
Fundamentals of Communications: Types of communication- Wired, wireless, mobile, Modes of transmission: Simplex, Half Duplex, Full Duplex, Multiplexing techniques, History and evolution of wireless and mobile systems, Transition and characteristics of 1G, 2G, 3G, 4G, Spectrum, regulations, and frequency allocation.

UNIT II
Fundamental of INTERNET: History, Internet working, Connections, Internet services, The World Wide Web, Tools for the WWW, Web servers, Web browsers, Web page makers and editors, Plug-ins and delivery vehicles.

UNIT III
E-Technologies: Electronic Commerce: Framework, Media Convergence of Applications, Consumer, Applications, Organization Applications, Electronic Payment Systems: Digital Token, Smart Cards, Credit Cards, Risks in Electronic, Payment System, Designing Electronic Payment Systems, Electronic Data Interchange (EDI): Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software, Implementation, EDI Envelope for Message Transport, Internet-Based EDI.

UNIT IV
E-Learning: Definition, Introduction, Types of e-Learning: Learner-led e-Learning, Facilitated e-Learning , Instructor-led e-Learning , Embedded e-Learning, Tele monitoring And e- Coaching E-Learning Models: WBT, CBT, LMS, LCMS , Virtual School Systems, E-Learning Tools And Technologies: e-mail, Online Discussion, Chat and Instant Messaging, Voting, Whiteboard, Application Sharing, Conferencing, Online Meeting Tools ,Case study.

UNIT V
Green Computing: Introduction, Why....Green Computing? Approaches to Green Computing- Virtualization, Power Management, Power supply, Storage, Video Card, Display, IT Equipment, Recycling, Remote Conferencing & Telecommuting Strategies, Product longevity, Resource allocation, Terminal servers, Operating system support, How to Implement? Industrial implementations of Green Computing- Blackle, Fit-PC, Zonbu computer, Sunray thin client.

UNIT VI
Social Networking: Definition, Overview of Social Networking Sites, Types of Social Networking Sites: General purpose, Niche. Advantages of Social Networking Sites, Drawbacks of Social Networking Sites, Features and Need of Social Networking, Security Issues with Social Networking Sites, Case Studies.

TEXT BOOKS:
1. Impact of E-Business Technologies on Public and Private Organizations by OzlemBak, Nola Stair.
2. Mobile Computing by Tomasz Imielinski , Henry F. Korth .
3. Broadband telecommunications technology by Byeong Gi Lee, Minho Kang, Jonghee Lee.

REFERENCE BOOKS:
1. Introduction to broadband communication systems by Cajetan M. Akujuobi, Matthew, N. O. Sadiku.
2. E-Learning Tools and Technologies William Hortan, Katherine Hortan,Wiley Pub
3. Internet (Use of Search Engines Google & Yahoo etc).

6th Semester

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.

7th Semester

CT1415	Network Security			L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

Objectives	Outcomes
1. Understanding of basic issues, concepts, principles and mechanisms in n/w security, mathematics of cryptography, determine appropniate mechanisms forprotecting networks.	1. To identify n/w security threats and determine efforts to counter them. 2. To apply basic Principles, Theorems, Algorithms to solve the problem. 3.To use different encryption Algorithms. 4. To apply approtunate function and protocols for massage authentication. 5.To design solution for securiedn/w application. 6.To analyze given system with respect to security.
PO, PSO MAPPING:- a,c,d,e,f,h,i,k,l,m	

UNIT I Introduction: Security goals, cryptographic attacks,Services and mechanism, techniques. Mathenatics of cryptography:Integer arithmetic, modular arithmetic, matrices,linear congruence. Mathematics of symmetric key cryptography: Algebraic structure, GF(2^n) Fields

UNIT II Traditional symmetric key ciphers: Introduction, substitution ciphers, Transposition ciphers, stream and block ciphers. Introduction to modern symmetric-key ciphers: Modern block ciphers, modern stream ciphers.

UNIT III DES, AES, Encipherment using modern symmetric key ciphers: Use of modern block ciphers, use of stream ciphers: RC4. Mathematics of asymmetric key cryptography: Primes, primality testing, factorization, Chinese remainder theorem, Quadratic congruence, Exponentiation and logarithms. Asymmetric key cryptography: RSA, ElGamal.

UNIT IV Message integrity and authentication: Message integrity, Random oracle model, message authentication. Cryptographic hash functions: Introduction, Description of MD hash family, Whirlpool, SHA-512. Digital signature: Comparison, process, services, attacks on digital signature, Digital signature schemes. Entity authentication: Introduction, passwords, Challenge-Response, Zero knowledge, Biometric. Key management: Symmetric key distribution, Kerberos, symmetric key agreement, Public key distribution.

UNIT V Security at application layer : E-mail, PGP, S/MIME. Security at transport layer: SSL architecture, four protocols, SSL message formats, Transport layer security. Security at network layer IPSec : Two modes, two security protocols, security association, security policy, Internet key exchange, ISAKMP

UNIT VI System security: Description of the system, Users, Trust and trusted systems, Buffer overflow and malicious software, malicious programs, worms, viruses, Intrusion detection systems, Firewalls: Definitions, construction and working principles

TEXT BOOKS:

1. Cryptography and Network Security, by Behrouz A. Forouzan, and Debdeep Mukhopadhyay, McGraw-Hill Publication.,2nd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security Principles and Practices , by William Stallings, Pearson Edu Asia
2. Networks Security Essentials, Applications and Standards, by William Stalling, Pearson Edu.

7th Semester

CT1451	Artificial Intelligence				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. The study of Artificial Intelligence course will equip the students with the sound understanding of AI concepts, perspectives to apply the AI themes to the challenging research are as related to AI. 2. To introduce the fundamental concepts in Artificial Intelligence, applications of AI, techniques in AI. 3. To concentrate on the basic algorithms for searching the goal, concepts of representation and control. 4. Provide the ability to assess the applicability, strengths, and weaknesses of the basic knowledge representation, various approaches. 5. To compare various Knowledge Representation methods and to understand Prolog fundamentals for Knowledge Representation. 6. To understand the reasoning process is carried out in Machines. 7. To understand how human thinking be emulated by a machine and Provide the ability to assess the applicability, strengths, and weaknesses of various learning methods.	1. Apply fundamentals of Artificial Intelligence for given problem statements. 2. Use basic algorithms for searching the goal, represent various knowledge structures in various applications of AI and related fields. 3. Assess the applicability, strengths , and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems. 4. Compare various knowledge representation approaches, solve problems based on knowledge representation methods. 5. Assess Monotonic and Non-monotonic reasoning methods. 6. Assess various learning methods, compare them.
PO, PSO MAPPING :- a,c,e,h,i,k,l	

UNIT I

Introduction to AI: Definition of AI, early work in AI, the importance of AI,AI and related fields, distributed AI, task domain of AI, Problems, problem spaces and searches: defining the problem on a state space search, Introduction to intelligent agents, generic architecture of intelligent agents.

UNIT II

Production systems and control strategies: depth first and breadth first search, back tracking, problem characteristics , issues in the design of search programs.
Heuristic search techniques: generate and test, hill climbing, best first search, problem reduction, constraint satisfaction, means-ends analysis.

UNIT III

Knowledge representation: issues, representation and mapping approaches, procedural Vsdeclarative knowledge, introduction to proposition logic, knowledge representation using predicate logic, unification and resolution algorithms.

UNIT IV

Representation of knowledge using rules, logic programming, forward backward reasoning, matching, control knowledge. Knowledge representation using semantics' nets, Prolog: Representation of Predicates, rules, and facts, recursion unification.

UNIT V

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

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

7th Semester

CT1451	Artificial Intelligence				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

UNIT VI

Learning: general learning model, overview of different forms of learning, learning decision trees, Artificial Neural Networks (Introduction).

Expert Systems: Design & Development of Expert System, knowledge based Systems, Rule Based Expert System, Expert System Shell, Application Areas of Expert System

TEXT BOOKS:

1. Artificial Intelligence by E. Richand K. Knight and Nair.

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence and Expert System by D. W. Patterson, PHI. Principles of Artificial Intelligence by N. J. Nilsson, Narosa.
2. Artificial Intelligence by George F. Lugar, 4 Edition, Pearson Education.
3. Expert Systems: Design and Development by John Durkin, Macmillan, USA.

7th Semester

CT1406	PE II : Neural Networks & Fuzzy Logic	L=4	T=0	P=0	Credits=4

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

OBJECTIVES	OUTCOMES
1. This course provides introduction various aspect so fneuralnet works, with emphasison element of design no ftrainable systems. The course introduces students to the fundamental theory, mathematics and modeling tools necessary to analyze and simulate natural and engineered systems.	1. Apply training and classification using the discrete perceptron and single layer continues perceptron networks for linearly separable classification. 2. Summarize Operations on fuzzy sets by solving the problem. 3. Compute fuzzy numbers. 4. Construct arithmetic operations on intervals and arithmetic operations on fuzzy numbers. 5. Apply lattice fuzzy numbers and Fuzzy equations to solve fuzzy controller problem.
PO, PSO MAPPING :- a,b,c,e,h,i,j,l	

UNIT I
Fundamentals concepts and model so fartificial neural systems: Biological neurons and their artificial models, models of artificial neural networks, learning and adaptation, neural network learning rules, overview of neural networks, Simple Programming exercise in "C".

UNIT II
Single-layer perceptron classifiers: Discriminant functions, linear machine and minimum distance classification, training and classification sing the discrete perceptron: algorithm and example, single layer continuous perceptron networks for linearly separable classification.

UNIT III
Multi layer feedback networks: linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors, Hopfield networks, Applications of Neural Networks.

UNIT IV
From classical (CRISP) sets to fuzzy sets: introduction crispsets: an overview, fuzzy sets: basic t ypes, fuzzy sets: basic concepts, characteristics and significant of the paradigms hift. Fuzzy set sversuscrisp sets, representation of fuzzy sets, alpha cuts cardinality, Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersection: t- norms, fuzzy unions: t-Conorms, Distinction between Probability, Fuzzy and Random System.

UNIT V
Linguistics variables, linguistic edges, Fuzzy relations, Binary Operation on a single set, projection and cylindrical extension, Extension principles for fuzzy sets, Fuzzy Arithmetic: fuzzy numbers, arithmetic operations on fuzzy numbers, Fuzzy Equations.

UNIT VI
Defuzzification methods, design fuzzy rule base, Fuzzy Inference Systems: Mamdani Vs Sugeno, Steps indesign of a fuzzy controller, applications of fuzzy logic, Use of MATLAB for Design and Arguments

TEXT BOOKS:
1. Introduction to Artificial Neural System by J. M. Zurada, Jaico Publishing House, India.
2. Fuzzy logic & Neural Network b yT. J. Ross, TMH.

7th Semester

CT1453	PE II : Probabilistic Statistical Data Analysis				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To introduce basic statistical formulae to find out the tendency of data 2. To introduce probability and probability distribution concepts 3. To introduce the concepts of sampling and estimation 4. To introduce hypothesis testing and various scenarios for testing hypothesis 5. To introduce the statistical method for comparing more than two proportions 6. To introduce the modeling technique, regression to perform the predictive analysis	1. Able to analyze the hidden meaning in the data using some basic formulae and able to implement it using 'R Statistics' 2. Able to find out the probability and probability distribution for the given samples 3. Able to analyze the data using sampling technique 4. Able to take the decisions by using hypothesis testing on samples 5. Able to compare the population proportions 6. Able to create the model for predictive analysis

UNIT I [7 Hrs]

Introduction: Grouping and displaying data to convey meaning: Raw data, arranging data, frequency distribution, Measures of central tendency and dispersion in frequency distribution: arithmetic mean, weighted mean, geometric mean, Median, mode, dispersion, ranges, Exploratory data analysis(EDA). Introduction to R Statistics

UNIT II [8 Hrs]

Probability and Probability distribution: Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence. Probability distribution: What is probability distribution, random variables, use of expected value in decision making, and various distributions.

UNIT III [7 Hrs]

Sampling and Sampling Distribution and Estimation: Introduction to sampling, random sampling, Introduction to sampling distribution. Estimation: Introduction, Point estimates, Interval estimates and confidence interval, interval estimates using t distribution, determining the sample size in estimations

UNIT IV [8 Hrs]

Testing Hypothesis: One sample test, Two sample tests: Introduction, testing hypothesis, hypothesis testing of means when the population standard deviation is known, measuring power of hypothesis, hypothesis testing of proportions, HT when standard deviation is not known, hypothesis testing for means and proportions, test for difference between means for various sample sizes.

UNIT V [7 Hrs]

Chi-square and analysis of Variance: Introduction, chi-square as a test of independence, chi-square as a test of goodness of fit: testing the appropriateness of a distribution, analysis of variance, inference about a population variance, Inference about two population variance

UNIT VI [8 Hrs]

Simple Regression and Correlation and Multiple Regression and Modeling: Estimation using regression line, correlation analysis, making inference about population parameters, multiple regression and correlation analysis, finding the multiple regression equation, making inference about population parameters, modeling techniques

Text Book:

1. "Statistics for Management", Richard I. Levin & David S. Rubin, 7th Edition, Pearson Education.

Reference Book:

1. "Practical Statistics for Data Scientists, 50 Essential Concepts", Peter Bruce & Andrew Bruce, O'Reilly Media
2. "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer Press

7th Semester

CT1408	PE III: CLOUD COMPUTING				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
Main objective is to create, promote and exploit an open-source Cloud API and platform targeted for designing and developing multi- Cloud-oriented applications.	1. Explain software and hardware support for enterprise and cloud computing. 2. Perform data modeling for enterprise and cloud knowledge bases. 3. Design enterprise and cloud software applications. 4. Implement and run distributed and cloud applications. 5. Ensure security and privacy in enterprise and cloud applications.
PO, PSO MAPPING :- a,b,c,d,e,f,g,h,i,k,l,m	

UNIT I

Introduction to Cloud Computing: Defining Cloud Computing; Cloud Types and different models-The NIST model, The Cloud Cube Model, Deployment models, Service models; Examining the Characteristics of Cloud Computing; Benefits of cloud computing; Disadvantages of cloud computing; Assessing the Role of Open Standards.

UNIT II

Cloud Architecture, Services and Applications: Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frame works, Software as a Service, Identity as a Service, Compliance as a Service .

UNIT III

Abstraction and Virtualization: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT IV

Exploring Cloud Infrastructures: Managing the Cloud Administrating the Clouds, Management responsibilities, Lifecycle management Cloud Management Products, Emerging Cloud Management Standards, understanding Service Oriented Architecture- Introducing Service Oriented Architecture.

UNIT V

Managing & Securing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, The security boundary, Security service boundary, Security mapping, Brokered cloud storage access, Establishing Identity and Presence.

UNIT VI

Cloud Computing Cost Analysis, Selecting an IaaS Provider, Capacity Planning and Disaster Recovery in Cloud Computing, basic AWS Cloud architectural principles, basic/core characteristics of deploying and operating in the AWS Cloud, the key services on the AWS Platform and their common use cases, Define the billing, account management, and pricing models, Introduction to Amazon EC2. Case Studies: Microsoft Azure, Dropbox

TEXT BOOKS:

1. Cloud Computing Bible, by Sosinsky B. Wiley India.
2. Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online by Miller Michael, Pearson Education India.

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigm by Buyya R. Broberg, J. Goscinski, A. John Wiley & Sons.
2. Cloud Computing – A practical Approach by T. Velte, A. Elsenpeter, R. Tata McGraw Hill.
3. Cloud Computing and SOA Convergence in Enterprise by Linthicium D. Pearson Education India.
4. Enterprise Cloud Computing by Shroff G, Cambridge University Press
5. Private Cloud Computing by Smooth S. Tan, N. Morgan Kauffman.
6. Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online by Miller Michael, Pearson Education India .

7th Semester

CT1437	PE III : Parallel Computing				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To provide basics of concepts related to parallel computing 2. To understand principles of parallel algorithm design 3. To understand performance measuring metrics for parallel system 4. To understand basics of thread programming 5. To familiarize different directives of parallel programming framework i.e OpenMp To understand concepts of Dynamic Programming	1. identify areas where parallel computing is applicable 2. design parallel algorithm for real life problems 3. find the speedup factor by analyzing parallel programs 4. implement parallel programs using thread programming 5. implement different algorithms using OpenMp implement dynamic programming problems using parallel programming

PO, PSO MAPPING

Unit I :
Introduction to Parallel Computing: Motivating Parallelism Scope, Applications, Parallel Programming Platforms: Implicit Parallelism: Limitations of Memory System Performance, Dichotomy of Parallel Com puting Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process Processor Mapping and Mapping Techniques

Unit II :
Principles of Parallel Algorithm Design: Preliminaries Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, Basic Communication operations: One to All Broadcast and All to One Reduction, All to All Broadcast and Reduction, All Reduce and Prefix Sum Operations, Scatter and her, All to All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations

Unit III :
Analytical Modeling of Parallel Programs: Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics, Programming Using the Message Passing Paradigm: Principles of Message Passing Programming, The Building Blocks: Send and Receive Operations , MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators,

Unit IV :
Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing synchronous Programs,

Unit V
OpenMP: a Standard for Directive Based Parallel Programming, Dense Matrix Algorithms: Matrix Vector Multiplication,Matrix Matrix Multiplication, Solving a System of Linear Equations Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort, Other Sorting Algorithms, Graph Algorithms: Minimum spanning tree Prims Algorithm, Single Source Shortest Paths: Dijkstra's Algorithm
Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search,Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms

7th Semester

CT1437	PE III: Parallel Computing				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

Unit VI

Dynamic Programming: Overview of Dynamic Programming, Serial Monadic DP Formulations, Monadic DP Formulations, The Longest Common Subsequence Problem, Serial Polyadic DP Formulations, Floyd's All Pairs Shortest-Paths Algorithm, Nonserial Polyadic DP Formulations, The Optimal Matrix Parenthesization Problem, Fast Fourier ransform:
The Serial Algorithm, The Binary Exchange Algorithm, The Transpose Algorithm 27

Books :
1.
Introduction to Parallel Computing, Ananth Grama, Pearson Education

Reference Books:
1. Fundamental of Paralle Processing, Harry F. Jordan, Gita Alaghband, Pearson Education
2. Parallel Programming, Michael Allen, Barry Wilkinson, Pearson Ed

7th Semester

CT1454	PE III : Machine Learning Techniques				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESEDuration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To introduce basic concepts of machine learning and eexplain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To introduce the concepts of decision tree machine learning 5. To understand the different methods of evaluation of machine learning algorithms 6. To introduce advance topics of machine learning	1. Analyze a problem and identify the machine learning algorithm appropriate for its solution 2. Able to apply supervised learning for the given set of samples and design the model to meet desired needs 3. Able to apply unsupervised for the given set of samples 4. Able to design predictive model 5. Able to compare the different machine learning techniques demonstrates comprehension of the trade-offs involved in design choices 6. Able to apply other hybrid machine learning techniques

UNIT I [7 Hrs]

Introduction to machine learning. Introduction, machine learning classes (i.e., supervised, unsupervised and reinforced), well posed and ill posed learning problems, designing a learning system, perspective and issues in machine learning, applications

UNIT II [8 Hrs]

Supervised Learning: Learning a class from Bayesian learning, learning theory (bias/variance tradeoffs; VC theory; large margins), Generative/discriminative learning, parametric/non-parametric learning, linear and logistic regression, SVM

UNIT III [7 Hrs]

Unsupervised Learning: Introduction, Density Estimation, Clustering, Dimensionality reduction, PCA, kernel methods

UNIT IV [8 Hrs]

Decision Tree Learning: Introduction, decision tree representation, appropriate problems for Decision Tree learning, the basics decision tree learning algorithm, hypothesis space search, inductive bias in decision tree learning, issues in decision tree learning.

UNIT V [8 Hrs]

Design and Analysis of Machine Learning Algorithms. Introduction, Factors, Response, and Strategy of Experimentation, Guidelines for Machine Learning Experiments, Cross-Validation and Resampling Method, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms, Comparing Multiple Algorithms: Analysis of Variance, Comparison over Multiple Datasets

UNIT VI [7 Hrs]

Advance Topics. Ensemble methods, Introduce the concepts behind deep learning and benefits of deep over shallow networks, introduce the concepts of reinforcement learning

7th Semester

CT1454	PE III : Machine Learning Techniques				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESEDuration		
	15	15	10	60	100	3Hrs		

Text Book:

1. "Introduction to Machine Learning", Ethem Alpaydin, The MIT Press, second edition.
2. "Machine Learning", Tom Mitchell, McGraw-Hill Science/Engineering/Math, 1997

Reference Book:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning. http://research.microsoft.com/en-us/um/people/cmbishop/prml/.
2. R. Sutton and A. Barto, An Introduction to Reinforcement Learning (http://webdocs.cs.ualberta.ca/~sutton/book/ebook/thebook.html)
3. C. Szepesvari, Algorithms for Reinforcement Learning (http://www.sztaki.hu/~szcsaba/papers/RLAlgsInMDPslecture.pdf)
4. Deep learning:
Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning
(http://www.deeplearningbook.org/)

8th Semester

GE1408	Cyber Laws				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
PO, PSO MAPPING:	

UNIT I
Evolution of the Law relating to information Technology –Legal environment in Information Age-Technology and law-The international regime, The National regime and initiatives in internet legislation-Issues of jurisdiction in cyber space – International Convention on cyber space 2001 OECD model treaty and E-commerce.Internet Juridction

UNIT II
The basics of IT Act - Objectives, Scope and application of the Act of 2000, Application of the IPCode as a measure of penal statute to regulate cyber activities and cyber contracts. Basic foundations in the Information Technology Act for the protection of E commerce, E Contracts and E documents, Digital signatures and identity-Access requirements, contract formation related nomenclature as defined in Section 2 of the IT Act.Basic Contract Law – Formation of contracts, performance and discharge of contractual obligations under the Indian Contract Act, 1872., SLA, KPI

UNIT III
Legal aspect of Digital signature and Electronic signature:
Authentication of electronic record by electronic signature (5.3 and 3A),Legal recognition of econtract sand e-documents of the governments-ss.4, 5, 6 ,7A and 10A, Securing e-records and e-signatures, Duties of subscriber ss.40-42 ss. 14 and 15, Certification of e-signature (s.35,36,37,38,39), Regulation of certifying authorities through licensing application for license ,renewal of license, procedure for grant or rejection of license, suspension or revolution of license. Esign, Digital Locker.

UNIT IV Privacy and Security, basic Principal of Data Protection Act, Health Insurance Portability Accountability Act, concepts of ISO 27001 security Audit, Payment Card Industry Data Security Standard (PCI DSS), Computer crime investigation process and evidence collection, Incident Response Procedures, Net Neutrality

UNIT V Treatment of cyber crimes under the IT Act -2008
Offence and penalties prescribed in I.T Act 2008, Controller"s powers with respect to offences And their regulation. Law relating to Cyber crime Under Indian Penal Code (IPC) 1860 Making false electronic record (S.464 IPC) Punishment for forgery (S.465 IPC); forgery of public record etc. (S.466 IPC) and Forgery for purpose of cheating (S.468) Forged document or electronic record (S.470); Using as genuine a forged document or electronic record (S.471); Counterfeiting device or mark used for authenticating documents or electronic record or possessing counterfeit marked material, Falsifying accounts. (S.474 and S.477A).

UNIT VI
Implication of cyber law on intellectual property related issues and commercial transaction Copyright Act-definition of computer and computer program (S.2ffb), Subsistence of copyright in computer programs, Copyright and Internet, Copyright in digital medium, Copyright in computer databases Trade mark Act –Search engine and meta tags- Domain Names: digital marks in the online medium, Resolving domain name disputes, Cyber Squatting /TYPO squatting Domain name in Indian law, Uniform dispute resoloution policy.Other important issue like IP PANAROMA., BITCOINS, digital divide, Global Commans, Auto SAR, GIWG Guide line
WIPO copyright treaty (WCT) 1996,WIPO performance and phonograms treaty (WPPT) 1996.

1. Satyam infoway Ltd. Vs Sifynet solution Pvt. Ltd (2004) 6SCC145
2. The Napster"s story
3. Other case study

8th Semester

CT1450	Object Oriented Modeling				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To distinguish between procedure oriented and Object Oriented Methodology. 2. To understand the features of Object Oriented Programming. 3. To Understand the basic building blocks of C++ language. 4. To Understand the Utility and difference of various Data Structure. 5. To Understand the need of Exception. 6. Exception Handling Mechanisms of OOP Methodology using C++. 7. To study the concept of Templates . 8. To Understand the OOP methodology and relate to it day to day applications. 9. To relate various practical examples with the OOP Methodology.	1. Compare different types of Programming Languages 2. Describe Real World object, Structure and Class. 3. Implement the Programming Examples. 4. Implement the Concept of abstract class Concept of Interface. 5. Define and classify Data Structure. 6. Implement the Mechanisms and Concept of Exception , Types of Exception 7. Define stream, the Concept of File, Opening and Closing of File

PO, PSO MAPPING: a,c,e,g,i,j,k,l,m

UNIT I
Introduction: object orientation, Object Oriented development, modeling as a design technique, Class modeling:- the three models, object, classes, links and associations, navigation of class models, aggregation, abstract classes, metadata, packages.

UNIT II
State Modeling: events & states, transitions and conditions, state diagrams behavior, concurrency advanced state modeling concepts, nested state diagrams, concurrency, relation of class & state models. Interaction modeling: Use case. Sequence and activity models, relationships among the models.

UNIT III
System Analysis: Development life cycle and development style, system conception, domain analysis application analysis

UNIT IV
System Design: Overview, estimating performance, making are use plan, breaking into sub systems, identifying concurrency, allocation of sub systems, management of data storage, handling global resources, choosing software control strategy, handling boundary conditions, setting trade off priorities, common architectural styles.

UNIT V
Class Design, implementation modeling, object oriented languages.

UNIT VI
Databases: implementing structures basic and advanced, implementing functionality, object oriented databases. Object oriented programming style, reusability, extensibility, robustness.

TEXT BOOKS:
1. Object oriented modeling and design with UML by James Rumbaugh, Michal Blaha, Pearson Prentice Hall Second Edition.

REFERENCE BOOKS:
1. Practical Object Oriented Design with UML by Mark Priestley TMH 2nd Edition
2. The Unified Modeling Language user guide by Booch , Rumbaugh, Jacobson Addison Wesley 2nd Edition

8th Semester

CT1418	PE IV: Digital Image Processing				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To provide understanding of basics of Digital Image Processing, discuss fundamental concepts of neighborhood pixel, Spatial Domain Image Processing, provide insight of histogram processing, study the frequency Domain Image Processing, provide the details of segmentation and provide the regional and descriptors concept.	1. Apply Image Enhancement techniques in Spatial Domain. 2. Know and Apply Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging on images. 3. Perform Fourier Transform on images. 4. Understand and apply Homographic Filtering. 5. Apply different segmentation techniques on images.
PO, PSO MAPPING :- a,b,c,d,e,i,k,l	

UNIT I

Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception, Fundamentals of Image processing, A Simple Image Model, Sampling and Quantization, Some Basic Relationships. between Pixels, Image Geometry in 2D.

UNIT II

Image Enhancement in the Spatial Domain: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

UNIT III

Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Discrete Cosine Transform, Typical Applications

UNIT IV

Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering, Implementation.

UNIT V

Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.

UNIT VI

Image Representation: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models, introduction to image file formats: TIFF, JPEG, BMP, etc.

TEXT BOOKS:

1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
2. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing by A.K Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya & Ajo y K. Ray, Wille y Inter-Science.

8th Semester

CT1419	Lab. : PE IV: Digital Image Processing	L=0	T=0	P=2	Credits=1
Evaluation Schem	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Sr.No.	Practical Name
1	Study Practical on basic gray level transformation.
2	Write a program to create a contrast of image.
3	Create a histogram of given image.
4	Resize a given Image.
5	Write a program to create negative of an image.
6	Create a Binary Image.
7	Write a program to smooth an image.
8	Write a program to Sharpe an image.
9	Segment a given image.
10	Create a skeleton of region.
Beyond Syllabus Practical List:	
1	Apply wavelet transform to decompose an image.
2	Apply gabor filter to enhance an image.

8th Semester

CT1455	PE IV :Cyber Forensics			L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration	
	15	15	10	60	100	3Hrs	

OBJECTIVES	OUTCOMES
1. To study various accepts of Information security and protect the IT asset from outside word. 2. To study different modern techniques for with respect to Computer System and Networks 3. Ethical Hacking accepts for protecting information security. 4. To make comparative analysis of different forensics techniques for wireless technology 5. To study different legal web attacking technique for securing web servers 6. To study and compilation of report writing tool and technique used in digital forensics.	1. Able to apply various accepts of Information security and Information technology with respect to cyber laws 2. Able to analyse various tool and methodology for cyber forensics 3. Able to explorer ethical hacking and its countermeasure 4. Able to apply various technique for protecting data in wireless technology 5. Able to evaluate various web attacking technique and there countermeasure 6. Able to design report for different forensic cases for submitting in court of laws

Unit I **[7 Hrs]**

Types of Cyber Crime, security Attacks, Overview and Computer forensics in today's world computer hard ware basics Computer forensics investigation process, understanding hard disks and file systems, Types of computer forensics.

Unit II **[7 Hrs]**

Computer forensic: Data acquisition and duplication, Defeating anti-forensics techniques, operating system forensics, Log analysis and event viewer, File auditing, identifying rogue machines, Malware forensic Database forensic.

Unit III **[7 Hrs]**

IT fraud, Recovery of deleted files, Live Data collection and investigating Linux environment. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), email crimes.

Unit IV **[7 Hrs]**

Network forensics, investigating web attacks, Gathering Tools to create a response toolkit. Hidden files and unauthorized access points. Analyzing network traffic, sniffers Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc.

Unit V **[7 Hrs]**

Mobile Forensics, Live Data collection and investigating on android, ios, windows environment, Investigating report generation, investigation process, acquisition types, tools, report generation

Unit VI **[7 Hrs]**

Forensics report writing and presentation, Case studies

Text Books:

1. Mandia, K., Prosise, C., Pepe, M., Incident Response & Computer Forensics. 2nd edition, Tata-McGraw Hill,
2. Bill Nelson, Amelia Phillips, Frank Enfinger, and Chris Steuart, Guide to Computer Forensics and Investigations, 2nd edition, Thomson Learning

Reference Books:

1. Eoghan Casey ,Digital Evidence and Computer Crime, 2nd Edition , academic Press File System Forensic Analysis by Brian Carrier, addition Wesley
2. Harlan Carvey Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Syngress Publication
3 Steve Bunting, EnCE: The Official EnCase Certified Examiner Study Guide, 2nd Edition, Sybex Publication

8th Semester

CT1456	Lab : PE IV :Cyber Forensics	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Objectives	Outcomes
1. To study various accepts of Information security and protect the IT asset from outside word. 2. To study different modern techniques for with respect to Computer System and Networks 3. Ethical Hacking accepts for protecting information security. 4. To make comparative analysis of different forensics techniques for wireless technology 5. To study different legal web attacking technique for securing web servers 6. To study and compilation of report writing tool and technique used in digital forensics.	1. Able to apply various accepts of Information security and Information technology with respect to cyber laws 2. Able to analyse various tool and methodology for cyber forensics 3. Able to explorer ethical hacking and its countermeasure 4. Able to apply various technique for protecting data in wireless technology 5. Able to evaluate various web attacking technique and there countermeasure 6. Able to design report for different forensic cases for submitting in court of laws
Mapped Program Outcomes:	

List of Practical:

1. Study practical on cyber-crime and generation of Hash values on file system
2. Perform data accusation and imaging on digital evidences
3. Perform recovery and data carving on digital evidence
4. Explore and analyses tools on Email analysis an investigation
5. Password recovery tools, from RAR, DOC, PDF, windows password.
6. Mobile forensics SIM card analysis,
7. Mobile data Analysis AND Fraud Detection,
8. Vulnerability Analysis on Windows
9. Report and Evidence Submission using Tools

8th Semester

CT1433	Lab. : PE V : Software Project Management	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	40	60		100	

Sr.No.	Practical Name
1	Introduction to Software Project Management fundamentals.
2	To analyze requirements for a given case study .
3	To create a WBS for the given case study.
4	To perform risk management for the case study – 1.
5	To perform risk management for the case study – 2.
6	Overview of Planning tool.
7	To create Project Schedule for the case study-1.
8	To create Project Schedule for the case study-2.
9	To perform cost benefit analysis for case study.
10	To study contract management and contract document.
	Beyond Syllabus Practical List:
1.	To study and calculate Software Project Metrics.
2.	To study implementation of change control.

8th Semester

CT1443	PEV : Internet of Things				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		
OBJECTIVES				OUTCOMES				
To provide the details about the IoT(Internet of Things) and let understand and implements the emerging concepts about Internet of things				Students should be able to use, implements various platform from IoT and proficient to design and development of Smart Cites concepts.				
PO, PSO MAPPING :- a,b,c,e,h,k,l,								

UNIT I APPLICATION DEVELOPMENT

Introduction – Concepts behind the Internet of Things.

The IoT paradigm, Smart objects, Bits and atoms, Goal orientation, Convergence of technologies, In IoT architectures, IoT enabling technologies, IoT Big Data Analytics, IoT security and privacy concerns. Computing paradigms: Virtualization Vulnerabilities, Hypervisor Security-Related Issues, Side Channel Attacks, Data Segregation, ubiquitous, grid, cloud, pervasive, green, ad hoc (*mobile*, *vehicular*, *flying*) networks.

UNIT II

Governance of Inter of things, Bodies subjects to Governing principal, substantive Principe of IoT Governance IoT Infracture Governance, Future Governance Issue, implementation of Smart city and smart villages projects , challenges and issues in SMART Projects

UNIT III cloud computing enable technology

Radio frequency Identification technology

Radio frequency Identification technology overview, Principle of RFID, Components of RFID technology Overview, Wireless sensosor network tencnology overview, connecting node, networking securing communication, Power line communication technology overview, PLC Technology standard, archecture of home technology overview, RFID Research and related issue

UNIT IV Advance Cloud computing

Internet of things and cloud computing, IoT integration with Enterprise system, (XaaS) Everthing As a Services, Distributed business process in IoT, Distributed business processs in IoT, ubiquitous technology in cloud, middlewae for IoT, standards for SCDA, Standards for M2M, Unified mult tire WoT Architecture, SOA/EAI verus SODA MAI, Mobile cloud computing, four technology pillar, WoT Portal and Business Architectural

UNIT V ADVANCED SOCKETS-I

Routing sockets – Datalink socket address structure – Reading and writing – sysctl operations –get_ifi_info function – Interface name and index functions- Key Management sockets – Reading and writing – Dumping Security Association Database – Creating static Security Association – Dynamically maintaining SA's – Broadcasting – Broadcast addresses – Unicast versus Broadcast – (Client) Application development for broadcasting – Race conditions – Multicasting – Multicast addresses- Multicasting versus Broadcasting on a LAN – Multicasting on a WAN – Source specific Multicast – Multicast socket options – mcast_join, (Client) Application development for multicasting – Receiving IP multicast infrastructure session announcements – Sending and receiving.

UNIT VI Case Study and Projects

Introduction to Raspberry Pi, Setup and operate the Raspberry Pi ,Understand the basics of the Linux OS used on the Pi ,Understand the basics of the X Windows System (the GUI environment) , Program the Pi for a simple GUI-based game , Program the Pi to access a network, Raspberry Pi ARM ARM Architecture, ARM 11 future, Ardunio Basics Project and case study based on Ardunio and Pi

8th Semester

CT1443	PE V : Internet of Things				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

REFERENCES

1. W. Richard Stevens, "Unix Network Programming Vol-I", Second Edition, Pearson Education, 1998.
2. D.E. Comer, "Internetworking with TCP/IP Vol- III", (BSD Sockets Version), Second Edition, Pearson Education, 2003.
3. Michael Donahoo, Kenneth Calvert, "TCP/IP Sockets in C, A practical guide for programmers", Second Edition, Elsevier, 2009
4. Forouzan," TCP/IP Protocol Suite" Second Edition, Tata MC Graw Hill, 2003.

8th Semester

CT1445	PE V : Numerical Computing	L=3	T=1	P=0	Credits=4

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

Objectives	Outcomes
To develop in the engineering students the ability to analyze any engineering problem in simple mathematical manner and to apply to its solution, to understand basic mathematical principles.	Students should be able to apply various numerical techniques to solve engineering problems.

Mapped Program Outcomes: a,b,c,e,g,i,k,l,m

UNIT I : [6Hrs]
Introduction to numerical computing: Characteristics of Numerical computing, Approximations and errors in numerical computations, types of errors, analysis, error estimation, numerical instabilities in computation, convergence (convergence of iterative method),

UNIT II: [8Hrs]
Roots of Non-linear equations: Methods of solutions, Iterative methods, Horner's rule, Bisection method, Regula Falsi method, Iteration method, Newton Raphson method, Secant method, Muller method.

UNIT III :[8Hrs]
Solutions to System of Linear Algebraic Equations:
Existence of Solution, Solution By Elimination, Cramers rule, Basic Gauss Elimination Method, Gauss Elimination With Pivoting, Gauss – Jordan Method, Tringularization Methods, Choleskey's Method, Gauss Siedel method of iteration. Round Off Errors And Refinement, Ill – Conditioned System, Matrix Inversion Method.

UNIT IV :[8Hrs]
Interpolation and Approximation: Linear interpolation and high order interpolation using Lagrange and Newton Interpolation methods, finite difference operators and interpolation polynomials using finite differences.

UNIT V: [8 Hrs]
Numerical Differentiation and Integration: Numerical differentiation and errors in numerical differentiation, Newton-Cotes formulae, trapezoidal rule, Simpson's rule, Double integrals by Trapezoidal and Simpson rule, Romberg Integration.

UNIT VI:[8Hrs]
Numerical Solution of Ordinary Differential Equation: Solution By Taylor's Series, Picard's Method Of Successive Approximation, Euler's Method, Error Estimates For The Euler Method, Runge-Kutta Method for 2nd and 4th order, Predictor-Corrector Methods, Initial and boundary value problems.
Matrix Eigen – Equations: Concept of Eigen-System, Polynomial Method, Power Method for Eigen Values and Eigen-vector,

Text Books:
1. Sastry, S. S. "Introductory Methods of Numerical Analysis", 3rd Edition. Prentice- Hall of India, New Delhi (2002).

Reference Books:
1."Numerical Methods" , E. Balagurusamy, Tata McGraw hill.

2."Schaum's Outlines: Numerical Analysis", 2nd Edition, Tata McGraw Hill Publishing Co. Limited.

3."Numerical Computational Methods" P.B. Patil, U.P. Verma, Narosa Publishing, New Delhi, 2006.

8th Semester

CT1446	Lab. : PE V: Numerical Computing	L=0	T=0	P=2	Credits=1

Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration
	40	60	100	

Objectives	Outcomes
To apply the numerical methods to real life scenario.	Students should be able to apply theoretical numerical methods to solve real life problems.

Mapped Program Outcomes: b,c,e,g,i,k,l,m

COURSE OBJECTIVES
1. To apply the theoretical numerical methods to real life scenario.

LIST OF PRACTICAL
1. Write A Program To Find The Root Of The Equation $X^3 - 2x - 5 = 0$ By Using Bisection Method.
2. Write A Program To Find The Root Of The Equation $X^3 - 2x - 5=0$ By Using False Position Method.
3. Write A Program To Find The Root Of The Equation $X^2-3x+2=0$ By Using Newton Raphson Method
4. Write A Program To Find The Root Of The Equation $X^2-3x+2=0$ By Using Muller Method.
5. Write A Program To Solve The System Of Equation By Using Gauss Elimination Method.
6. Write A Program To Solve The System Of Equation By Using Triangular Factorization Method.
7. Write A Program To Find The Square Root By Using The Second Order Lagrange Interpolation Polynomial Equation.
8. Write A Program To Fit A Line Y=A + Bx To Given Set Of Data Point By Least Squares Method
9. Write A Program For Integrating A Given Function By Using Simpson 1/3rd Rule
10. Write A Program To Estimate The Solution In The First Order Differential Equation Y=F(X,Y) At Given Point By Using Euler's Method

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INFORMATION TECHNOLOGY

III SEMESTER

IT2205	Data Structures and Program Design- I	L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

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

Objective	Course Outcome
1. Given knowledge about structured programming, third semester CSE 2. students should develop skills to create error free and efficient programs; by applying data -structures fundamentals and program analysis techniques	• Learn how to use data structure concepts for realistic problems. • Ability to identify appropriate data structure for solving computing problems in respective language. • Ability to solve problems independently and think critically.

Unit No.	Contents	Max. Hrs.
1	Types and operations, Iterative constructs and loop invariants, Quantifiers and loops, Structured programming and modular design, Illustrative examples, Scope rules, parameter passing mechanisms, recursion, program stack and function invocations including recursion.	5
2	Overview of arrays and array based algorithms - searching and sorting, Sparse matrices. Asymptotic Notations, Time-Space trade off.	5
3	Structures (Records) and array of structures (records). Database implementation using array of records. Dynamic memory allocation and deallocation. Dynamically allocated single and multi-dimensional arrays, polynomial representation.	7
4	Concept of an Abstract Data Type (ADT), Lists as dynamic structures, operations on lists, implementation of linked list using arrays and its operations. Introduction to linked list implementation using self-referential-structures/pointers.	
5	Stack, Queues and its operations. Implementation of stacks and queues using both array-based and pointer-based structures. Applications of stacks and queues.	6
6	Files, operations on them, examples of using file.	5

Text Books/Reference Book			
Sr. No.	Title	Authors	Publisher
1	The C Programming Language	Brian W. Kernighan and Dennis M. Ritchie	Prentice Hall of India
2	Programming in ANSI C	E. Balaguruswamy	Tata McGraw-Hill
3	How to Solve it by Computer	R. G. Dromey	Pearson Education
4	Data Structures & Program Design in C	Robert Kruse, G. L. Tondo and B. Leung PHI-EEE	
5	Data Structures	Seymour Lipschutz	Tata McGraw-Hill
6	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	W. H. Freeman and Company.

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III SEMESTER

IT2206	Lab : Data Structures and Program Design- I	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration
	--	40	60	100	--

Objective	Course Outcome
1. Given knowledge about structured programming. 2. Students should develop skills to create error free and efficient programs; by applying data - structures fundamentals and program analysis techniques	Upon successful completion of this course, students will be able to: 1. Comprehend programming constructs like function, array, string, pointer, structure, file and also understand basic data structures like list, stack, queue. 2. Apply appropriate data structures in problem solving. 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Sr. No	Problem Statements
1	Program for counting number of digits in a random number
2	Program for generating list of random numerals and print them in words
3	Program to print Pascal's triangle 1 1 1 1 2 1 1 3 3 1

	1 4 6 4 1 1 5 10 10 5 1
4	Program for finding GCD of two numbers using factorial method
5	Program for finding GCD of two numbers using recursion. Also, print number of recursive calls.
6	Program for allocating memory dynamically for single dimensional array and sort it using quick sort and merge sort
7	Program for allocating memory dynamically for two-dimensional array printing it in spiral manner.
8	Program to create linked list of cell phone with any 3 attributes as data fields and print it
9	Program to create file for storing details of all the items needed for playing any game of your choice also perform display, insertion of new record at any location, deletion of any record
10	Program to implement stack and print MAX data item from it

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BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

III SEMESTER

IT2203	Object Oriented Programming		L=3	T=0	P=0	Credits=4
Evaluation Scheme	MSEs-	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	
Prerequisite Courses						

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

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development 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
IT	Understand basic features of JAVA as an object oriented-programming language.	1	2										2	1	
IT	Write, compile, test and run simple Java programs	2	3										2	2	
IT	Write object based programs with object oriented features	3	1										2	1	
IT	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 object	3	2										2	2	
IT	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.	2	2										2	1	
IT	Be able Use Java programming language features to design and create Java applets.	2	1										2	2	
		2	2										2	2	

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BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

III SEMESTER

IT2203	Object Oriented Programming		L=3	T=0	P=0	Credits=4
Evaluation Scheme	MSEs*	TA	ESE	Total		ESE Duration
	30	10	60	100		3 Hours
Prerequisite Courses						

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

Unit No.	Contents	Max. Hrs.
1	**UNIT I** : Introduction to Object oriented programming, Introduction to Java as OOP language: Importance of java, Parts of the java language, Java Environment, Structure Of A Java Program. Building blocks of java, Data types, Variable declarations ,operators and Assignments ,control structures, objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	08
2	**UNIT II** : Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	07
3	**UNIT III** : Arrays, Strings Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes,	08
4	**UNIT IV** : 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,	07
5	**UNIT V** : Collection Vector and Framework: Introduction to collection framework, Vectors, Array List, Linked list, Hashset, Treeset, Hashmap	07
6	**UNIT VI** : IO Steam, applets and Thread: 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, Introduction to applets, applet lifecycle, creating and executing applets, Introduction to multithreading, life cycle of Thread, Runnable interface and Thread class.	08

Text Books			
Sr.No	Title	Authors	Publisher
1	Thinking in Java	Bruce Eckel	Prentice Hall
Reference Books			
1	Java2 Complete Reference	Herbert Schildt	McGraw-Hill
2	Programming with Java	E. Balagurusamy	TATA McGraw-Hill

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III SEMESTER

IT2204	Lab: Object Oriented Programming		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs	TA	ESE	Total		ESE Duration
	--	10	60	100		3 Hours

Objective	Course Outcome
1. Be able to use the JAVA SDK environment to create, debug and run simple JAVA programs.	1. Design, develop, test, and debug programsusing object oriented principles using java s.

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

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BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

III SEMESTER

IT2207	Computer Architecture and Organization		L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSEs*	TA	ESE	Total		ESE Duration
	30	10	60	100		3 Hours
Prerequisite Courses						

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

Objective	Course Outcome
1. Study the fundamentals of computer organization and its relevance to classical and modern problems of computer Architecture. 2. Learn how to generate control signals for instructions using different architecture 3. Learn control units operations and its performance issues. 4. Study the different arithmetic operation including the algorithms & implementation for fixed-point and floating-point numbers. 5. Study the hierarchical memory system including cache memories and virtual memory 6. Study the different ways of communicating with I/O devices and standard I/O interfaces and advanced concept of computer architecture.	1. Students will be able to describe fundamentals of computer architecture and organization. 2. Students will be able to write control sequence for instructions. 3. Students will be able to identify control unit operations and understand performances issue in processor and memory. 4. Students will be able to perform arithmetic operations and describe its storage formats. 5. Students will be able to design main memory organization that uses banks for different word size operations and describe the concept of cache mapping techniques. 6. Students will be able to describe the concept of I/O organization and discuss some advanced methods for improving systems performance.

Unit No.	Contents	Max. Hrs.
1	Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, addressing methods and machine program sequencing : Memory Locations , addressing and encoding of information, Main memory operation . Instruction Format, limitations of Short word- length machines, High level language considerations	7
2	Processing Unit: Some fundamental concepts, Single, two, three bus organization, Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instruction, Instruction sequencing, addressing modes. Case study – instruction sets of some common CPUs.	8
3	Hardwired Control : Design Micro-programmed Control: Microinstructions, Grouping of control signals, Micro program sequencing, Micro Instructions with next Address field, Perfecting microinstruction, Emulation, Bit Slices. Case study – design of a simple hypothetical CPU	7
4	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.	8

5	The main Memory: some basic concepts, semiconductor RAM memories, Memory system consideration, semiconductor ROM memories, Multiple module memories and interleaving, Cache Memory, Mapping techniques, Replacement algorithms, write policies Virtual memories, memory management requirements.	8
6	Computer Peripherals: I/O Devices, I/O device interface, DMA, Interrupt handling Role of interrupts in process state transitions, I/O device interfaces – SCII, USB Introduction to Pipelining, Throughput and speedup, pipeline hazards Introduction to parallel processors.	7

Text Books			
Sr. No	Title	Authors	Publisher
1	Computer Organization and Design: The Hardware/Software Interface	David A. Patterson and John L. Hennessy	5th Edition Elsevier.
2	Computer Organization and Embedded Systems	Carl Hamacher .	McGraw Hill Higher Education 6th Edition
3	Computer architecture and organization	Carl Hamacher	McGraw Hill Higher Education 4th Edition
Reference Books			
1	Computer Architecture and Organization	John P. Hayes,	WCB/McGraw-Hill 3rd Edition
2	Computer Organization and Architecture: Designing for Performance	by William Stallings,	10th Edition Pearson Education.
	Computer System Design and Architecture	Vincent P. Heuring and Harry F. Jordan,	2nd Edition Pearson Education

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INFORMATION TECHNOLOGY

III SEMESTER

IT2208	Lab: Software Lab		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration	
	--	40	60	100	--	

Course Learning Objective	Course Outcomes
1. Understanding data types, data structures, control , and Loop statements in Python. 2. Learn def function definitions, and modules. 3. Learn basic object oriented concepts using Python. 4. Developing applications in Python using customized and built in modules and packages.	After learning the course, the students will be able to 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python 2. To understand the concepts of functions modules and packages and write complex programs using them. 3. To understand defining and handling Python objects and develop classes required for the given application 4. To develop a useful application in Python.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1---.-	Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python	3													
IT1---.-	To understand the concepts of functions modules and packages and write complex programs using them.	3	1												
IT1---.-	To understand defining and handling Python objects and develop classes required for the given application	3	1												
IT1---.-	To develop an useful application in Python	2	2	2	1	1				2			2	1	1

Contents:

Module 1: Introduction: Build-in Data types: Data type & Variables, Python numbers, Python Strings, Python built in data structures: Lists, Dictionaries, Tuples, Sets, Arrays. Datatype conversion. Statements: Assignment statement, import statement, print statement, input statement, Python Control Statements: if, if – else, elif statements, Loop statements: For, while, continue and break, try and except statement, raise, with statements, case statement.

Module 2: Python Functions, Modules and Packages: The def statement, returning values, parameters, arguments, local variables, global variables and global statement, doc strings for functions, Mathematical Function, Generating Random numbers, File Handling.

Module 3: Python Object and Classes: A simple class, defining methods, member variables, The constructor, calling methods, adding inheritance, class variables, class methods and static methods, Interfaces, New-style classes, Doc strings for classes, Private members, Python Operator Overloading, Python inheritance and polymorphism, Exception Handling, Python Modules.

Module 4: Developing applications in Python using built in and customized modules and packages.

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III SEMESTER

IT2208	Lab: Software Lab		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total		ESE Duration
	--	40	60	100		--

Sr. .	Topics to be Covered	Sample Problem Statement
1.	Demonstration of Build-in Data types: Data type & Variables, Python numbers	Write a Python program to compute the roots of a quadratic equation
2.	Demonstration of Python Lists.	Write a Python program to perform following operations: **i)** Insertion of element in a given list **ii)** Deletion of element from the given list
3.	Demonstration of different Statements: Assignment statement, import statement, print statement, input statement	Write a Python program to find square root of a number
4.	Demonstration of control statements: if, if – else, elif statements	Write a Python program to enter day number (1-7) and print the corresponding day of week name using if else. (e.g 5 then Friday)
5.	Demonstration of Loop statements: For, while, break, continue	Write a Python program to print all prime numbers from 1 to 100 (using nested loops, break and continue)
6.	Demonstration of try and except statement, raise, with statements, case statement	Write a Python program which take character as input and determine about vowels and consonants using case statement.
7.	Demonstration of Python Functions: The def statement, returning values, parameters, arguments	Write a Python program using user defined function to find the sum of following series. 1/1! + 2/2! + 3/3! + ……1/N!
8.	Demonstration of Python Mathematical Function	Write a Python Program to implement some mathematical functions
9.	Demonstration of Python File Handling	Write a Python program to read data from "Input.txt" file using File Input Class and write output to "Output.txt" using File Output class.
10.	Demonstration of Python Object and Classes: A simple class, defining methods, member variables	Write a program to define a class Employee with four data members such as Emp_name, Emp_id, Salary and department_id. Define appropriate methods to initialize and display the values of data members. Also calculate Gross salary of employee based on Basic Salary, TA, DA and HRA of employee
11.	Demonstration Python inheritance	Create a class Account that stores the customer name, account, number and type of account. From this derive the classes Current-acct and Saving-acct to make them more specific to their requirement. Include necessary methods in order to achieve the following tasks: (a) Accept deposit from a customer and update the balance. (b) Display the balance (c) Compute and deposit interest. (d) Permit withdrawals (e) Check the minimum balance, impose penalty, if necessary and update the balance
12.	Demonstration of Python Exception Handling.	Write a program to implement Exception handling in Python.
13	Building Application	Develop some useful application in Python

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Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

IV SEMESTER

IT2251	Data Structures and Program Design-II	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses	Data Structures and Program Design-I, Programming Language C				

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

Objective	Course Outcome
• To understand the basic structure concept such as Abstract Data Types, Linear and Non Linear Data structures. • To understand the notations used to analyze the Performance of algorithms. • To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graph and their representations. • To choose the appropriate data structure for a specified application. • To understand and analyze various searching and sorting algorithms. • To write programs in C to solve problems using data structures such as array, linked lists, queues, trees, graphs, hash tables, search trees.	Upon successful completion of this course, students will be able to: 1. Understand data structures like Tree, Graph, Set, Hash table. 2. Apply appropriate data structures in problem solving. 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Unit No.	Contents	Max. Hrs.
1	Trees, binary trees: representation and traversals, Binary search Trees (BSTs), Height-balanced trees	5
2	Heap tree, Splay trees, B-trees, B+ trees. Applications of trees	7
3	Graphs: representation & traversals. Spanning trees, shortest path algorithm, topological sort	5
4	Sets: Representation and Operations. Sorting and searching	6
5	Pattern matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.	5
6	Hash table, File Organization, external sort	5

Text Books/Reference Book

Sr. No.	Title	Authors	Publisher
1	The C Programming Language	Brian W. Kernighan and Dennis M. Ritchie	Prentice Hall of India
2	Programming in ANSI C	E. Balaguruswamy	Tata McGraw-Hill
3	How to Solve it by Computer	R. G. Dromey	Pearson Education
4	Data Structures & Program Design in C	Robert Kruse, G. L. Tondo and B. Leung	PHI-EEE
5	Data Structures	Seymour Lipschutz	Tata McGraw-Hill
6	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	W. H. Freeman and Company.

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV SEMESTER

IT2252	Lab: Data Structures and Program Design-II		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	
Prerequisite Courses	Data Structures and Program Design-I, Programming Language C					

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

Objective	Course Outcome
• To understand the basic structure concept such as Abstract Data Types, Linear and Non Linear Data structures. • To understand the notations used to analyze the Performance of algorithms. • To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graph and their representations. • To choose the appropriate data structure for a specified application. • To understand and analyze various searching and sorting algorithms. • To write programs in C to solve problems using data structures such as array, linked lists, queues, trees, graphs, hash tables, search trees.	Upon successful completion of this course, students will be able to: 1. Understand data structures like Tree, Graph, Set, Hash table. 2. Apply appropriate data structures in problem solving. 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Sr. No	Problem Statements
1	Program for displaying nodes of linked list in reverse order using recursion
2	Implement queue using linked list
3	Program to Print the Alternate Nodes in a Linked List using Recursion
4	Program based on Binary tree: creation, display
5	Program based on Binary tree: deletion and traversals
6	Program for Heap sort
7	Program for inserting a key and searching a key in tries
8	Program for printing BFS and DFS sequence of graph
9	Program for detecting presence of cycle in given graph G
10	Program for printing topological sort of given graph

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INFORMATION TECHNOLOGY

IV SEMESTER

IT2253	Computer Networks	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

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

Objective	Course Outcome
Student will study : 1. To understand the modern network architectures from a design and 2. Models perspective. 3. Understand the basic of hardware, software and types of transmission media used in computer networks. 4. Understand the concept of various protocols used in data link layer 5. Understand the Concept of adaptive and no adaptive routing algorithms 6. Understand the concept of Quality of Service provided by the transport layer 7. Understand the concept of knowledge cryptography techniques for network security.	After completion of the course students will be able to: 1. Explain the functions of the different layer of architectures and Models. 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. Demonstrate 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												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1338.1	Explain the functions of the different layer of architectures and Models	**3**													
IT1338.2	Demonstrate basic understanding of hardware, software and types of transmission media used in computer networks		**2**												
IT1338.3	Describe the concept of various protocols used in data link layer		**2**												
IT1338.4	Demonstrate the knowledge of adaptive and no adaptive routing algorithms	**2**	**2**												
IT1338.5	Demonstrate the concept of Quality of Service provided by the transport layer		**2**												
IT1338.6	Apply basic knowledge cryptography techniques for network security	**2**		**2**			**2**								
		2	2	2			2								

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV SEMESTER

IT2253	Computer Networks		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	
Prerequisite Courses						

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

Unit No.	Contents	Max. Hrs.
1	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	05
2	Physical layer: theoretical basis for data communication, Guided transmission media, wireless transmission: electromagnetic spectrum, radio transmission, infrared transmission. Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	05
3	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA	07
4	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	09
5	**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. Performance issues: performance problems in networks, network performance measurement.	08
6	**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Network security: cryptography, introduction to symmetric and public key algorithms, digital signatures, authentication protocols, e-mail and web security.	06

IV SEMESTER

IT2254	Lab: Computer Networks		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total		ESE Duration
	--	40	60	100		--

Objective	Course Outcome
Students will be able to: 1. Study the services and features of the Computer networks. 2. Study Errors in data transfer and configuration of the DNS and DHCP Servers	Students will be able to: 1. Understand and describe the services and features of the Computer networks. 2. Detect Errors in data transfer and configure the DNS and DHCP Servers

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1339.1	Students will be able to Understand and describe the services and features of the Computer networks .	**2**	**2**											**1**	
IT1339.2	Detect Errors in data transfer and configure the DNS and DHCP Servers	**2**	**2**		**1**	**3**								**2**	
		2	**2**		**1**	**3**								**1**	

Sr. No	Problem Statements
1.	To Study different types of network & networking commands in Linux.
2.	To Configure DNS Server using CISCO Packet Tracer
3.	To implement client-server application using java network programming.
4.	Write a program to perform Bit stuffing.
5.	Write a program to implement CRC.
6.	Write a program to implement Hamming Code.
7.	To Configure DHCP using CISCO Packet Tracer
8.	To Configure RIP server using CISCO Packet Tracer.
9.	To Configure Simple VLAN server using CISCO Packet Tracer.
10.	To Study campus networking of YCCE.

IV SEMESTER

IT2255	Operating Systems	L=0	T=0	P=2	Credits=1

Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration
	30	10	60	100	3 Hours
Prerequisite Courses					

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

Course Learning Objective	Course Outcomes
Student will study : 1. To understand the role, components, and designing issues associated with operating systems. 2. 2. To understand processes and threads, CPU scheduling algorithms, and process synchronization mechanisms 3. 3. To comprehend the concepts of memory management including virtual memory. 4. 4. To understand issues related to file system interface and implementation, and disk scheduling.	**After undergoing this course students will be able to** • understand the fundamental concepts in Operating Systems (OS) and understand how various hardware features support OS functionality. • explain various OS mechanisms and policies for managing system resources. • analyze algorithms and techniques for managing various OS resources in a multiprogramming and other environments. • evaluate the performance of algorithms for managing various OS resources.

Unit No.	Contents	Max. Hrs.
1	**Introduction to OS:** evolution of OS, basic hardware support necessary for modern operating systems, Layered Structural of OS, Services provided by OS, system calls, Dual mode of operation. Input-output Management : Basics of I/O hardware, Polling, Interrupts and DMA.	(6)
2	**Process management:** introduction, process control block, process states, process context switch, introduction to threads, CPU scheduling, goals of scheduling, Algorithmic evaluation of CPU scheduling algorithms.	(5)
3	**Interposes communication:** process cooperation and synchronization, race condition, critical region, mutual exclusion and implementation, semaphores, classic problems of Synchronization using semaphores.	(6)
4	**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.	(5)
5	**Memory management techniques:** -contiguous allocation, static and dynamic partitioning, and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads.	(5)
6	**Virtual memory:** demand paging, page replacement algorithms, thrashing, working set model. **Deadlocks**: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.	(7)

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV SEMESTER

IT2255	Operating Systems			L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE		Total		ESE Duration
	30	10	60		100		3 Hours
Prerequisite Courses							

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

Text Books			
Sr. No.	**Title**	**Authors**	**Publisher**
1	Operating system concepts	8th Edition	Silberchatz & galvin
2	Operating System	5th Edition	William Staling
Reference Books			
1	Modern operating systems	2nd Edition	A.S. Tanenbaum
2	Operating system concepts	2nd Edition	Milan MilenKovic

IV SEMESTER

IT2256	Lab: Operating Systems		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total		ESE Duration
	--	40	60	100		--

Objective	Course Outcome
To understand the working of Operating System services, algorithms and mechanism practically .	Students will be able to: 1 Understand the advanced OS commands 2 understand the working of processes and threads and their synchronization practically. 3 Understand various algorithms and techniques used by OS for managing resources through software simulation.

Sr. No	Problem Statements
1	Study of Advanced Linux shell commands (Process management, Memory management, Networking, etc.)
2	Study of Window task manager (about its applications, processes, services, networking, performance etc.)
3	Write a program that illustrates the creation of child process using fork system call. Each child and parent Processes perform different task.
4	Write a multithreaded program to multiply two given matrices.
5	Simulate any two of the following CPU Scheduling Algorithms (One each from preemptive and non-preemptive types) : FCFS, SJF, SRTN, Round Robin, Preemptive priority, Non-preemptive priority
6	Simulate any one of the following Dynamic Memory allocation algorithms First Fit, Best Fit, Worst Fit.
7	Simulate any one of the following Page replacement algorithms: FIFO, LRU, Optimal
8	Write a program to perform Inter-Process-Communication using shared memory OR, pipes OR message queues.

9	Write a program that gives a deadlock and starvation free solution to the Dining philosophers problem using semaphores
10	Write a program to simulate Banker's Deadlock avoidance algorithm.

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(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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BE SoE and Syllabus 2014

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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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BE SoE and Syllabus 2014

Information Technology

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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BE SoE and Syllabus 2014

Information Technology

5th Semester

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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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BE SoE and Syllabus 2014

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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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BE SoE and Syllabus 2014

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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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BE SoE and Syllabus 2014

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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Information Technology

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)

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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

YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
BE SoE and Syllabus 2014-15
Information Technology
(Academic Year : 2019-20)

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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BE SoE and Syllabus 2014

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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BE SoE and Syllabus 2014

Information Technology

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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Information Technology

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

Nagar Yuwak Shikshan Sanstha's

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BE SoE and Syllabus 2014

Information Technology

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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BE SoE and Syllabus 2014

Information Technology

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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BE SoE and Syllabus 2014

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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Information Technology

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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Hingna Road, Wanadongri, Nagpur – 441110
Ph.07104-242919, 242623. Website: www.ycce.edu

LANGUAGE LAB

YCCE/LanguageLab/2019-2020/Report/01

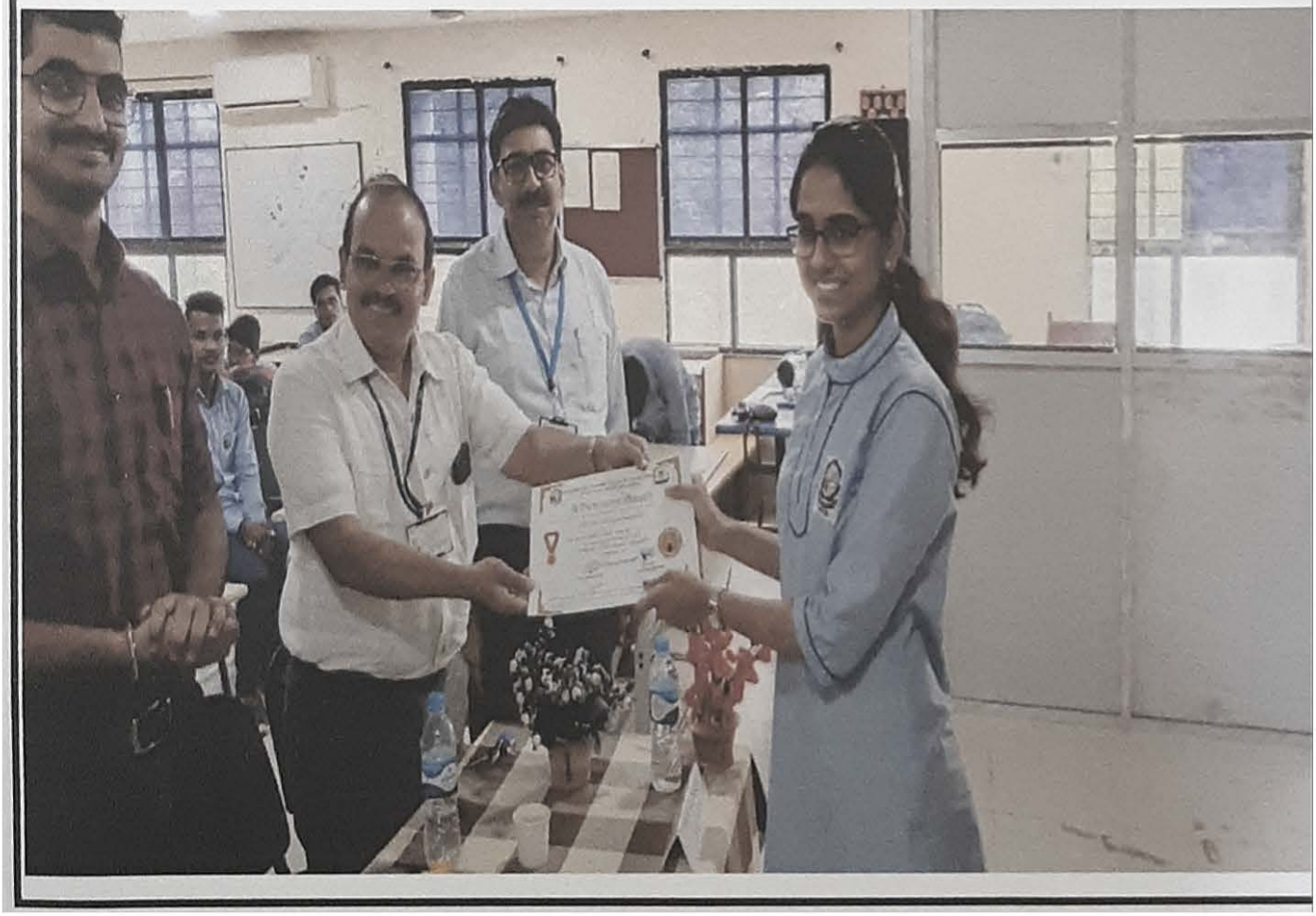
15.10.201

Debate Competition "Listen Up" Organized

A Debate Competition was Organized by The Language Lab & The Literature Club of YCCE on 12th October 2019. The event was graced by Mr. Abhay Nawathe as the Chief Guest of the Event. The event was jointly judged by Prof. H. V. Ganvir (Phy Deparment,YCCE). The event was also graced by First Year Coordinator Prof. A. B. Thatere, Prof. P. B. Bahatkar and Prof. Meenal Kale. The competition commenced by the lamp lighting All participants actively participated. The Topic of Debate was "Artificial Intelligence – A Boon Or Curse".

Prof. Meenal Kale,
InCharge, Language Lab,
YCCE.

Prof. A. B. Thatere
First Year Coordinato
YCCE.



The Judge for the Competition Mr. Abhay Nawathe (Engineer MSEB), Prof. Hemlata Ganvir (Judge), Prof. P.B. Bahatkar (Maths & Humanities, YCCE) ,Prof. A. B. Thatere (FYC, YCCE)

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

Department of Applied Mathematics & Humanities

COMMUNICATION SKILLS (GE-2107)

Assignment- 2019-20 (ODD)

" One Sentence Story"

Objective: In communicating your ideas effectively we need to understand the importance of communicating briefly with less and impactful words. One sentence story is a way of doing it effectively in an impactful manner.

Task: Prepare "**One Sentence Story**" with pictures on topic like- social, political, sports, education etc. Students of section- **A,B,C,D,E,F,G,P** are divided in groups and have to submit the assignment as per the following assigned topics and groups.

Submission: **1. Use chart and creative methods to present data**
2 Date: on or before16 November 2019

GROUPS	Topic:	ROLL NO.
1.	*"One Sentence Story"*	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

Note: Visit Following link for examples of "One Sentence Story"

www.scoopwhoop.com

Course Faculty: 1.Ms.Meenal R Kale
2.Mrs.Nanda K Thakre

The face you see in the mirror is not you, You all that What Other People Sees.
....

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Board of Studies (General Engineering)

Communication Skills Syllabus
GE- 2107
Academic session 2019-20

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 ➢ To make students aware about basic concepts and strategies of technical communication ➢ To introduce the basic concepts of phonetics so as to convey thoughts effectively ➢ To prepare students to stretch beyond their comfort zone in order to become good team members and leaders in the industry. ➢ To develop skills of expressing ideas in simple, concise and direct language so that they can contribute more productively in the organization.	**Students will be able to** ➢ To explain the basic of communication process as well as identify the barriers in communication ➢ To classify and describe the different speech sounds of English language ➢ To apply different strategies & techniques of presentation, Interview and group skills. ➢ To prepare and draft reports, memos and emails with apt content.

Unit 1:- Basics of Communication

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 speaking skills

Organs of speech, Consonants and vowels sounds of English language, Phonetic translation, word and sentence stress, vocal cues (Activity of reading phonetic translation in lab), General and technical vocabulary.

Unit 3- Effective Presentation

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 4 – Interview Skills

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

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.

Unit 5- Group Skills

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

Symposium and seminar

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

Unit 6- Reports and Memo

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

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

Email etiquettes.

Text Book-

1) Raman & Sharma," Technical communication", Oxford University Press.
2) T. Balsubramaniam, " Textbook of English Phonetics for Indian Students", Macmillan India LTD.

Reference books :-

1) Asha Kaul, Effective Business 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

Yeshwantrao Chavan College of Engineering

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Syllabus 2019-2020

GE 1311- Fundamentals of Management

5th & 6th 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	20	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 ofmanagement 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.*

Dr.Manjusha P.Gandhi

Chairman – BOS-General Engineering

Yeshwantrao Chavan College of Engineering, Nagpur
Department of Applied Mathematics & Humanities

GE -2317	Introduction to German Language			L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	20	60	100	3 hours		

Objectives	Course Outcomes :
Objectives	**Students will be able to**
Learning Basic Vocabulary	Alphabets, Counting, Days of the Week,Time of the Day, Country names
Building on Basic Grammar Skills	Gender of the words, Articles,First/Second/Third Person, Sentence building using first/second person
Learn to build very simple Sentences	Very basic sentences like self introduction – Name, Age, Profession etc. Asking and giving directions
Describing people, Working world and household	Asking and giving opinions, Interact in Shops, restaurants, returning faulty goods. Asking about houseld stuffs like where to buy this..or I like your wardrobe, vaccum cleaner or washing machine… etc
Writing Simple Letters, Enquiries in Speaking and Writing	Letter to house owner for fixing..Letter to your neighbour since you're not at home and your brother may arrive to collect the keys etc..Having enquiries at railway station, restaurant, book store etc
Listening and Practical Exercises	Playing CD's and letting students practice listening exercises on various topics. Asking students to interact with each other and performing speaking exercises for Banks, Shopping Mall, Restaurant, Library etc.

Unit I:

Learning about Alphabets,Counting,Days of the week,Time of the day,Country Names. **(7 hours)**

Unit II :

B a sic Grammar skills- Learning about Gender for words,Learing Articles,First person/Second Person/Third Person,Build simple sentence using First/Second Person. **(7 hours)**

Unit III:

Learn to build very simple sentences about oneself –
What is your name,Where are you from,What is your profession,What is your Age,What are you doing,When are you going,What did you eat etc.
Learn to asking/giving directions, asking/giving informations and instructions - Do you know where can I find …..,You can go there by taxi or using a bus number …Do you know this place well ? I was looking for …, I'm so lost right now, How can I reach ….,Can you please go there and pick up ….. for me,I am not able to find the restaurant …….Have you been to Berlin ? The best thing about Berlin is it's friendly people. **(7 hours)**

Unit IV:

Asking for and giving opinions, the working world, returning faulty goods to a shop – Do you find the shoes good ?,As far as I know this restaurant is not good to eat. Last time I had a terrible experience,Germany is very popular for it's outstanding architectures and museums,Excuse me, last week I came and purchased this electronic Razor but it's not suiting me. I want to return it or either replace with a better quality product.
Discussing home and the household, Describing people and their character, defining shape, size and color of objects -
Where is your home ? I somehow cannot find it,I like the way you have set up your home. Everything is in place and your walls are painted so nicely,How do you manage to keep your home so clean ?,Do you have a Vaccum cleaner at home ?,I know he's a good friend of yours but he's sometimes quite rude,Can you please show me this product in better quality. I also somehow don't like the color as well,I need to replace a shoe I bought last week. Its aching me and I can't walk properly. **(7 hours)**

Unit V:

How to make simple enquiries in speaking and writing -

I want to catch a train to Bamberg, could you please tell me fastest train to reach Bamberg from Berlin ?,Excuse me, I was looking to find a place to eat Pizza. Are you aware of the good restaurants nearby ?,I am looking to find a recent book about ..... could you please tell me in which rack can I find it ?, What do you like to eat during lunches ?,Do you like playing sports ? I play a lot of sports, particularly my fav sports are swimming and walking. **(6 hours)**

Unit VI:

Learn to Write very simple letters

Letter to Your House Owner for fixing water tap,Letter to your neighbour since you won't be coming home late in the evening and your brother will be coming to collect keys from him Small Listening Exercises ,Small Practical Exercises - Restaurant, Shopping Market, Bank, University Library. **(6 hours)**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Studio D A1 Deutsch Buch	2014	Funk and Kuhn	Cornelsen Verlag (Goyal Publishers India)
2	Netwerk Deutsch als Fremdspache	2015	Stefanie Dengler	Goyal Publishers
3	Tangram aktuell	2004	Hueber	Max Hueber Verlag

Dr.Manjusha P.Gandhi

Chairman- BOS-General Engineering

YESHWANTRAO CHAWAN COLLEGE OF ENGINEERING, WANADONGRI, NAGPUR

(An Autonomous Institution Affiliated to RTMNU)
NAAC Accredited With "A" Grade

Session
2019-2020

12/10/2019

DEBATE COMPETITION

On

"Arificial Intelligenge; boon or Bane"

FEEDBACK FORM

Put your marks on the scale of 1 to 4 Rating (4: Highest, 3: High , 2:Medium, 1: low)

Sr. No.	Parameter/Question
1	Was the topic interesting?
2	Should such topics be discussed in the form like debate?
3	Did the competition help you enhance your soft skills?
4	Would you like to have such competition in future?

Name of the student	Question : 1	Question : 2	Question : 3	Question : 4
S. AKSHANSH	4	4	3	4
Aditya Tidke	3	4	4	3
Tushar Shinde	2	3	3	3
Anshul Nipane	4	4	4	4
Nandhi Deshmukh	3	3	3	4
Khushbu Rathi	3	3	4	3
KHEMENDRA	2	3	3	4
Vaibhav Paidlewar	4	3	3	4
pranjal Bapate	4	4	4	4
DHANSHREE [illegible]	3	3	4	3
Shreyash Patil	2	2	4	4
SAHIJ BHAGAT	4	4	4	4
Pranjal Bopte	3	3	4	4
Asmita Dange	4	4	2	3
DHAIRYA	3	3	4	3
Deepam	4	4	3	4
Arya Ahenav	3	3	4	4
Astha Ahenav	3	4	4	4
RUTUJ KHAWAS	4	4	4	4
Piyush H.	4	3	2	4
Radhika G.	4	3	4	3
Sakshi T.	3	3	4	4
Sejal Dhanej	4	4	4	4
GOVIND.P.	3	4	3	4
ANKITA G.	4	3	3	4

Timestamp	Name (Write Names of both members of Team)	Branch (Of Both Members)	Year (Of Both Members)	Section (Of Both Members)	Registration Number (eg. Of Both Members)	Mobile Number (Of Both the Members)	E Mail	Signature
2019/09/30 4:29:49 PM GMT+5:30	S Akshansh , Aditya Tidke	Computer Technology , Electronics and Telecommunications Engineering	1st , 1st	G, G	19010927, 19010922	7587305364	s.akshansh01@gmail.com , adityatidke75@gmail.com	
2019/09/30 4:36:25 PM GMT+5:30	Tushar Shende and Anshul ninawe	Information and technology, electronics and telecommunications	2019-20	Both from L section	19010530 And 19010041	9307636892	TUSHARSHENDE683@GMAIL.COM	
2019/10/01 6:48:08 AM GMT+5:30	Dhanashree Indurkar	ETC	2019	N	19010248	9307516020	dni.hgt@ yahoo.com	
2019/10/01 10:31:14 AM GMT+5:30	Needhi deshmukh & khushbu rathi	Etc and c tech	1st year	C	19010726 and 19010731	8600968990	Needhideshmukh05@gmail.com Khushbupr2001@gmail.com	
2019/10/01 11:46:18 AM GMT+5:30	~~Anjali Harwani and Akshata Mhaski~~	Electronics and telecommunication	2nd year	A	18010035 and 18010842	7559213520	harwanianjali00@gmail.com and akshatamhaski2000@gmail.com	
2019/10/01 1:41:15 PM GMT+5:30	KHEMENDRA UDEPURE & Vaibhav PAIDLEWAR	ELECTRICAL ENGINEERING	1st	C	KHEMENDRA: VAIBHAV:19010636	9890585091	vipulpaidlewar@gmail.com khemendraudepure@gmail.com	
2019/10/01 1:44:39 PM GMT+5:30	KHEMENDRA UDEPURE, VAIBHAV PAIDLEWAR	ELECTRICAL ENGINEERING	1st	C	19010330;19010636	9890585091	vipulpaidlewar@gmail.com	
2019/10/01 7:18:36 PM GMT+5:30	Amisha kale Janhavi khalatkar	Electronics ETC	1 1	A and I	19010054 19010274	8669447740	khalatkarjanhavi@gmail.com	
2019/10/02 9:05:04 AM GMT+5:30	Sakshi Kohad & Dhanshree Joshi	Sakshi- Electronics & telecommunications Dhanshree- electronics	1st year (both)	Sakshi -C , Dhanshree-B	Sakshi- 19010746 Dhanshree- 19010429	9552235561.9359288383	sakshi.kohad13@gmail.com	
2019/10/02 11:52:10 AM GMT+5:30	GUNJAN KHONDE,SHOAIB ANSARI	CTECH,IT	FIRST YEAR,FIRST YEAR	J SECTION	19010757,19010710	9403142356	Shoaibshamimansari@gmail.com	
2019/10/05 12:00:53 PM GMT+5:30	Pranjal Bopate ; Asmita Dangre	Mechanical engineering	1st year	E	19010781 ; 19010836	9545353249	pranjalbopate19@gmail.com	
2019/10/07	Shreyas Patil Sahil	Electronics	First year	B	19010116	7887557454	ruffalo407@gmail.com	
						7972025608	Gptankit159@gmail.com shubhankardesh009@gmail.com	

Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering Nagpur
(An Autonomous Institute Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

	Team)		Members)	Both Members)	(eg. DI Both Members)	Members)		
15)	2019/10/09 7:40:10 PM GMT+5:30	~~Soham Kottawar~~ ~~Hrishikesh Vinzey~~	Electronics and Telecommunication ETC	1st Year 1st year	F F	19010039 19010038	9309510228 7720950949	kottawarsoham17@gmail.com hrishikesh.vinzey@gmail.com
16)		Astha Aherrao,	C.Tech	1st Yr	G	19011015	7720856892	aherrao.astha@gmail.com
		Arya Aherrao	C.Tech.	1st Yr	G	19011017	9373664975	aherrao.arya@gmail.com
17)		Rutuj Khawas	Civil	1st Yr	G	19010928	7719[illegible]6423	rutujrk13@gmail.com
		Piyush Handle	ETC	1st Yr	G	19010959	9403610513	piyushhandekar@gmail.com
18)		Radhika Gawande	EE	1st Yr	E	19010860	9561985799	radhika.gawande15@gmail.com
		Sakshee Tembhurkar	Mech.	1st Yr	E	19010892	7410162489	sakshee.tembhurkar@gmail.com
19)		Dnyandeep T. Pawar	Mech.	1st Yr	C	19010322	7666366742	dnyandeep086@gmail.com
		Sejal L. Dhanij	CE	1st yr	B		9172687019	ms.sejaldhanvij@gmail.com
(20)		Dhairya Gupta	Mech.	1st yr	A	19011161	8380076923	dhairya.gupta00@gmail.com
		Govind Prasad	Mech	1st yr	M	19106[illegible]2	7709098943	[illegible]
(21)		Ritik Thakre	civil	1st yr	C	19010752	9284258227	ritikthakre7102@gmail.com
		Pranjali D. Thawari	C. Tech	1st yr	L	19010240	9850362036	pranjalithawari@gmail.com
(22)		Anjali Gabhane	Civil.	1st yr	H	19010222	7447307399	anjaligabhane36099@gmail.com
23)		ANSHUL AJAY NAGARKAR	C-Tech	1st yr.	I	19010632	9309745849	student.anshul7@gmail.com
		ANIKET MASRAM	I.T.	1st yr.				aniketmasram11@gmail.com

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Department of Applied Physics

Academic Year 2019-20

Course code: GE2106 **Name of the course: Engineering Physics Lab.**

Expt.No.	Course Outcomes	Statement of Course outcomes
		Students are able to
7,8,9	CO1	Examine the intensity variation of light due to interference , diffraction and its applications.
1,3,4,10,11	CO3	Develop ability to classify and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.
2,5	CO4	Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices.
6,12	CO5	Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry.

GE2106 Engineering Physics Lab. : CO- PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	2	3										
CO3	2	2										
CO4	3	3										
CO5	3	3										
Average:	2.6	2.8										

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Department of Applied Physics

Course code: GE2106 **Name of the course: 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.	CO3	PO1,PO2
2.	To measure the amplitude and frequency of sinusoidal voltage obtained from the secondary of a step down transformer using CRO.	CO 4	PO1,PO2
3.	To study the static characteristics of semiconductor diode; (Germanium and Silicon diode) in forward and reverse bias mode	CO 3	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 4	PO1,PO2
6.	Determination of the velocity of ultrasonic waves in a non electrolytic liquid by ultrasonic interferometer.	CO 5	PO1,PO2
7.	To determine the radius of curvature of Plano-convex lens by using Newton's Rings apparatus.	CO 1	PO1,PO2
8.	To determine the thickness of thin paper using Air Wedge arrangement.	CO 1	PO1,PO2
9.	To determine the wavelength of sodium light using Plane Transmission Grating.	CO 1	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 3	PO1,PO2
	Demonstration Experiment		
12.	To study the Fraunhoffer diffraction pattern of a grating and to determine the wavelength of light using laser source.	CO 5	PO1,PO2

Dr. J. R. Ghulghule

HOD

Applied Physics

Head and Professor
Department of Applied Physics
Y. C. College of Engineering
Wanadongri, Hingna Road,
Nagpur- 441110

YCCE

First Year BE

DEPARTMENT OF CHEMISTRY

2019-20

Name of Course: Engineering Chemistry Practical **Course code: GE 2104**

EXPERIMENT NUMBER	TITLE OF THE EXPERIMENT	CO	PO
1	Estimation of hardness	CO1	PO1, PO2
2	Estimation of Nickel	CO5	PO1, PO2
3	Estimation of alkalinity	CO1	PO1, PO2
4	Estimation of copper	CO5	PO1, PO2
5	Estimation of iron	CO5	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	CO1	PO1, PO2
11	Determination of conductivity	CO1	PO1, PO2
12	Determination of pH	CO1	PO1, PO2
13	Preparation of urea formaldehyde resin	CO4	PO1

14	Determination of surface tension	CO1	PO1, PO2

Experiment Number	PO	CO	STATEMENT
			Students will be able to:
1,3,10,11,12,14	PO1, PO2	CO1	Assess qualitative and quantitative aspects of water as a conventional material for industrial and domestic applications.
	PO1	CO2	Apply the knowledge of basic electrochemistry to understand battery technology, corrosion process and preventive techniques.
6,7,8,9	PO1, PO2	CO3	Know the basics and assess analytical aspects of industrial materials like fuels and lubricants for efficient utilization.
13	PO1	CO4	Get introduced to the science and significance of cement and advanced engineering materials in technological applications
2,4,5	PO1, PO2	CO5	Estimate metals like iron, Ni and copper using various titrimetric and spectrophotometric methods

UNIT	Experiment no	CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	1,3,10, 11,12,1 4	CO1	3	2										
II, III		CO2	2											
IV, V	6,7,8,9	CO3	2	2										
VI	13	CO4	2											
	2,4,5	CO5	2	2										

SEAL

PRINCIPAL
Yeshwatrao Chavan
College of Engineering
Wanadongri, Hingna Road,
NAGPUR - 441110

Department of Applied
E. C. College of Engineering
NAGPUR

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 2019-20

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
1	PE IV : Advanced Surveying	CV-1452	Employability
2	PE V : Water Transmission and Distribution Systems	CV-1432	Employability
3	Industrial Training / CRT	EL1406	Employability
4	Project Phase I	EL1407	Employability
5	Project Phase II	EL1420	Employability
6	Electronic Devices	EE2201	Employability
7	Signals and Systems	EE2203	Employability
8	Advanced Mathematical Techniques	GE2204	Employability
9	Electromagnetic Fields	EE2257	Employability
10	Electronic Circuit	EE2251	Employability
11	Microcontroller & its application	EE2253	Employability
12	Analog Communication	EE2255	Employability
13	Analog Communication	EE1301	Employability
14	Signals and Systems	EE1306	Employability
15	Analog Integrated Circuit & its Application	EE2303	Employability
16	Power Electronics	EE1304	Employability
17	Switching Theory & Finite Automata	EE1307	Employability
18	Computer Organisation	EE1324	Employability
19	OE1:Data Acquisition & Signal Conditioning	EE2341	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:Embedded System	EE1401	Employability
27	PEII:Digital CMOS Circuits	EE1403	Employability
28	PEII:Algorithm & Data Structures	EE1405	Employability
29	Electronics Circuit Design	EE1407	Employability
30	Digital Communication	EE1409	Employability
31	RF & Microwave Laboratory	EE1435	Employability
32	PE3:Computer Communication Network	EE1414	Employability
33	PE3: Micro Electro Mechanical Systems	EE1437	Employability
34	PE4:Soft Computing	EE1417	Employability
35	PE4:Analog VLSI Design	EE1419	Employability
36	PE4:Object Oriented Programming	EE1423	Employability
37	PE5: Biomedical Instrumentation & its Applications	EE1425	Employability
38	PE5: Optical Communication	EE1426	Employability
39	PE5: Wireless Communication	EE1427	Employability
40	PE5: Mechatronics	EE1428	Employability
41	PE II:Fundamentals of Computing	ET1344	Employability
42	PE I : Algorithm & Data Structure	ET1307	Employability
43	PE I :Object Oriented Programming	ET1309	Employability
44	PE I :Discrete Structures	ET1311	Employability
45	PEII :TV and Video Engineering	ET1323	Employability
46	OE 1 : Microcontroller & Embedded Systems	ET1331	Employability
47	OE 1 : Principles of Communication Engineering	ET1333	Employability
48	OE 1 : Fundamentals of Image Processing	ET1335	Employability
49	OE II : Soft computing	ET1340	Employability
50	OE II : Industrial Instrumentation	ET1341	Employability
51	OE II : Medical Electronics	ET1342	Employability
52	OE II : Display Technology and Applications	ET1343	Employability
53	PE III : Optical Communication	ET1405	Employability
54	PE III : Microwave Integrated circuit	ET1407	Employability
55	PE III : Communication Networks	ET1409	Employability
56	PE IV : Power Electronics	ET1419	Employability
57	PE IV : Wireless Mobile Communication Systems	ET1420	Employability
58	PE IV : Satellite Communication & RADAR Engineering	ET1433	Employability
59	PE IV: Biomedical Instrumentation	ET1434	Employability
60	PE IV: : Display Technology	ET1437	Employability
61	PE V : Fuzzy Logic & Neural Networks	ET1422	Employability
62	PE V : RF Circuit Design	ET1424	Employability
63	PE V : Multimedia Communications	ET1426	Employability

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
64	CMOS VLSI Design	ET1417	Employability
65	PE II : Embedded System	ET1319	Employability
66	Object Oriented Programming	CT2202	Employability
67	Lab: Object Oriented Programming	CT2203	Employability
68	Data Structures	CT2204	Employability
69	Operating Systems	CT2251	Employability
70	Advanced Data Structures	CT2253	Employability
71	Mathematical Foundations for Data Analysis	CT2255	Employability
72	Theoretical Foundation of Computer Science	CT1301	Employability
73	Computer Networks	CT1340	Employability
74	OE I: Introduction to DBMS	CT1342	Employability
75	OE I: Operating System Concepts	CT1343	Employability
76	OE I: Essentials of IT	CT1344	Employability
77	Design & Analysis of Algorithm	CT1314	Employability
78	Language Processors	CT1318	Employability
79	Network Security	CT1415	Employability
80	Artificial Intelligence	CT1451	Employability
81	Lab. Artificial Intelligence	CT1452	Employability
82	PE II: Neural Network & Fuzzy Logic	CT1406	Employability
83	PE III: Parallel Computing	CT1437	Employability
84	PE III:: Machine Learning Techniques	CT1454	Employability
85	PE III: Fundamentals of Parallel Computing	CT1457	Employability
86	Cyber Laws	GE1408	Employability
87	PE IV: Digital Image Processing	CT1418	Employability
88	Lab.: PE IV: Digital Image Processing	CT1419	Employability
89	PE IV: Cyber Forensics	CT1455	Employability
90	Computer Architecture & Organization (Self -Learning-Online)	IT2207	Employability
91	Operating Systems	IT1303	Employability
92	Software Engineering	IT1305	Employability
93	Material Science & Metallurgy	ME2201	Employability
94	Mechanics of Material	ME2205	Employability
95	Kinematics of Machines	ME2207	Employability
96	Fluid Mechanics	ME2208	Employability
97	Engineering Thermodynamics	ME2252	Employability
98	Fluid Machines	ME2351	Employability
99	Automation In Production systems	ME1435	Employability
100	Optimisation Techniques	ME1475	Employability
101	Digital Communication	EE2353	Employability
102	Lab: Digital Communication	EE2354	Employability
103	PE II: Internet of Things	EE2361	Employability
104	Lab: PE II: Internet of Things	EE2362	Employability
105	PE II: Digital CMOS Circuits	EE2363	Employability
106	PE II: Digital Image Processing	EE2365	Employability
107	Lab: PE II: Digital Image Processing	EE2366	Employability
108	PE II: Object Oriented Programming	EE2367	Employability
109	Lab : PE II: Object Oriented Programming	EE2368	Employability
110	Business Intelligence	IT1330	Employability , Enterprenurship
111	PE I: Mobile Operating System	CT1347	Employability , Skill Development
112	Lab. :PE I: Mobile Operating System	CT1348	Employability , Skill Development
113	Software Lab (Mini Project)	CT1329	Employability , Skill Development
114	PE II: Probabilistic Statistical Data Analysis	CT1453	Employability , Skill Development
115	Industrial Training/ CRT	CT1413	Employability , Skill Development
116	Data Structures and Program Design-I	IT2205	Employability , Skill Development
117	Object Oriented Programming	IT2203	Employability , Skill Development
118	Data Structures and Program Design-II	IT2251	Employability , Skill Development
119	Computer Networks	IT2253	Employability , Skill Development
120	Operating Systems	IT2255	Employability , Skill Development
121	PE:Data Analysis & Statistics	IT1328	Employability , Skill Development
122	PE:Web Programming	IT1327	Employability , Skill Development
123	OE: Object Oriented Programming	IT1325	Employability , Skill Development
124	OE:Web Technology	IT1322	Employability , Skill Development
125	Internet of Things	IT1334	Employability , Skill Development
126	Data Base Management Systems	IT1316	Employability , Skill Development
127	Design & Analysis of Algorithms	IT1318	Employability , Skill Development

offered by the institution

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
128	Computer Networks	IT1338	Employability , Skill Development
129	Artificial Intelligence	IT1311	Employability , Skill Development
130	Data Mining	IT1427	Employability , Skill Development
131	Neural Networks & Fuzzy Logic	IT1415	Employability , Skill Development
132	Network Programming	IT1417	Employability , Skill Development
133	PE III: Cloud Computing	IT1432	Employability , Skill Development
134	Computer Architecture & Organisation	CT2201	Employability and Skill Development
135	PE I : Pavement Design	CV-1323	Employability/ Entrepreneurship
136	PE IV : Matrix Analysis of Structures	CV-1429	Employability/ Entrepreneurship
137	PE V : Advanced Steel Design	CV-1433	Employability/ Entrepreneurship
138	PE III : Advanced RCC	CV-1447	Employability/ Entrepreneurship
139	PE3:Display Technology	EE1436	Employability/ Entrepreneurship
140	PE I: : Introduction to Geographical Information System	CT1353	Employability/ Entrepreneurship/ Skill development
141	Electronics workshop Laboratory	EE1310	Employability/ Entrepreneurship/ Skill development
142	Seminar	EE1311	Employability/ Entrepreneurship/ Skill development
143	Project Phase 1	EE1412	Employability/ Entrepreneurship/ Skill development
144	Industrial Training	EE1413	Employability/ Entrepreneurship/ Skill development
145	(EDA)Electronics Design Automation Laboratory	EE1433	Employability/ Entrepreneurship/ Skill development
146	Comprehensive Viva-voce	EE1430	Employability/ Entrepreneurship/ Skill development
147	Extra Curricular / Competitive Exam	EE1431	Employability/ Entrepreneurship/ Skill development
148	Project Phase 2	EE1432	Employability/ Entrepreneurship/ Skill development
149	PE3:Operating System Concepts	EE1415	Employability/ Entrepreneurship/ Skill development
150	Fundamental of management	GE1311	Employability/ Entrepreneurship/ Skill development
151	PE III: Cloud Computing	CT1408	Employability/ Entrepreneurship/ Skill development
152	Computing using Python Laboratory	EE2204	Employability/ Entrepreneurship/ Skill development
153	PE III : Remote Sensing and GIS	CV-1448	Employability/ Skill Development
154	PE II : Computer Applications in Civil Engineering	CV-1459	Employability/ Skill Development
155	Digital Logic Design	EE2205	Employbility and Entreprenurship
156	Network Analysis	EE2207	Employbility and Entreprenurship
157	Advanced Instrumentation	EE1305	Employbility and Entreprenurship
158	Design of Machine Elements	ME2251	Employbility and Entreprenurship
159	Manufacturing Process-II	ME2254	Employbility and Entreprenurship
160	Mechanical measurement & Metrology	ME2256	Employbility and Entreprenurship
161	Heat Transfer	ME2301	Employbility and Entreprenurship
162	Dynamics of Machines	ME2303	Employbility and Entreprenurship
163	Production Management	ME2305	Employbility and Entreprenurship
164	OE I : Operations Research Techniques	ME2331	Employbility and Entreprenurship
165	OE I : Automobile Engineering	ME2332	Employbility and Entreprenurship
166	OE I : Robotics and Subtractive Manufacturing	ME2333	Employbility and Entreprenurship
167	OE I : Control System Engineering	ME2334	Employbility and Entreprenurship
168	OE II : Total Quality Management	ME2341	Employbility and Entreprenurship
169	OE II : Reliability Engineering	ME2342	Employbility and Entreprenurship
170	OE II : Power Generation Engineering	ME2343	Employbility and Entreprenurship
171	OE II : Project Evaluation & Management	ME2344	Employbility and Entreprenurship
172	Design of Mechanical Drives	ME2354	Employbility and Entreprenurship
173	OE III : Operations Research Techniques	ME2381	Employbility and Entreprenurship
174	OE III : Automobile Engineering	ME2382	Employbility and Entreprenurship
175	OE III : Robotics and Subtractive Manufacturing	ME2383	Employbility and Entreprenurship
176	OE III : Control System Engineering	ME2384	Employbility and Entreprenurship
177	OE IV : Total Quality Management	ME2391	Employbility and Entreprenurship
178	OE IV : Reliability Engineering	ME2392	Employbility and Entreprenurship
179	OE IV : Power Generation Engineering	ME2393	Employbility and Entreprenurship

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
180	OE IV : Project Evaluation & Management	ME2394	Employability and Entreprenurship
181	PE I : Finite Element Methods	ME2361	Employability and Entreprenurship
182	PE I :Industrial Fluid Power	ME2363	Employability and Entreprenurship
183	PE I : I.C. Engines	ME2365	Employability and Entreprenurship
184	PE I : Refrigeration & Cryogenics	ME2367	Employability and Entreprenurship
185	PE I : Computer Integrated Manufacturing	ME2369	Employability and Entreprenurship
186	Production Management	ME1447	Employability and Entreprenurship
187	Design Of Mechanical Drives	ME1448	Employability and Entreprenurship
188	PE-I: Tool Design	ME1401	Employability and Entreprenurship
189	PE-I: Material Handling Systems	ME1402	Employability and Entreprenurship
190	PE-I: Engineering Of Plastics	ME1404	Employability and Entreprenurship
191	PE-I: Project Evaluation & Management	ME1405	Employability and Entreprenurship
192	PE-I: Computational Fluid Dynamics	ME1449	Employability and Entreprenurship
193	PE-I: Advanced Manufacturing Techniques	ME1456	Employability and Entreprenurship
194	PE-I: Rapid Prototyping	ME1461	Employability and Entreprenurship
195	PE-I: Fuel Cells Technology	ME1462	Employability and Entreprenurship
196	PE-I: Data Structure and Algorithm	ME1463	Employability and Entreprenurship
197	Synthesis Of Mechanism	ME1408	Employability and Entreprenurship
198	Finance & Cost Management	ME1409	Employability and Entreprenurship
199	Renewable Energy System	ME1410	Employability and Entreprenurship
200	Artificial Intelligence	ME1411	Employability and Entreprenurship
201	Maintainance Management	ME1412	Employability and Entreprenurship
202	Design For Manufacturing & Assembly	ME1466	Employability and Entreprenurship
203	Quantitative Techniques	ME1467	Employability and Entreprenurship
204	Database Management System	ME1468	Employability and Entreprenurship
205	Finite Element Methods	ME1406	Employability and Entreprenurship
206	I.C. Engines	ME1419	Employability and Entreprenurship
207	Refrigeration & Air Conditioning	ME1421	Employability and Entreprenurship
208	Mechatronics	ME1445	Employability and Entreprenurship
209	Refrigeration & Cryogenics	ME1469	Employability and Entreprenurship
210	Machine Tool Design	ME1476	Employability and Entreprenurship
211	PE-IV: Vibration	ME1415	Employability and Entreprenurship
212	PE-IV: Industrial Fluid Power	ME1437	Employability and Entreprenurship
213	PE-IV: Cnc & Robotics	ME1439	Employability and Entreprenurship
214	PE-IV: Vehicle Engineering	ME1441	Employability and Entreprenurship
215	PE-IV: MIS	ME1443	Employability and Entreprenurship
216	PE-IV: Solar Energy and Utilization	ME1478	Employability and Entreprenurship
217	PE-V: Stress Analysis	ME1451	Employability and Entreprenurship
218	PE-V: Design Of Experiments And Taguchi Methods	ME1452	Employability and Entreprenurship
219	PE-V: Value Engg.	ME1453	Employability and Entreprenurship
220	PE-V: Lean Sigma	ME1454	Employability and Entreprenurship
221	PE-V: Product Design And Development	ME1455	Employability and Entreprenurship
222	PE-V: Power Plant Engineering	ME1457	Employability and Entreprenurship
223	PE-V: Machine Tool Design	ME1458	Employability and Entreprenurship
224	PE-V: Advance Welding Techniques	ME1460	Employability and Entreprenurship
225	PE-V: Air Conditioning	ME1482	Employability and Entreprenurship
226	PE-V: Cryogenic Systems	ME1483	Employability and Entreprenurship
227	PE-V: Industrial Safety	ME1459	Employability and Entreprenurship:
228	PE-I: Advanced Manufacturing Techniques	ME1456	Employobility and Enterprenurship
229	PE-I: Rapid Prototyping	ME1461	Employobility and Enterprenurship
230	PE-I: Fuel Cells Technology	ME1462	Employobility and Enterprenurship
231	PE-I: Data Structure and Algorithm	ME1463	Employobility and Enterprenurship
232	Synthesis Of Mechanism	ME1408	Employobility and Enterprenurship
233	Extra Curricular Activities / Competitive Exam	EL1430	Entrepreneurship
234	OE II: Current Trends and Technologies	CT1352	Entrepreneurship
235	OE II : Introduction to E-Commerce	IT1336	Entrepreneurship
236	PE III: E-Commerce	IT1430	Entrepreneurship
237	OE1:Consumer Electronics	EE1323	Entrepreneurship
238	PE II :Digital System Design	ET1321	Entrepreneurship
239	Embedded Systems and DSP processor	ET 3909	entrepreneurship
240	Fundamental of Economics	GE1312	Entrepreneurship
241	Manufacturing Process -I	ME2203	Entreprenurship and Emplobility
242	PE-III: Mechatronics	ME1446	Skill Development
243	PE-III: Refrigeration & Cryogenics	ME1470	Skill Development
244	PE-III: Machine Tool Design	ME1477	Skill Development

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
245	Communication Skills	GE2107	Skill Development
246	Introduction to German Language	GE2317	Skill Development
247	Engineering Physics Lab.	GE2106	Skill Development
248	Engineering Chemistry Lab.	GE2104	Skill Development
249	Lab: Concrete Technology	CV2252	Skill Development
250	Lab: Surveying	CV2254	Skill Development
251	Lab:- Structural Analysis	CV2256	Skill Development
252	Lab:- Transportation Engineering	CV2258	Skill Development
253	Lab: Surveying -II	CV1302	Skill Development
254	Lab: Structural Analysis-I	CV1308	Skill Development
255	Lab: Transportation Engineering –I	CV1305	Skill Development
256	Lab : Fluid Mechanics –II	CV1311	Skill Development
257	Seminar	CV1314	Skill Development
258	Lab : Structural Analysis-II	CV1403	Skill Development
259	Lab : Computer Applications in Civil Engineering	CV1442	Skill Development
260	Industrial Training / CRT	CV1406	Skill Development
261	Comprehensive Viva-voce	CV1424	Skill Development
262	Extra / Co-curricular / Competitive Examination	CV1426	Skill Development
263	Lab: Strength of Materials	CV2202	Skill Development
264	Lab: Geotechnical Engineering	CV2204	Skill Development
265	Lab: Fluid Mechanics	CV2206	Skill Development
266	Lab: Water Supply Engineering	CV2208	Skill Development
267	PE-I : Advance Surveying	CV2311	Skill Development
268	PE-I : Advanced Concrete Technology	CV2319	Skill Development
269	PE-I : Geographical Information Systems	CV2327	Skill Development
270	Lab:- Material Science & Metallurgy	ME2202	Skill Development
271	Lab:- Manufacturing Process -I	ME2204	Skill Development
272	Lab:- Mechanics of Material	ME2206	Skill Development
273	Lab:- Fluid Mechanics	ME2209	Skill Development
274	Lab:- Machine Drawing	ME2253	Skill Development
275	Lab:- Manufacturing Process-II	ME2255	Skill Development
276	Lab:- Mechanical measurement & Metrology	ME2257	Skill Development
277	Lab:- Dynamics of Machines	ME2304	Skill Development
278	Lab:- Fluid Machines	ME2352	Skill Development
279	Lab:Computer Aided Design	ME2353	Skill Development
280	PE I : Lab:- Finite Element Methods	ME2362	Skill Development
281	PE I : Lab:- Industrial Fluid Power	ME2364	Skill Development
282	PE I : Lab:- I.C. Engines	ME2366	Skill Development
283	PE I : Lab:- Refrigeration & Cryogenics	ME2368	Skill Development
284	PE I : Lab:- Computer Integrated Manufacturing	ME2370	Skill Development
285	Automation In Production systems LAB	ME1436	Skill Development
286	PE-III: Finite Element Methods	ME1407	Skill Development
287	PE-III: CIM	ME1418	Skill Development
288	PE-III: I.C. Engines	ME1420	Skill Development
289	PE-III: Refrigeration & Air Conditioning	ME1422	Skill Development
290	PE-III: Mechatronics	ME1446	Skill Development
291	PE-III: Refrigeration & Cryogenics	ME1470	Skill Development
292	PE-III: Machine Tool Design	ME1477	Skill Development
293	Lab. : PE-IV: Vibration	ME1416	Skill Development
294	Lab. : PE-IV: Industrial Fluid Power	ME1438	Skill Development
295	Lab. : PE-IV: Cnc & Robotics	ME1440	Skill Development
296	Lab. : PE-IV: Vehicle Engineering	ME1442	Skill Development
297	Lab. : PE-IV: MIS	ME1444	Skill Development
298	Lab. : PE-IV: Solar Energy And Utilization	ME1479	Skill Development
299	PEI:Advance Power Electronics	EL1311	Skill Development
300	PEI:Illumination Engineering	EL2363	Skill Development
301	PEII:Artificial Intelligence based system	EL1427	Skill Development
302	PE III : Power System Operation and Control	EL1422	Skill Development
303	PEIV:Fundamentals of Smart Grid	EL1436	Skill Development
304	PEIV:Electric Vehicles	EL1437	Skill Development
305	Lab. : Electronics Engineering Workshop	EL2202	Skill Development
306	Lab: Electrical Machines	EL2204	Skill Development
307	Lab: Computer Programming	EL2206	Skill Development
308	Lab: Electrical Measurement & Instrumentation	EL2208	Skill Development
309	Lab. : Power Electronics	EL1303	Skill Development

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
310	Lab. : Microprocessors	ET1330	Skill Development
311	Lab. : Electronics Engineering Workshop	EL1318	Skill Development
312	Lab.: Control System	EL1307	Skill Development
313	Lab.: Electrical Drives	EL1310	Skill Development
314	Lab. : Simulation in Power Electronics & Drives	EL1312	Skill Development
315	Lab. : High Voltage Engineering	EL1402	Skill Development
316	Lab.: Computer Applications in Electrical Engg	EL1404	Skill Development
317	Lab.: Simulations in Power System	EL1405	Skill Development
318	Lab. :Renewable Energy Sources	EL1434	Skill Development
319	Lab.: Switchgear and Protection	EL1417	Skill Development
320	Lab.: Substation Design	EL1418	Skill Development
321	Lab.: Comprehensive Viva-voce	EL1419	Skill Development
322	Electronic Devices Laboratory	EE2202	Skill development
323	Digital Logic DesignLaboratory	EE2206	Skill development
324	Network Analysis Laboratory	EE2208	Skill development
325	Electronic Circuit Laboratory	EE2252	Skill development
326	Microcontroller & its application Laboratory	EE2254	Skill development
327	Analog Communication Laboratory	EE2256	Skill development
328	Electronic Workshop Laboratory	EE2258	Skill development
329	Analog Communication Laboratory	EE1302	Skill development
330	Analog Integrated Circuit & its Application Laboratory	EE2304	Skill development
331	Digital Signal Processing	EE1314	Skill development
332	Digital Signal Processing Laboratory	EE1315	Skill development
333	Digital System Design Laboratory	EE1317	Skill development
334	Microcontroller & Interfacing Laboratory	EE1327	Skill development
335	OEII:Fuzzy Logic & Neural Network	EE1328	Skill development
336	PEII:Embedded System Laboratory	EE1402	Skill development
337	PEII:Digital CMOS Circuits Laboratory	EE1404	Skill development
338	PEII:Algorithm & Data Structures Laboratory	EE1406	Skill development
339	Electronics Circuit & Design Laboratory	EE1408	Skill development
340	Digital Communication Laboratory	EE1410	Skill development
341	RF & Microwave	EE1434	Skill development
342	PE4:Soft Computing Laboratory	EE1418	Skill development
343	PE4:Analog VLSI Design Laboratory	EE1420	Skill development
344	PE4:Object Oriented Programming Laboratory	EE1424	Skill development
345	Lab.: PE II:Fundamentals of Computing	ET1345	Skill development
346	Lab.: PE I: Algorithm & Data Structure	ET1308	skill development
347	Lab.: PE I: Object Oriented Programming	ET1310	Skill development
348	Lab.: PE I: Discrete Structures	ET1312	Skill development
349	Lab. : PE II : Embedded System	ET1320	Skill development
350	Lab. : PE II : Digital system Design	ET1322	Skill development
351	Lab. : PE II : TV & Video Engineering	ET1324	Skill development
352	Lab. :PE III : Optical Communication	ET1406	Skill development
353	Lab. :PE III : Microwave Integrated circuits	ET1408	Skill development
354	Lab. :PE III : Communication Networks	ET1410	Skill development
355	Lab.: PE V : Fuzzy Logic & Neural Networks	ET1423	Skill development
356	Lab.: PE V : RF Circuit Design	ET1425	Skill development
357	Lab.: PE V : Multimedia Communications	ET1427	Skill development
358	Data Structures and Program Design- I-LAB	IT2206	Skill Development
359	Object Oriented Programming-lab	IT2204	Skill Development
360	Software Lab	IT2208	Skill Development
361	Data Structures and Program Design-II-lab	IT2252	Skill Development
362	Computer Networks-lab	IT2254	Skill Development
363	Operating Systems-lab	IT2256	Skill Development
364	Lab: Operating Systems	IT1304	Skill Development
365	Software Engineering-LAB	IT1306	Skill Development
366	Data Base Management Systems -LAB	IT1317	Skill Development
367	Lab:Design & Analysis of Algorithms	IT1332	Skill Development
368	Business Intelligence-lab	IT1331	Skill Development
369	Lab:Data Mining	IT1428	Skill Development
370	Lab: Network Programming	IT1418	Skill Development
371	Lab:- Heat Transfer	ME2302	Skill Development
372	Lab: Data Structures	CT2205	Skill Development
373	Lab: Python Programming	CT2206	Skill Development
374	Lab:Operating Systems	CT2252	Skill Development

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
375	Lab: Advanced Data Structures	CT2254	Skill Development
376	Lab: Mathematical Foundations for Data Analysis	CT2256	Skill Development
377	Database Management Systems	CT2257	Skill Development
378	Lab: Database Management Systems	CT2258	Skill Development
379	Lab. : Computer Networks	CT1341	Skill Development
380	Lab. :Language Processors	CT1319	Skill Development
381	PE I: Business Intelligence and its Applications	CT1349	Skill Development
382	Lab. :PE I: Business Intelligence and its Applications	CT1350	Skill Development
383	Lab. :PE I: : Introduction to Geographical Information System	CT1354	Skill Development
384	OE II: Multimedia and Animation	CT1351	Skill Development
385	Project Phase I	CT1414	Skill Development
386	Lab.: PE IV: Cyber Forensics	CT1456	Skill Development
387	PE V: Numerical Computing	CT1445	Skill Development
388	PE V: Introduction to Internet of Things	CT1458	Skill Development
389	Lab. : PE V: Software Project Management	CT1433	Skill Development
390	Lab. : PE V: Introduction to Internet of Things	CT1459	Skill Development
391	Lab. : PE V: Numerical Computing	CT1446	Skill Development
392	Project Phase -II	CT1426	Skill Development
393	Extra/Co-curricular / Competitive Examination	CT1427	Skill Development
394	PE I: Business Intelligence and its Applications	CT1349	Skill Development and Entrepreneurship
395	Lab: Web Technology	CT2207	Skill Development and Entrepreneurship
396	Software Engineering	CT1345	Skill Development and Entrepreneurship
397	Lab. : Software Engineering	CT1346	Skill Development and Entrepreneurship
398	PE1 : Computing with Python	CT1357	Skill Development and Entrepreneurship
399	Object Oriented Modeling	CT1450	Skill Development and Entrepreneurship

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