Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur-441 110
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2020-21

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
College of Engineering
Wanadongri Hingna Road,
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Highlighted Curriculum/ Syllabus of the Courses

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.

V Semester

CV2303 – LAB : Analysis and Design Studio

COURSE OBJECTIVES	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 analyze sway frames using moment distribution method. 3. To be able to analyze multistoried frame structures using approximate methods. 4. To be able to develop models (Beam model, Plane truss model and 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 analyze and design the RCC structural elements using standard software package without any error. 7. To be able to understand the comparison of result between manual analysis and design and software analysis and design	The student will be able to- 1. develop and execute the Beam models in the software package without any error 2. Develop and execute the Plane truss models in the software package without any error. 3. Develop and execute the Frame models in the software package without any error. 4. Develop, analyze and design the RCC structural elements in the software package without any error. 5. Compare the result between hand calculation (manual analysis) and output result of the software.
Mapped Program Outcomes : 1,2,4,5,12 **PSO** : i	

Minimum Ten Practical to be performed

1. Analyze a ***continuous beam with and without 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.
2. 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.
3. Analyze a ***continuous beam*** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result with manual analysis result. For manual analysis use **Stiffness Matrix Method.** Conclude it from both the result.
4. Analyze a ***non-prismatic fixed beam (beam splits into three parts)*** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Column Analogy Method**. Conclude it from both the result.
5. 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.
6. 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.

V Semester
CV2303 – LAB : Analysis and Design Studio

7. 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 or Portal Frame Method.** Conclude it from the result.
8. Design a simply supported beam using software package. Compare the software result of design with manual design result.
9. Design a short column using software package. Compare the software result of design with manual design result.
10. Design a slab using software package. Compare the software result of design with manual design result.
11. Design an isolated footing using software package. Compare the software result of design with manual design result.
12. Analyze and Design a multistoried building (G+2) using software package.

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
4. P.C. Vergese, Limit State Design of Reinforced Concrete, Prentice Hall Publishers, 2nd edition, 2008
5. Shah and Karve, Reinforced Concrete Structures, Structures Publishers, Pune, 5th edition, 2015.
6. Sinha S.N, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007

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
3. P.C. Varghese, Advanced Design of Structures, Prentice Hall Publishers,2009
4. Punmia B.C., Jain A.K., Jain A.K, Reinforced Concrete Structures (Vol-I), Laxmi Publications Pvt Ltd, New Delhi, 2007

VI Semester
CV2352 – LAB : Building Design and Drawing

COURSE OBJECTIVE	COURSE OUTCOMES
Student will be introduced to 1. Importance of building drawing and its use to civil engineers. 2. The principles of planning and their use in planning of a building. 3. The principles and method of drawing a perspective view of a building. 4. Latest computational techniques and software used for building drawing.	After the completion of course student will be able to 1. Draw various orthographic views of a building 2. Draw submission drawings of a building using principles of planning of a building. 3. Recognize importance of various building bye-laws provided by the authorities. 4. Draw perspective view of a building and its elements. 5. Understand latest computational techniques and software used for building drawing
Mapped Program Outcomes : 1,5,10,12 **PSO :** iii	

Following Practicals will be conducted:

1. Development of Line plan for a residential building. **(01 Assignments)**
2. Submission drawing of a residential building. **(01 Assignments)**
3. Line Plan of public building on A1 size graph sheet. **(01 Assignment)**
4. Two Point Perspective of a building or its element **(01 Assignment)**
5. Submission drawing of a residential building using AutoCAD. **(01 Assignment)**
6. Free Hand Sketches (minimum 30) of various elements of building in **A3 size sketchbook**.

VI Semester
CV2354 – LAB : Hydraulic Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the various types of flow, major and minor losses in pipes. 2. To understand the analysis of water distribution pipe network 3. To study the various flows in channel and flow around immersed bodies. 4. To study the various hydraulic machines.	1. An ability to carry out the head loss in pipes for design of pipe network. 2. An ability to carry out analysis of water distribution network. 3. An ability to determine velocity and sketch various profiles, back water length, hydraulic jump, roughness, concept of specific energy in open channels and forces around submerged body and flow lines around immersed bodies. 4. An ability to determine the performance of hydraulic machines.
Mapped Program Outcomes : 1,2,3	

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. Determination of Manning's or Chezy's constant for uniform flow in an open channel.
4. Study of hydraulic jump in a horizontal rectangular channel.
5. Development of specific energy diagram for rectangular channel.
6. Study of flow over horizontal contraction.
7. Determination of minor losses in pipes.
8. Determination of velocity in open channels flow by using current meter.
9. Design problems of pipe network analysis.
10. Sketch the various profiles in open channels flow
11. Computation of water surface length in open channel by using direct step method.
12. Study of performance of centrifugal pump.
13. Study of performance of pelton wheel turbine

Reference Books:

1. Laboratory work in Hydraulic Engineering, 2006, Asawa, G.L., New Age International Publishers.

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.

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
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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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VI Semester

CV2366 - PE-II : Introduction To Remote Sensing

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–1 : Basics of Remote Sensing : Definition of Remote sensing, Principles of Remote Sensing, Electromagnetic spectrum, Interaction of EM Radiation with atmosphere, and target, Atmospheric Widows, Spectral signature of various land cover features.	**[06 Hrs.]**
UNIT–2 : Elements of Remote Sensing System: Platforms : Types of platforms, ground, airborne, and space born platforms, Orbit of satellites, satellites for Earth observations studies, Sensors : Types and classification of sensors, sensor resolutions. Scanners : Types of scanners push broom scanner, whiskbroom scanner.	**[07 Hrs.]**
UNIT–3 : Basics of Aerial Photogrammetry, Determination and calculation of elevation from RS data, Relief displacement, image parallax and vertical exaggeration, Visual Image Interpretation: Elements of interpretation, interpretation key.	**[07 Hrs.]**
UNIT–4 : Digital Image Processing : Basics of DIP, Image Rectification and Registration, Image Enhancement, Image Classification . Remote Sensing Data Formats.	**[07 Hrs.]**
UNIT–5 : Introduction to Geographical Information System, Introduction to Global Positioning System (GPS)	**[06 Hrs.]**
UNIT–6 : Role of Remote Sensing and GIS in Natural Resources Management, Environmental Impact Assessments, Agriculture, Land use & Land Cover, Disaster Management.	**[06 Hrs.]**

Text Books :

1. Remote sensing and GIS: Basudeb Bhatta, Oxford University Press
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Higher surveying volume III: Dr B C Punmia

Reference Books :

1. Remote Sensing Principles and Interpretation by Sabins F F
2. Remote Sensing and Image Interpretation by Lilles and T M and Kieffer R W.

VI Semester
CV2369 - PE-II : Water Transmission & Distribution System

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Losses, various valves and its operation, pumps, three reservoirs and multi-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 mechani cs and related applications and estimate discharges in multi -reservoir system 2. Analyze the water distribution network by using various method 3. Design water distribution network and optimal diameter of rising main 4. Optimize water distribution network
Mapped Program Outcomes : 1,2,3,5	

UNIT–1 : General Hydraulic Principles, major losses,& minor losses, Head loss formulae- Darcy-Weisbach formula, Hazen – Williams formula, continuity equation, Equivalent length of Pipes, three Reservoirs, multi reservoir, Pumps and Valves in Water distribution systems.	**[07 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.	**[06 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.	**[07 Hrs.]**
UNIT–4 : Estimation of reservoir capacity, Optimal and Economical diameter of pumping main. Design of pumping main considering rising main diameter as continuous as well as discrete variable and explicit function.	**[06 Hrs.]**
UNIT–5 : Design of water distribution networks: Design of single source branching network using Critical path method, Determining number of branching configuration for a looped network by graph theory, Use of path concept and minimum spanning tree concept.	**[07 Hrs.]**
UNIT–6 : Optimal Design Water Distribution Networks: Cost head loss Ratio (CHR) method – CHR criterion, Problem formulation CHR methodology (for single source branching networks).	**[06 Hrs.]**

Text Books:

1. Bhave P. R Optimal design of water distribution networks, Narosa publishing house pvt. Ltd 2003
2. Bhave P.R., & Gupta R. Analysis of Water Distribution Networks, Narosa publishing house pvt. Ltd 2006
3. Walski T.M. (1984) "Analysis of Water Distribution System" Van Nostrand Reinhold Co. New York, N.Y. USA.

Reference Books:

1. Bhave P.R Analysis of flow in water distribution networks, Technomic publishing co, INC, Lancaster, USA.

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VIII SEMESTER

CV1447	PE III: Advanced R.C.C.			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand different methods design of specialized RCC structures. 2. Understand different methods of bridge design. 3. Understand design methods of water tank, 4. Understand design methods of retaining walls. 5. Understand design methods of multistoried building	1. An ability to understand the importance of various structures like multistoried buildings, bridges, water tanks and retaining walls. 2. An ability to analyse the structures for various types of loading conditions as per Codal provisions 3. An ability to design various structures such as bridges, tanks, and retaining walls.
Mapped Program Outcomes: 1,2,10	

UNIT – 1 :

Design of circular and rectangular water tanks resting on ground.
Design of overhead service reservoirs. Analysis and design of staging by cantilever method including wind forces as per relevant IS codes. Design of foundation- Annular raft, Full raft.

[10 Hrs.]

UNIT – 2 :

Design of flat slab, Grid slab, design for cutouts in slab.Introduction to design of bridge deck slab for IRC loadings.

[09 Hrs.]

UNIT – 3 :

Design of building frames up to two bay/four story, including design of foundation. Using Limit state Method including effect of lateral loads. Introduction to ductile detailing & provisions of IS 13920.

[10 Hrs.]

UNIT – 4 :

Design of retaining walls–cantilever and counterfort.Introduction to reinforced earth retaining wall.

[10 Hrs.]

Text Books:

1. Dr. S.S. Bhavikatti, Advance R.C.C. Design Volume II, New Age international (p) limitedpublishers NEW DELHI. 1st Edition
2. N. Krishana Raju, Advanced concrete structures, CBS Publishers and Distributors NewDelhi.2nd Edition-
3. T.R. Jagadeesh, M.A. Jayaram, Design of bridge strucures, prentice Hall of India private limited , M-97 connaught circus New Delhi 1stEdition
4. George Verghese, Advanced RCC, Prentice-Hall of India Pvt. ltd New Delhi-2nd Edition

Reference Books:

1. Jain and Jaikrishana, Plain and Reinforced Concrete Structures Vol-II., Indian Standards Institution. New Delhi.-2nd Edition
2. Johnson & Victor, Essentials of Bridge Engineering, IBH Publishing Co. Pvt. Ltd., New Delhi. Sixth edition
3. A K. Jain, -Reinforced Concrete Structures-published by Laxmi publication private limited, 22 Golden house, Daryaganj, New Delhi- 3rd Edition
4. Dr. V.L. Shah, Dr. S.R. Karve-structures publications Jal Tarang, 36 parvati pune411009, 5th Edition

CV1429	PE IV: Matrix Analysis of Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	15	10	60		100	3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
At the end of the course the student will be able to understand 1. Basic concepts of direct stiffness method. 2. Analysis of various structural elements by stiffness method	1. An ability to understand the stiffness method for analyzing statically indeterminate structures. 2. An ability to model the behaviour of various structural elements and systems. 3. An ability to understand the effect of various loading and support conditions on structural elements and systems. 4. An ability to implement the computer program to analyse the structures.
Mapped Program Outcomes: 1,2,4,5	
Mapped Program Specific Outcomes:1	

UNIT – 1 :
Basic terminology, degree of freedom, basic concept of direct stiffness method, derivation of all stiffness coefficients, formulation of compatibility equations, rotation transformation matrix.

[06 Hrs.]

UNIT – 2 :
Analysis of Beam (without axial deformation): Formulation of elemental stiffness matrix for Beam, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, uniformly distributed load and moment, assembly of global load matrix, solution to problem without sinking of support with maximum three degree of freedom.

[07 Hrs.]

UNIT – 3 :
Analysis of Plane Truss: Formulation of elemental stiffness matrix and global stiffness matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, assembly of global load matrix, solution to problem of plane truss with maximum three degree of freedom.

[06 Hrs.]

UNIT – 4 :
Analysis of Plane Frame (Without axial deformation): Formulation of elemental stiffness matrix and, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[06 Hrs.]

UNIT – 5 :
Analysis of Plane frame (With axial deformation): Formulation of elemental stiffness matrix and transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[07 Hrs.]

UNIT – 6 :
Analysis of Beam with sinking of support, analysis of member for temperature loading, lack of fit in trusses with maximum three degree of freedom, storing of global stiffness matrix, full storage, banded storage and band minimization.

[07 Hrs.]

VIII SEMESTER

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

CV2303 – LAB : Analysis and Design Studio

COURSE OBJECTIVES	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 analyze sway frames using moment distribution method. 3. To be able to analyze multistoried frame structures using approximate methods. 4. To be able to develop models (Beam model, Plane truss model and 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 analyze and design the RCC structural elements using standard software package without any error. 7. To be able to understand the comparison of result between manual analysis and design and software analysis and design	The student will be able to- 1. develop and execute the Beam models in the software package without any error 2. Develop and execute the Plane truss models in the software package without any error. 3. Develop and execute the Frame models in the software package without any error. 4. Develop, analyze and design the RCC structural elements in the software package without any error. 5. Compare the result between hand calculation (manual analysis) and output result of the software.
Mapped Program Outcomes : 1,2,4,5,12 **PSO** : i	

Minimum Ten Practical to be performed

1. Analyze a ***continuous beam with and without 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.
2. 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.
3. Analyze a ***continuous beam*** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result with manual analysis result. For manual analysis use **Stiffness Matrix Method.** Conclude it from both the result.
4. Analyze a ***non-prismatic fixed beam (beam splits into three parts)*** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Column Analogy Method**. Conclude it from both the result.
5. 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.
6. 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.

V Semester
CV2303 – LAB : Analysis and Design Studio

7. 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 or Portal Frame Method.** Conclude it from the result.
8. Design a simply supported beam using software package. Compare the software result of design with manual design result.
9. Design a short column using software package. Compare the software result of design with manual design result.
10. Design a slab using software package. Compare the software result of design with manual design result.
11. Design an isolated footing using software package. Compare the software result of design with manual design result.
12. Analyze and Design a multistoried building (G+2) using software package.

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
4. P.C. Vergese, Limit State Design of Reinforced Concrete, Prentice Hall Publishers, 2nd edition, 2008
5. Shah and Karve, Reinforced Concrete Structures, Structures Publishers, Pune, 5th edition, 2015.
6. Sinha S.N, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007

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
3. P.C. Varghese, Advanced Design of Structures, Prentice Hall Publishers,2009
4. Punmia B.C., Jain A.K., Jain A.K, Reinforced Concrete Structures (Vol-I), Laxmi Publications Pvt Ltd, New Delhi, 2007

V Semester

CV2313 - PE-I : Computer Application In Civil Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Student will be able to 1. Create the knowledge of C programming language 2. Develop computer programs for the solution of Civil Engineering problems. 3. Apply the knowledge of various numerical with their applicability and accuracy to specific mathematical problems 4. Evaluate and Apply numerical methods into simple, reusable program modules.	At the end of course student will be able to 1. Understand the basic concepts of C Programming language. 2. Develop computer programs for the solution of Civil Engineering problems. 3. Translate numerical methods into simple, reusable program modules 4. Develop good technical understanding & application.
Mapped Program Outcomes : 1,2,3,4,5,10	

UNIT–1 : Introduction : C-Fundamentals, character set data type constant and variables, Declaration of constants & variables, Expression, Statements, Symbolic constants. Operator and Expression, Arithmetic operator, Unary operator, Relation and Logical operator, Assignment operators, the conditional operator. Data input & output.	**[06 Hrs.]**
UNIT–2 : Control Statements:-Control statement and its application, the WHILE statements, do-while, for nested loop, if –else, switch break, continue, go to statement.	**[07 Hrs.]**
UNIT–3 : Advance Topics:-User defined Functions, Library functions, Storage class, Arrays, Pointers, structures and Unions, Data files, File Handling.	**[06 Hrs.]**
UNIT–4 : Fundamental of Numerical Methods, Interpolation & extrapolation. Numerical Integration (Simpson's method, Trapezoidal method, Newton's Gauss Quadrature method), Interactive Computer Program Development.	**[07 Hrs.]**
UNIT–5 : Computer program based on Transportation Engineering, Geotechnical Engineering, Hydraulic Engineering, Irrigation Engineering, Surveying, Estimating & costing.	**[07 Hrs.]**
UNIT–6 : Computer program based on Structural analysis, Structural Design, Environmental Engineering, Matrix algebra, Use of excel in structural design, estimating & costing	**[06 Hrs.]**

Reference Books :

1. C programming language, 2th Edition 1996, Dennis Ritchie, Pearson
2. C: The Complete Reference, 4thEdititon 2017, Herbert Schildt, McGraw Hill

VII Semester
CV2402 - LAB : Estimating and Costing

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand IS 1200, Tender documents and conditions of contracts. 2. To study specifications and rate analysis in details. 3. To study the estimate of buildings and earthwork of roads. 4. To study the estimate of wood work for door and windows. 5. To study the calculation of reinforcement in RCC Beam and Slabs.	Students will be able to 1. Prepare and draft tender documents and conditions of contracts. 2. Write detail specifications and to calculate quantities of materials in various items. 3. Estimate the quantities in buildings and roads. 4. Estimate the quantities of doors and windows. 5. Calculate the quantity of steel in RCC beams and slabs.
Mapped Program Outcomes : 1,2,8,10,11, **PSO** : iii	

PRACTICALS (Any 8 of the following practicals will be perform)

1. Study of IS-1200
2. A complete set of Tender documents
3. Set of major Conditions of contracts
4. Detailed specification of five major items.
5. Rate analysis of five major items.
6. Detailed estimate of Earth work of road for 1km length.
7. Detailed estimate of Load bearing structures –
   i. Two room plan
   ii. Four room plan
8. Detailed estimate of RCC frame structures –
   i. One room plan
   ii. Three room plan
9. Detailed estimate of wood work for Doors and Windows.
10. Calculation of reinforcement in RCC with bar bending Schedule.
11. Expert Lecture on "Role of Quantity Surveyor"

Reference Books :

1. Estimating, Costing, Specification & valuation in Civil Engineering, Chakraborti M. UBS Publication, Calcutta, 2010.
2. Estimating, Costing and valuation, Rangwala S.C, Charotar Publishing house, opposite Amul diary, court road, Anand, 2011.
3. Estimating & costing in civil Engineering, Dutta B.N, UBS Publishers distributors ltd., 5 Ansari road, New Delhi, February 1999.

VII Semester

CV2440 - PE-V : Structural Engineering Practices

COURSE OBJECTIVE	COURSE OUTCOMES
5. To make the students aware about Structural Engineering Practices and pre-requisites in initiating structural design 6. To provide the students the knowledge about various standards and specifications frequently referred by Structural Engineers and their use in practice 7. To make the students aware about architectural plans, structural analysis and design of structural elements, identification of points for discussion between an architect and structural designer 8. To design an RCC building and prepare structural drawings.	5. An Ability to understand structural engineering practices and pre-requisites. 6. An ability to understand relevant standards and software related to structural design. 7. An ability to understand important construction process related to structural members. 8. An ability to design building components and prepare detailed structural drawings.
Mapped Program Outcomes : 1,2,3,4,12 **PSO** : i	

UNIT–1 : Importance of various architectural building plans and sections for the structural design. Structural behavior, Design basis, Design Intent, Standards, Manuals, Methods, material testing, Material Properties, Mix design, Quality Control, Different Tests & checks carried out at site, cube tests, buckling, creep, Shrinkage, etc. Professional ethics	**[07 Hrs.]**
UNIT–2 : Preparation of the structural framing plan of the building, beam locations, column positions, column orientations, shear walls locations. Introduction of SP16, IS:1893, IS:13920	**[06 Hrs.]**
UNIT–3 : Importance, determination & calculation of different loads like Dead load, live load, wall load, seismic load, wind load, finish load, temperature load, vibratory load, etc. Various load combinations.	**[06 Hrs.]**
UNIT–4 : Three dimensional Modeling of the Structure, Boundary Conditions, Section Properties, Applications of Loading, Static & Dynamic Analysis of structure, Design of structure, Understanding & Interpretation of the results, Deformation control, Mode Shapes, Vibrations, Acceptance Criteria's, Tolerances, , .	**[7 Hrs.]**
UNIT–5 : Foundations – Importance of soil exploration, Various types of Foundation, Selection of type of foundation. Construction Methods.	**[07 Hrs.]**
UNIT–6 : Reinforcement detailing of Structures as per SP24 and as per exposure conditions, Fire Rating, etc.	**[06 Hrs.]**

Text books:

1. P.C. Vergese, Limit State Design of Reinforced Concrete, Prentice Hall Publishers, 2nd edition, 2008
2. Shah and Karve, Reinforced Concrete Structures, Structures Publishers, Pune, 5th edition, 2015.
3. Sinha S.N, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007
4. Ashok K. Jain, Reinforced Concrete –Limit State Design, Nem chand and Brothers, 7th edition,2012

Reference books:

1. P.C. Varghese, Advanced Design of Structures, Prentice Hall Publishers,2009
2. Punmia B.C.,Jain A.K.,Jain A.K,Reinforced Concrete Structures (Vol-I),Laxmi Publications Pvt Ltd, New Delhi, 2007
3. N. Krishana Raju,Prestressed Concrete,Tata McGraw Hill Publishing Company Limited, New Delhi, 5th edition 2012

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

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.

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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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.

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2252	Lab: Electrical Machines in Power System	L=0	T=0	P=2	Credits=1

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

Course Objective	Course Outcomes
To make student aware about The basic principle, construction, operation, performance characteristics and steady state and transient analysis of synchronous machines. The principle, construction, operation, control and applications of special electric motors	The student will be able to understand : 1) Explain constructional features, develop phasor diagram and winding layout, examine steady state performance of synchronous machines and determine induced emf and voltage regulation of synchronous alternator 2) Illustrate the need and method of parallel operation of alternators, analyse and evaluate the behaviour of synchronous machine connected to infinite bus. 3) Interpret behaviour & determine time constant and equivalent circuit parameters under transient conditions of synchronous machines. 4) Explain the principle, construction and operation of special machines and identify their applications

Mapped program outcomes	1	2	3				

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

Expt. No.	Experiments based on
01	To determine voltage regulation of an alternator by direct loading.
02	To determine voltage regulation of an alternator by synchronous impedance method.
03	To plot external characteristics of synchronous generator at different power factor loads.
04	To perform slip test on a 3-phase synchronous machine.
05	To study synchronization of a 3-phase alternator with infinite bus-bars.
06	To determine sub-transient reactances of synchronous machine.
07	To determine negative sequence reactance of a 3-phase synchronous machine.
08	To determine zero sequence reactance of a 3-phase synchronous machine.
09	To observe armature voltage and current waveforms of a 3-phase alternator during slip-test on C.R.O.
10	To plot V and inverted V curves of a 3-phase synchronous motor.

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IV SEMESTER

EL2254	Lab.: Renewable Energy Sources		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	--	40	60	100	--	

Course Objective	Course Outcomes
To make student aware about The basic principle, construction, operation, performance characteristics and steady state and transient analysis of synchronous machines. The principle, construction, operation, control and applications of special electric motors	The student will be able to understand : 1) Explain constructional features, develop phasor diagram and winding layout, examine steady state performance of synchronous machines and determine induced emf and voltage regulation of synchronous alternator 2) Illustrate the need and method of parallel operation of alternators, analyse and evaluate the behaviour of synchronous machine connected to infinite bus. 3) Interpret behaviour & determine time constant and equivalent circuit parameters under transient conditions of synchronous machines. 4) Explain the principle, construction and operation of special machines and identify their applications

Minimum Eight practical are to be performed based on the following :-

Expt. No.	Experiments based on
01	To plot V-I characteristics of a single PV module.
02	To plot V-I characteristics of a series connected PV modules.
03	To plot V-I characteristics of a parallel connected PV modules
04	To study the effect of tilt angle on power output of module.
05	To study the effect of shadow on power output of solar PV module.
06	To study the solar based battery charger
07	To study the wind based battery charger
08	To study the hybrid wind and solar based charger
09	To study the biogas generation plant model set up at YCCE Campus
10	To study the box type solar cooker
11	To study solar water heater in natural convection and force convection mode
12	Study of Hydroelectric Power Plant
13	To design home solar PV system.
14	To study Parabolic Solar Cooker

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ELECTRICAL ENGINEERING

IV SEMESTER

EL2256	Lab.: Electrical Engineering Workshp		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total		ESE Duration
	--	40	60	100		--

Course Objective	Course Outcomes
This practical will allow to handle different electrical daily use equipment used by electrical engineer. Concept of illumination from design point is also studied. House wiring concept will also be understood by student.	The student will be able to 1. Describe the basic concept of various electrical components. 2. Demonstrate, formulate and solve the basic maintenance and troubleshooting of household equipments, energy saving etc. 3. Outline the fundamentals of major electrical devices and actual operation of devices like induction motor.

Mapped Program Outcomes	1	2	3	4	5	6	12

Practical based on following topics :-

Expt. No.	Experiments based on
01	a. To set up a staircase wiring using given lamp, controlledby switches. b. To set godown wiring using given lamp, controlled by switches.
02	Determination of polarity marking of single phase transformer.
03	To make connections of a fluorescent lamp wiring and to study accessories of the same.
04	To implement residential house wiring using switches, fuse, indicator, lamp and energy meter.
05	Study of 11 KV sub-station at YCCE.
06	Testing of DC Compound Motor
07	To study internal and external parts of ceiling fan.
08	To measure earth resistance by Earth Tester.
09	Study of Power Cables.
10	Study of line insulators.

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IV SEMESTER

EL2258	Lab.: Microprocessors		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	--	40	60	100	--	

Course Objective	Course Outcomes
1) To learn the microprocessor applications in electrical engineering 2) To understand principle of microprocessor chip working. 3) To study Interfacing with memory and other peripherals	The students will be able to: CO1: List, select and explain types of memory devices and architecture of 8085 microprocessor CO2: Recall, experiment with and make use of assembly language instructions of 8085. CO3: Demonstrate and test microprocessors and its interfacing devices. CO4: Illustrate and make use of DMA controller and timer.

Mapped Program Outcomes	1	2	3	12

Practical based on following topics :-

Expt. No.	Experiments based on
01	Write Assembly Language Program (ALP) to add 16 bit numbers 1324 H & 4532 H.
02	Write Assembly Language Program (ALP) to add two 08 bit BCD numbers 78 + 45 & store result in memory 2150 H.
03	Write Assembly Language Program (ALP) to subtract two 08 bit BCD numbers78 – 45 store result in memory 215 H.
04	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.
05	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.
06	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.
07	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.
08	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.
09	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.

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

V Semester

EL 2302 - Power Electronics Lab

S.N	TITLE
1	To show V-I characteristics of SCR and measure holding and latching current of SCR.
2	To estimate sensitivity of four modes operation of TRIAC
3	To evaluate average dc voltage of single phase half wave rectifier with Resistive load.
4	To show transfer and output characteristics of Power MOSFET.
5	To show speed control of DC Shunt Motor with Semi Converter.
6	To demonstrate single phase step down Cycloconverter with Resistive load.
7	To demonstrate Forced Commutation methods of SCR.
8	To evaluate RMS AC Voltage of single phase MOSFET based full Bridge inverter.

V Semester

EL 2305 - Electrical Drives Lab

S.N	TITLE
1	To evaluate and explain the control circuit of star delta starter
2	To evaluate and explain control circuit of direct online starter (DOL)
3	To explain function of side rotary limit switch.
4	To categorize different types contactors
5	To classify and explain programming logic control (PLC) M-1200, M-1400 and LOGO PLC.
6	To make use of operating limit switch to turn ON contactor (output device).
7	To design ladder programming in PLC to control lamp.
8	To design ladder programming using LOGO PLC to control lamp.
9	To explain Implementation of timer using LOGO PLC
10	To design ladder programming in PLC to Control of lamps in pre defined sequence
11	To design a program for Reversal of synchronous motor using PLC
12	To make use of limit switch, and sensors to turn ON contactor motor, lamp .

VI Semester

EL2361- PE-I: Advanced Power Electronics

Course Objective	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.

.

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 (SHE) Space Vector Pulse Width Modulation (SVPWM), Random PWM.

UNIT 5: Harmonics

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

Unit 6:Harmonics Mitigation Techniques

Passive Filter ,Active Power Filter-Series and Shunt(Open Loop and Closed Loop Control).

VI Semester

EL2361- PE-I: Advanced Power Electronics

Text Books				
S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics:Converters,Application and Design	2007	Ned Mohan, T.M. Undeland and W.P. Robbins	Wiley Publication(Wiley Student Edition)
2	Power Electronics;Principles and Applications	2017	Joseph Vithayathil	Tata McGraw Hill Publication (Indian Edition)
3	Power Electronics and AC Drives	2003	B.K. Bose	Pearson Education
Reference Books				
1	Power Semiconductor Circuits	1984	S.B. Dewan and Straughen	John Wiley and Sons, Inc

VI Semester

EL2362- PEI: Electrical Distribution in Power System

Course Objectives	Course Outcomes
Student will be able to understand the various Aspects of distribution system **Mapped Program Outcomes: a,b,d,f,j**	The student will be able to understand the 1) The factors which affect the performance of distribution system, nature of load, its growth and forecasting. 2) Types of feeders, its loading, causes of unbalance, fault isolation, System restoration. 3) Distribution line parameter, supports and the causes and effects of voltage drop in distribution line 4) Different method Reactive power compensation Benefits of power factor improvement. 5) To decide optimal location of substation 6) Problems with existing distribution systems and function of substation automation system

UNIT-1: Load Forecasting

Introduction, Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor, load & load characteristics, load and load duration curve, relation between load and loss factor, load curve and diversified demand, load modeling,load growth and forecasting.

UNIT-2: Distribution Feeders:

Introduction, Primary and secondary distribution, Radial and loop types, Distribution substation location and planning, Feeder loading and voltage drop considerations, Voltage drop in feeder with different loading, Engineering considerations for voltage levels and loading, causes of unbalance and unequal drops, common faults in feeders, fault location, fault isolation, restoration.

UNIT-3: Overhead lines and Cables

Introduction, Line parameters, Overhead lines, insulators and supports, cables, Insulation resistance, Voltage drop and power loss in conductors, voltage drop in ac single phase distribution system, voltage drop computation based on load density, voltage drop in underground cable distribution.

UNIT-4: Reactive power compensation and applications of capacitors

Introduction, advantages and benefits of power factor improvement, power factor improvement using capacitors: mathematical calculations, location of capacitors, application of capacitor banks for power factor improvement, sub harmonic oscillations and ferro resonance due to capacitor banks, optimum power factor for distribution system.

UNIT-5: Substation & Metering, instrumentation & Tariffs

Introduction, substation types, substation components, equipment and layouts, substation location and size, Grounding, earth connection and earthing system, measurement of power, measurement of energy, maximum demand and trivector meter, automatic meter reading (AMR), AMR systems, substation instrumentation, tariffs and billing.

VI Semester

EL2362- PEI: Electrical Distribution in Power System

UNIT-6: Distribution automation (DA) & SCADA

Problems with existing distribution systems, need for distribution automation, distribution automation, feeder automation, communication requirements for DA. Remote terminal unit (RTU), Block diagram of SCADA, Components of SCADA, Functions of SCADA, SCADA applied to distribution automation, Advantages of DA through SCADA,DA integration mechanisms, Functions of substations automation systems, state and trends of substation automation.

Text books				
1	Electrical Power Distribution Systems	2009	V. Kama Raju	Tata Mcgraw Hill Education Private Ltd., New Delhi
2	A Text Book of Electric Power Distribution Automation	1st Edition, 2010	Dr. M. K. Khedkar And Dr. G. M. Dhole,.	University Science Press

Reference books:				
1	Electric Power Distribution	4th edition, 1997	A.S.Pabla	Tata Mc Graw-Hill Publishing Company
2	Electrical Distribution System	1st Edition,2013	Dr.H.P.Inamdar	Electrotech Publication

VI Semester
EL2363- PEI: Illumination Engineering (MOOC)

Unit I:
Radiation & Colour
Eye & Vision
Different entities of illuminating systems

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

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

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

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

Unit VI:
Different type of loads and their individual protections
Selection of cable/wire sizes; potential sources of fire hazards and precautions. Emergency supply stand by& UPS
A specific design problem on this aspect

VI Semester
EL2364- PEI: Electric Vehicles

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 (Numerical), Propulsion power, Velocity and acceleration, Propulsion system design.

Unit 2:- Battery and other alternative Energy Sources

Battery basics, lead acid battery, alternative batteries, battery parameters (Numerical), technical characteristics of battery, targets and properties of batteries, battery modeling.

Fuel cells- Basic Operation, Fuel Cell model and cell voltage, No-Load and Load voltage of a PEM(Numerical), Basic Operation of super capacitorsand ultra-capacitors, Basic Operation of flywheels.

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(Numerical).

Unit 4:- Power Electronics and motor Drives

Electric drive components, dc drives, operating point analysis, ac drives, Buck Converter in Continuous Conduction Mode (CCM) (Numerical), Boundary Conduction Mode (BCM) (Numerical), Discontinuous Conduction Mode (DCM),PM synchronous motor drives, Switched Reluctance motor drives, design of current and speed controller.

Unit 5: Drive Train

EV transmission configuration, transmission components, gears, automobile differential, clutch, brakes, ideal gear box, EV motor sizing(Numerical).

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 Book: -

1) Iqbal Husain, "**Electric and Hybrid Vehicles: Design Fundamentals**", CRC Press, 2005.

2) John G. Hayes, John G. Hayes,"**Electric Powertrain- Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles**", John Wiley & Sons, 2018

VI Semester
EL2365- PEI: Electric Power Utilization

Course Objectives	Course Outcomes
Student will understand. The knowledge about energy utilization .The application of electrical energy such as lightning, heating welding, fans and pumps.	The student on completion will be able to understand 1) Types of electric heating techniques, their field of application, relative advantages and limitations. 2) Types of electric welding techniques, their field of application, relative advantages and limitations, defects in welding, new advancements in welding technology. 3) Basic concepts of illumination, various types of lamps along with their light characteristic and field of application. They will be able to design illumination system for various criterions. 4) Basic refrigeration cycle, VCRS and VARS, various types of air conditioning systems and its use as per requirement. 5) Difference between fans and blowers with respect to its characteristics , various energy saving methods to be used. They can classify pumps with respect to its characteristic and field of application. 6) Classification of compressors, application of compressors as per requirement of compressed air. They will understand basics of DG system, its major components, working under different conditions and energy saving opportunities in DG system

UNIT-1: **Electric Heating**

Introduction, Advantages of electric heating, modes of heat transfer, methods of electric heating, resistance heating, arc heating, arc furnaces, induction heating, dielectric heating, infrared and radiant heating.

UNIT-2: **Electric Welding:**

Definition, welding process, resistance electric welding, electric arc welding, submerged arc welding, MIG welding, Ultrasonic welding, laser beam welding, welding of various metals, underwater welding, defects in welding, testing of welding joints.

UNIT-3: Illumination :

Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.

VII Semester

EL2411- PEII: Fundamentals of Power Quality

Objective	Course Outcome
• To introduce students the power quality issues their causes, effects and solutions. • To familiarize students to the synthesis of voltage sag, principle operation, analysis and applications of passive power filter, active power filter and custom power devices. • To provide strong foundation for further study of power quality issues	**On completion of this course, the student will be able to** **1.** Illustrate power quality disturbances and typical problems associated with it. **2.** Analyse and evaluate the voltage sag. **3.** Appraise the fundamentals of harmonics and develop solutions through filters to minimise the harmonic distortion. **4.** Plan of mitigating the power quality events through custom power and network configuring devices with applying suitable control strategies

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Illustrate power quality disturbances and typical problems associated with it	3												1	
CO2	Analyse and evaluate the voltage sag.	3	2											2	
CO3	Appraise the fundamentals of harmonics and develop solutions through filters to minimise the harmonic distortion	3	2	2										2	1
CO4	Appraise the fundamentals of harmonics and develop solutions through filters to minimise the harmonic distortion	3													1

VII Semester

EL2411- PEII: Fundamentals of Power Quality

Unit No.	Contents	Max. Hrs.
1	**Overview and definition of power quality** Overview and definition of power quality (PQ): Sources of pollution and regulations, Power quality problems: rapid voltage fluctuations voltage unbalance, Voltage dips and voltage swells, Short duration outages, long duration variations, power acceptability curves.	6
2	**Voltage sag analysis** Definitions Voltage sag analysis: Sag caused by motor starting, Sag caused by utility fault clearing, Sag magnitude and duration calculations, RMS voltage, calculation in single phase systems, Computers, AC and DC drives etc. performance in presence of sag.	7
3	**Harmonics** Power system harmonics: Harmonic analysis, Harmonic sources and their effects, Introduction to power converters, Fourier analysis, Total harmonic distortion, rms & average value calculation, Effects of harmonic distortion on power factor.	7
4	**Filter Design** Filters: passive filters, active filters, hybrid filter design and working principles.	6
5	**Control of APF and configuring devices** Control of APF : Instantaneous reactive power theory (p-q theory) ,Synchronous reference frame theory(d-q theory), Synchronous detection theory, Regulation of DC link voltage and frequency domain control. Network configuring devices: Solid State Current Limiter (SSCL),Solid State Breaker(SSB),Solid State Transfer Switch(SSTS)	7
6	**Custom power devices** Introduction to custom power devices, Dynamic Voltage Restorer (DVR) ,Distribution Static Compensator (DSTATCOM) and Unified Power Quality Conditioner (UPQC), Control strategies, Applications.	7

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Electrical Power Systems Quality	2nd edition.	R. C. Dugan, M. F. Mcgranaghan	McGraw-Hill
2	Power Quality	1st edition 2002 E book 2017	C. Sankaran	CRC Press
3	Understanding Power Quality Problems: Voltage sag and interruptions	2011	M. H. Bollen Ledwich	Wiley India

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power System Harmonics	2nd edition, 2003	J. S. Arillaga	Wiley
2	Power Quality Enhancement using custom power devices	2002	Arindam Ghosh Ledwich	Kluwer Academic Publishers

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ELECTRICAL ENGINEERING

VII Semester

EL2412- PEII: Electrical Installation Design

Objective	Course Outcome
The student should be able to To understand and design the methods used in electrical installation for commercial building and the tools used for it as per IE and IS Standards .	**On completion of this course, the student will be able to** 1) Classify, various techniques used to identify the load pattern. 2) Demonstrate, apply and evaluate the various wires and cables and their tests. 3) Demonstrate, apply and estimate the various types of luminaries and its calculation. 4) Explain, develop and determine the components involves in substation and their function.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, various techniques used to identify the load pattern.	1													1
CO2	Demonstrate, apply and evaluate the various wires and cables and their tests.	2	1										1		
CO3	Demonstrate, apply and estimate the various types of luminaries and its calculation.	1	2	3		1							2	1	
CO4	Explain, develop and determine the components involves in substation and their function.	3		1			1		1	1			2	2	1

Unit No.	Contents	Max. Hrs.
1	Load forecasting, regression analysis, numerical based on linear and exponential trends, Electrical installation for domestic, commercial and industrial consumers, calculation of connected load, selection of transformers, switchgears, cables and wires, single line diagram, special provisions for high rise buildings (IER-50-A), earthing requirements, megger and earth tests, use of earth leakage circuit breakers (special reference to be given to IER 2 (i, n, o, p, v, aa, aaa, aq, aqq, ar, av).	7
2	Cables: PVC and XLPE cables, their construction in brief, current ratings, specifications, derating factors, Megger and continuity test. Overhead distribution lines upto 33 kV, Line apparatus and basic construction, clearances, selection of AAC and ACSR conductors, voltage drop calculations, Selection of Insulators, earthing requirements. (Special reference to be given to IER 77, 79, 80, 81, 87, 89, 90, 91, 92)	7

VII Semester

EL2412:PEII: Electrical Installation Design

Unit No.	Contents	Max. Hrs.
3	Definitions, polar curves, simple calculations, working principles of fluorescent, sodium vapour and mercury vapour lamps, Capacitors and power factor improvement: Determination of rating and location of capacitors, calculation of payback period for additional capacitors.	6
4	Single line diagram, plan, elevation and clearances for 11 kV pole mounted, 11 kV plinth mounted (upto 1000 kVA and above 1000 kVA), 33 kV (upto 2500 kVA and above 2500 kVA) substations. Single line diagram for substation with two transformers in parallel, specifications of isolators, lightening arrestors, horn gap fuses, D.O. fuses, circuit breakers, instrument transformers, power transformers, LV HRC fuses, LV circuit breakers, (Special reference to be given to IER 31, 33, 35, 43, 44, 47, 48, 50, 51, 54, 58, 64, 64A, 67 and IS3043)	7
5	Determination of fault levels of various locations in substation, use of current limiting reactors, philosophy of protective relaying, over current, earth fault, REF protection, earth leakage protection, OTI, WTI, Buchholz relays, Firefighting equipments, restoration of a person affected by electric shock, Earthing: types, measurement of earth resistance.	6
6	Site testing of transformers (Visual, pre-commissioning tests like megger, magnetic balance, turns ratio), testing of oil, operational test for Buchholz, OTI, WTI, alarm and trip functions.	7

Text Books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Electric Power	2016	Soni, Gupta, Bhatnagar	Dhanpat Rai Publication
2	Electrical Installation Design	2012	Jain, Bajaj	Laxmi Publication
3	Power Electronics and AC Drives	2003	B.K. Bose	Pearson Education

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Electric Power Distribution Systems	2004	Pabla	McGraw Hill
2	Electrical Substation	1992	S. Rao	Khanna Publication
3	Electrical Engineering handbook	2018	C.L.Wadhwa	New Age International
4	IER (Latest edition)			

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ELECTRICAL ENGINEERING

VII Semester

EL2413- PEII: Electrical Machine Design

Course Objective	Course Outcome
The course will help the students to understand the step by step procedure for the complete design of electrical machine specificifically diameter,length,height aand such other parameters depending on application or requirement	**On completion of this course, the student will be able to** 1. Classify, select various materials used in construction of electrical machines and interpret their rating and performance 2. Demonstrate, apply and evaluate design parameters of transformer 3. Demonstrate, apply and estimate stator, rotor design of induction motor 4. Explain, develop and determine design parameters of synchronous machine

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Classify, select various materials used in construction of electrical machines and interpret their rating and performance	3	2	1	1									1	
CO2	Demonstrate, apply and evaluate design parameters of transformer	3	2	1	1									2	
CO3	Demonstrate, apply and estimate stator, rotor design of induction motor	3	2	1	1									2	
CO4	Explain, develop and determine design parameters of synchronous machine	3	2	1	1									3	

Unit No.	Contents	Max. Hrs.
1	**Review of material used in construction of electrical machines** Magnetic material such as amorphous, ferrite etc. Classification of insulating materials depending upon permissible temperature rise, properties of transformer oil, standard specifications, C.M.R. and short time of machines, Heating and cooling characteristics.	6
2	**Transformer design : Main Dimensions** Output equation, equation for voltage per turn for power and distribution transformer, core design, overall dimensions of single phase and three phase transformer.	7

VII Semester

EL2413 - PEII: Electrical Machine Design

Unit No.	Contents	Max. Hrs.
3	**Transformer design : Performance Characteristics** Resistance and leakage reactance of winding for concentric cylindrical and sandwich type winding, estimation of no load current , method of cooling and cooling tank design.	7
4	**Induction motors: Stator Design** Total loading, specific loading on the machine, output equation, main dimension, estimation of axial lengths and air gap diameter based on different design criterion, estimation of number of slots, area of slot, stator teeth and stator core dimensions, length of mean turn, stator winding.	7
5	**Induction motor rotor design** Air gap length, no. of rotor slots, cage rotor and wound rotor , Design of rotor bar and slots, design of end ring, design of wound rotor, rotor teeth and rotor core design, Calculation of no load current, stator and rotor resistance and other performance characteristics for design data.	7
6	**Synchronous machines** Types of synchronous machines, Output equation , specific loadings, Design of salient pole (Main dimensions, length of air gap, shape of pole face, armature design) and turbo alternators (Main dimensions , length of air gap, stator and rotor design), Effect of SCR on machine performance, ventilation of synchronous generator, cooling circuit design, Hydrogen and water as cooling media	6

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Performance and Design of A.C. Machine	1995	M.G. Say.	English L B S
2	Electrical Machine Design	2016	A.K. Sawhney	Dhanpat Rai & Sons, Delhi

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Electrical Machine Design	3rd	Balbir Singh	Brite Student Publication, Pune
2	Power Transformers	2nd	S.B.VasuBinsky	

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ELECTRICAL ENGINEERING

VII Semester

EL2421- PEII: Power System Operation and Control

Objective	Course Outcome
The student should be able to 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. .	**On completion of this course, the student will be able to** 1. Explain, analyse reserve requirement & load forecasting methods. 2. Analyse optimal scheduling of generating units, determine with the help of flowcharts. 3. Develop and illustrate optimal unit commitment problem & its solution methods. 4. Discuss various methods of voltage control & Load Frequency Control and design of reactive power compensation equipment used for transmission line.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Explain, analyse reserve requirement & load forecasting methods		3	3									1	1	
CO2	Analyse optimal scheduling of generating units, determine with the help of flowcharts.		3	3									1	1	
CO3	Develop and illustrate optimal unit commitment problem & its solution methods		3	3	2								1	1	
CO4	Discuss various methods of voltage control & Load Frequency Control and design of reactive power compensation equipment used for transmission line.		1	1	2								1	1	

VII Semester

EL2421:PEII: Power System Operation and Control

Unit No.	Contents	Max. Hrs.
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.	6
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 commitment, unit commitment using priority ordering.	7
3	**Load Frequency Control (LFC)** Introduction, necessity of maintaining frequency constant, Load frequency Control, Governor Characteristics of single Generator, Adjustment of Governor Characteristic of Parallel Operating Unit, LFC (P-f control) Q-V Control, Generator Controller (P-f control & Q-V controllers), P-f control versus Q-V control, Dynamic Interaction between P- F and Q-V Loops, Speed-Governing System, Control Area Concept, Incremental Power Balance of Control Area, Requirements of the Control Strategy, Integral control, Concept of two area.	7
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.	7
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,	6
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.	7

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power System Operation and control	1st edition	S. Sivanagarju and G. Srinivasan	Pearson Publisher
2	Power System Stability and control	1st edition	P. Kundur	TMH Publisher
3	Electrical Power system	6th edition	C. L. Wadhwa	New Age International Pvt Ltd Publisher
4	Economic Operation of power system studies	3rd edition 2010	L. K. Kirchmayer	Wiley Eastern India, New Delhi

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Generation, Operation and control	2nd Edition	A. J. Wood and B.F. Woolenberg	John Wiley & Sons
2	Power System: Operation & Control	1st edition, 2013	Dr. K. Uma Rao	Wiley

VII Semester

EL2422- PEIII: FACTS Devices

Objective	Course Outcome
The student should be able to To understand the problems and constraints related with stability of large interconnected systems and to study their solutions using different FACTS Controllers, Shunt (SVC,STATCOM),Series (TCSC,GCSC,SSSC),Series Shunt(UPFC),Series Series(IPFC)	**On completion of this course, the student will be able to** 1. Define FACTS Concept, various FACTS Controllers, its classification and explain its applications in Transmission system. 2. Explain, show, implement and design different shunt and series compensators and its control schemes 3. Demonstrate, examine and apply voltage and phase angle regulators in power system 4. Extend, apply and analyze the FACTS concept using combine series-shunt and series-series controllers to evaluate the improved transmission system performance

CO	Statement	Mapped PO												PSO	
		PO 1	PO 2	PO 3	PO 4	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
1	Define FACTS Concept, various FACTS Controllers, its classification and explain its applications in Transmission system.	1												1	
2	Explain, show, implement and design different shunt and series compensators and its control schemes	1	2	2										3	
3	Demonstrate, examine and apply voltage and phase angle regulators in power system	1	2	2										3	
4	Extend, apply and analyze the FACTS concept using combine series-shunt and series-series controllers to evaluate the improved transmission system performance	1	2	2										3	

VII Semester

EL2422- PEIII: FACTS Devices

Unit No.	Contents	Max. Hrs.
1	**Flexible AC Transmission Systems (FACTS)** FACTS concept and General System Consideration, Transmission interconnections, Flow of power in an AC System, factors affecting the Loading Capability, power flow and Dynamic Stability Consideration of Interconnected Transmission. Importance of controllable Parameters, FACTS Controller. HVDC and FACTS.	7
2	**Static shunt compensators** SVC and STATCOM, Objectives of Shunt Compensation, Methods of Controllable Var Generation, Static Var Compensators SVC and STATCOM,Control scheme for SVC and STATCOM ,Comparison between STATCOM and Static Var System (SVS).	7
3	**Static Series Compensators** GCSC, TSSC, TCSC and SSSC, Objectives of series Compensation, Variable Impedance Type Series compensators, Switching Converter Type Series Compensators, Control Schemes for GCSC,TSSC,TCSC and SSSC, External (System) Control for Series Reactive Compensators	6
4	**Static Voltage and Phase Angle Regulators** TCVR and TCPAR, Objectives of Voltage and phase angle regulators, Approaches to Thyristor Controlled Voltage Regulators (TCVR) and Thyristor Controlled Phase Angle Regulators (TCPAR), Switching Converter- Based Voltage and Phase Angle regulators, Hybrid Phase Angle Regulators.	7
5	**Shunt-Series Compensators:UPFC** Shunt series Compensators UPFC, Operating modes of UPFC, Basic control system for P and Q control, Comparison of UPFC to Series Compensators and Phase angle regulators.	6
6	**Other FACTS Controllers** Series –series compensators IPFC,Basic structure and operation,Thyristor controlled braking resistor	7

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Understanding FACTS	2001	Narayan G.Hingorani	Standard Publishers
2	FACTS : Controllers in Power	1st edition 2007	K. R. Padiyar	New Age International
3	Transmission & Distribution	1st edition 2002	R. Mohan Mathur, Rajiv K Verma	Wiley

Reference Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Flexible AC Transmission System(FACTS)		Edited by Yong Hua and Johns	IEEE Press

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester

EL2423:PEIII: Electrical Energy Management And Audit

Objective	Course Outcome
The student should be able to Understand various operating characteristics of electrical equipments, its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving, its global impact and its performance evaluation.	On completion of this course, the student will be able to 1. Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003. 2. Demonstrate, apply and evaluate different forms of electrical and thermal energy. 3. Demonstrate, apply and estimate the Energy Management, Energy Audit,Energy Monitoring and Targeting. 4. Evaluating the Performance of Electric Motor and variable Speed drivesand cogeneration systems. .

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS 1	PS 2
1	Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003.	1				1	1		1				2	1	1
2	Demonstrate, apply and evaluate different forms of electrical and thermal energy	1	1			1				1			1		1
3	Demonstrate, apply and estimate the Energy Management, Energy Audit,Energy Monitoring and Targeting	1	1	1		1	2			1			2	1	1
4	Evaluating the Performance of Electric Motor and variable Speed drivesand cogeneration systems.	1	1		3					2			2	1	2

VII Semester

EL2423:PEIII: Electrical Energy Management And Audit

Unit No.	Contents	Max. Hrs.
1	Energy Scenario Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.	6
2	Basics of Energy and its various forms Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion	7
3	Energy Management & Audit Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	7
4	Energy Monitoring and Targeting Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).	7
5	Performance Evaluation of Electric Motor and variable Speed Drives Methods for determining motor loading, methods of determining motor efficiency, evaluating performance of rewound motors, variable speed drive: principles and applications, factors for successful implementation of variable speed drive.	7
6	Captive and Cogeneration Systems Introduction, purpose of the performance test, performance terms and definitions, reference standards, field testing procedure, examples, Case study of bottoming cogeneration in industries.	6

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Principles of Energy Conversion		Archie,W Culp	McGraw Hill
2	Energy Management Handbook		Wayne C Turner	John Willey and Sons
3	Bureau of Energy Efficiency Study Material for Energy Managers and Auditors Examination			Bureau of Energy Efficiency www.beeindia.in

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Handbook on Energy Audit and Management		Amit Kumar Tyagi	

VII Semester

EL2424 - PEIII: ADVANCED CONTROL SYSTEM

Objective	Course Outcome
The student should be able to elaborate concept of compensation in control system. Compensation design is explained. Optimal control and sample data control system is also discussed in this subject	On completion of this course, the student will be able to **1)** Explain concept of lag and lead compensator design in time and frequency domain, theory of PI, PD and PID control in time domain and frequency domain. **2)** Illustrate and apply state variable approach with solution of state models and concepts of controllability, observability and state variable feedback. **3)** Classify and analyse non-Linear Control System, types of non-linearities, its characteristics. Students will also be able to demonstrate and apply different methods of evaluating non-linear control like describing function method and phase plane method for stability analysis. **4)** Explain sample data control system, Stability analysis with Z-transforms and solution of discrete time systems.

CO	Statement	Mapped PO													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	Explain concept of lag and lead compensator design in time and frequency domain, theory of PI, PD and PID control in time domain and frequency domain.	2	1	1	1								1	1	3
2	Illustrate and apply state variable approach with solution of state models and concepts of controllability, observability and state variable feedback.	3	2	1											3
3	Classify and analyse non-Linear Control System, types of non-linearities, its characteristics. Students will also be able to demonstrate and apply different methods of evaluating non-linear control like describing function method and phase plane method for stability analysis.	3	2		1									1	3
4	Explain sample data control system, Stability analysis with Z-transforms and solution of discrete time systems.	3	2		1										3

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ELECTRICAL ENGINEERING

VII Semester

EL2424:PEIII: ADVANCED CONTROL SYSTEM

Unit No.	Contents	Max. Hrs.
1	**UNIT-1: Compensation** Compensation: - Review of performance Analysis of type O, type 1 & type 2 systems. Need for compensation. Performance Analysis of Compensators in time & frequency domain, Bode Plots and Design of Compensators.	6
2	**Design of PID Controller:** Fixed configuration design, theory of PI, PD and PID control in time domain and frequency domain, Zeigler Nichol"s method of PID tuning.	7
3	**State variable Feedback** Design by State variable Feedback: Review of state variable representations. Solution of state equation Controllability & observability, Design of State Feedback.	7
4	**Non Linear control system (NLCS)** Non Linear Control System: Types of non-linearities, characteristics of NLCS. Inherent & intentional non- linearities. Describing function method for Analysis Describing functions of some common non-linearities. Stability analysis. Limit cycles & stability of limit cycles.	7
5	**Phase -Plane Method** Phase -Plane Method:Singular points stability from nature of singular points Construction of trajectory by Isocline and Delta Method Computation oftime.	6
6	**Sample Data control System (SDCS)** Sample Data control System; - Representation of SDCS, Sample and Hold Circuit Z-Transform, Inverse Z- Transform & solution of difference equation "Z" & "S" domain relationship. Stability by Bi-linear transformation & Jury"s test. Discretization of continuous time state equation.	7

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Control Systems Analysis	4th edition2008	I.J.Nagrath, M.Gopal	
2	Modern Control Theory	2014	M.Gopal	New Age International Private Limited

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Modern Control Engineering	4th	Katsuhiko Ogata	Prentice Hall Pearson Edcation International
2	Automatic Control Systems	9th	B C..Kuo Farid Golnaraghi	WILEY
3	Modern Control System		B.C.Kuo	2003

VII Semester

EL 2425 - PEIII: ARTIFICIAL INTELLIGENCE BASED SYSTEM

Objective	Course Outcome
The student should be able to understand the concept of fuzzy logic and neural network and the basic concepts and mathematical models of fuzzy and neural network are covered	On completion of this course, the student will be able to **1)** Recall, explain, solve and analyse the principles of fuzzy logic and control. **2)** Explain and discuss adaptive fuzzy control. **3)** Explain, analyse and solve problems in basic neural networks and associative memories **4)** Explain, analyse and solve problems on recurrent networks and neural control.

CO	Statement	Mapped PO												PSO	
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	Recall, explain, solve and analyse the principles of fuzzy logic and control.	3	3	2	1									3	3
2	Explain and discuss adaptive fuzzy control.	3	3	2	1									3	3
3	Explain, analyse and solve problems in basic neural networks and associative memories	3	3	2	1									3	3
4	Explain, analyse and solve problems on recurrent networks and neural control.	3	3	2	1									3	3

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ELECTRICAL ENGINEERING

VII Semester

EL 2425 - PEIII: ARTIFICIAL INTELLIGENCE BASED SYSTEM

Unit No.	Contents	Max. Hrs.
1	**Introduction:-** Fundamental concepts of fuzzy systems Fuzzy sets, Approximate reasoning Representing set of rules. Fuzzy knowledge based (FKBC) parameters. Introduction rule and data base inference engine, choice of fuzzification and defuzzification processes.	6
2	**Nonlinear fuzzy control** Introduction, Control problem, FKBC as nonlinear transfer element, types of FKBC.	7
3	**Adaptive Fuzzy control** Introduction, design and performance evaluation, main approach to design.	7
4	**Artificial Neural Network** Fundamental concept of ANN. 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.	7
5	**Recurrent networks** Mathematical foundation of discrete time & gradient type Hopfield networks, transient response & relaxation modeling.	7
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.	6

Text books

S.N	Title	Year/Edition	Author	Publisher
1	Introduction of Artificial Neural Networks	1992	Jacek Zurada	JPH
2	An Introduction to Fuzzy Control	2010	D. Drianko	Springer
3	Design of Neural Networks	2nd edition	Hagen,Demuth,Beale	Cengage Learning,ISBN-10:0-9717321-1-6,ISBN-13:978-0-9717321-1-7

Reference books

S.N	Title	Year/Edition	Author	Publisher
1	Neural Network & Fuzzy Systems	1992	Bart Kosko	Prentice Hall of India
2	Neural Networks	2009	Simon Haykin	(Maxwell) Macmillan Canada Inc.)
3	Fuzzy ets:Uncertainty and information	1988	Klir and Folger	Prentice Hall of India
4	MATLAB Toolbox			

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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ELECTRICAL ENGINEERING

VII Semester

EL 2431 - PEIV: ADVANCED ELECTRICAL DRIVES

Objective	Course Outcome
The student should be able 1) To study the converter and Chopper control of DC drives. 2) To study the semiconductor based control of Induction and Synchronous motors. 3) To learn the basics of Switched reluctance motor and Brushless DC motor. 4) To Study the non-conventional and renewable energy based drives	On completion of this course, the student will be able to 1) Analyse and determine the converter parameters of bridge and chopper controlled DC drives. 2) Analyse the various schemes for Induction motor control and estimate the parameters of converters for Induction motor drives. 3) Explain synchronous motor, stepper motor and switched reluctance motor drives. **4)** Explain and compare the various drives used in electrical traction and explain solar and battery powered drives.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Analyse and determine the converter parameters of bridge and chopper controlled DC drives	3	2	2	1										2
CO2	Analyse the various schemes for Induction motor control and estimate the parameters of converters for Induction motor drives	3	2	2	1										2
CO3	Explain synchronous motor, stepper motor and switched reluctance motor drives	3	2	2	1										2
CO4	Explain and compare the various drives used in electrical traction and explain solar and battery powered drives.	3	2	2	1										2

VII Semester

EL 2431 - PE IV: ADVANCED ELECTRICAL DRIVES

Unit No.	Contents	Max. Hrs.
1	**Introduction to Electric Drives** Dynamics of electric drives and control of electric drives, Fundamental Torque equation, Control Schemes, Power modulator, Four Quadrant operation, Energy conservation in electric drives.	6
2	**D.C. Drives** Controlled rectifier fed D.C. drives, single phase and three phase rectifier control of Separately excited D.C. motor; Dual Converter control of separately excited D.C. motor; Power factor, supply harmonics and ripples in motor current; Chopper controlled of separately excited dc motor; chopper control of series motor; source current harmonics.	7
3	**Induction Motor Drives** Stator voltage control, V/f control, static rotor resistance control, slip power recovery schemes, variable frequency control using voltage source inverter. Current sources inverter and cyclo converter, Introduction to vector control of Induction motor	7
4	**Synchronous Motor Drives** Starting and Braking of Synchronous motor; variable frequency control; self-controlled synchronous motor drive employing load commutated thyristor inverter , Introduction of Cyclo-converter control of Synchronous motor; starting of large synchronous motors.	7
5	**Special Motors Drives** Brush less dc motor, stepper motor switched reluctance motor drives and eddy current drives. Introduction to solar and battery powered drives.	7
6	**Traction Drives** DC and AC traction drives, semiconductor converter controlled Drives; 25 KV AC traction using semi conductor converter controlled DC motor; DC traction using semiconductor chopper controlled dc motors; polyphase AC motors for traction drives.	6

Text books

S.N	Title	Year/Edition	Author	Publisher
1	Fudamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
2	Modern Electric Traction	2003	H.Pratap	Dhanpat Rai & Company
3	Electric drives concepts and applications	2005	V.Subramaniam	Tata McGraw Hill
4	Electric Motor Drives	2001	R. Krishnan	Prentice Hall India

Reference books

S.N	Title	Year/Edition	Author	Publisher
1	Electrical Machines Drives and Power Systems	6th edition 2008	Theodore Wildi	Pearson Education

VII Semester

EL 2432 - PE IV: FUNDAMENTALS OF SMARTGRID

Course Objectives	Course Outcomes
• To introduce the students with basics of Smart Grid. • To inform about components and communication tools of smart grid. • To explain methodology to identify computational tools and performance analysis of smart grid. • Knowledge about Strategic issues related with sustainable development, storage and renewable energy.	**The student should be able to:** 1. To compare conventional and smart grid and illustrate role of stake holders and functions of smart grid. 2. To identify components and computational tools for smooth functioning of smart grid. 3. To determine the performance of smart grid based on congestion, security and contingency studies for optimal solutions. 4. To discuss designing of smart grid with options like automation, sustainable energy and storage.

CO	Statement	Mapped PO											PSO	
		PO	PO	PO	PO	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
1	To compare conventional and smart grid and illustrate role of stake holders and functions of smart grid	2	1				1							3	
2	To identify components and computational tools for smooth functioning of smart grid	2				2	3						1	2	
3	To determine the performance of smart grid based on congestion, security and contingency studies for optimal solutions.	3	2		2	2	2						1	2	
4	To discuss designing of smart grid with options like automation, sustainable energy and storage.	2		3	2	2	1	3	1		1	1	1	3	

VII Semester

EL 2432 - PE IV: FUNDAMENTALS OF SMARTGRID

Unit No.	Contents	Max. Hrs.
1	**Introduction to Smart Grid & Power System Enhancement:** Introduction to smart grid, Comparison between Present grid and Smart grid, Electricity Act 2003, Energy Conservation Act 2001, Energy Independence and Security, computation intelligence, Communication Standards, Environment and Economics. General view of the Smart grid market drivers, Function and role of stakeholder, Smart grid based performance measures, Representative Architecture, Functions of smart grid components	6
2	**Smartgrid Communications :** Communication and measurement, Monitoring, PMU, Smart meters, Measurement technologies, GIS and Google mapping tools, multi agent technology, microgrid and smart grid comparison.	7
3	**Performance Analysis Tools for Smart grid 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.	7
4	**Computational Tools for Smart grid Design** Introduction to computational tools, Decision support Tools (DS), Heuristic Optimization, Evolutionary Computational Techniques, Adaptive Dynamic Programming Techniques, Hybridizing optimization techniques and applications to the smart grid, Computational Challenges.	7
5	**Pathway for designing Smart grid:** Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, General Level Automation, Bulk Power Systems Automation of the Smart Grid, Distribution System Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization.	7
6	**Renewable Energy and Storage:** Sustainable energy options for the smart grid, Penetration and variability issues associated with sustainable energy technology, Demand-response issue, Electric vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	6

Text books:

	TITLE	YEAR	AUTHOR	PUBLICATION
1	Smart Grid: Fundamentals of Design and Analysis	2012	James Momoh	Wiley

Reference books:

1	Smart Grid: Technology and Applications	March 2012	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama	Wiley

VII Semester

EL 2433 - PE IV: COMPUTER METHODS IN POWER SYSTEM

Course Objectives	Course Outcomes
The student should be able to 1. The theory and applications of the main components used in power system Protection. 2.The protection systems used for electric machines, transformers, bus bars, Transmission lines. 3. The theory, construction, and applications of main types of circuit breakers. 4. To design the feasible protection systems needed for each main part of a power system.	**The student should be able to:** 1) Explain, different types of Matrix using graph theory , Apply different methods to Build & Develop the A, B, C, K and Bus Impedance Matrix 2) Classify, Compare, Make use of different methods and Analyze Load Flow studies 3) Analyze & Inspect the system for different types of faults 4) Analyze & make use of different methods for Transient Stability Studies .

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	Explain, different types of Matrix using graph theory , Apply different methods to Build & Develop the A, B, C, K and Bus Impedance Matrix	1	1	2		1				1			1		
2	Classify, Compare, Make use of different methods and Analyze Load Flow studies	1	1	2		1				1			1	2	1
3	Analyze & Inspect the system for different types of faults	1	1	2		1		1	1				1	2	1
4	Analyze & make use of different methods for Transient Stability Studies	1	1	1		1		1	1	1			1	2	

VII Semester

EL 2433 - PE IV: COMPUTER METHODS IN POWER SYSTEM

Unit No.	Contents	Max. Hrs.
1	**UNIT-1: Incidence and network matrices** Incidence and network matrices: - Graph incidence Matrices, Primitive network, formation of network matrices by singular transformations	6
2	**Algorithm for single phase network** Algorithm for formation of Bus Impedance and Bus Admittance matrix for system without mutual coupling	7
3	**Three Phase Networks** Three Phase Networks: - Three phase balance network elements with balanced and unbalanced excitation incidence and network matrices for three phase element Algorithm for formation of three phase bus impedance matrices without mutual coupling	6
4	**Short circuit studies** Short circuit studies: Three phase network short circuit calculations using bus impendence matrix for balanced and unbalanced faults. Computer programme for short circuit studies on simple system	7
5	**Transient stability studies** Transient stability studies: Modelling of synchronous machine, power system network for transient stability studies. Numerical solution of swing equation by modified Euler and Runge Kutta 4th order method..	7
6	**Load Flow Studies** Load Flow Studies: Power system load flow equation, solution technique: Gauss Seidal , Newton Raphson and fast decoupled technique with and without (voltage) control buses. Representation of tap changing and phase shifting transformers. Elementary load flow programmes	7

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	Computer Methods in Power Systems	1st 1968	Stag and El – Abiad	Mc Graw Hill
2	Elements of Power System Analysis	1982	William D.Stevenson	Mc Graw Hill

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	Computer Analysis in Power System Modern Power System Analysis	1982	R.N.Dhar	Mc Graw Hill
2	Modern Power System Analysis	3rd-2006	D.P.Kothari and I.J.Nagrath	TMH

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ELECTRICAL ENGINEERING

VII Semester

EL 2434 - PE IV: EHVAC-HVDC TRANSMISION

Objective	Course Outcome
The student should be able The student will understand the various aspects of transmission system, systems for power flow control, design parameters of filters and layout of HVDC power plant .	On completion of this course, the student will be able to **1)** Design and analyse Power handling capacity of EHVAC Transmission systems. **2)** Explain and analyse Corona, the concept of Electrostatic and electromagnetics, Electrical safety. **3)** Demonstrate , Classify HVDC Transmission system , Analyse the methods of HVDC Control. **4)** Design of Harmonic filters and reactive power configuration, HVDC Circuit breaker and Types and applications.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Design and analyse Power handling capacity of EHVAC Transmission systems	3	2	1									1	1	
CO2	Explain and analyse Corona, the concept of Electrostatic and electromagnetics, Electrical safety	3	2				3						1		
CO3	Demonstrate , Classify HVDC Transmission system , Analyse the methods of HVDC Control	2	3										1		
CO4	Design of Harmonic filters and reactive power configuration, HVDC Circuit breaker and Types and applications	3	2	2									1		1

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ELECTRICAL ENGINEERING

VII Semester

EL 2434 - PE IV: EHVAC-HVDC TRANSMISION

Unit No.	Contents	Max. Hrs.
1	**Power handling and voltage gradient** 1) Power handling capacities of EHV AC transmission lines. 2) Voltages gradients: Electric field of point charge, sphere gap line-charge. Single and three phase lines, and bundled conductors. Maxwell"s potentials coefficients.	6
2	**Electrostatic and electromagnetic fields of EHV lines & corona** 1) Electrostatic and electromagnetic fields of EHV lines, electric shock and Threshold current , calculation of electrostatic field of A.C. lines (3 phase single and double circuit lines only). Effect of high electrostatic field. 2) Corona: Types, critical disruptive voltages, Factors affecting corona, Methods for reducing corona power loss (empirical formula), corona current waveform, audible noise and radio interference.	7
3	**HVDC Power transmission** DC Power transmission technology: Introduction, comparison of AC and DC Transmission, application of DC transmission, Description of DC transmission system, configuration, planning for HVDC transmission, types of DC link. Introduction to HVDC light, Earth electrode and earth returns. Introduction, objectives, location and configuration, resistance of electrodes, means of reducing earth electrode resistance	7
4	**Analysis of HVDC converters** Analysis of HVDC converters: Pulse number, choice of converter configuration, simplified Graetz circuit, converter bridge characteristics, characteristics of twelve pulse converter Power flow control in HVDC system :- Constant current. Constant voltage, constant ignition and excitation angle control, control characteristics.	7
5	**Harmonic Filters & Reactive power compensation** Harmonic Filters :- Introduction, Filters, surge capacitors and damping circuits, shunt filters, series filters, AC filters, design of AC filters and tuned filters, double frequency and damped filters, cost considerations and ratings. Harmonics on D.C side of converters. DC Harmonics filters. - Reactive power requirement of HVDC converters, substations.	6
6	**HVDC circuit breakers** HVDC circuit breakers: - Introduction, construction and principle of operation. Interruption of DC current, application of MRTB, Type of HVDC circuit breaker, capability and characteristics of HVDC circuit breakers	7

Text books:

	Title	Edition	Author	Publication
1.	EHV AC & HVDC Transmission & Distribution	**3rd-2006**	S. Rao	Khanna
2.	EHV AC Transmission	2nd	Begamudre	New Age international Publisher
3.	Power system Stability and Control	**2nd - 2006**	P. Kundur	Publisher

Reference books:

1	HVDC Power Transmission System	1982	R.N.Dhar	Publisher

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

		June 2019	1.00	Applicable for AY 2019-20 Onwards
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.

		June 2019	1.00	Applicable for AY 2019-20 Onwards
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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.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

4th Semester

Electronics Engineering

28 June 2019

IV Semester

GE2204 - Advanced Mathematical Techniques

Objective	Outcomes 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

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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

		June 2019	1.00	Applicable for AY 2019-20 Onwards
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).

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

5th Semester

Electronics Engineering

28 June 2020

V Semester

GE2311 - Fundamentals of Management

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management

Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management

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

UNIT-4: Project Management

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

UNIT-5: Marketing Management

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

V Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

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

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

V Semester

EE2301 – Digital Signal Processing

Objective	Course Outcome
1. This course will provide solid foundations of discrete time signal processing fundamental concepts, Transform domain analysis, Mathematical analysis of FIR and IIR filter design.	**On completion of this course, the student will be able to** 1. Apply DFT and Z transform for the analysis of signals and systems 2. Construct and optimize structures for the realization of discrete Time system 3. Design of Analog and Digital Filters for given specifications 4. Understand fundamentals and architecture of DSP processor. 5. Simulation and verification of various transform techniques and filter Design

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Apply DFT and Z transform for the analysis of signals and systems	3	2	1	2	2									
CO 2	Construct and optimize structures for the realization of discrete Time system	3	3	1	2	2									
CO 3	Design of Analog and Digital Filters for given specifications	3	3	3	2	2									
CO 4	Understand fundamentals and architecture of DSP processor	2	2	1	1	1									
CO 5	Simulation and verification of various transform techniques and filter Design	2	2	2	2	2								2	2

V Semester

EE2301 – Digital Signal Processing

Unit No.	Contents	Max. Hrs.
1	Discrete Time(DT) Signals and System, Classification of DT signals, classification of DT systems, linear Convolution, Sampling and reconstruction.	7
2	Discrete Time Fourier Transform, Discrete Fourier Transform, Computation of DFT, Properties of DFT, convolution of data sequences, FFT algorithms, Decimation in time, Decimation in Frequency	7
3	Digital Filter structures: FIR digital filter structures, IIR digital filter structures, Lattice structures, Finite word length effect.	7
4	IIR Digital filter Design, Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Butterworth and Chebyshev filter.	7
5	FIR Digital Filter Design, FIR filter design using windowing techniques	7
6	Multirate Digital Signal processing fundamentals, sampling rate alteration, multirate structures, Decimator and Interpolator and Multistage design.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Discrete time signal processing	2nd edition, 1999	V. Oppenheim, R, W, Schafer	PHI
2	Digital signal processing – Principles, algorithms and applications	3rd Edition ,1996	J. G. Proakis, D. G. Manolakis	PHI

V Semester

EE2302 – Lab: Digital Signal Processing

Expt. No.	Name of Experiment
1	Sampling and reconstruction of signal using MATLAB
2	To generate and plot discrete time signals.
3	To perform operations on discrete time signals.
4	To compute convolution on discrete time signals.
5	To compute DFT and IDFT of discrete time signals.
6	To determine pole zero plot and inverse Z transform of a signal.
7	To design FIR and IIR filter using FDA Tool.
8	To illustrate signal processing application using SP Tool.
9	To perform upsampling and downsampling on discrete time signal.
10	To study of DSP Starter Kit (TMS 320C6XX DSK).

V Semester

EE2303 –Analog Integrated Circuits & Its Applications

Objective	Course Outcome
1. The objective of this course is to analyze and design a wide variety of operational amplifier / integrated circuits based applications and to have a firm grasp of basic principle of these to adapt to a changing technology as the new devices appear in the market	**On completion of this course,** 1. Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier. 2. Student will analyze and design the linear applications of the operational amplifier. 3. Students will analyze and design active Butterworth filters using operational amplifier 4. Student will analyze and design the non-linear applications of the operational amplifier.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier.	3													
CO 2	Student will analyze and design the linear applications of the operational amplifier.	2	3	3										2	
CO 3	Students will analyze and design active Butterworth filters using operational amplifier	1	3	3										2	
CO 4	Student will analyze and design the non-linear applications of the operational amplifier.	1	2	3										2	

V Semester

EE2303 –Analog Integrated Circuits & Its Applications

Unit No.	Contents	Max. Hrs.
1	Differential Amplifier, configurations, DC & AC Analysis of DIBO and DIUBO, Differential amplifier using swamping resistor, constant current bias, current mirror, cascaded differential amplifier. DC Level Shifter.	8
2	OPERATIONAL AMPLIFIER FUNDAMENTALS: Block Diagram of Op-AMP, Ideal Op-Amp, OPAMP parameters, Basic Op-Amp Configurations: Open loop, Feedback in OPAMP circuit: Inverting, Non-inverting, voltage follower. Compensation of error parameters :Input Bias and Offset Current, Input Bias and Offset voltages, frequency compensation.	7
3	LINEAR APPLICATIONS : Summing, difference amplifier, integrator, differentiator, Current-to-Voltage Converter, Voltage-to-Current Converter, Instrumentation Amplifiers, Instrumentation Applications, Transducer Bridge amplifiers.Precision Rectifiers, Log/Antilog amplifiers.	7
4	ACTIVE FILTERS: Transfer function, first order filter, Standard second order response, higher order filter, KRC Filters, Multiple feedback filters, second and higher order Butterworth filter design.	8
5	NONLINEAR CIRCUITS: Voltage Comparators, Comparator Applications, Peak Detectors, Schmitt Triggers: Inverting & Non-inverting, Sample-and-Hold Circuits, clipper, clamper, WAVEFORM GENERATORS: multivibrators, triangular wave generator, Sinusoidal Oscillators.	7
6	Phase Locked Loop IC565, Monolithic timer IC555, D-A AND A-D CONVERTERS: Performance Specifications of D-A Converters (DACs) and A-D Converters (ADCs), D-A Conversion Techniques, A-D Conversion Techniques.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Linear Integrated Circuits	3rd Edition	S. Salivahanan, V. S. Bhaaskaran	Tata McGraw Hill Publication
2	Op-amps and Linear Integrated Circuits	3rd Edition	RamakantA.Gayakwad,	Prentice Hall Publication

Reference Books

SN	Title	Edition	Authors	Publisher
1	Linear Integrated Circuits	3rd Edition	D. Roy Chaudhuri, Shail Jain	New Age International
2	Design with Operational Amplifiers and Analog Integrated Circuits	3rd Edition	Sergio Franco	McGraw-Hill

V Semester

EE2304 –Lab: Analog Integrated Circuits & Its Applications

Exp No.	Name of Experiment
1	Verify differential amplifier configurations DIBO and DIUBO using simulation.
2	Verify Gain relationship of Inverting and Non-inverting amplifier and plot frequency response of Non-Inverting amplifier and verify gain bandwidth relation. (Bread-Board and simulation)
3	Determine CMRR and Slew rate of OP-AMP and compare with theoretical values.(Bread-Board and simulation)
4	Verify gain relationship of Summer, Scalar and Subtractor circuits.(Bread-Board and simulation)
5	Determine cut-off frequencies f_a and $f_b$of Integrator using frequency response and verify input output waveforms.(Bread-Board and simulation)
6	Determine cut-off frequencies f_a and $f_b$ofDifferntiator using frequency response and verify input output waveforms.(Bread-Board and simulation)
7	Determine cut-off frequency of second order Butterworth Low pass filter using frequency response and verify order of filter from stop band of frequency response.(Bread-Board and simulation)
8	Determine cut-off frequency of second order Butterworth High pass filter using frequency response and verify order of filter from stop band of frequency response.(Bread-Board and simulation)
9	Verify Comparator operations using single supply op-amp configuration. (Bread-Board and simulation)
10	Verify VUT and VLT of Schmitt trigger using OP-AMP IC 741 and plot the hysteresis curve.(Bread-Board and simulation)
11	Determine frequency of operation and duty cycle of Astable Multivibrator using OP-AMP IC 741.(Bread-Board and simulation)
12	Determine frequency of operation and duty cycle of Astable Multivibrator using IC 555 and modify it for 50% duty cycle.(Bread-Board and simulation)
13	Design a Wein bridge oscillator and study its operation using 741 op-amp.(Bread-Board and simulation)
14	Verify the operation of Half wave and Full wave Precision Rectifier using OP AMP IC 741. (Bread-Board and simulation)

V Semester

EE2311 – PE I: Computer Communication Network

Objective	Course Outcome
1. To learn basics of data communication, wireless transmission, spread spectrum, medium access control- FDMA, TDMA & CDMA. 2. To study TCP/IP, ARP, RARP, UDP protocols & addressing. 3. To study network security & its applications.	**On completion of this course, Students will be able to** 1. Describe various protocols, models in Computer Networks 2. Compare Connectors, Network hardware, Media Types (cables, Wireless) 3. Design, implement and analyze simple computer networks. 4. Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe various protocols, models in Computer Networks	2	2												
CO 2	Compare Connectors, Network hardware, Media Types (cables, Wireless)	2	2												
CO 3	Design, implement and analyze simple computer networks	2	2												
CO 4	Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols	2	2												

V Semester

EE2311 – PE I: Computer Communication Network

Unit No.	Contents	Max. Hrs.
1	Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model.	8
2	LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN	7
3	Physical layer and data link layer: transmission media, PSTN. Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.	8
4	Network layer and transport layer: Network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways	7
5	Application layer: Network security cryptography, secrete key, public key, digital signature, domain name system, electronic mail system	8
6	Multimedia, real time transport protocol, e-mail security, web security, communication security, electronic mail, world wide web.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Networks	3rd Edition,1996	Tanenbaum	Prentice Hall
2	Data Communications and Networking	4th edition, 2007	Behrouz a Forouzan	Tata Mc. Graw Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Data and Computer Communication	8th Edition,2006	W. Stallings	Prentice Hall
2	Telecommunication switching systems and networks	2004.	T. Vishwanathan	Prentice Hall

V Semester

EE2312 – Lab: PE I: Computer Communication Network

Expt. No.	Name of Experiments
1.	To perform stuffing and de-stuffing operation on a given array.
2.	To Perform data encryption and data decryption.
3.	Perform network utility commands.
4.	How to bring two computers in a network.
5.	To study LAN structures.
6.	To configure DNS server.
7.	To configure DHCP server.
8.	Write a program for simple stop n wait protocol.
9.	Write a program for go back n protocol.
10.	Write a program for selective repeat ARQ protocol.

V Semester

EE2313 – PE I: Embedded Systems

Objective	Course Outcome
To provide the acquaintance with 1. Concept of RISC processor, coprocessor, bus structure, memory management. 2. Concept of RTOS &different communication protocols	**On completion of this course, Students will be able to** 1. Understand & Learn concept of Architecture & organization of ARM. 2. Understand & Learn concept of RTOS Architecture. 3. Apply the concept of programming language to interface I/O Devices. 4. Establish the communication between the different Devices.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand & Learn concept of Architecture & organization of ARM.	3	3	3											
CO 2	Understand & Learn concept of RTOS Architecture	2	3	3											
CO 3	Apply the concept of programming language to interface I/O Devices.	1	2	3											
CO 4	Establish the communication between the different Devices	1	2	3											

V Semester

EE2313 – PE I: Embedded Systems

Unit No.	Contents	Max. Hrs.
1	Introduction to ARM, Advantages of architectural features of ARM Processor, Processor modes, Register organization, Exceptions and its handling, 3/5- stage pipeline ARM organization.	7
2	Memory and memory-mapped I/Os, ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs.	8
3	Buses: ARM floating point architecture, Memory buses: AMBA, ASB, & APB. Architectural support for system development.	7
4	Memory management: DMA Architecture, Memory Hierarchy, memory size and speed, on-chip memory, caches, cache design, memory *management*.	7
5	OS Supports: Architectural support for operating system, RTOS issues, µCOS-II and embedded Linux features, the shared Data Problem, Software Architectures (Round Robin, Round Robin with Interrupts, Function Queue Scheduling,),Selecting a software Architecture, Introduction to RTOS :tasks and task states, tasks and data, semaphores and shared data, message queues, mailboxes and pipes, events, RT Linux	8
6	Case for Real Time Operating System, Embedded ARM applications such as USB interface, Bluetooth, Ethernet.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	ARM System–on-chip Architecture	2nd edition, 2000	Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2002.	Craig Hallabaugh	Addison-Wesley Professional
3	ARM System Developer's Guide: Designing and Optimizing	2005	Sloss Andrew N, Symes Dominic & Wright Chris	Morgan Kaufman Publication

Reference Books

SN	Title
1	Technical references on www.arm.com.
2	Web base resources for RTOS and µCOS.

V Semester
EE2314 – Lab: PE I: Embedded Systems

Expt. No.	Name of Experiment (Any Ten)
1	To swap data byte
2	To perform addition, subtraction of 16 bit number
3	To find larger of a two numbers.
4	To perform factorial of a given number
5	To perform ON/OFF LED and show status of LED on LCD
6	To display number from 0 to 9 on seven segment display.
7	To ON/OFF LED using Switch.
8	To rotate a stepper motor in clockwise & anti-clock wise direction with equal delay.
9	Perform experiment on DAC of LPC2103
10	ADC and display value on LCD.
11	To find 1's complements of a given number.
12	Study of RTOS
13	device driver for UART.
14	Modify scheduler in such a way that it will assign highest priority to keypad.
15	values from RTC and display on LCD.
16	SMS to any mobile number.
17	Interface pen drive for writing predefined file.

V Semester

EE2315 – PE I: Algorithm & Data Structure

Objective	Course Outcome
1. To Study different Programming Aspect 2. To understand performance of System as per Time and Space Trade-off 3. To learn the various data structures	**On completion of this course, Students will be able to** 1. Study the trade off method Demonstrate and analyze various techniques. 2. Demonstrate various operation on data Structure 3. Understand various types Data Structure 4. Implement various types algorithm and analyze performance of system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Study the trade off method Demonstrate and analyze various techniques.	3	3	1	1	1									
CO 2	Demonstrate various operation on data Structure	3	3	3	3	2									
CO 3	Understand various types Data Structure	3	3	3	3	3									
CO 4	Implement various types algorithm and analyze performance of system.	3	2	3											

V Semester

EE2315 – PE I: Algorithm & Data Structure

Unit No.	Contents	Max. Hrs.
1	Introduction to Algorithms, Basics of Algorithm, Sub Algorithms, Procedures and Functions, Analysis of Algorithms, Time and Space Complexity, Programming aspects with respect to structured programming, Top down and bottom Up Approach	7
2	Arrays, Operations, Types, Representation of 1D, 2D arrays in memory, Sparse Matrices, Sorting, Quick Sort, Merge Sort, Insertion, Radix, Selection and Bubble Sort, Heap Sort, Searching , Linear, Binary Search, Hashing and collision Handling mechanism.	8
3	Stack , Fundamentals, Operations, Push , Pop , Applications of Stacks, Evaluation of Expressions, Recursion, Stack Machines and Multiple Stacks, Queues , Operations, Add , Delete, Types of Queues , Priority Queues, Circular Queue, Dequeue	7
4	Fundamentals of singly, Doubly, Circular, Linked Stacks and Queues, Examples of Linked List, Circular Linked List, Doubly Linked List and Dynamic Storage Management, Garbage Collection, Compaction and Applications of Linked List, Operations of Polynomials, Generalized Linked List.	8
5	Basic Terminology , Binary Tree Traversals, Threaded Storage Representation, Binary Search Tree, Applications of Tree, Preliminary Treatment of AVL Trees, B-Trees, B+ Trees	7
6	Basic Terminology, Graph Representation, Matrix, List, Multi-List, Graph Traversals, Breath First Search, Depth First Search, Minimum Cost Spanning Trees, Shortest Path Algorithm, Topological Sort, Critical Path.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Structures and Program, Design in C	Second Edition	Kruse, Leung and Tondo	PHI
2	Fundamentals of Data Structures	Fifth Edition	Ellis Horowtiz and Sartaj Sahani	Galgotia,Publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	An Introduction to Data Structures with Applications	Second Edition	Tremblay & Sorenson	TMH
2	Data Structures, Schuam Series,	Fifth Edition	Seymour Lipschutz, G.A. V. Pai,	TMH

V Semester

EE2316 – Lab: PE I: Algorithm & Data Structure

Expt. No.	Name of Experiment (Any Ten)
1	Write a program on control Structure & Statements
2	Write a program on If –else structure
3	Write a program on Case Statement
4	Write a program on Functions
5	Write a program on Macros
6	Write a program on Pointers
7	Write a program on Structures
8	Write a program on Linked List
9	Write a program on Doubly linked list
10	Write a program on graphs
11	Write a program on Trees
12	Write a program on Search Algorithms
13	Write a program on Stacks

V Semester

EE2317 – PE I: Applied Machine Learning

Objective	Course Outcome
1. The basic concepts of machine learning and the relative strengths and weaknesses of different machine learning methods. 2. To understand the concepts of different types of machine learning algorithms and how to apply a learning algorithms to sample. 3. To understand the different methods of evaluation of machine learning algorithms 4. To understand different ensembling methods and new techniques like deep and shallow learning	**On completion of this course, Students will be able to** 1. Develop an appreciation for what is involved in learning from data, machine learning techniques that are suitable for the different applications 2. Design an appropriate learning model from set of samples to meet the desired needs 3. Compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices 4. Integrate machine learning algorithms with ensembling methods and explain modern technologies like deep and shallow learning

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Develop an appreciation for what is involved in learning from data, machine learning techniques that are suitable for the different applications	3	3	2											
CO 2	Design an appropriate learning model from set of samples to meet the desired needs	3	3	3	2	2	2	2	2				2		
CO 3	Compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices	3	3	3	2	2	2	2	2				2		

CO 4	Integrate machine learning algorithms with ensembling methods and explain modern technologies like deep and shallow learning	3	3	3	1	1							1		

V Semester
EE2317 – PE I: Applied Machine Learning

Unit No.	Contents	Max. Hrs.
1	**Introduction to machine learning:** Introduction, machine learning classes (i.e., supervised, unsupervised and reinforced), foundation of machine learning with data pre-processing methods and data cleaning methods	7
2	**Regression**: Linear regression, Non linear regression, model evaluation methods(Feature extraction methods used in machine learning, feature extraction from numerical data, feature extraction from text data, feature extraction from image data, feature extraction from video data)	8
3	**Classification:** Classification methods (supervised and un-supervised), classification system using pre-processing and feature extraction, accuracy estimation of the designed system.	7
4	**Clustering:** Basic clustering, design of a real time clustering , Design of feature selection methods, introduction to Bio-inspired Algorithms (majorly Genetic Algorithm & PSO) for improving the accuracy using feature selection	8
5	Training, testing and validation sets for classifiers, design and implementation of prediction algorithms (like regression learning, Naïve Bayes, Random Forest), introduction to perception and neural networks for classification and prediction	7
6	Introduction to Convolutional Neural Networks, different layer designs in CNNs, usage of standard CNNs like GoogLeNet, AlexNet and VGGNet, design of CNN for highly accurate classification	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Machine Learning	second edition	Ethem Alpaydin	MIT Press
2	Machine Learning	1997	Tom Mitchell	McGraw-Hill Science/Engineering /Math

Reference Books

SN	Title	Edition	Authors	Publisher
1	Pattern Recognition and Machine Learning	15 Feb 2010	Christopher M. Bishop	Springer
2	. http://research.microsoft.com/enus/um/people/cmbishop/prml/.			

V Semester
EE2318 – Lab: PE I: Applied Machine Learning

Expt. No.	Name of Experiment
1.	Data Pre-processing and cleaning
2.	Linear Regression
3.	Non Linear Regression
4.	K-Nearest Neighbours
5.	Decision Tree
6.	Support Vector Machine
7.	K-Means Clustering
8.	Hierarchical Clustering
9.	Content based Recommendation System
10.	Collaborative filtering Recommendation System

V Semester

EE2331 – OE I: Fuzzy Logic & Neural Network

Objective	Course Outcome
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective	**On completion of this course, Students will be able to** **CO1:** Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks. **CO2:** Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches **CO3:** Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks **CO4:** Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks.	3	2	1	-	1	1	1	2	1	1	-	1	-	-
CO 2	Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches	3	3	3	2	2	1	1	2	1	1	-	1	3	-
CO 3	Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks	3	3	3	3	2	2	1	2	2	2	1	3	3	-

CO 4	Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.	3	3	3	3	2	2	1	2	2	2	2	3	3	-

V Semester

EE2331 – OE I: Fuzzy Logic & Neural Network

Unit No.	Contents	Max. Hrs.
1	Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets	8
2	Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations	7
3	Fuzzy controllers: an overview with applications, applications of fuzzy logic	7
4	Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning	8
5	Brief introduction to single layer and multilayer perceptions, ADALINE and MADALINE, feed-forward networks, back propagation networks and applications.	8
6	Radial basis function network, Self organizing feature map and applications	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI

2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Fuzzy Logic with engineering applications,	3rd Edition	Timothy Ross,	Wiley Publication
4	Principles of Soft Computing	2nd Edition	S. N. Sivanandanam and S. N. Deepa,	Wiley Publication

V Semester

EE2332 – OE I: Basics of Analog and Digital Communication Systems

Objective	Course Outcome
1. To Study different analog and digital modulation techniques. 2. To understand transmitter & receivers in communication systems	**On completion of this course, Students will be able to** 1. Understand different modulation and demodulation schemes for analog communication with the concept of noise 2. Understand different pulse analog and digital modulation techniques. 3. Understand different digital modulation schemes 4. Understand the different coding techniques for communication systems.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand different modulation and demodulation schemes for analog communication with the concept of noise	2	1												
CO 2	Understand different pulse analog and digital modulation techniques.	2	1												

CO 3	Understand different digital modulation schemes	2	1												
CO 4	Understand the different coding techniques for communication systems	2	1												

V Semester

EE2332 – OE I: Basics of Analog and Digital Communication Systems

Unit No.	Contents	Max. Hrs.
1	Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.	8
2	Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.	7
3	Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Basic digital Modulation System- PCM.	7
4	Channel capacity, DPCM, Delta Modulation, ADM, ADPCM, Adaptive sub-band coding, applications.	8
5	Digital Modulation techniques: ASK, FSK, PSK, BPSK, QPSK, MSK, DPSK, BFSK, M-ary PSK, FSK, and QAM.	8
6	Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication System	Fourth Edition,	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications	1999	SymonHykin	Wiley, 1988

Reference Books

SN	Title	Edition	Authors	Publisher

1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

V Semester
EE2333 – OE I: Biomedical Instrumentation

Objective	Course Outcome
1. This course is intended for introducing the students to evolution and development of biomedical instrumentation. 2. The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. 3. Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethys mograph and spirogyra 4. Understand the fundamentals of Telemedicine like Teleradiology, Telecardiology, Telepsychiatry and Medical Informatics	**On completion of this course, Students will be able to** 1. Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation	3	2	1		1									

CO 2	Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram	3	2	1		1									
CO 3	Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care.	3	2	1		1									
CO 4	Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.	3	2	1		3									

V Semester
EE2333 – OE I: Biomedical Instrumentation

Unit No.	Contents	Max. Hrs.
1	Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.	8
2	Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers	7
3	The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers	7
4	Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG	8
5	Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators, Electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments.	8
6	Computers in biomedical instrumentation, digital computer, Telemedicine concept, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Biomedical Instrumentation & Measurement	19 Jan 2010	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	Prentice Hall

2	Biomedical Instrumentation	1 Jan 2010	Mandeep Singh	Prentice Hall

Reference books:				
1	Handbook of Biomedical Instrumentation	1987	R.S.Khandpur	TMH
2	Bioelectronics Measurement	1983	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	1 August 2008	Jacobson and Webster	PHI

V Semester

EE2341 – OE II: Data Acquisition & Signal Conditioning

Objective	Course Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques	After study through lectures and assignments, Students will be able to: 1. Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning 2. Identify the various types of data acquisition hardware and the serial data communication standards. 3. Distinguish different standards for connection of different programmable instruments like GPIB and SCPI 4. Define use of Ethernet, Medium Access control and USB

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning	3	2	2											

CO 2	Identify the various types of data acquisition hardware and the serial data communication standards	2	1	1											
CO 3	Distinguish different standards for connection of different programmable instruments like GPIB and SCPI	3	2	1											
CO 4	Define use of Ethernet, Medium Access control and USB	3	2	1											

V Semester

EE2341 – OE II: Data Acquisition & Signal Conditioning

Unit No.	Contents	Max. Hrs.
1	Definition of data acquisition and control, Fundamentals of data acquisition, Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.	8
2	Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.	7
3	Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.	7
4	Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection.	8
5	IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).	8
6	Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Data Acquisition for Instrumentation and Control Systems	10 June 2003	John Park and Steve Mackay	Elsevier

Reference books:				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Electronic Analog Digital Conversion	1st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1st Edition , 1993	B. S. Sonde	Tata McGraw Hill

V Semester
EE2342 – OE II: Microprocessor Programming

Objective	Course Outcome
▪ To understand the architecture, programming and addressing modes of Intel 8085 ▪ To study the instruction set and programming of 8085 ▪ To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085. 2. Will demonstrate the ability to identify, Formulate and design Program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor in their respective field.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Will be able to understand the architecture of 8085.	3	3	3	3										

CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2										
CO 3	Will be able to interface Peripheral devices	1	2	3	1										
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1										

V Semester
EE2342 – OE II: Microprocessor Programming

Unit No.	Contents	Max. Hrs.
1	Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.	8
2	Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization	7
3	Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses,Programs based on instructions.	7
4	Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.	8
5	MICROPROCESSOR APPLICATIONS - Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .	8
6	USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Interfacing 8085	1 Dec 2000	Ramesh Gaonkar	Penram Publication

Reference books:				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	8085 Microprocessor	2014	Ajit Pal	Tata Mc-Graw Hill ,
2	Microprocessors & interfacing	2005	D. V. Hall	Tata McGraw-hill

V Semester

EE2343 – OE II: Consumer Electronics

Objective	Course Outcome
➢ To give knowledge and competencies regarding consumer electronic equipments.	Students will be able to 1. Understand the knowledge of the safety aspects in the field of Electrical and Electronics products. 2. Analyze the basics of Audio and Video Systems. 3. Know about recent trends in Processors and computer peripherals, mobile and wireless technologies. 4. Understand the basics of refrigeration cycle and cooling system.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO 1	Will be able to understand the architecture of 8085.	3	3	3	3	3									
CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2	2									
CO 3	Will be able to interface Peripheral devices	1	2	3	1	1									
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1	1									

V Semester

EE2343 – OE II: Consumer Electronics

Unit No.	Contents	Max. Hrs.
1	Standards and Safety norms:Electronics and Electrical safety norms and standards, Electronic products covered under compulsory registration	8
2	Audio Systems: Sound Recording and reproduction, Hi-Fi Sound System, Audio Mixers, Graphics Equalizers, Public Address System.	7
3	Video Systems:Color fundamentals, Luminance and Chrominance signal , Color camera, digital television systems.	7
4	Wireless Technology & Mobile phones:Mobile Phones, various wireless technologies, Introduction to 3G, WiFiTechnology, GSM	8
5	Air conditioner and Refrigerators:Fundamentals, Refrigeration cycles, compressors, home automation	8
6	Computers:Recent microprocessor, Pentium family architecture and salient features , Recent Memories technologies (RAM, HDD), Computer peripherals	7

Text books:				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Consumer Electronics	First Edition	S.P. Bali	Pearson Education
2	Consumer Electronics'',	2000	B. R. Gupta, Vandana Singhal	S. K. Kataria& Sons,

V Semester

EE2310 – Industry Visit and its Report

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2018

6th Semester

Electronics Engineering

28 June 2019

VI Semester

GE2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
Recognizes consumer's behavior and pricing.	Relate their buyer behaviour to particular product and the pricing in the market.
Extrapolates an operations in market with productions constrain.	Examine and classify various market structure and factors of production and its role in production process.
Describes the national income accounting and public finance.	Analyse the national income accounting and the various issues related to banking, taxation, and inflation.
Interprets international trade and institutions.	Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

UNIT-1: Introduction to Economics and Consumers' Behaviors:

Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. **(8 Hours)**

UNIT-2: Production and Costs

Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation. **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price

Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination. **(7 Hours)**

UNIT-4: National income accounting:

Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation. **(5 Hours)**

UNIT-5: Money, Banking and Public Finance

Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.

(7 Hours)

VI Semester
GE2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions. **(5 Hours)**

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

VI Semester

EE 2351- Control System Engineering

Objective	Outcome
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 importance of stability in control systems and the various methods to determine it. 5 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. Understand the use of block diagram and signal flow graph as a modeling tool and the role of feedback in control systems. 2. Understand the response characteristics of basic first- and second-order dynamic systems. Be able to use Routh's criterion for absolute and relative stability analysis. 3. Construct and recognize the properties of root-locus and its role in the analysis of control systems. 4. 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.

Unit II: Mathematical modeling of physical system:
Mathematical modelling of physical system such as –electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic etc., Analogous systems,**Characteristics of Feedback Control Systems:** Effect of negative feedback compared to open loop system such as –sensitivity to parameter variation. sensitivity to parameter variation such gain and forward path, Speed of time response, bandwidth, and disturbance rejection., Linearizing effect, Effect of positive feedback.

Unit III: Time Domain Analysis of Control Systems:
Concept of transient response, Steady state response, 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 (ess) analysis, static error constants and system type, dominant poles. Relation between roots of characteristic equation, damping ratio and transient response.

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, Routh-Hurwitz stability criterion with special cases, relative stability analysis. State Variable Analysis.

VI Semester
EE 2351- Control System Engineering

Unit V: Root Locus Technique:
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, and correlation between time and frequency response, polar plot, Bode plot, all pass and minimum, log magnitude verses phase plot. **Stability in Frequency domain:**Nyquist stability criteria, concept of gain margin and phase margin and its computation using polar plot and log magnitude verses phase plot. **Lag, lead and lag-lead compensation**

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Control system engineering	5th Edition	I. J. Nagrath& M. Gopal	New Age International
2	Automatic control systems	7thEdition	B. C. Kuo	PHI Learning Private Limited
	Modern control engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited

VI Semester

EE2352- Transmission Lines and Wave Guides

Objective	Outcome
➢ To enable the students, to have a fair knowledge about the theory and problems of EM wave transmission through waveguides and transmission line. ➢ To lay a strong foundation on the theory of transmission line. ➢ To avail deep knowledge and mathematical analysis of Radiation of EM wave, Classification of different types of waveguides and their characterization.	After the completion of course students will able to, 1. Explain fundamental parameters of transmission line and its constraints in high frequency transmission of information. 2. Make use of Transmission line to develop impedance matching networks and any communication system. 3. Relate the propagation characteristics of electromagnetic waves in various wave guide structures. 4. Analyze transmission line using Smith Chart and Design Impedance Matching network.

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)

VI Semester

EE2352- Transmission Lines and Wave Guides

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	2003	L.Ganesan,S.S.Sreeja Mole	PHI

VI Semester

EE2353- Digital Communication

Objective	Outcome
➢ This course provides compressive coverage of digital communication systems and understanding of the operation of digital modulation schemes.	A student who completes this course will be able to: 1. Learn pulse modulation & discuss the process of sampling, quantization & coding that is fundamental to the digital transmission of analog signals. 2. Understand fundamental concepts & limits in information theory in the context of digital communication theory/ 3. Analyze mathematical model of digital communication systems. 4. Apply error control coding techniques at the receiver.

Unit I: PCM, DM, ADM, DPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding.

Unit II: Introduction to information theory, entropy, Huffman, Prefix code, and L-Z encoding algorithm, Rate distortion theory for optimum quantization.

Unit III: Gram-Schmitt procedure, Signal space representation of baseband and modulated signals, line coding and baseband digital transmission, Error probability and optimum receivers for AWGN channels, Matched filters.

Unit IV: Digital Modulation techniques, Transmitter, Receiver and signal space representation of BPSK, BFSK,QPSK Introduction to TDM,FDM.

Unit V :Channel capacity Review of channel coding, Linear block codes, cyclic codes, convolution, encoding and decoding, distance properties, Viterbi algorithm and Fano algorithm. Trellis coded modulation methods

Unit VI: Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, performance analysis, synchronization methods for spread spectrum. Application of spread spectrum, CDMA.

Text books:				
1	Digital communication	3rd Edition, 2004	John G Prokis	Springer publication
2	Digital communication	2nd Ed, 2002.	Simon Haykin	John Wiley & sons

Reference books:

1	Modern Communication systems (Principles and application)	6th Edition, 2002	Leon W. Couch	Pearson
2	Digital Communication	5th Edition, 2003.	ShanmughamK.Sam	John Wiely
3	Modern Digital & Analog Communication Systems	3rd Edition, 1999.	B.P.Lathi	Oxford university Press

VI Semester

EE2354- Lab: Digital Communication

Objective	Outcome
This course gives implementation of various modulation techniques, coding, decoding & mathematical modeling using related software.	Students will be able 1. Understand different modulation and demodulation schemes 2. Apply the knowledge of signal space representation 3. Analyze the coding techniques for communication systems. 4. Describe different digital spread spectrum techniques

Expt. No.	Name of Experiment
1	Study of sampling process (MATLAB & Simulink)
2	Study of Pulse Coded Modulation Technique (MATLAB & Simulink)
3	Study of Delta Modulation Technique (MATLAB & Simulink)
4	Calculation of Entropy ,Efficiency,Average code word length,Variance for Huffman Code
5	Gram Schimdtorthogonalization procedure for given set of signals
6	Plot Amplitude Shift Keying, Frequency Shift Keying , Phase shift keying
7	Design of coherent Binary Phase shift keying system
8	Design of coherent Quaternary Phase shift keying system
9	Design of Encoder for Cyclic Hamming Code
10	Convolutional code generation (Time domain & Transform domain approach)

VI Semester
EE2361- PE II: Internet of Things

Objectives	Outcomes
➢ Get acquainted with various IOT environments. ➢ Study IOT architecture and its enabling technologies. ➢ Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, the student will be able to: 1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved 2. Understand IoT sensors andtechnological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules 3. Market forecast for IoT devices with a focus on sensors 4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

UNIT-1 :Introduction
Internet of Things Promises–Definition–Scope–Sensors for IoT Applications–Structure of IoT–IoT Map Device
(7Hr)

UNIT -2: Seven Generations of IOT Sensors
Industrial sensors –Description & Characteristics–First Generation –Description & Characteristics–Advanced Generation –Description & Characteristics–Integrated IoT Sensors –Description & Characteristics–Polytronics Systems –Description & Characteristics–Sensors' Swarm –Description & Characteristics–Printed Electronics –Description & Characteristics–IoT Generation Roadmap
(7Hr)

UNIT -3 : Technological Analysis
Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module
(7Hr)

UNIT -4 :IOT Development Examples
ACOEM Eagle –EnOcean Push Button –NEST Sensor –Ninja Blocks -Focus on Wearable Electronics
(7Hr)

UNIT -5 :CreatingSensor Projects
Creating the sensor project -Preparing Raspberry Pi -Clayster libraries -Hardware-Interacting with the hardware -Interfacing the hardware-Internal representation of sensor values -Persisting data -External representation of sensor values -Exporting sensor data -Creating the actuator project
(7Hr)

UNIT -6:Preparinglot Projects
Hardware -Interfacing the hardware -Creating a controller -Representing sensor values -Parsing sensor data -Calculating control states -Creating a camera -Hardware -Accessing the serial port on Raspberry Pi -Interfacing the hardware -Creating persistent default settings -Adding configurable properties -Persisting the settings -Working with the current settings -Initializing the camera
(7Hr)

Text Books:
1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Développement Copyrights ,2014
2. NPTEL course material on Introduction to Internet of Things

REFERENCES
1.Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
2.Editors OvidiuVermesan Peter Friess,'Internet of Things –From Research and Innovation to Market
3.Deployment', River Publishers, 20145.N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014

VI Semester
EE2362- Lab: PE II: Internet of Things

Objective	Outcomes
➢ Get acquainted with various IOT environments. ➢ Study IOT architecture and its enabling technologies. ➢ Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, the student will be able to: 1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved 2. Understand IoT sensors andtechnological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules 3. Market forecast for IoT devices with a focus on sensors 4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

Expt. No.	Name of Experiments
1.	Define and Explain Eclipse IoT Project.
2.	List and summarize few Eclipse IoT Projects
3.	Sketch the architecture of IoT Toolkit and explain each entity in brief
4.	Demonstrate a smart object API gateway service reference implementation in IoT toolkit
5.	Write and explain working of an HTTP-to-CoAP semantic mapping proxy in IoT toolkit
6.	Describe gateway-as-a-service deployment in IoT toolkit
7.	Explain application framework and embedded software agents for IoT toolkit
8.	Explain working of Raspberry Pi
9.	Connect Raspberry-Piwith your existing system components
10.	Give overview of Zetta

VI Semester

EE2363- PE II: Digital CMOS Circuits

Objective	Outcomes
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To understand basic properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	A student who completes this course will be able to: 1. Describe and interpret the basic concepts of MOS transistors, 2. Construct the ability to design a system, component or process as per needs and specifications. 3. Analyze inverter design, characteristics and applications and performance parameters of CMOS Circuits. 4. Evaluate circuits using different CMOS styles and measure performance of the complex logic structures

UNIT-1: (6 Hours)

Introduction of MOSFETs: CMOS Fabrication Process steps, NMOS Enhancement Transistor, MOS Transistor Operations, PMOS Enhancement Transistor, Regions of Operations, Threshold Voltage, MOS Device Equations, Small Signal Modeling of MOSFETs.

UNIT-2 (6 Hours)

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.

UNIT-3: (6 Hours)

MOS inverter Characteristics: Resistive load inverter, Inverters with n type MOSFET load, CMOS inverter, Principle of operation, DC characteristics, Tristate Inverter, Noise Margin, Introduction to Bi-CMOS Inverter.

UNIT-4: (6 Hours)

Combinational circuit design, static CMOS, Ratioed Logic circuits, 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, Complex Logic Structures, Complementary Static CMOS, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, CMOS Pass Transistor Logic

UNIT-5: (6 Hours)

Sequential Circuit Design, Latches and Flip Flops. Advanced Techniques in CMOS Logic Circuits: and Flip-Flops, data path design

UNIT-6: (6 Hours)

Data path VLSI System Components: Comparators, barrel shifters, Multiplexers, Binary Decoders, Equality Detectors and Comparators, Priority Encoders, Shift and Rotation Operations, Bit Adder Circuits,Multipliers.

Text books:				
1	Principle of CMOS VLSI Design	4th Edition, 2013	Neil H. E. WesteHarris	Addison Wesley VLSI Series
2	Introduction to VLSI Circuits and Systems	First Edition	John P. Uyemura	Wiley Publication

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

VI Semester

EE2364- Lab: PE II: Digital CMOS Circuits

Objective	Outcomes
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To understand basic properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	A student who completes this course will be able to: 1. Describe and interpret the basic concepts of MOS transistors, 2. Construct the ability to design a system, component or process as per needs and specifications. 3. Analyze inverter design, characteristics and applications and performance parameters of CMOS Circuits. 4. Evaluate circuits using different CMOS styles and measure performance of the complex logic structures

Expt. No.	Name of Experiment (Any Ten)
1	Design of CMOS Inverter using DSCH2 Tool.
2	Gate Level Analysis of 2-Input NAND & NOR Gate.
3	Implement the Following Function using Compound Gates. F(A,B,C,D)=(ABC+CD)'
4	Design Half Adder using NAND Gates.
5	Design Full Adder using NAND Gates.
6	Design 2:1 Multiplexer using NAND Gates.
7	Design 2:4 Decoder using NAND Gates.
8	Design of 4 bit binary Adder
9	Draw Layout of CMOS Inverter Microwind/Cadence Tools
10	Draw Layout of 2-Input NAND Gate using Microwind /Cadence Tools
11	Draw Layout of Multiplexer
12	Design 4 bit adder circuits
13	Design Multiplier circuits

VI Semester

EE2365- PE II: Digital Image Processing

Objective	Outcomes
➢ The objective of this course is to introduce the students to the concepts of Digital Image Processing so that it can be used in advanced studies and projects.	Students will be to 1. Understand the basic concepts of digital image processing and f digital image geometry. 2. Implement the image enhancement and restoration techniques in spatial and frequency domain. 3. Apply and implement image segmentation techniques using edge detection and merging. 4. Apply different Image processing algorithms.

UNIT-1:

Digital image fundamentals : Digital Image through scanner, digital camera, Concept of gray levels, Gray level to binary image conversion, Sampling and quantization, Relationship between 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

VI Semester

EE2366- Lab:PE II: Digital Image Processing

Objective	Outcomes
➢ The objective of this course is to introduce the students to the concepts of Digital Image Processing so that it can be used in advanced studies and projects.	Students will be to 1. Understand the basic concepts of digital image processing and f digital image geometry. 2. Implement the image enhancement and restoration techniques in spatial and frequency domain. 3. Apply and implement image segmentation techniques using edge detection and merging. 4. Apply different Image processing algorithms.

Expt. No.	Name of Experiment
1	To Explore statistical properties of Image
2	Spatial Image Enhancement
3	Histogram equalisation and modification
4	Image smoothing operations
5	Image Transform : DFT, DCT
6	Bit-plane Slicing
7	Spatial Filtering
8	Frequency Domain Filtering
9	Edge detection
10	Segmentation using threshold
11	Region based segmentation

VI Semester

EE2367- PE II: Object Oriented Programming

OBJECTIVES	OUTCOMES
1. The course aims is to introduce the concept of Object Oriented Programming 2. Demonstrate mastery of object oriented programming concepts: inheritance, polymorphism, and operator overloading. 3. To teach efficient storage mechanisms of data for an easy access 4. Demonstrate pointers, iterators, memory management including object creation and destruction	1. Understand the concept of concepts of Object Oriented Programming. 2. Analyze the using the concept of Inheritance, Polymorphism, Overloading 3. Choose the appropriate data structure and algorithm design method for a specified application. 4. Develop and use linear and non linear data structures and advanced features.

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

VI Semester

EE2368- Lab:PE II: Object Oriented Programming

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 learn the basic concepts of Object Oriented Programming. 2. Will design programming the concept of Inheritance, Polymorphism, Overloading 3. Can choose the appropriate data structure and algorithm design method for a specified application. 4. Will be able to use linear and non linear data structures and advanced features of C++ specifically stream I/O, templates and Exception Handling.

Exp 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

VI Semester

EE2381- OE III : Fuzzy Logic & Neural Network

Objective	Outcome
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective	**On completion of this course, Students will be able to** **CO1:** Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks. **CO2:** Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches **CO3:** Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks **CO4:** Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.

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

VI Semester
EE2381- OE III : Fuzzy Logic & Neural Network

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

VI Semester

EE2382- OE III : Basics of Analog and Digital Communication Systems

Objective	Outcome
➢ To Study different analog and digital modulation techniques. ➢ To understand transmitter & receivers in communication systems.	Students will be able to 1. Understand different modulation and demodulation schemes for analog communication with the concept of noise 2. Understand different pulse analog and digital modulation techniques. 3. Understand different digital modulation schemes 4. Understand the different coding techniques for communication systems.

Unit I: Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.

Unit II: Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.

Unit III: Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Basic digital Modulation System- PCM.

Unit IV: Channel capacity, DPCM, Delta Modulation, ADM, ADPCM, Adaptive sub-band coding, applications.

Unit V: Digital Modulation techniques: ASK, FSK, PSK, BPSK, QPSK, MSK, DPSK, BFSK, M-ary PSK, FSK, and QAM.

Unit VI: Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.

Text books:				
1	Electronic Communication System	Fourth Edition, 1999	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications		SymonHykin	Wiley, 1988
Reference books:				
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

VI Semester

EE2383-OE III: Biomedical Instrumentation

Objective	Outcome
➢ This course is intended for introducing the students to evolution and development of biomedical instrumentation. ➢ The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. ➢ Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethysmograph and spirogram ➢ Understand the fundamentals of Telemedicine like Teleradiology, Telecardiology, Telepsychiatry and Medical Informatics	Students will be able to 1. Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

UNIT-1:
Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.

UNIT-2:
Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers

UNIT-3 :
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers

UNIT-4:
Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG

UNIT-5 :
Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators, Electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments

UNIT-6:
Computers in biomedical instrumentation, digital computer, Telemedicine concept, Telemedicine applications, video conferencing,
digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry

Text Books

SN	Title	Edition	Authors	Publisher
1	Biomedical Instrumentation & Measurement	19 Jan 2010	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	Prentice Hall
2	Biomedical Instrumentation	1 Jan 2010	Mandeep Singh	Prentice Hall

VI Semester

EE2383-OE III: Biomedical Instrumentation

Reference books:				
1	Handbook of Biomedical Instrumentation	1987	R.S.Khandpur	TMH
2	Bioelectronics Measurement	1983	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	1 August 2008	Jacobson and Webster	PHI

VI Semester

EE2391-OE IV : Data Acquisition & Signal Conditioning

Objective	Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques	After study through lectures and assignments, Students will be able to: 1. Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning 2. Identify the various types of data acquisition hardware and the serial data communication standards. 3. Distinguish different standards for connection of different programmable instruments like GPIB and SCPI 4. Define use of Ethernet, Medium Access control and USB

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 Mac

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

VI Semester

EE2392- OE IV : Microprocessor Programming

Objective	Outcome
▪ To understand the architecture, programming and addressing modes of Intel 8085 ▪ To study the instruction set and programming of 8085 ▪ To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085. 2. Will demonstrate the ability to identify, Formulate and design Program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor in their respective field. .

Unit I: Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.

Unit II: Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization

Unit III: Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses,Programs based on instructions.

Unit IV: Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.

Unit V: MICROPROCESSOR APPLICATIONS - Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .

Unit VI: USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259

Text books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Interfacing 8085	1 Dec 2000	Ramesh Gaonkar	Penram Publication

Reference books:

SN	Title	Edition	Authors	Publisher
1	8085 Microprocessor	2014	Ajit Pal	Tata Mc-Graw Hill ,
2	Microprocessors & interfacing	2005	D. V. Hall	Tata McGraw-hill

VI Semester

EE2393- OE IV : Consumer Electronics

Objective	Outcome
➢ To give knowledge and competencies regarding consumer electronic equipments.	Students will be able to 1. Understand the knowledge of the safety aspects in the field of Electrical and Electronics products. 2. Analyze the basics of Audio and Video Systems. 3. Know about recent trends in Processors and computer peripherals, mobile and wireless technologies. 4. Understand the basics of refrigeration cycle and cooling system.

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 , RISC Processor.

Text books:

SN	Title	Edition	Authors	Publisher
1	Consumer Electronics	First Edition	S.P. Bali	Pearson Education
2	Consumer Electronics",	2000	B. R. Gupta, Vandana Singhal	S. K. Kataria& Sons,

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	

VI Semester

ET2361 - PE I : Object Oriented Programming

Course Objective	Course Outcome
Students should be able to 1. Learn the basic concepts of Object Oriented Programming. 2. Understand the concepts of function, class, object and operator overloading. 3. Understand the fundamentals of data structures: lists, stacks, queues, trees, graphs. 4. Learn concepts of file handling, template, exception handling and command line arguments.	Students will be able to 1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects. 2. Demonstrate the use of various OOPs concepts with the help of C++ programs. 3. Design and develop C++ programs for implementing data structures using array and linked list. 4. Implement the concept of file handling, template and exception handling to develop the software.

UNIT-1:
Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP. Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators. Expressions and Control Structures, Pointer, Arrays **06Hrs**

UNIT-2:

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

06Hrs

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, Asymptotic 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.

06Hrs

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.
New topic to be announced time to time

06 Hrs

Text books:				
1	Object Oriented programming with C++	3rd. Edition Year 2008	E. Balagurusamy	McGraw-Hill
2	Object Oriented Programming in Microsoft C++	4th edition 2002	Robert Lafore	Galgotia
Reference books:				
1	Fundamental of data structure in C++	5th edition,	Horowitz and S.Shani	Galgotia
2	Computer algorithms	2nd Edition	Horowitz, S.Shani and S.Rajasekaran	Galgotia

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

VI Semester

ET2362 - Lab.: PE I: Object Oriented Programming

Course Objective	Course Outcome
Students should be able to 1. Learn the basic concepts of Object Oriented Programming. 2. Understand the concepts of function, class, object and operator overloading. 3. Understand the fundamentals of data structures: lists, stacks, queues, trees, graphs. 4. Learn concepts of file handling, template, exception handling and command line arguments.	Students will be able to 1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects. 2. Demonstrate the use of various OOPs concepts with the help of C++ programs. 3. Design and develop C++ programs for implementing data structures using array and linked list. 4. Implement the concept of file handling, template and exception handling to develop the software.

Sr.No.	Name of Experiment
1	To implement • Different Control Structures in C++ • Concept of type casting
2	To implement the concept of • Function • Function overloading
3	To implement concepts of Class, Object And Constructor.
4	To implement concepts of Inheritance and Virtual function
5	To implement concepts of operator overloading.
6	To implement concepts of friend function.
7	To implement Stack and Queue using array
8	To implement Stack and Queue using link list.
9	To implement the concepts of file handling and template.
10	To implement the concept of command line arguments and exception handling

VI Semester

ET2371 - PE I : Fundamentals of Computing

Course Objective	Course Outcome
Students should be able to 1. Understand the use of Python as a scripting language for programmers. 2. Learn Python programming and to design applications	Students will be able to 1. Describe and develop Python programming using data types, operators and control structures 2. Develop python programs using loops and decision statements. 3. Describe and apply strings, lists, tuples, Numpy and dictionaries in Python programs. 4. Develop python programs using functions and recursions .

UNIT-1

Introduction to Python ,Python syntax ,comments variables, basic programming **(06 Hours)**

UNIT-2:

Data types, numbers, Casting strings Booleans, python operators: basic, membership and bitwise **(06 Hours)**

UNIT-3:

Conditions, Control statements: if-else, loops, Use of while loops in python Loop manipulation using pass, continue, break and else **(06 Hours)**

UNIT 4

Python String Defining list and list slicing, Use of Tuple data Types **(06 Hours)**

UNIT 5:

List and Dictionary Manipulations Building blocks of python programs **(06 Hours)**

UNIT 6:

Numpy, Functions, recursion and advanced programming **(06 Hours)**

Text books:				
1	NPTEL material		Swayam.gov.in	NPTEL material
2	Complete Reference	Martin C Brown		TATA McGraw Hill
Reference books:				
1.	Core Python Programing	Wesley Chun,		Prentice Hall publications

VI Semester

ET2372 - Lab: PE I -Fundamentals of Computing

VI Semester

ET2372 - Lab: PE I -Fundamentals of Computing

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

VI Semester
ET2377 - PE II : Antenna Theory & Design

Course Objective	Course Outcome
Students should be able to 1. Learn the basic principles and of antenna parameters. 2. Design and analyze dipole antennas. 3. Design and analyze loop antennas & Arrays. 4. Design and Analyze Travelling wave & Broadband Antennas. 5. Design & Analyze aperture, Reflector and Patch Antennas. 6. Study different antenna measurements.	Students will be able to 1. Evaluate various parameters of antennas. 2. Analyze performance parameters of various antennas & antenna array. 3. Perform of antenna measurements by using different antenna measurement techniques. 4. Design and Analyze various antennas

UNIT I : BASIC ANTENNA CONCEPTS:
Introduction to antenna , need of Antenna, Types of antennas, Radiation mechanism of single wire and two wire , Radiation Pattern, Antenna field zones, Beam solid angle, radiation power density , radiation intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Polarization, impedance, bandwidth, impedance, effective length and equivalent area

(6 Hours)

UNIT II : DIPOLE ANTENNA:
Vector potentials for electric current source , Vector potentials for Magnetic current source, Infinitesimal Dipole, Finite dipole, Half wavelength dipole.

(6 Hours)

UNIT III : LOOP ANTENNAS AND ARRAYS:
circular loop ,polygonal loop and ferrite loop antenna, Two element array, N-element linear array ,broad side, end fire, phase array , planar Array system.

(6 Hours)

UNIT IV : TRAVELING WAVE ANTENNA
Introduction to traveling wave antenna, long wire, V antenna, rhombic antenna, Helical antenna, Electric - Magnetic Dipole, Yagi - Uda array of linear Elements.

(6 Hours)

UNIT V: SPECIAL ANTENNAS:
Babinet's principle, Rectangular Horn antenna, conical horn, corrugated Horn, plane reflector antenna, corner reflector antenna, parabolic reflector antenna, Cassegrain reflector antenna, Patch Antenna, antenna feeding techniques.

(6 Hours)

UNIT VI: ANTENNA MEASUREMENTS
Antenna reflection Ranges, Antenna Free space Ranges, Anechoic Chamber, Near field to farfield method, instrumentation system for measurement, Gain Measurement, Impedance Measurement, Current Measurement, Polarization Measurement. **New topic to be announced time to time**

(06 Hours)

VI Semester

ET2377 - PE II : Antenna Theory & Design

Text books:				
1.	Antenna Theory Analysis and Design Technology	2009 Third edition	Balanis C.A	Wiley India
2.	Antennas	Second edition 1988	John D.Krauss	McGraw - Hill International edition
Reference books:				
1.	Electromagnetic waves and Radiating systems	1993	Edward C.Jordan, Keith G.Balmain	Prentice Hall of India.
2.	Antennas and Radio Propagation	1985	R.E. Collins	McGraw-Hill

VI Semester

ET2378 - PE II : Lab. Antenna Theory & Design

SN	List of Experiment
1	To measure radiation Pattern of Yagi-Uda Antenna and its Characteristic using Antenna trainer Kit.
2	To measure radiation Pattern of Log Periodic Antenna and its Characteristic using Antenna trainer Kit.
3	To measure radiation Pattern of λ/2 Dipole Antenna and its Characteristic using Antenna trainer Kit.
4	To measure radiation Pattern of 3λ/2 Dipole Antenna and its Characteristic using Antenna trainer Kit.
5	To design and Simulate Patch Antenna with Probe Feed using Simulation software.
6	To design and Simulate Patch Antenna with Microstrip Feed line using Simulation software.
7	To Study parametric analysis of Patch Antenna using Simulation software.
8	To design and Simulate Lambda/2 Dipole Antenna using Simulation software and study it's Characteristic.
9	To design and Simulate Yagi-Uda Antenna using Simulation software and study it's Characteristic.
10	To design and Simulate Horn Antenna using Stimulation software and study it's Characteristic.
11	To design and Simulate Parabolic reflector Antenna using Stimulation software and study it's Characteristic.
12	Study the fabrication process of Antenna
13	Measurement of Antenna Parameter Using Vector Network Analyzer.
14	Mini Project on antenna.

VI Semester
ET2381- PE II : Internet of Things (IoT)

Course Learning Objective Students should be able	Course Outcomes Students will be able to
1. To understand the physical and Logical design of IoT. 2. To study the M2M and NETCONF. 3. To understand python programming. 4. To understand physical servers and cloud offerings.	1. Explore the physical and Logical design of IoT. 2. Explore the M2M and NETCONF. 3. Explore python programming. 4. Apply basic skills of IoT to solve real life problems.

UNIT-1: **5 Hrs.**
Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels.

UNIT-2: **6Hrs**
Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

UNIT-3: **7Hrs**
M2M & System Management with NETCONF-YANG: M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG.

UNIT-4: **6Hrs**
Developing Internet of Things & Logical Design using Python: Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions,

UNIT-5: **6Hrs**
Python Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages, Iot Device-Raspberry Pi, Programming Raspberry pi with Python

UNIT-6: **7Hrs**
IoT physical servers and cloud offerings, Introduction to cloud storage models and communication APIs, Python web application frame work-Django, Amezon web service for IoT
New topic to be announced time to time

Text books:				
1	Internet of Things: A Hands-On Approach	1st edition 2015	by Arshdeep Bahga, Vijay Madisetti	Orient Blackswan Private Limited - New Delhi
Reference books:				
1	Designing the Internet of Things	1st edition	By Adrian McEwen	Wiley
2	Python for Everybody		Charles R. Severance	

VI Semester

ET2382- PE II : Lab. Internet of Things (IoT)

Expt. No.	Name of Experiment
01	Add ten natural numbers in python
02	Experiment on functions in python
03	Experiment on string manipulation in python
04	Interfacing LED with Raspberry pi.
05	Interfacing DHT11 sensor with Raspberry pi.
06	File handling using Python.
07	Reading data from server.
08	Experiment on python Django.
09	Experiment on python Django.
10	Preparing complete IoT system using AWS server
11	Mini-project

VI Semester

ET2379 - PE II : Digital System Design

Course Objective	Course Outcome
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.	Students will be able to 1) Compare and contrast different FPGA and CPLD architectures. 2) Design, develop and analyze combinational circuits. 3) Design, develop and analyze sequential circuits. 4) Implement digital system using CAD tool.

UNIT-1:
Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs **(06 Hours)**

UNIT-2:
HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module **(06 Hours)**

UNIT-3
Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog & Testbench, Compilation and synthesis, Timing analysis **(06 Hours)**

UNIT-4:
Data Flow Modelling , Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modelling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives

(06 Hours)

UNIT 5:
Behavioural Modelling, Initial, Always, Procedural Assignment, Blocking and Non-Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign De-assign, Force Release, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines

(06 Hours)

Unit 6: Advanced feature:
Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Stacks and Queues, Multi bit Adders & Multiplier, Huffman Coding, Processor and Memory Model, CPU, System Tasks and Functions, Design Verification, **New topic to be announced time to time (06 Hours)**

VI Semester

ET2380- PE II : Lab. Digital system Design

Course Objective	Course Outcome
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.	Students will be able to 1) Compare and contrast different FPGA and CPLD architectures. 2) Design, develop and analyze combinational circuits. 3) Design, develop and analyze sequential circuits. 4) Implement digital system using CAD tool.

Expt. No.	Experiments based on
1	Write a VERILOG code for Basic gates.
2	Write a VERILOG Dataflow code for Half Adder, Half Subtractor.
3	Write a VERILOG Dataflow code for 4:1 MUX, 2:4 Decoder, 1:4 DEMUX.
4	Write a VERILOG Dataflow code for 1-bit, 2-bit Comparator
5	VERILOG code for Full Adder
6	write VERILOG code for Full Subtractor
7	Write Behavioral VERILOG code for SR latch.
8	Write Behavioral VERILOG code for D latch
9	Write Behavioral VERILOG code for 4-bit Shift register, 4-bit counter.
10	Write VERILOG code for 8 Bit Carry Look Ahead Adder using FA.
11	Write VERILOG Code for 4 bit Sequence Detector MEALY M/C, Overlapping allowed
12	Write VERILOG Code for 4 bit Sequence Detector MOORE M/C, Overlapping allowed

VI Semester

ET2367 - PE I : Electronic Instrumentation

Course Objective	Course Outcome
Students should be able to	Students will be able to
1. Study the characteristics of Instruments.	1. Design instrumentation system using various transducers and its calibration process.
2. Understand the Concepts of Pressure and temperature Measurements and its calibration process.	2. Analyze pressure and temperature using measuring instruments and its calibration process.
3. Learn the working principle of various flow & level transducers.	3. Measure and analyze flow and level using flow transducers.
4. Learn the working principle of various transducers like level , thickness speed, ph value etc.	4. Measure and analyze various parameters like level, thickness speed, ph value etc.
5. Learn Programmable logic controller and their programming language	5. Develop PLC programs by using ladder diagram

UNIT-I INTRODUCTION

Block diagram of instrumentation system, functions of instruments, characteristic equation of instrument in general form, calibration process, cables and connectors and its analysis.

05 Hours

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 Hours

UNIT-III TEMPARATURE MEASUREMENT, THERMOCOUPLES AND PYROMETERS

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 and their circuits. 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.

07 Hours

UNIT-IV FLOWMETERS& LEVEL MEASUREMENT

Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube. Variable area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flow meters flow measurements for gases. Float type level indication, capacitive, ultrasonic level measurement

06 Hours

UNIT-V MISCELLANEOUS MEASUREMENT

Electrical level gauge: – Resistive , capacitive , Nuclear radiation , Radar type ,Speed measurement -D.C and A.C tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, pH Measurement, measurement of AC current by Hall effect transducer.

06 Hours

UNIT- VI Data Logger & PLC

Data Logger, Introduction to PLC, PLC programming, ladder diagram logic for process control applications, Introduction to SCADA.

New topic to be announced time to time **06 Hours**

VII Semester
ET 2411 – PE III : Power Electronics

Prerequisites	----------
Course Objective Students should be able to 1. Understand the characteristics of different power electronics switches and selection of components for different applications, 2. Learn different types of power devices 3. Understand the switching behaviour of power electronics circuits such as DC/DC converters. 4. Learn the role of different type of inverters.	**Course Outcome** Students will be able to 1. Analyze and design Power semiconductor devices. 2. Analyze and design DC/DC converter and Cyclo-converters. 3. Analyze and design inverter circuits. 4 . Apply the knowledge of power electronics to solve real Life problems.

UNIT I: Power semiconductor devices (part A)
Power Semiconductor Diodes, classification, reverse recovery Characteristics, series and shunt connection of power diodes, Power Transistors, Switching characteristics of power transistor, Base drive control.

06Hrs

UNIT II : Power semiconductor devices(part B)
Power MOSFETs, IGBT, Silicon controlled rectifier(SCR), dynamic Turn ON and Turn OFF characteristics of SCR, Firing circuit, Diac, Triac.

06Hrs

UNIT III : AC –DC Converter
Commutation methods of SCR, Single phase half wave and full wave Controlled Rectifier with resistive and inductive load,

06Hrs

UNIT IV: DC-DC Converters (Chopper) Step up, step down Choppers, design of choppers AC Voltage Controllers. Principle of ON-OFF control, Phase control, single phase cyclo-converter

06Hrs

UNIT V : DC –AC Converter
Inverters—Series resonant inverters, Modified series inverter, parallel inverter, single phase bride inverter, current source inverter, Three phase bridge Inverter: 120 degree and 180 degree mode, design of inverter applications.

06Hrs

UNIT VI:
Solar converter, buck converter, boost converter, Cuk converter, Design of Gate Drive circuits for SCR,SCR protection circuits, design of snubber circuit, Introduction to AC and DC drives, SMPS.

06Hrs

VII Semester
ET2412 – PE III: Data compression and encryption

Course Objective	Course Outcome
Students should be able to 1. Understand text, audio and video compression techniques. 2. Understand data security issues 3. Understand Symmetric and Asymmetric Key Cryptography schemes. 4. Understand network security.	Students will be able to 1. Implement text, audio and video compression techniques. 2. Describe data security issues 3. Implement Symmetric and Asymmetric Key Cryptography schemes. 4. Describe network security issues.

Unit 1.Introduction to Data Compression

Data Compression : Modelling and Coding, Statstical Modelling, Dictionary Schemes, LZ, Lossy Compression Shannon – Fano Algorithm, Huffman Algorithm, Adaptive Huffman Coding

Difficulties in Huffman Coding, Arithmetic Coding – Decoding, Dictionary Based Compression, Sliding Window Compression: LZ-77, LZ-78, LZW **(6 hours)**

Unit2. Image Compression

DCT, JPEG, JPEG – LS, Differential Lossless Compression, DPCM, JPEG – 2000 Standards **(6 hours)**

Unit 3.Video and Audio Compression

Analog Video, Digital Video, MPEG – 2, H – 261 Encoder and Decoder Sound, Digital Audio, μ-Law and A-Law Companding, MPEG – 1 Audio Layer (MP3 Audio Format) **(6 hours)**

Unit 4. Data Security

Security Goals, Cryptographic Attacks, Techniques Symmetric Key: Substitution Cipher, Transposition Cipher , Stream and Block Cipher DES, AES **(6 hours)**

Unit 5. Number Theory and Asymmetric Key Cryptography

Prime Numbers, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Discreet Logarithms

Principles of Public Key Crypto System, RSA Key Management, Deffie-Hellman Key Exchange

Message Integrity, Message Authentication and Hash Functions, SHA, H MAC, Digital Signature Standards **(6 hours)**

Unit 6. Network Security

Email, PGP, S/MIME, Intrusion Detection System Web Security Considerations, SSL Architecture, SSL Message Formats, TLS, Secure Electronic Transactions Kerberos, X.509 Authentication Service, Public Key Infrastructure **(6 hours)**

VII Semester
ET 2413 –PE III :Analog VLSI Design

Prerequisites	**----------**
Course Objective Students should be able to 1. Understand the concept and basics of small signal model of MOS transistor &Perform analysis of single stage amplifiers with or without load 2. Understand small signal parameters of Differential Amplifier. 3. Understand current mirrors as bias element and single stage amplifiers in frequency domain 4. Study Performance parameters of CMOS op amp	**Course Outcome** Students will be able to 1. Analyze small signal model of MOS transistor &Perform analysis of single stage amplifiers with or without load. 2. Analyze small signal parameters of Differential Amplifier. 3. Analyze Performance parameters of CMOS op amp. 4. Analyze Performance parameters of converters.

UNIT-1 Basic MOS Device Physics

Threshold voltage, Derivation of I/V characteristics, second order effects, MOS device capacitance, MOS small signal models, MOS SPICE models

(06 Hours)

UNIT-2: Single stage amplifiers

Basic concept, common source, common source stage with resistive load, CS stage with source degeneration, source follower, common gate. **(06 Hours)**

UNIT-3: Differential amplifiers

Single ended & differential operation, Basic differential pair, qualitative and quantitative analysis, Common mode response.

(06 Hours)

UNIT 4: Operational amplifiers

Performance parameters, one stage op amp, Gain boosting, Noise in op amp

(06 Hours)

Unit 5: ADC converter and DAC converter

Converting Analog Signals to Digital Signals, Sample-and-Hold (S/H) Characteristics, Digital-to-Analog Converter (DAC) Specifications, Analog-to-Digital Converter (ADC) Specifications. **(06 Hours)**

Unit 6: Sigma Delta Converter

The Oversampling ADC, The First-Order **Sigma Delta** Modulator , The Higher Order **Sigma Delta** Modulators.

(06 Hours)

VII Semester
ET 2414 – PE III: Error Correcting Code

Prerequisites	**----------**
Course Objective Students should be able to 1) Understand the concept and basics of information theory and the basics of source and channel coding/decoding. 2) Understand various mathematical tools: groups and finite fields, Linear algebra in the development of codes and sequences and explain the conventional digital communication system with error control codes like block code, Linear code 3) Understand the properties of error control codes like Cyclic code, BCH code. 4) Understand various error control techniques for Convolutional codes.	**Course Outcome** Students will be able to 1. Apply the concept and basics of information theory and the basics of source and channel coding/decoding. 2. Apply various mathematical tools: groups and finite fields, Linear algebra in the development of codes and sequences and explain the conventional digital communication system with error control codes like block code, Linear code 3. Analyze the properties of error control codes like Cyclic code, BCH code. 4. Demonstrate competence in analyzing and evaluating the practice of different error control techniques for Convolutional codes.

UNIT-1 : CHANNEL CAPACITY AND CODING
Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Random Selection Of Codes, Hamming Distance, Few Points Of Information Theory. **(06 Hours)**

UNIT-2:BLOCK CODES
Coding for reliable digital transmission and storage. Groups, Rings, Vector Spaces, Galois Fields, Polynomial ringsThe Digital Communication Channel, Introduction To Block Codes, Single Parity Check Codes, Product Codes, Repetition Codes, Hamming Codes, Minimum Distance Of Block Codes, Soft – Decision Decoding, Automatic Repeat Request Schemes **(06 Hours)**

UNIT-3:LINEAR CODES
Definition of Linear Codes, Generator Matrices, The Standard Array, Parity - Check Matrices, Error Syndromes, Error Detection And Correction, Shortened And Extended Linear Codes.. **(06 Hours)**

UNIT 4: CYCLIC CODES
Definition Of Cyclic Codes, Polynomials, Generator Polynomials, Encoding Cyclic Codes, Decoding Cyclic Codes, Factors Of XN +1, Parity-Check Polynomials, Dual Cyclic Codes, Generator And Parity-Check Matrices Of Cyclic Codes **(06 Hours)**

Unit 5:BCH CODES
Linear Algebra, Galois Field, Definition and Construction of Binary BCH Codes, Error Syndromes In Finite Fields, Decoding SEC and DEC, Reed- Solomen Codes, LDPC codes **(06 Hours)**

Unit 6:CONVOLUTION CODES
Convolution, Encoding Convolutional Codes, Generator Matrices For Convolutional Codes, Generator Polynomials For Convolutional Codes, Graphical Representation Of Convolutional Codes, The Viterbi Decoder. Concept Of Interleaver And Puncture Coding, Applications of error control coding
(06 Hours)

VII Semester
ET2422- PE IV: Embedded System

Prerequisites	----------
Course Objective Students should be able to 1. Study & understand the detailed architectural features of ARM processor. 2. Study instruction set of ARM processor and apply the same for programming 3. Explore the details about LPC 2148 Develop programs in interfacing of different peripherals with NODE MCU ESP8266 4. Understand memory management in ARM and operating system..	**Course Outcome** Students will be able to 1. Explore the architectural features of ARM processors 2. Apply ARM instruction set in developing assembly language programs. 3. Explore Basic embedded C programs for GPIO and interfacing with LPC 2148 and Develop programs in interfacing of different peripherals with NODE MCU ESP8266 4. Acquire knowledge about memory management in ARM and operating system.

UNIT-1Introduction to embedded system and ARM Processor

Difference between RISC & CISC, Advantages of architectural features of ARM Processor, Processor modes, Register Organization, Exceptions and its handling. 3/5- stage pipeline ARM organization. LPC2148 ARM 7 microcontroller, Features of LPC2148, Block diagram of LPC2148, Pin diagram of LPC2148, Architectural overview, On-chip flash program memory, On-chip RAM.

(06 Hours)

UNIT-2: Memory and memory-mapped I/Os

ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs. **(06 Hours)**

UNIT-3: ARM floating point architecture and DSP extensions

ARM floating point architecture and DSP extensions, ARM co-processors. ARM 9 TDMI ARCHITECTURAL STUDY: - H/W architecture, Timing diagrams for various accesses, Memory buses: AMBA, ASB, & APB. Architectural support for system development **(06 Hours)**

UNIT 4: Basic embedded C programs

Basic embedded C programs for GPIO and interfacing of different devices like LED, LCD, Stepper Motor, Study and programming of on-chip peripherals like timers, counters, on-chip ADC, DAC, Introduction to NODE MCU ESp8266 and ESP 32, NODE MCU ESP8266 Features & Using It with Arduino IDE, NODE MCU ESP8266 Pinout, Power requirement. **(06 Hours)**

VII Semester
ET 2424 – PE IV: Topics in Machine Learning

Prerequisites	Basic probability and statistics, linear algebra and calculus
Course Objective Students should be able to 1) Understand the concepts of machine learning and regression models 2) Understand the concept of classification for model evaluation. 3) Learn Supervised and unsupervised learning algorithms. 4) Learn the concept of artificial neural network and deep networks	**Course Outcome** Students will be able to 1) Apply and analyze the model using regression. 2) Apply and evaluate the performance of system for classification. 3) Apply Supervised and unsupervised learning for problem solving. 4) Apply neural network algorithms for classification. 5) Describe and evaluate deep neural network with computational complexity.

UNIT-1 Regression
Supervised and Unsupervised Learning, Regression, Model and Cost Function, Gradient Descent, Multivariate Linear Regression, Feature Scaling, Gradient Descent for multivariable **(06 Hours)**

UNIT-2: Classification
Classification, Hypothesis Representation, Decision Boundary, Cost function and Gradient Descent, Multi-classification, Regularization, Model Evaluation **(06 Hours)**

UNIT-3: Supervised Learning
KNN, SVM, Decision tree, Naive Bayes Classifiers, Random Forest **(06 Hours)**

UNIT 4: Unsupervised learning
K-means clustering, Hierarchical Clustering, DBSCAN Clustering, PCA, Anomaly Detection, Recommender System **(06 Hours)**

Unit 5:Artificial Neural Network
Introduction to neural network, Activation Functions, Perceptron rule, backpropagation **(06 Hours)**

Unit 6: Deep Learning
Introduction to deep learning, building blocks of CNN, Computational Complexity, case studies based on CNN architectures, **New topics to be announced time to time.** **(06 Hours)**

Text books:				
1	Understanding Machine Learning. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html	2017	Shai Shalev-Shwartz and Shai Ben-David.	Cambridge University Press.
2	The Elements of Statistical Learning. https://web.stanford.edu/~hastie/ElemStatLearn/	2009	Trevor Hastie, Robert Tibshirani and Jerome Friedman.	Second Edition
3	Pattern Recognition and Machine Learning. https://www.microsoft.com/en-us/research/people/cmbishop/downloads/	2006	Christopher Bishop.	Springer

VII Semester
ET 2425 – PE IV: Multimedia Communications

Prerequisites	**Basics of digital data and computer networks**
Course Objective Students should be able to 1. Learn the basics of image ,audio representation and transmission 2. Understand basic concepts of image ,audio and video compression 3. Learn basic concepts of multimedia communication networks. 4. Understand basic concepts of Content-Based Retrieval in Digital Libraries	**Course Outcome** Students will be able to 1. Explain basics of analog and digital video 2. Implement image compression techniques and describe videocompression techniques 3. Describe various network protocols 4. Describe basics of image retrieval from digital libraries

UNIT-1:
Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video **(6 hours)**

UNIT-2:
Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio **(6 hours)**

UNIT-3:
Multimedia data compression: Lossless compression algorithm: DCT, Wavelet- Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT), Basic Audio Compression Techniques **(6 hours)**

UNIT-4:
Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, MPEG2, MPEG4 **(6 hours)**

UNIT-5:
Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications :Quality of Multimedia Data Transmission, Multimedia over IP, RTCP,RTP,SIP Transport of MPEG-4,DMIF, Media-on-Demand(MOD) ,Multimedia Broadcasting schemes **(6 hours)**

UNIT-6:
Content-Based Retrieval in Digital Libraries C-BIRD— A Case Study ,C-BIRD GUI Color Histogram Color Density Color Layout Texture Layout Search by Illumination Invariance Search by Object Model **(6 hours)**

Text books:				
1	Fundamentals of Multimedia	Ze-Nian Li , Mark S Drew	2004	PHI/Pearson Education
2	Multimedia Applications	Steinmetz, Nahrst	2004	Springer.

Reference books:				
1	Multimedia Communications: Applications, Networks, Protocols and Standars	Fred Halsall	2001	Addison-Wesley

VII Semester
ET2431-PE V: Display Technology

Prerequisites	----------
Course Objective Students should be able to 1. To provide the fundamental knowledge for understanding concepts of different display technologies related to manufacturing techniques and materials selection 2. To explore specifications required for display technologies and understand properties of Luminescence materials for different display types. 3. To understand the addressing methods, backplane Technology and Driver Integration part of different new displays. 4. To understand new displays properties of materials modes.	**Course Outcome** Students will be able to 1. Identify different display technologies and manufacturing process. 2. Characterized and analyzed specifications of display technology and Luminescence materials. 3. Explore design parameters for displays and analyze addressing matrix and backlight unit technologies. 4. Elaborate applications of different new displays.

UNIT I :
Overview of display technologies, information capacity of displays, introduction to different flat panel display technologies. LCD Display Internal structure and working, Fundamentals of Photometry,
(06 Hours)

UNIT II :
Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, driving power, efficiency, speed, memory and storage, degradation, resolution, addressability, physiological factors, and measurement instrumentation, Colorimetry, CIE colorimetry
(06 Hours)

UNIT III :
Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, processes responsible for the transfer of energy in luminescent materials, chemistry and preparation of luminescent materials, and emission properties of the prepared materials;
(06 Hours)

UNIT IV:
Basics of matrix addressing of displays: active and passive matrix. Technical discussion of display technologies: LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.
(06 Hours)

UNIT V:
Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.)
(06 Hours)

UNIT VI:
Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes
(06 Hours)

VII Semester
ET 2433 – PE V: Fuzzy Logic & Neural Network

Prerequisites	**Basic set theory,** Basic probability and statistics, linear algebra and calculus
Course Objective Students should be able to 1. Learn computing algorithms in Neural network and Fuzzy logic concepts 2. Understand operation of basic elements in fuzzy controller, fuzzy reasoning, relations. 3. Understand supervised and unsupervised algorithms in neural networks. 4. Learn deep learning fundamentals and develop algorithms to solve real life applications.	**Course Outcome** Students will be able to 1. Comprehend and apply fuzzy/ neural network concepts to handle uncertainty in engineering problem. 2. Apply Fuzzy relation, implications and Design Fuzzy logic controller for solving real life problems 3. Apply supervised/unsupervised algorithms for pattern recognition/classification problems. 4. Describe Deep learning models and apply deep networks to computer vision analysis

UNIT-1 Fuzzy Logic & Arithmetic Operations

Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions, fuzzy compliments, t-norms and t-conorm, extension principle, Fuzzy arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations **(06 Hours)**

UNIT-2 Fuzzy Relations & Decision Making

Fuzzy relations, projections and cylindric extensions, binary fuzzy relations, fuzzy equivalence, Fuzzy Rules and Fuzzy Reasoning, Fuzzy implications, Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy controllers **(06 Hours)**

UNIT-3: Neural Network Concepts

Introduction to Biological neural network, and Artificial Neuron Models, Neural Network learning rules, NN architectures, Hebb Net, Learning in single discrete and continuous perceptron,Perceptron training algorithm, Feed forward vs feedback networks, ADALINE, MADALINE NN **(06 Hours)**

UNIT-4: Supervised Neural Networks

Supervised Learning Neural Networks, Backpropagation algorithm, factors affecting back propagation training, Radial Basis Function Networks, Recurrent Networks, Adaptive Multilayer NN **(06 Hours)**

UNIT 5: Unsupervised Neural Networks

Unsupervised Learning Neural Networks, Winner take networks, Adaptive Resonance architectures, Self-Organizing Map, Associate memory models **(06 Hours)**

Unit 6:Deep learning

Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Basic structure of Convolutional Network, Case studies: Alex net, VGGNet, GoogLeNet, Applications of CNN: Train deep neural networks for computer vision tasks, **New topic to be announced time to time** **(06 Hours)**

VII Semester

ET2435 – PE V : RF Circuit Design

Prerequisites	----------
Course Objective Students should be able to 1. Learn fundamentals of series and parallel RF circuits. 2. Understand the use of HF component in design the RF circuit and bandwidth estimation techniques. 3. Learn the design of high frequency amplifier an phase detectors 4. Understand the concept of CMOS technology in RF circuits.	**Course Outcome Students will be able to** 1. Compare the behavior of series and parallel RLC circuit at HF. 2. Analyze the HF circuit design and Distinguish the different bandwidth estimation techniques. 3. Compare the power amplifier parameters with HF amplifier with phase detector. 4. Apply the knowledge of CMOS technology for design of supply independent bias circuit

UNIT-1 Fundamentals of RF Circuits

Introduction, History of wireless Communication, Noncellular wireless Applications, Propagation, Parallel RLC Tank Circuit, Series RLC Circuit , RLC Network as Impedance Transformer, Skin Effect, Resistor, Capacitor, Inductor **(06 Hours)**

UNIT-2: MOSFET and Transmission Lines

MOSFET Physics, MOS Device Physics in Short Channel Regime , Other Effects, Link Between Lumped and Distributed Regime ,Driving Point impedance at iterated structures , Transmission line , Behavior of finite length Transmission line. **(06 Hours)**

UNIT-3: Bandwidth Estimation

Review of Smith Chart and S-Parameter, Application of smith chart, Rise time, Delay, Bandwidth Estimation Techniques - Open Circuit Time Constant , Short Circuit Time constant

(06 Hours)

UNIT 4: HF RF Amplifier and Bandwidth Detection

Introduction to High Frequency Amplifier Design, Zeros as Bandwidth Enhancer , The shunt series Amplifier, Tuned Amplifiers, Neutralization and Unilateralization Cascaded Amplifiers,

(06 Hours)

Unit 5:Biasing of RF Circuit

Introduction to Voltage references and Biasing, Review of Diode Behavior, Diodes and Bipolar transistors in CMOS Technology Supply independent bias circuits, Band gap Voltage References, Amplifier linearity. **(06 Hours)**

Unit 6: RF Power Amplifier and Phase Detectors

Introductions to RF Power Amplifiers, Classification of Power Amplifiers, Modulation of Power Amplifiers, Introduction to Phase lock loops , Linear zed PLL Model, Phase Detector, Sequential Phase Detector, Loop Filters and Charge Pumps **(06 Hours)**

Text books:				
1.	The Design of CMOS Radio Frequency Integrated Circuits	2nd Edition	Thomas H. Lee	Cambridge University Press
2.	RF Circuit Design Theory and Applications	2nd Edition	R. Ludwig & P. Bretchko	Pearson Publication

Reference books:				
1.	Analysis and Design of Analog Integrated Circuits	4th Edition	Paul R. Gray	Whiley India Publication

	Analog Integrated Circuits			Publication

VII Semester
ET2441-PE VI : CMOS VLSI Design

Prerequisites	Logic Circuit Design, MOSFET Operation, Sequential Circuits .
Course Objective Students should be able to 1. To understand and study analysis of the MOS transistor with first order and second order effects. 2. To study the static and dynamic operating principles of inverter circuit. 3. To understand the different CMOS implementation process. 4. To learn switching characteristics and interconnection effects of MOS device, advanced techniques in CMOS logic.	**Course Outcome** Students will be able to 1. An ability to analyze the characteristics of MOSFET. 2. An ability to analyze the voltage transfer characteristics of MOS inverters. 3. An ability to apply the LAMBDA design rules for design of optimized CMOS circuits and describe the process of fabrication for CMOS circuits 4. An ability to design and analyze switching characteristics and interconnection effects of MOS device, advance CMOS logic circuits.

UNIT –I : Basic MOS Device Physics
General Consideration: MOS as a switch, MOS Structure & Symbols, MOS I/V Characteristics, MOS Enhancement Transistor, Second order effect of MOS: Body Effect, Junction Effect, Gate Leakage Effect, Channel Length Effect, Tunneling Effect, Velocity Modulation, Mobility Variation **06 Hrs**.

UNIT-2:
MOSFET Inverter Characteristics
Resistive Load Inverter , Inverter with n type MOSFET load,CMOS Inverter, Principle of operation & DC Characteristics, Tri-stated Inverter, Noise Margin Calculation. **07 Hrs**

UNIT-3:
Fabrication & Layout of CMOS IC
CMOS Fabrication Technology: N-well, P-well, Twin Tub Process, Silicon on Insulator (SOI) Process, Physical Design of Logic Gates, Euler's Path, Stick Diagram, Layout, Latch-up Effect. **06 Hrs.**

UNIT-4:
Switching Characteristics & Interconnection Effect
MOS Device Capacitance Estimation, Switching Characteristics: Rise Time, Fall Time, Propagation Delay, Delay Estimation: Propagation Delay, Contamination Delay, Power Dissipation in CMOS: Static & Dynamic Power Calculation, Charge Sharing, Fan-in, Fan-out. **05 Hrs**

UNIT-5: Combinational Circuit Design
Circuit Families, Static CMOS , Ratioed Circuits , Cascode Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits, Circuit Pitfalls, More Circuit Families. **06 Hrs**

UNIT-6: Sequential **Circuit Design**
Introduction, Sequencing Static Circuits . . Sequencing Methods , Max-Delay Constraints, Min-Delay Constraints,Time Borrowing, Clock Skew, Circuit Design of Latches and Flip-Flops, Conventional CMOS Latches, Conventional CMOS Flip-Flops, Design Using Various Logic Families such as Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, Zipper Logic, Clocked CMOS Logic, CVSL, Bi-CMOS Logic Family
06 Hrs

VII Semester
ET2442– PE VI: Digital Image Analysis for Remote Sensing

Prerequisites	Principles of Image Analysis
Course Objective Students should be able to 1) Understand Remote Sensing & sensor Concepts 2) Understand the fundamentals and image characteristics of remote sensing. 3) Learn image enhancement techniques 4) Study image classification technique and hyperspectral image analysis	**Course Outcome** Students will be able to 1) Comprehend the basic and applied principles of remote sensing, RS image characteristics 2) Understand and evaluate image spatial and spectral transforms and their effect on image quality and data integrity 3) Apply the image correction techniques and classification algorithms on remote sensing images 4) Analyze high-dimensional remote sensing imagery with appropriate remote sensing data and processing methods.

UNIT-1: Remote Sensing Concepts

Review of Remote Sensing Concepts: spatial and radiometric characteristics – spectral and temporal characteristics, Optical Radiation Model: The wave/ particle models - energy/matter interaction – Radiometric Correction–Atmospheric Correction, Image sensors

(06 Hours)

UNIT-2: Digital Image Formation and Characteristics

Digital Image Formation: point spread functions – sampling and quantization

Digital Image Characteristics: Univariate and multivariate image statistics – noise models- power spectral density- co-occurrence matrix

(06 Hours)

UNIT-3: Image Enhancement and Spectral Transforms

Contrast enhancement – band rationing – principal component analysis – vegetation transforms – texture transforms, Spatial Transforms: convolution concept - low and high pass filtering – spatial transformations – Fourier transform – wavelet transforms.

(06 Hours)

UNIT 4: Geometric Correction

Sensor geometry and empirical models for geometric corrections techniques.

(06 Hours)

Unit 5:RS Image Classification

Thematic Information Extraction: review of supervised and unsupervised Image classification – Maximum Likelihood and Bayesian classification, Non-parametric & parametric classification.

(06 Hours)

Unit 6: High Dimension Image Analysis

Subpixel classification: Linear mixing model, fuzzy set classification, Hyperspectral Image Analysis: Feature extraction, classification algorithms for hyperspectral data, Applications of Remote Sensing, **New topic to be announced time to time**

(06 Hours)

VII Semester
ET2444 – PE VI: Communication Networks

Prerequisites: Digital Communication	----------
Course Objective **Students should be able to** Understand Networks, Network topologies and service primitives. 1. Learn the structure and applications of Connecting devices. 2. Learn basics of LAN, MAN, WAN. 3. Understand Multimedia Networking. 4. Comprehend Network applications andNetwork Securities	**Course Outcome** **Students will be able to** 1. Compare data transmission protocols and understand the applications of communication network 2. Apply the knowledge of LAN structure to design data communication system. 3. Detect Data transmission errors in communication networks. 4. Compare different data security protocols.

Unit-1Computer Network and Internet **6 Hours**

Internet, the network edge, ISPs and Internet backbone, Protocol layers and their service models, History of Computer network and Internet

Unit-2 Application Layer **6 Hours**

Principles of Network Applications, the web and HTTP, FTP, Email, DNS,

Unit-3: Transport Layer **6 Hours**

Transport layer design issues, transport service primitives, internet transport protocol TCP/IP architecture, TCP/IP protocol, TCP/IP utilities, wireless TCP

Unit-4: Network layer **6 Hours**

Network layer design issues, IP packets, IP addressing, virtual circuit and datagram networks, router and routing algorithms, congestion, internetworking, UDP, routers and gateways

Unit-5: The link layer and Local area Network **6 Hours**

Services,error detection and correction techniques, multiple access protocols, and link layer addressing, Ethernet, Hubs and Switches, PPP

Unit-6: Security in Communication Networks **6 Hours**

Network Security, cryptography, authentication, Integrity, firewalls, attacks and countermeasures,

Text books:				
1	**Data Communication and Networking**	Behrouz Forouzan	**Fifth Edition**	McGraw Hill
2	**Computer Networking A top down Approach Featuring and Internet**	James F. Kurose	**Third Edition**	**Pearson**
Reference books:				
1	**Computer Networks**	Andrew Tanenbaum	**Fourth Edition**	Prentice Hall PTR

VII Semester
ET2446 – PE VI: PLCs & SCADA

Prerequisites	**----------**
Course Objective **Students should be able to:** 1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Understand the working of Timing Circuits, Programming techniques with Input/Output Instructions and Addressing, overview of PLC timers and their application in industrial control. 3) Understand the PLC Counters, Data Comparators Instructions and application of sequencers based on these systems 4) Understand the networking using PLC systems and peripherals advanced PLC programming languages which are widely used in industrial automation.	**Course Outcome** **Students will be able to:** 1) Describe automation, its importance, expectations from automation and applications in industry. 2) Describe and analyze Timing Circuits and Program PLC using ladder diagram for various applications. 3) Analyze and apply various instructions of PLC, PLC counters. 4) Explain the basic concepts of networking using PLC systems and peripherals

UNIT-1 :-

Introduction to Programmable Controllers

Definition , A Historical Background , Principles of Operation , PLCs Versus Other Types of Controls , PLC Product Application Ranges, Ladder Diagrams and the PLC , Advantages of PLCs, PLC Sizes and Scopes of Applications

Processors, the Power Supply, and Memory

Introduction , Processors, Processor Scan , The System Power Supply , Programming Devices, Memory Overview , Memory Types, Memory Structure and Capacity. Configuring the PLC Memory—I/O Addressing.

The Input/Output System

Introduction to Discrete I/O Systems , I/O Rack Enclosures and Table Mapping , Remote I/O Systems PLC Instructions for Discrete Inputs, Types of Discrete Modules, PLC Instructions for Discrete Outputs Overview of Analog Input Signals , Analog Input Connections, Special Analog, Temperature, and PID Interfaces.

(06Hours)

UNIT-2:

Introduction to Programming Languages

Types of PLC Languages, Ladder Diagram Format , Ladder Relay Instructions , Ladder Relay Programming, IEC 1131-3 Programming Languages – FBD/ST/IL/SFC, Control Task Definition, Control Strategy , Implementation Guidelines.

Programming Instructions

NO-NC & coil based instructions(Relay based Instructions), Timers, Counters, Compare, Mathematics, Jump and Subroutines, Scaling (Analog Instructions).

Installation & Wiring

I/O Installation, Wiring, and Precautions ,PLC Start-Up and Checking Procedures.

(06 Hours)

VII Semester
ET2446 – PE VI: PLCs & SCADA

UNIT-3:

Introduction to SCADA

Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, the components of a SCADA system, Types of SCADA,

SCADA Programming

Graphics Building & Simulation, Tag types & Management, Tools, Programming techniques, Alarms & Trends Configuration, Screen Navigation, Properties, Scripts, Security.

Database & Controller Connectivity

Using Spreadsheets to Create Points Lists, ODBC Server, Excel communication, Creating Records for data, PLC connectivity through interface and protocols.

(06 Hours)

UNIT 4:

Introduction to HMI

FOUNDATIONS OF HMI: The Human: History of User Interface Designing, Types, Features, General architecture ,Conventional & current HMI systems, Difference between HMI & SCADA, HMI Hardware interfaces, Practical uses in Industries.

Programming HMI

Software Description, Tools Handling, Screen Developments, HMI objects & Object Libraries, Alarms generation, Trends Plotting & its usages, Security & Recipe Management. HMI interfacing with PLC's.

(06 Hours)

Unit 5:

Data comparison instructions & PLC sequencers

Data comparison instructions such as EQU, LES, and GRT,. Introduction to the principles of Data Transfer, Move Instruction, Introduction to Shift Registers & Its types.Purpose and application of PLC Sequencers, Masking techniques and the various types of Sequencers, SQO and SQC instructions.

(06 Hours)

Unit 6:

Distributed Control System:

Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

(06 Hours)

Text books:				
1	Introduction to Programmable Logic controllers		Gary Duning	Delmar Thomson Learning
2	SCADA: Supervisory Control and Data Acquisition	Fourth Edition	Stuart A Boyer	ISA 1999

Reference books:				
1	Programmable Logic Controllers	W.Bolton	Elsevier Publisher	

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

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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

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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

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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

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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

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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		

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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

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

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

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

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.

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INFORMATION TECHNOLOGY

III SEMESTER

IT2203	Object Oriented Programming		L=3	T=0	P=0	Credits=4
Evaluation Scheme	MSEs-	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	
Prerequisite Courses						

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

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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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

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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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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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.

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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

			1.00	Applicable for AY2019-20 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

BE SoE and Syllabus 2018

INFORMATION TECHNOLOGY

IV SEMESTER

IT2255	Operating Systems		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	
Prerequisite Courses						

* 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

V Semester

IT 2301 - Data Base Management Systems

Objective	Course Outcome
The student should be able to 1) Understand Database management system's basic operations & design process using ER, EER diagram, SQL and with the use of Normalization. 2) Understand Transaction with ACID properties and their implementation. 3) Understand various storage structures, Query Processing and query optimization techniques to build a robust database management system. 4) Understand concurrency control mechanism using various concurrency control protocols.	**On completion of this course, the student will be able to** 1) To obtain sound knowledge in the theory, principles and applications of database management system. 2) Design and develop data model given their specifications and within performance and cost constraints. 3) Acquire and understand new knowledge, use them to develop data centric application and to understand the importance of lifelong learning. 4) Perform experiments in different disciplines of database management system.

Unit No.	Contents	Max. Hrs.
1	Introduction to Database Management System: General File System vs. DBMS, Data Abstraction, Data Independence, Keys, Data Modeling using the Entity Relationship(ER) Model, The enhanced Entity Relationship(EER) model.	8
2	Relational Model: Structure of Relational Databases, The Relational Algebra and Relational Calculus(TRC & DRC) Introduction to SQL Programming: (DDL, DML, Joins, Nested Queries/Sub Queries/Inner Queries) Integrity Constraints.	7
3	Database Design: Functional Dependency and Normalization for Relational Databases, Desirable properties of decomposition.	7
4	Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions. Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results.	8
5	Transaction Processing: Introduction to Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels.	8
6	Concurrency control Techniques: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, and Timestamp-Based Protocols. Data Control Language: GRANT, REVOKE; Concept of Triggers and Views.	8

V Semester

IT 2301 - Data Base Management Systems

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Database System	5th Edition(2006)	Elmasri & Navathe	
2	Database System Concepts	6th Edition, (2010)	Abraham Silberschatz, Henry F. Korth and S. Sudarsha	McGraw-Hill Education
3	Database Management Systems	Second Edition	Raghu Ramakrishnan, Johannes Gehrke	McGraw-Hill, 2002

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database in Depth – Relational Theory for Practitioners		C.J. Date	O`Reilly Media, 2005
2	Database design, Application Development and Administration	4th Edition(2008)	Michael Mannino	

V Semester

IT 2303 - Software Engineering

(Self-learning- online)

Objective	Course Outcome
The student should be able to 1. To understand the different Software Process Model and Architectural Style for Developing a Software 2. To acquire knowledge of Different Software Testing Techniques 3. To understand the various UML Diagrams 4. To understand different Tools and Techniques for Engineering Practice.	**On completion of this course, the student will be able to** 1. Analyze and evaluate the different software process model and appropriate architectural style while developing a software 2. Understand and Apply the software testing techniques in a variety of ways to test the software. 3. Analyze and design various UML diagram and UML based design and analysis with the help of various diagrams. 4. Demonstrate an ability to use the techniques and tools necessary for engineering practice

Unit No.	Contents: NPTEL Videos As Per Syllabus	Max. Hrs.
1	1.Introduction to Software Engineering ,2 Introduction to Software Engineering,3 Overview of Phases 4 Overview of Phases,5 Requirements Engineering / Specification,25 Software Evolution, 8 Systems Modeling Overview.	8
2	17 Architectural Design,16 Class and Component Level Design, 9 Process Modeling - DFD , Function Decomp,10 Process Modeling - DFD, Function Decomp ,11 Data Modeling - ER Diagrams, Mapping , 15 Design Patterns, 14 Software Design - Primary Consideration, 26 Agile Development.	8
3	18 Software Testing – I, 19 Software Testing – II.	6
4	21 Software Metrics and Quality, 22 Verification and Validation, 29 Introduction to Project Management 30 Project Scope Management, 31 Project Time Management,32 Estimation – I,33 Estimation - II 34 Project Quality Management,35 Quality Management Systems – I,36 Quality Management Systems 37 Project Configuration Management,38 Project Risk Management,39 Other PM Processes, 13 Production Quality Software – Introduction.	7
5	12 Data Modeling - ER Diagrams, Mapping.	7
6	23 Case Study,24 Case Study, 27 Software Reuse,28 Reuse Continued	6

Semester

IT 2303 - Software Engineering

(Self-learning- online)

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Software Engineering -A Practitioner's Approach	Seventh Edition	Roger S. Pressman	Pressman
2	Object Oriented Software Engineering	2nd Edition,2005	Lethbridge and Pearson	Pearson Education

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Software Engineering	10th Edition, 2014,	I. Somerville	Oxford University Press
2	An integrated approach to software Engineering'	3rd Edition,1991,	Dr. Pankaj Jalota	Narosa Pub

Reference: NPTEL Guru Course Name: Software Engineering

Instructors: Prof. Rushikesh K Joshi , Prof. Umesh Bellur , Prof. N. L. Sarda, IIT Bombay

http://122.15.102.21/LocalGuru

Username : ycce, Password: ycce

http://122.15.102.21/LocalGuru/listLectures.php?cid=1daf52be74f11d45&lid=&opt=&pg=1

V Semester

PE-1: IT 2311 - Web Programming

Objective	Course Outcome
The student should be able to 1. Get familiar with basics of HTML, HTML tags, DHTML CSS. 2. Get familiar with client server architecture and able to develop a web application using java technologies 3. Get familiar with markup languages with their structures and syntax. 4. To get familiarised with PHP frame work	On completion of this course, the student will be able to 1. Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS. 2. Understand client server architecture and Develop interactive web pages using java script and client and server side programming. 3. Understand the concept of Markup languages and Make the use of mark up languages in development of web pages. 4. Understand the concepts of PHP and Develop web applications using PHP

Unit No.	Contents	Max. Hrs.
1	Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames	8
2	Dynamic HTML (DHTML): Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections	8
3	Scripting Languages:- Java Script objects and forms, server side and client side scripting languages	6
4	XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
6	Introduction to AngularJS, AngularJS Expressions: Numbers, Strings, Objects, Arrays, Expressions using {{ }} and ng-bind. Modules: Creating a module, adding a controller & directive, myApp.js, myCtrl.js, Loading library. Directives: Data Binding, ng-init, ng-repeat, ng-app & ng-model directives, custom directives.2 way binding, Validating User Input, Status, ng-empty, ng-touched, ng-valid, ng-pending. Data Binding: Synchronization between model and view. AngularJS Controllers: ng-controller, Controller Methods, External Files.Scope: $scope, understanding the scope, $rootScope	6

V Semester

IT 2311 - PE-1: Web Programming

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The Complete Reference HTML and XHTML		Thomas A.Powell	McGraw Hill Pub
2	Learning angular JS		Dayley, Brad Dayley	

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites		Robin Nixon	

V Semester

IT 2313 - PE-1: Data Analysis and Statistics

Objective	Course Outcome
The student should be able to 1. Know basics of data analysis using statistics and probability. 2. Become familiar with different statistical methods. 3. Determine parameters given in problem statement, analyze it and find the solution and Draw inference from obtained solutions and know applications of data analysis. 4. Use and explore a tool to perform data analysis using it	On completion of this course, the student will be able to 1. Apply fundamental concepts of statistics and probability for data analysis(PO1-3) 2. Apply appropriate statistical methods on simple datasets(PO2-3) 3. 3.Formulate and solve problems in a systematic manner and Interpret output obtained from statistical analysis on datasets.(PO2-3, PO4-3) 4. Obtain hands on experience with some popular software (like R)for analysis and visualization of data (PO2-3,PO4-3,PO5-3)

Unit No.	Contents	Max. Hrs.
1	INTRODUCTION TO STATISTICS & PROBABILITY: Statistics,–Definition, Types. Types of variables– organizing data , Descriptive Measures. Basic definitions and rules for probability, conditional probability independence of events, Baye's theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.	6
2	SAMPLING DISTRIBUTION: Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques.	7
3	ESTIMATION THEORY: Estimation: Point and Interval estimates ,confidence intervals ,calculating interval estimates for population parameters of large sample and small samples, determining the sample size	6
4	TESTING OF HYPOTHESIS: Hypothesis testing: statistical hypothesis null hypothesis, tests of hypothesis and significance, type I and type II errors, one tailed and two tailed tests , p-value one sample tests for means and proportions of large samples (z-test), one sample tests for means of small samples (t-test), Chi-square tests for goodness of fit. Analysis of variance.	7
5	NON-PARAMETRIC METHODS: Sign test for paired data. Rank sum test. Mann –Whitney U test and Kruskal Wallis H test. One sample run test, rank correlation. Kolmogorov-Smirnov –test.	7
6	REGRESSION and CORRELATION: Estimation of regression line by least square method, linear and multiple regressions, Correlation analysis, Time series analysis: components of Time series, Variations in time series, trend analysis.	7

V Semester

IT 2313 - PE-1: Data Analysis and Statistics

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Probability and Statistics ,	Third edition .	Murray R. Spiegel, John J.Schiller, R AluSrinivasan	Mc Graw Hill education
2	Statistics for Management, ,	7th edition	Levin R.I. and Rubin D. S.	Prentice Hall India Pvt.Ltd., New Delhi, 2001

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Business forecasting	8th Edition	John Hanke,Dean W. Wichern	Prentice Hall India

V Semester

IT 2315 - PE-1: Customer Relationship Management

Objective	Course Outcome
The student will study 1. To understand the principles of CRM and concepts of Salesforce CRM 2. To Understand object, Tabs and Security Features in Salesforce CRM 3. To Understand Automated Business Process and Approval Process in CRM 4. To Understand Advanced Featured in Salesforce CRM	On completion of this course, the student will be able to 1. Analyze and Evaluate the CRM and Concepts of Salesforce CRM 2. Understand and Apply the Security Features of Salesforce CRM 3. Analyze and Evaluate the Automated Business Process and Approval Process in CRM 4. Understand and Apply the Advanced Features in Salesforce CRM

Unit No.	Contents	Max. Hrs.
1	**Introducing the Force.com Platform**. - Introduction to the Force.com Platform. The Basics of an App's User Interface. The Benefits of a Force.com Data-Centric, Collaborative Apps, The Technologies Behind a Force.com Platform App, Multitenant Architecture, A Metadata-Driven Development Model, Apex . Custom User Interface Mobile, AppExchange.	7
2	**Objects and Tabs:** Introduction to Objects ,The Position Custom Object, Introducing Tabs , Setup Detail Pages and Related Lists ,Introduction to Fields , Advanced Fields, Data Validation, and Page Layouts , Adding Advanced Fields , Introduction to Picklists , Field Dependencies , Dependent Picklist ,Custom Formula Fields , Dynamic Default Values , Validation Rules ,Page Layouts , Page Layout Editor Group Fields Edit Field Properties , Page Layouts , Compact Layouts.	7
3	**Relationships:** Introduction to Relationship Custom Fields, Page Layout Properties, Record Highlights, Introduction to Search Layouts, Additional Search Layouts Managing Review Assessments, Introduction to Roll-Up Summary Fields, Many-to-Many Relationship, Customizing Related Lists in a Many-to-Many Relationship.	6
4	**Securing and Sharing Data:** Controlling Access to Data in App, Data Access Concepts. Controlling Access to Objects, Introduction to Profiles ,Standard Profiles ,Introduction to Permission Sets ,Profiles and Permission Sets ,Introduction to Field-Level Security ,Controlling Access to Records, , Set Org-Wide Defaults, Introduction to Hierarchies ,Comparing Roles, Profiles, and Permission Sets ,Role, Introduction of Sharing Rules , Define a Public Group ,Define Sharing Rules ,Introduction to Manual Sharing , Manual Sharing Rule ,Displaying Field Values and Page Layouts According to Profile ,Overriding Sharing with Object Permissions ,Delegated Administration Groups .	8
5	**Automating Business Processes**: Introduction to Process Builder, Process Builder: A Closer Look Creating a Process That Updates Field Values, Introduction to Queues, Introduction to Scheduled Actions, Email Alerts, Introduction to Email Templates, Introduction to Approvals, Planning for Approval Processes. Analyzing Data with Reports and Dashboards, Introduction to Reports, Report Formats	7
6	**Apex and Lightning Aura:** Introduction to Apex, Collections, SOQL and SOSL, DML Operations, Controllers In APEX Using Apex Class and Triggers, Asynchronous APEX, Batch APEX, Introduction to Aura component, attributes handling in Aura component.	7

V Semester

IT 2315 - PE-1: Customer Relationship Management

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Force.com Platform Fundamentals An Introduction to Custom Application Development in the Cloud		Phil Choi, Chris McGuire Caroline Roth	salesforce.com
2	Salesforce Handbook Paperback – 20 Mar 2011		Wes Nolte, Jeff Douglas	Publisher: Lulu.com

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Salesforce CRM: The Definitive Admin Handbook Paperback –	Second Edition	Paul Goodey	Packt Publishing Limited

VI Semester

GE2311 - Fundamentals of Management

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management

Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management

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

UNIT-4: Project Management

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

UNIT-5: Marketing Management

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

VI Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

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

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

VI Semester

IT2351 - Design & Analysis of Algorithms

Objective	Course Outcome
The student should be able to 1. Study asymptotic notations and recurrence relation. Analysis of iterative and recessive algorithms, complexity of algorithms 2. Use of various algorithmic design techniques in problem solving 3. Performance analysis (time and space complexities) of algorithms in best, worst and average cases. 4. How to synthesize and design efficient algorithms for real world problems	**After completion of the course students will be able to** 1. Understand asymptotic analysis of iterative and recursive algorithms, complexity of algorithms 2. Apply important algorithmic design techniques for problem solving 3. Analyze the performance of algorithms 4. Synthesize and design efficient algorithms for real world problems

Unit No.	Contents	Max. Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions.	8
2	Asymptotic notations of analysis of algorithms, analyzing control structures, worst case and average case analysis, amortized analysis, External Sorting, lower bound proof.	7
3	Divide and conquer basic strategy, quick sort, merge sort etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, optimal binary search trees, Matrix-chain Multiplication, traveling salesman problem.	8
5	Connected components, Branch and bound, Backtracking basic strategy, 8 – Queen's problem, graph coloring, Hamiltonian cycles etc.	8
6	NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook's Theorem, decision and optimization problems, polynomial reduction	8

VI Semester

IT 2351 - Design and Analysis of Algorithms

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Algorithms	2nd Edition	Horowitz, Sahani, Rajsekharan	Silicon Press
2	Introduction to Algorithm	3rd Edition, 2009	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	MIT press
3	Fundamentals of Algorithms	1st edition,1995	Brassard, Bratley	Prentice Hall
4	The Algorithm Design Manual	2nd Edition	Steven S. Skiena	Springer

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation,	3rd Edition, 2013	Michael Sipser	Cengage Learning
2	Algorithms	1st Edition, 2006	S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani	
3	The art of Computer programming Vol. 3	2nd Edition, 1998	Donald E. Knuth	Addison-Wesley

VI Semester

PE-II: IT 2361 - Machine Learning

Objective	Course Outcome
The student should be able to 1. To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To understand different methods of evaluation of machine learning models	After undergoing the course, student will be able to: 1. Understand various models of supervised and unsupervised learning 2. analyze a problem and identify the machine learning algorithm appropriate for its solution 3. apply supervised learning for the given set of labelled samples and design the model to meet the desired needs 4. apply unsupervised learning for the given set of samples, and design the model to meet the desired needs

Unit No.	Contents	Max. Hrs.
1	**Introduction to machine learning.** What Is Machine Learning, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Supervised and Unsupervised Learning, Reinforcement Learning, Generalization, Over-fitting, and Under-fitting	(6)
2	**Supervised Learning-1:** k-Nearest Neighbors, linear Models, Naive Bayes Classifiers, Decision Trees	(6)
3.	**Supervised Learning-2:** Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers, The Decision Function, predicting Probabilities, Uncertainty in Multiclass Classification, multivariate classification and regression.	(6)
4	**Unsupervised Learning**: *k*-Means Clustering , Expectation-Maximization Algorithm, Supervised Learning after Clustering , Hierarchical Clustering, Choosing the Number of Clusters	(6)
5	**Design and Analysis of Machine Learning Experiments:** Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Bootstrapping, Measuring Classifier Performance, Hypothesis Testing, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms.	(5)
6	**Advances in Machine Learning**: Combining multiple learners, bagging and boosting, introduction to learning using Neural networks, shallow and deep networks.	(6)

VI Semester

PE-II: IT 2361 - Machine Learning

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Machine Learning, Second Edition		Ethem Alpaydın	The MIT Press
2	Introduction to Machine Learning with Python, A Guide for Data Scientists		Andreas C. Müller and Sarah Guido	ORIELLY

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Machine Learning		Tom M. Mitchel	McGraw Hill

VI Semester

IT 2363 - PE-II: Business Intelligence

Objective	Course Outcome
Student will : 1. Understand the business relevance and technical basics of business intelligence (BI), knowledge management (KM), and decision support and describe how OLAP is different from OLTP. 2. Appreciate the use of SQL for BI 3. Understand principles of dimensional modeling. 4. Understand Business intelligence system architecture, its building blocks, life cycle of a typical BI project. 5. Get acquainted to BI tool	After completion of the course: 1. Students will be able to : ➢ Assemble BI as a Process, identify its application in various domains and functional area, its roles and responsibilities. ➢ Identify functions of building blocks in N_tier BI ecosystem ➢ Identify different stages in Lifecycle of a BI project. ➢ Differentiate between traditional BI and self service BI **(PO1-2)** **2.** Apply SQL as a universal language for BI **(PO23)** **3.** Model a business scenario; identify the metrics, indicators, various dimensions, and aggregation strategies and make recommendations to achieve the business goal **(PO3-3)** **4.** Obtain hands on experience with some popular BI software for analysis, reporting, visualization of results **(PO1-2, PO2-2,PO3-2,PO5-3)**

Unit No.	Contents	Max. Hrs.
1	**Introduction to Business Intelligence** What is business intelligence, why do we need BI, EIS,MIS,DSS& BI, information pyramid-data, information, Knowledge & intelligence. Basis For operational, tactical & strategic decision making , OLTP vs. OLAP, Requirement gathering in BI through business question BI in various domains and functional area.	6.
2	**SQL the universal language for Business Intelligence** Introduction to RDBMS, Language for retrieving data from a database, various clauses in a SQL retrieving data from multiple tables- joins filtering, sorting & grouping datasets, Introduction to DDL & DML statements, various built- in functions in SQL, Use of sub-queries, data dictionary and dynamic SQL.	7

VI Semester
IT 2363 - PE-II: Business Intelligence

3	**Principles of Dimensional modeling** Foundation for fact based decision making, star and snowflake schema, Pros& cons of the star/snowflake schema dimensional model, Slowly changing dimension tables, Fact-less fact strategy, Time dimension.	6
4	**Business Intelligence system architecture** Need for enterprise class business intelligence infrastructure, The BI ecosystem, Building blocks of a n- tier BI system-servers & communication protocols, The central repository-metadata, Information consumption user interfaces-desktop vs. web vs. Mobile. Open architecture, Scalability, performance in BI-in memory analytics.	7
5	**BI Project Lifecycle** Typical BI project lifecycle, Requirements gathering & analysis-functional & non- functional requirements, reports and dashboards design- mock – up and storyboarding, Testing in a BI project, BI project deployment, Post production support, Applications of BI, BI best practices	7
6	**Self-service Analytics** What is Self-service Analytics, What are the use cases of self-service analytics, Business Paradigm vs IT paradigm and the Paradigm Shift with self-service analytics, Challenges of Self-service Analytics, Introduction to MicroStrategy Desktop – Overview	7

VI Semester

IT 2363 - PE-II: Business Intelligence

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Data Warehousing ETL toolkit, Indian edition.		Ralph Kimball and Margy Ross	
2	Fundamentals of Business Analytics2nd edition		R. N. Prasad, Seema Acharya	Wiley.
3	Business Intelligence: The Savvy Manager's Guide,2nd Edition		David Loshin	

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Business intelligence for the enterprise		Mike Biere,	IBM

VI Semester

IT 2365 - PE-II: Internet of Things

Course Objective	Course Outcome
The student will study 1. The students will be able to describe IoT as a Process, its architecture and Management, compare and contrast old and new challenges in IoT 2. The students will be able to Apply various communication protocol and its building blocks in IoT applications. 3. The students will be able to Illustrate relevance of IoT with cloud and Web and analyze various security challenges and also evaluate various control strategies for the same 4. The students will be able to create, Design and Develop various applications based on IoT concepts	On completion of this course, the student will be able to 1. Students will able to describe various communication protocol and its building blocks. 2. Students will able to describe relevance of IoT with cloud and the application areas of IOT. 3. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor 4. Able to understand building blocks of Internet of Things and characteristics. 5. The students will study and implement IoT project by studying different IoT components, electronic board and their uses.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, The 6LoWPAN,Domains of IOT, M2M vs IOT, Management of IOT, IOT Platforms, IOT Languages, IOT Physical Systems, Tools for IOT	8 hrs
2	IoT Communication Protocols: Protocol Standardization for IOT, Issues with IOT Standardization, M2M and WSN Protocols, SCADA and RFID Protocols, IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Unified Data Standards.	8 hrs
3	Web of Things: Web of Things versus Internet of Things, The Two Pillars of the Web, Architecture Standardization for Web of Things, Platform Middleware for Web of Things, Unified Multitier Web of Things Architecture, Web of Things Portals and Business Intelligence	7 hrs

VI Semester
IT 2365 - PE-II: Internet of Things

4	Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards, Cloud Providers & Systems, Mobile Cloud Computing, Cloud of Things Architecture. Models of Implementation, Service Level Agreement (SLA), Examples of Applications.	7 hrs
5	Security Aspects: Security in IOT: Introduction, Purpose, Issues, Challenges. IOT Threats to Individual and Organizations, Challenges to Secure IOT Development, Recommended Security Controls. Cybersecurity and IOT. Layered Security Protections to Defend IOT Assets.	7 hrs
6	IoT Applications: IOT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IOT electronic equipment. Use of Big Data and Visualization in IOT. Role of IOT for Increased Autonomy and Agility in Collaborative Production Environments, Resource Management in the IOT.	7 hrs

Text Books

SN	Title	Edition	Authors	Publisher
1	Internet of Things: A Hands-on-Approach		Arshdeep Bahga & Vijay Madisetti	Orient Blackswan Publisher
2	The Internet of Things: Key Applications and Protocols		Olivier Hersent, David Boswarthick & Omar Elloumi	Wiley publication

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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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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

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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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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

Communication Skills-GE2107

Academic Session-2020-21

Assignment- Presentation Skills

Object :- to make student camera friendly and to make them communicate effectively by using proper vocal nuances for effective & apt communication

Task:- A common script was given to each section on which they have to Prepare an audio visual cli; either by using a manuscript mode or an extempore mode of delivery

Purpose: - To test the vocal and presentation skills

Section Even	BOOK	CHAPTER
P	*Who will Cry when You will Die? (Robin Sharma)*	*Increase your value (65)*
Q		*Carry a goal card (68)*
R		*Be More Than your mood (69)*
S		*Imagine a richer reality (75)*
		Become the CEO of your life

{Note:- The audio visual should be clear}

Ms. Meenal R. Kale

(Course Teacher)

Communication Skills-GE2107

Academic Session-2020-21

Assignment- Presentation Skills

Object :- to make student camera friendly and to make them communicate effectively by using proper vocal nuances for effective & apt communication.

Task:- A common script was given to each section on which they have to Prepare an audio visual cli; either by using a manuscript mode or an extempore mode of delivery

Purpose: - To test the vocal and presentation skills

Section	BOOK	CHAPTER
A	*Who will Cry when You will Die? (Robin Sharma)*	*Increase your value (65)*
B		*Carry a goal card (68)*
C		*Be More Than your mood (69)*
D		*Imagine a richer reality (75)*
E		*Become the CEO of your life*

{Note:- The audio visual should be clear}

Ms. Meenal R. Kale
(Course Teacher)

ıctions Student work

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MAYANK ASHTEKAR



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JAY CHARDE

PARTH CHATI

SAMRUDDHI CHAWARE

AKANKSHA CHAWHAN

NITIN BHAVE



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RAJAS CHANDURKAR



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TANUJA DARNE



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AROM DHABE



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YASHIKA DHOLE

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YASH BARAPATRE



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AMIT BOBADE



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RISHABH CHOUDHARI



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YeshwantraoChavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Accredited 'A' Grade by NAAC
Hingna Road, Wanadongri, Nagpur-441110

Board of Studies (General Engineering)

Communication Skills Syllabus
GE- 2107
Academic session 2020-21

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"**

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BOS Chairman,

General Engineering,

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Nagar Yuwak Shikshan Sanstha's

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

Syllabus 2020-2021

GE 2311- Fundamentals of Management

5th Semester

GE 2311	**Fundamentals of Management**	**L=3**	**T=0**	**P=0**	**Credits=3**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	30	40	100	3 Hrs

Objectives	Outcomes Students will be able to
To introduce the fundamentals and legal provision of management	Explain the legal provision and function of management
To introduce the Human Resource and Financial practice of Organisation	Analyze the role of Human Resource and Financial Management in the Organisation
To introduce the Project Management	Analyze the Project life Cycles
To provide knowledge of Marketing activities of Management	Identify tools and techniques for the marketing of goods and services

Unit – 1 - Principle of Management

Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up ofthe Company

UNIT-3: Human Resource Management

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

UNIT-4: Project Management

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

UNIT-5: Marketing Management

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

UNIT-6: Financial Management

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

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning,Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

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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	30	40	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

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V&VI-Semester B.E. (Open Elective)

GE-2369	Introduction to Spanish Language			L=3	T=0	P=0	Credits =3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objectives	Course Outcomes : Students will be able to
Learning Basic Vocabulary	Alphabets, Numbers, Days of the Week, Months of the Year, Seasons, Greetings, Professions
Building on Basic Grammar Skills	Gender of the words, Articles, Subject pronouns, Verbs, Sentence building using Verbs and nouns
Learn to build very simple Sentences	Very basic sentences like self-introduction – Name, Age, Profession etc. Ordering food at restaurants.
Describing people, house, places	Learning Adjectives, Demonstrative adjectives to describe people, house and other places.
Write about hobbies, likes and dislikes, daily routine	Learning to write about leisure activities, what are the likes and dislikes and describing daily routine activities.
Speaking, Listening and Practical Exercises	Playing Videos to practice listening skills. Conversation practice and Role play to enhance speaking skills.

Unit-I : Introduction and basic grammar - 6 hours

- Learning about Alphabets, Numbers
- Days of the week, Months of the year, Seasons
- Common expressions, Professions, Colors
- Subject Pronouns, SER verb
- Articles, Adjectives, Demonstrative Adjectives

Unit-II : Learning to build simple sentences- 6 hours

- ESTAR verb to describe placements
- Prepositions of place
- SER ESTAR differences and application
- Using Hay for description
- Build simple sentences about yourself, your friends, classroom objects, household objects

Unit-III : Question words, Plurals, Present Tense and Present Continuous Tense of AR verbs - 7 hours

- Question words of What, who, where, which, why, when, how
- Build conversation skills by answering questions
- Making plurals of sentences
- Learning conjugations of AR verbs in Present Tense
- Learning Present continuous tense of AR Verbs
- Learning to Present oneself

Unit- IV : ER Verbs, Stem Changing Verbs and Tener - 7 hours

- Learning conjugations of ER verbs in Present Tense
- Learning Present continuous tense of ER Verbs
- Learning Food vocabulary
- Learning Basic Conversation at restaurant
- Stem changing Verbs conjugations
- Tener Verb to talk about age, describe family

Unit-V : SaberConocer, Time, IR Verbs, Leisure activities- 7 hours

- Saber Conocer to talk about abilities and personal acquaintance
- Learn to say Time in Spanish and Time related expressions
- Learning conjugations of IR verbs in Present Tense
- Learning Present continuous tense of IR Verbs
- Speak about activities what you do in leisure using all groups of verbs.

Unit-VI : Obligations, Prepositions, Possessive Adjectives, Gustar, Possessive Pronouns and Daily routine with reflexive verbs - 7 hours

- Talk about what has to be or should be done
- Learn prepositions for connecting sentences
- possessive adjectives to learn about my, your, his her, our.
- Learn likes and dislikes with Gustar
- Possessive pronouns to learn about mine, yours, ours.
- Reflexive verbs to Speak about daily routine.

Text Books & Reference Books:

Clan 7, Listos

Aula1, Chicoschicas

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V&VI-Semester B.E. (Open Elective)

GE-2370	Introduction to French Language			L=3	T=0	P=0	Credits =3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objectives	Course Outcome: At the end of the course students will be able to:
The objective of this course is to impart preliminary knowledge about the French language and civilization and is therefore of an elementary level. At the end of the one year course, the student is expected to acquire the following skills: 1) Elementary communication skills, based on aural and written comprehension of common words and simple sentences in French. 2) Simple oral and written expression.	a) Understand simple words and expressions spoken slowly and distinctly in French and used in day-to-day situations related to the student's immediate environment. b) Read and understand common words and sentences in French. c) Say a few words in French in conversations related to simple day-to-day situations.

Unit-I : Grammar I – 6 hours
- French alphabets
- Pronunciation Guide
- Indefinite and definite articles
- Present tense: -er verbs (regular)

Unit-II : Grammar II – 6 hours
- etre, avoir (irregular verbs)
- Nouns (singular & plural)
- Adjectives
- Pronouns (subject)

Unit-III : Vocabulary – 6 hours
- Numbers (1-100)
- Days of the week
- Months of the year
- Nationalities
- Colours
- Adjectives words for common use used

- Nouns words for common use used

Unit-IV : Communication skills I – 7 hours

- Greetings
- Presentation, introduction

Unit-V : Communication skills II – 7 hours

- Interrogation relating to everyday situations
- Replying to simple questions.

Unit-VI : Civilization – 7 hours

- Day to day life, eg.
- Classroom
- Friends
- Family
- School
- Vacations
- Introduction to France: Geography.

Text Books:

1) Ranjit, Mahita& Singh, Monica . `Apprenons le frangais', Part 1. Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007.

2) Ranjit, Mahitha&Batra, Simran. 'Cahier d'exercices', (Apprenons le francais) 1. Saraswati Book House Pvt. Ltd., New Delhi, 2007.

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Department of Applied Physics

Academic Year 2020-21

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 codes : GE2106 **Name of the courses : Engineering Physics Lab.**

List of Experiments

Expt.No.	Name of Experiment	CO	PO
1.	To study variation of Hall voltage with current and magnetic field, and to determine Hall coefficient, concentration and polarity of charge carriers.	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

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YCCE

First Year BE

DEPARTMENT OF CHEMISTRY

2020-21

Name of Course: Engineering Chemistry Practical **Course code: GE 2104**

EXPERIMENT NUMBER	TITLE OF THE EXPERIMENT	CO	PO
1	Estimation of hardness	CO-1 CO-5	PO1 PO2 PO4 PO7
2	Estimation of alkalinity	CO-1 CO-5	PO1 PO2 PO4 PO7
3	Estimation of copper	CO-5	PO1 PO2 PO4 PO7
4	Estimation of iron	CO-5	PO1 PO2 PO4 PO7
5	Determination of viscosity	CO-3	PO1 PO2 PO4 PO7
6	Analysis of coal	CO-3	PO1 PO2 PO4 PO7
7	Determination of Flash point by Pensky-Marten's apparatus	CO-3	PO1 PO2 PO4 PO7
8	Determination of ion exchange capacity of resin	CO-1	PO1 PO2 PO4 PO7
9	Determination of pH	CO-1	PO1 PO2 PO4 PO7
10	Preparation of urea formaldehyde resin	CO-5	PO1 PO2 PO4 PO7

11	Workshop on analytical techniques	CO-1	PO1 PO2 PO4 PO7
12	Mini project	CO-4	PO1 PO7
13	Initial and final setting time of cement	CO-5	PO1 PO2 PO4 PO7

PO	Expt. No.	CO	Statement of Course Outcomes
PO1 PO2 PO4 PO7	1, 2,8,9, 11	CO-1	Assess qualitative and quantitative aspects of water as a conventional material for industrial and domestic applications.
PO1		CO-2	Apply the knowledge of basic electrochemistry to understand battery technology, corrosion process and preventive techniques.
PO1 PO2 PO4 PO7	5,6,7	CO-3	Know the basics and assess analytical aspects of industrial materials like fuels and lubricants for efficient utilization.
PO1 PO7	12	CO-4	Recognize the significance of cement and advanced engineering materials in technological applications.
PO1 PO2 PO4 PO7	1,2,3,4 ,10,12	CO-5	Analyze and generate analytical and instrumental techniques.

Head
Department of Applied
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...nt no	CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1,2,8,9, 11	CO1	3	2		2			2					
	CO2	3											
5,6,7	CO3	2	2		2			2					
12	CO4	2						2					
1,2,3,4, 10,12	CO5	3	3		2			3					

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

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Mapping of Courses to Employability/ Entrepreneurship/ Skill Development

1.1.3 Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during the year 2020-21

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
1	Engineering Mathematics III	GE2201	Employability
2	Electronic Devices	EE2201	Employability
3	Signals and Systems	EE2203	Employability
4	Advanced Mathematical Techniques	GE2204	Employability
5	Electromagnetic Fields	EE2257	Employability
6	Electronic Circuit	EE2251	Employability
7	Microcontroller & its application	EE2253	Employability
8	Analog Communication	EE2255	Employability
9	Fundamentals of Management	GE2311	Employability
10	Digital Signal Processing	EE2301	Employability
11	Lab: Digital Signal Processing	EE2302	Employability
12	Analog Integrated Circuits & Its Applications	EE2303	Employability
13	Lab: Analog Integrated Circuits & Its Applications	EE2304	Employability
14	PE I: Computer Communication Network	EE2311	Employability
15	Lab: PE I: Computer Communication Network	EE2312	Employability
16	PE I: Embedded Systems	EE2313	Employability
17	Lab :PE I: Embedded Systems	EE2314	Employability
18	PE I: Algorithm & Data Structure	EE2315	Employability
19	Lab :PE I: Algorithm & Data Structure	EE2316	Employability
20	PE I: Applied Machine Learning	EE2317	Employability
21	Lab :PE I: Applied Machine Learning	EE2318	Employability
22	OE I: Fuzzy Logic & Neural Network	EE2331	Employability
23	OE I: Basics of Analog and Digital Communication Systems	EE2332	Employability
24	OE I: Biomedical Instrumentation	EE2333	Employability
25	OE II: Data Acquisition & Signal Conditioning	EE2341	Employability
26	OE II: Microprocessor Programming	EE2342	Employability
27	OE II: Consumer Electronics	EE2343	Employability
28	Fundamental of Economics	GE2312	Employability
29	Control System Engineering	EE 2351	Employability
30	Transmission Lines and Wave Guides	EE2352	Employability
31	Digital Communication	EE2353	Employability
32	Lab: Digital Communication	EE2354	Employability
33	PE II: Internet of Things	EE2361	Employability
34	Lab: PE II: Internet of Things	EE2362	Employability
35	PE II: Digital CMOS Circuits	EE2363	Employability
36	Lab : PE II: Digital CMOS Circuits	EE2364	Employability
37	PE II: Digital Image Processing	EE2365	Employability
38	Lab: PE II: Digital Image Processing	EE2366	Employability
39	PE II: Object Oriented Programming	EE2367	Employability
40	Lab : PE II: Object Oriented Programming	EE2368	Employability
41	OE III: Fuzzy Logic & Neural Network	EE2381	Employability
42	OE III: Basics of Analog and Digital Communication Systems	EE2382	Employability
43	OE III: Biomedical Instrumentation	EE2383	Employability
44	OE IV: Data Acquisition & Signal Conditioning	EE2391	Employability
45	OE IV: Microprocessor Programming	EE2392	Employability
46	OE IV: Consumer Electronics	EE2393	Employability
47	PEII:Digital CMOS Circuits	EE1403	Employability
48	PEII:Algorithm & Data Structures	EE1405	Employability
49	Electronics Circuit Design	EE1407	Employability
50	Digital Communication	EE1409	Employability
51	PE3:Computer Communication Network	EE1414	Employability
52	PE3:Operating System Concepts	EE1415	Employability
53	PE3: Micro Electro Mechanical Systems	EE1437	Employability
54	PE4:Soft Computing	EE1417	Employability
55	PE4:Analog VLSI Design	EE1419	Employability
56	PE4:Digital Image Processing	EE1427	Employability
57	PE4:Object Oriented Programming	EE1423	Employability
58	PE5: Biomedical Instrumentation & its Applications	EE1425	Employability
59	PE5: Optical Communication	EE1426	Employability
60	PE I : Object Oriented Programming	ET2361	Employability
61	PE I : Fundamentals of Computing	ET2371	Employability
62	PE II : Antenna Theory & Design	ET2377	Employability
63	PE II : Internet of Things (IoT)	ET2381	Employability
64	PE I : Electronic Instrumentation	ET2367	Employability
65	PE III : Power Electronics	ET2411	Employability
66	PE III : Data Compression & Encryption	ET2412	Employability
67	PE III : Analog VLSI	ET2413	Employability
68	PE III : Error Correcting Codes	ET2414	Employability
69	PE IV : Embedded System	ET2422	Employability

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
70	PE IV : Topics in Machine Learning	ET2424	Employability
71	PE IV : Multimedia Communications	ET2425	Employability
72	PE V : Display Technology	ET2431	Employability
73	PE V : Fuzzy Logic & Neural Network	ET2433	Employability
74	PE V : RF Circuit Design	ET2435	Employability
75	PE VI : Digital Image Analysis for Remote Sensing	ET2442	Employability
76	PE VI : Communication Networks	ET2444	employability
77	PE VI : PLCs & SCADA	ET2446	Employability
78	Object Oriented Programming	CT2202	Employability
79	Lab: Object Oriented Programming	CT2203	Employability
80	Data Structures	CT2204	Employability
81	Operating Systems	CT2251	Employability
82	Advanced Data Structures	CT2253	Employability
83	Mathematical Foundations for Data Analysis	CT2255	Employability
84	Network Security	CT1415	Employability
85	Artificial Intelligence	CT1451	Employability
86	Lab. Artificial Intelligence	CT1452	Employability
87	PE II: Neural Network & Fuzzy Logic	CT1406	Employability
88	PE III: Parallel Computing	CT1437	Employability
89	PE III:: Machine Learning Techniques	CT1454	Employability
90	PE III: Fundamentals of Parallel Computing	CT1457	Employability
91	Cyber Laws	GE1408	Employability
92	PE IV: Digital Image Processing	CT1418	Employability
93	Lab.: PE IV: Digital Image Processing	CT1419	Employability
94	PE IV: Cyber Forensics	CT1455	Employability
95	Material Science & Metallurgy	ME2201	Employability
96	Mechanics of Material	ME2205	Employability
97	Kinematics of Machines	ME2207	Employability
98	Fluid Mechanics	ME2208	Employability
99	Engineering Thermodynamics	ME2252	Employability
100	Fluid Machines	ME2351	Employability
101	Automation In Production systems	ME1435	Employability
102	Optimisation Techniques	ME1475	Employability
103	PE VI : CMOS VLSI Design	ET2441	employability
104	Software Engineering	IT 2303	Employability
105	Data Structures and Program Design-I	IT2205	Employability , Skill Development
106	Object Oriented Programming	IT2203	Employability , Skill Development
107	Data Structures and Program Design-II	IT2251	Employability , Skill Development
108	Computer Networks	IT2253	Employability , Skill Development
109	Operating Systems	IT2255	Employability , Skill Development
110	Data Base Management Systems	IT 2301	Employability , Skill Development
111	Web Programming	IT 2311	Employability , Skill Development
112	Data Analysis and Statistics	IT 2313	Employability , Skill Development
113	Customer Relationship Management	IT 2315	Employability , Skill Development
114	Design & Analysis of Algorithms	IT2351	Employability , Skill Development
115	Machine Learning	IT 2361	Employability , Skill Development
116	Business Intelligence	IT 2363	Employability , Skill Development
117	Internet of Things	IT 2365	Employability , Skill Development
118	Data Mining	IT1427	Employability , Skill Development
119	Neural Networks & Fuzzy Logic	IT1415	Employability , Skill Development
120	Network Programming	IT1417	Employability , Skill Development
121	PE III: Cloud Computing	IT1432	Employability , Skill Development
122	Computer Architecture & Organisation	CT2201	Employability , Skill Development
123	Project Phase 1	EE1412	Employability/ Entrepreneurship/ Skill development
124	Industrial Training	EE1413	Employability/ Entrepreneurship/ Skill development
125	Comprehensive Viva-voce	EE1430	Employability/ Entrepreneurship/ Skill development
126	Extra Curricular / Competitive Exam	EE1431	Employability/ Entrepreneurship/ Skill development
127	Project Phase 2	EE1432	Employability/ Entrepreneurship/ Skill development
128	Fundamental of management	GE1311	Employability/ Entrepreneurship/ Skill development
129	Computing using Python Laboratory	EE2204	Employability/ Entrepreneurship/ Skill development
130	PE III: Cloud Computing	CT1408	Employability/ Entrepreneurship/ Skill development
131	PE III : Introduction to Remote Sensing	CV2366	Employability/ Skill Development
132	PEII : Water Transmission and Distribution Systems	CV2369	Employability/ Skill Development
133	PE III : Advanced RCC	CV1447	Employbility and Entreprenurship
134	PE IV : Matrix Analysis of Structures	CV1429	Employbility and Entreprenurship
135	**PE V :** Advanced Steel Design	CV1433	Employbility and Entreprenurship
136	PE-V : Structural Engineering Practices	CV2440	Employbility and Entreprenurship
137	PEII:Embedded System	EE1401	Employbility and Entreprenurship
138	PE3:Display Technology	EE1436	Employbility and Entreprenurship
139	Digital Logic Design	EE2205	Employbility and Entreprenurship
140	Network Analysis	EE2207	Employbility and Entreprenurship
141	Design of Machine Elements	ME2251	Employbility and Entreprenurship
142	Manufacturing Process-II	ME2254	Employbility and Entreprenurship

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
143	Mechanical measurement & Metrology	ME2256	Employability and Entreprenurship
144	Heat Transfer	ME2301	Employability and Entreprenurship
145	Dynamics of Machines	ME2303	Employability and Entreprenurship
146	Production Management	ME2305	Employability and Entreprenurship
147	OE I : Operations Research Techniques	ME2331	Employability and Entreprenurship
148	OE I : Automobile Engineering	ME2332	Employability and Entreprenurship
149	OE I : Robotics and Subtractive Manufacturing	ME2333	Employability and Entreprenurship
150	OE I : Control System Engineering	ME2334	Employability and Entreprenurship
151	OE II : Total Quality Management	ME2341	Employability and Entreprenurship
152	OE II : Reliability Engineering	ME2342	Employability and Entreprenurship
153	OE II : Power Generation Engineering	ME2343	Employability and Entreprenurship
154	OE II : Project Evaluation & Management	ME2344	Employability and Entreprenurship
155	Design of Mechanical Drives	ME2354	Employability and Entreprenurship
156	OE III : Operations Research Techniques	ME2381	Employability and Entreprenurship
157	OE III : Automobile Engineering	ME2382	Employability and Entreprenurship
158	OE III : Robotics and Subtractive Manufacturing	ME2383	Employability and Entreprenurship
159	OE III : Control System Engineering	ME2384	Employability and Entreprenurship
160	OE IV : Total Quality Management	ME2391	Employability and Entreprenurship
161	OE IV : Reliability Engineering	ME2392	Employability and Entreprenurship
162	OE IV : Power Generation Engineering	ME2393	Employability and Entreprenurship
163	OE IV : Project Evaluation & Management	ME2394	Employability and Entreprenurship
164	PE I : Finite Element Methods	ME2361	Employability and Entreprenurship
165	PE I :Industrial Fluid Power	ME2363	Employability and Entreprenurship
166	PE I : I.C. Engines	ME2365	Employability and Entreprenurship
167	PE I : Refrigeration & Cryogenics	ME2367	Employability and Entreprenurship
168	PE I : Computer Integrated Manufacturing	ME2369	Employability and Entreprenurship
169	Production Management	ME1447	Employability and Entreprenurship
170	Design Of Mechanical Drives	ME1448	Employability and Entreprenurship
171	PE-I: Tool Design	ME1401	Employability and Entreprenurship
172	PE-I: Material Handling Systems	ME1402	Employability and Entreprenurship
173	PE-I: Engineering Of Plastics	ME1404	Employability and Entreprenurship
174	PE-I: Project Evaluation & Management	ME1405	Employability and Entreprenurship
175	PE-I: Computational Fluid Dynamics	ME1449	Employability and Entreprenurship
176	PE-I: Advanced Manufacturing Techniques	ME1456	Employability and Entreprenurship
177	PE-I: Rapid Prototyping	ME1461	Employability and Entreprenurship
178	PE-I: Fuel Cells Technology	ME1462	Employability and Entreprenurship
179	PE-I: Data Structure and Algorithm	ME1463	Employability and Entreprenurship
180	Synthesis Of Mechanism	ME1408	Employability and Entreprenurship
181	Finance & Cost Management	ME1409	Employability and Entreprenurship
182	Renewable Energy System	ME1410	Employability and Entreprenurship
183	Artificial Intelligence	ME1411	Employability and Entreprenurship
184	Maintainance Management	ME1412	Employability and Entreprenurship
185	Design For Manufacturing & Assembly	ME1466	Employability and Entreprenurship
186	Quantitative Techniques	ME1467	Employability and Entreprenurship
187	Database Management System	ME1468	Employability and Entreprenurship
188	Finite Element Methods	ME1406	Employability and Entreprenurship
189	CIM	ME1417	Employability and Entreprenurship
190	I.C. Engines	ME1419	Employability and Entreprenurship
191	Refrigeration & Air Conditioning	ME1421	Employability and Entreprenurship
192	Mechatronics	ME1445	Employability and Entreprenurship
193	Refrigeration & Cryogenics	ME1469	Employability and Entreprenurship
194	Machine Tool Design	ME1476	Employability and Entreprenurship
195	PE-IV: Vibration	ME1415	Employability and Entreprenurship
196	PE-IV: Industrial Fluid Power	ME1437	Employability and Entreprenurship
197	PE-IV: Cnc & Robotics	ME1439	Employability and Entreprenurship
198	PE-IV: Vehicle Engineering	ME1441	Employability and Entreprenurship
199	PE-IV: MIS	ME1443	Employability and Entreprenurship
200	PE-IV: Solar Energy and Utilization	ME1478	Employability and Entreprenurship
201	PE-V: Stress Analysis	ME1451	Employability and Entreprenurship
202	PE-V: Design Of Experiments And Taguchi Methods	ME1452	Employability and Entreprenurship
203	PE-V: Value Engg.	ME1453	Employability and Entreprenurship
204	PE-V: Lean Sigma	ME1454	Employability and Entreprenurship
205	PE-V: Product Design And Development	ME1455	Employability and Entreprenurship
206	PE-V: Power Plant Engineering	ME1457	Employability and Entreprenurship
207	PE-V: Machine Tool Design	ME1458	Employability and Entreprenurship
208	PE-V: Advance Welding Techniques	ME1460	Employability and Entreprenurship
209	PE-V: Air Conditioning	ME1482	Employability and Entreprenurship
210	PE-V: Cryogenic Systems	ME1483	Employability and Entreprenurship
211	Manufacturing Process -I	ME2203	Employability and Entreprenurship
212	PE-V: Industrial Safety	ME1459	Employability and Entreprenurship:
213	Fundamentals of Management	GE2311	Entrepreneurship
214	PE III: E-Commerce	IT1430	Entrepreneurship
215	PE II : Digital system Design	ET2379	Entrepreneurship

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
216	Software Lab	IT2208	Skill Development
217	Lab: Concrete Technology	CV2252	Skill Development
218	Lab: Surveying	CV2254	Skill Development
219	Lab:- Structural Analysis	CV2256	Skill Development
220	Lab:- Transportation Engineering	CV2258	Skill Development
221	LAB : Building Design and Drawing	CV2352	Skill Development
222	LAB : Hydraulic Engineering	CV2354	Skill Development
223	Comprehensive Viva-voce	CV1424	Skill Development
224	Extra / Co-curricular / Competitive Examination	CV1426	Skill Development
225	PE-I : Advance Surveying	CV2311	Skill Development
226	PE-I : Advanced Concrete Technology	CV2319	Skill Development
227	PE-I : Geographical Information Systems	CV2327	Skill Development
228	Lab: Strength of Materials	CV2202	Skill Development
229	Lab: Geotechnical Engineering	CV2204	Skill Development
230	Lab: Fluid Mechanics	CV2206	Skill Development
231	Lab: Water Supply Engineering	CV2208	Skill Development
232	Lab: Analysis & Design Studio	CV2303	Skill Development
233	PE-I : Computer Application In Civil Engineering	CV2313	Skill Development
234	LAB : Estimating and Costing	CV2402	Skill Development
235	**Lab:-** Material Science & Metallurgy	ME2202	Skill Development
236	**Lab:-** Manufacturing Process -I	ME2204	Skill Development
237	**Lab:-** Mechanics of Material	ME2206	Skill Development
238	**Lab:-** Fluid Mechanics	ME2209	Skill Development
239	**Lab:-** Machine Drawing	ME2253	Skill Development
240	**Lab:-** Manufacturing Process-II	ME2255	Skill Development
241	**Lab:-** Mechanical measurement & Metrology	ME2257	Skill Development
242	**Lab:-** Dynamics of Machines	ME2304	Skill Development
243	**Lab:-** Fluid Machines	ME2352	Skill Development
244	**Lab**:Computer Aided Design	ME2353	Skill Development
245	PE I : Lab:- Finite Element Methods	ME2362	Skill Development
246	PE I : Lab:- Industrial Fluid Power	ME2364	Skill Development
247	PE I : Lab:- I.C. Engines	ME2366	Skill Development
248	PE I : Lab:- Refrigeration & Cryogenics	ME2368	Skill Development
249	PE I : Lab:- Computer Integrated Manufacturing	ME2370	Skill Development
250	Automation In Production systems LAB	ME1436	Skill Development
251	PE-III: Finite Element Methods	ME1407	Skill Development
252	PE-III: CIM	ME1418	Skill Development
253	PE-III: I.C. Engines	ME1420	Skill Development
254	PE-III: Refrigeration & Air Conditioning	ME1422	Skill Development
255	PE-III: Mechatronics	ME1446	Skill Development
256	PE-III: Refrigeration & Cryogenics	ME1470	Skill Development
257	PE-III: Machine Tool Design	ME1477	Skill Development
258	Lab. : PE-IV: Vibration	ME1416	Skill Development
259	Lab. : PE-IV: Industrial Fluid Power	ME1438	Skill Development
260	Lab. : PE-IV: Cnc & Robotics	ME1440	Skill Development
261	Lab. : PE-IV: Vehicle Engineering	ME1442	Skill Development
262	Lab. : PE-IV: MIS	ME1444	Skill Development
263	Lab. : PE-IV: Solar Energy And Utilization	ME1479	Skill Development
264	Lab. : Electronics Engineering Workshop	EL2202	Skill Development
265	Lab: Electrical Machines	EL2204	Skill Development
266	Lab: Computer Programming	EL2206	Skill Development
267	Lab: Electrical Measurement & Instrumentation	EL2208	Skill Development
268	Lab.:Electrical Machines in Power System	EL2252	Skill Development
269	Lab.:Renewable Energy Sources	EL2254	Skill Development
270	Lab: Electrical Engineering Workshop	EL2256	Skill Development
271	Lab.:Microprocessor	EL2258	Skill Development
272	Lab.:Power Electronics	EL2302	Skill Development
273	Lab.:Electrical Drives	EL2305	Skill Development
274	PEI:Advanced Power Electronics	EL2361	Skill Development
275	PEI:Electrical Distribution in Power System	EL2362	Skill Development
276	PEI:Illumination Engineering (MOOC)	EL2363	Skill Development
277	PEI:Electric Vehicles	EL2364	Skill Development
278	PEI:Electric Power Utilization	EL2365	Skill Development
279	PEII: Fundamentals of Power Quality	EL2411	Skill Development
280	PEII:Electrical Installation Design	EL2412	Skill Development
281	PEII:Electrical Machine Design	EL2413	Skill Development
282	PEII: Power System Operation and Control	EL2421	Skill Development
283	PEIII:FACTS Devices	EL2422	Skill Development
284	PEIII:Electrical Energy Management And Audit	EL2423	Skill Development
285	PEIII:Advanced Control System	EL2424	Skill Development
286	PEIII:Artificial Intelligence Based System	EL2425	Skill Development
287	PEIV:Advanced Electrical Drives	EL2431	Skill Development
288	PEIV:Fundamentals of Smart Grid	EL2432	Skill Development

Sr. No	Name of the Course	Course Code	Category Employability/ Entrepreneurship/ Skill development
289	PEIV:Computer Methods in Power System	EL2433	Skill Development
290	PEIV:EHVAC-HVDC Transmission	EL2434	Skill Development
291	Electronic Devices Laboratory	EE2202	Skill development
292	Digital Logic DesignLaboratory	EE2206	Skill development
293	Network Analysis Laboratory	EE2208	Skill development
294	Electronic Circuit Laboratory	EE2252	Skill development
295	Microcontroller & its application Laboratory	EE2254	Skill development
296	Analog Communication Laboratory	EE2256	Skill development
297	Electronic Workshop Laboratory	EE2258	Skill development
298	PEII:Embedded System Laboratory	EE1402	Skill development
299	PEII:Digital CMOS Circuits Laboratory	EE1404	Skill development
300	PEII:Algorithm & Data Structures Laboratory	EE1406	Skill development
301	Digital Communication Laboratory	EE1410	Skill development
302	PE4:Soft Computing Laboratory	EE1418	Skill development
303	PE4:Analog VLSI Design Laboratory	EE1420	Skill development
304	PE4:Digital Image Processing Laboratory	EE1428	Skill development
305	PE4:Object Oriented Programming Laboratory	EE1424	Skill development
306	PE I : Lab. Object Oriented Programming	ET2362	Skill development
307	PE I : Lab Fundamentals of Computing	ET2372	Skill development
308	PE II : Lab. Antenna Theory & Design	ET2378	Skill development
309	PE II : Lab. Internet of Things (IoT)	ET2382	Skill development
310	PE II : Lab. Digital system Design	ET2380	Skill development
311	Lab: Data Structures	CT2205	Skill Development
312	Lab:Operating Systems	CT2252	Skill Development
313	Lab: Advanced Data Structures	CT2254	Skill Development
314	Lab: Mathematical Foundations for Data Analysis	CT2256	Skill Development
315	Database Management Systems	CT2257	Skill Development
316	Lab: Database Management Systems	CT2258	Skill Development
317	Project Phase I	CT1414	Skill development
318	Lab.: PE IV: Cyber Forensics	CT1456	Skill development
319	PE V: Numerical Computing	CT1445	Skill development
320	PE V: Introduction to Internet of Things	CT1458	Skill development
321	Lab. : PE V: Software Project Management	CT1433	Skill development
322	Lab. : PE V: Introduction to Internet of Things	CT1459	Skill development
323	Lab. : PE V: Numerical Computing	CT1446	Skill development
324	Project Phase -II	CT1426	Skill development
325	Extra/Co-curricular / Competitive Examination	CT1427	Skill development
326	Communication Skills	GE2107	Skill Development
327	Introduction to German Language	GE2317	Skill Development
328	Introduction to Spanish Language	GE2369	Skill Development
329	Introduction to Frech Language	GE2370	Skill Development
330	Engineering Physics Lab.	GE2106	Skill Development
331	Engineering Chemistry Lab.	GE2104	Skill Development
332	**Lab:-** Heat Transfer	ME2302	Skill Development
333	Lab:- Transportation Engineering	CV2258	Skill Development
334	Lab: Surveying -II	CV1302	Skill Development
335	Lab: Structural Analysis-I	CV1308	Skill Development
336	Lab: Transportation Engineering –I	CV1305	Skill Development
337	Lab: Python Programming	CT2206	Skill Development & Entrepreneurship
338	Lab: Web Technology	CT2207	Skill Development & Entrepreneurship
339	Object Oriented Modeling	CT1450	Skill Development & Entrepreneurship
340	Lab: Web Technology	CT2207	Skill Development & Entrepreneurship
341	Software Engineering	CT1345	Skill Development & Entrepreneurship
342	PE II: Probabilistic Statistical Data Analysis	CT1453	Skill Development and Employability
343	Industrial Training/ CRT	CT1413	Skill development and Employability
344	RF & Microwave	EE1434	Skill development/Employability
345	RF & Microwave Laboratory	EE1435	Skill development/Employability
346	(EDA)Electronics Design Automation Laboratory	EE1433	Skill development/Employability
347	Electronics Circuit & Design Laboratory	EE1408	Skill development/Employability

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