INDEX

Civil Engineering

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

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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.

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
CV2409 - Mini Project

<table>
<tr><th>COURSE OBJECTIVES</th><th>COURSE OUTCOME</th></tr>
<tr><td>1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.
2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.
3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.
4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.
5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.</td><td>On successful completion of the course students will be able to:
1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team.
4. Communicate effectively to discuss and solve engineering problems.</td></tr>
<tr><td colspan="2">Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 PSO : i,ii,iii</td></tr>
</table>

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

VII Semester
CV2410 - Campus Recruitment Training (CRT)

COURSE OBJECTIVE	COURSE OUTCOMES
1. To get information about latest methodologies and techniques used in the field of civil engineering. 2. To understand current practices adopted in construction management.	1. An ability to prepare detail notes and reports. 2. An ability to communicate effectively. 3. An ability to implement the field knowledge to the practical applications.
Mapped Program Outcomes : 1,2,5,10,11	

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

VIII Semester
CV2451 - Major Project

(Thrust Area : Geotechnical Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	Students will be able to 1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 9, 10, 11 **PSO :** ii.	

(Thrust Area : Structural Analysis and Construction Materials)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Application of mathematics, science, and engineering in a global, economic, environmental, and societal context. 2. Design a model, a system or components and analyze and interpret the data. 3. Teamwork and independent functioning of professional and ethical responsibility and life-long learning. 4. Effective communication and use the techniques, skills, and modern engineering tools and contemporary issues necessary for engineering practices. 5. Analyze, design and cost estimates of civil engineering structures.	Students will be able to 1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 **PSO :** i, iii	

VIII Semester
CV2451 - Major Project

(Thrust Area : Transportation Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	Students will be able to 1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	

(Thrust Area : Water Pollution and Water Resources Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	Students will be able to 1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 **PSO :**i, ii, iii	

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

VIII Semester
CV2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. To plan extracurricular events in order to foster a competitive spirit, teamwork, leadership, diligence, punctuality, and a sense of belonging among students. 2. Foster the development of creative ability, self-confidence, and a sense of accomplishment. 3. Designing procedures that consider environmental, social, political, ethical, and health and safety considerations.	Students will be able to 1. Develop leadership through the engagement of collaboration, and then put it into action to complete the task 2. Employ with a diverse range of individuals. 3. Operate to the advancement of society and the identification of health-related problems 4. Produce independently as well as member of a team in order to achieve established goals
Mapped Program Outcomes : 6, 7, 8, 9, 10, 11, 12	

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).

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
CV2317 - PE-I : LAB - MATRIX ANALYSIS OF STRUCTURES

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Knowledge of basic concepts of direct stiffness method. 2. Analysis of continuous beam, plane truss, plane frame neglecting axial deformation, plane frame considering axial deformation by stiffness method. 3. Analysis of various structures subjected to special effects. 4. Modern techniques and storage techniques.	Students will be able to 1. Apply the stiffness method for structural analysis. 2. Analyze continuous beams, plane truss, plane frame neglecting axial deformation, plane frame considering axial deformation. 3. Recognize special effects on behavior structures. 4. Implement various storage techniques used in computer programming for structural analysis.
Mapped Program Outcomes : 1,2,4,5, **PSO** : i	

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 degrees 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 degrees of freedom.	**[07 Hrs.]**
UNIT–4 : **Analysis of Plane Frame (Without axial deformation):** Formulation of elemental stiffness matrix and, 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 degrees 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 degrees of freedom, inclined member problem.	**[06 Hrs.]**
UNIT–6 : Analysis of member for sinking of supports in beam, temperature loading, lack of fit and inclined roller in truss with maximum three degrees of freedom, storing of global stiffness matrix, full storage, banded storage and band minimization.	**[07 Hrs.]**

V Semester
CV2317 - PE-I : MATRIX ANALYSIS OF STRUCTURES

Text Books :
1. Gere and Weaver, Matrix Method of Structural Analysis, McGraw Hill. 2004
2. Kanchi M.B., Matrix Method of structural Analysis, New age International,1993
3. Martin H.C. Introduction to Matrix Method of Structural Analysis, 1966
4. Pandit Gupta, Structural Analysis: A Matrix Approach, Tata McGraw-Hill, 2001

Reference Books :
1. Meghre A.S. &Deshmukh S.K., Matrix Method of Structural Analysis, Charotar Publishing House Pvt. Limited, 2003
2. Flemming Computer Analysis of Structures, McGraw-Hill Education, 1996
3. Wang C K,, Intermediate Structural Analysis, McGraw-Hill Education, 2010
4. S. Rajasekaran, G. Sankarasubramanian Computational Structural Mechanics, PHI Learning Private Limited, 2004

VI Semester
CV2363- PE-II : Construction Management And Machinery

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be able to understand 1. The concepts related with Construction management system and Role of engineering in developing economics of country, which involves Planning, scheduling, controlling, organizing of project and Execution of the project with economic development & prosperity. 2. To learn basic principles of Construction Management & Various networking techniques (CPM and PERT) of project controlling in the context of various construction aspects. 3. Development of projects by managing resources and its scarcity, Various management functions to control and analysis of equipment management and material management. 4. Exposure to equipments of drilling and blasting techniques and concrete equipments and economics.	Students will have the ability to 1. Understand and analyze scope and role of civil engineer in developing economy of Nation and construction industry. 2. Evaluate the development of network technique of major projects, material and equipment and its safety management. 3. Develop knowledge about quality and finance management system carried out in industry. 4. Practical exposure to various major construction equipments used in construction and economics of demand and supply.
Mapped Program Outcomes : 1,4,8,9,10,11,12	

UNIT–1 : **Construction Industry**: Nature, Characteristics, size and structures. Role in economic development of nation, Employment generation and Infrastructure development related to other industries. **Construction Management**: Necessity, Application of management functions viz. Planning, Organizing, Staffing, Leading and controlling to the construction. **Construction manager**: Role, Qualities, Ethics, Duties, Responsibilities, Authorities. **Legal Aspect and Laws Applicable to Construction Industry**: Works contract act, Child labour act, Workman's compensation Act, Employees provided fund Act 1952, Minimum wages Act, Payment of bonus Act 1965, Maternity leave Act.	**[06 Hrs.]**
UNIT–2 : Project management: Introduction, Types of projects, Various phases of project, Project Proposal, Components of planning, Objectives of planning, Factors affecting planning, Organizational setup, Typical layout of a few major construction projects. **Job Planning**: Bar diagrams & Bar charts, Application of Network techniques (CPM & PERT) for planning. Estimation of critical path and project duration. Resource planning, Resource Allocation, Resource leveling, Optimization of project cost, Cost slope concept.	**[07 Hrs.]**
UNIT–3 : **Material management**: Functions, objectives, purchasing, procedures, records, stock taking, inventory control, EOQ, ABC analysis, material storing. **Equipment management**: Classification of construction equipments, factors affecting selection, Operation & Maintenance cost, Depreciation & Replacement cost, Economic life, Down time cost, Cost of owning equipment. **Safety Management**: Construction hazards, safety in construction, industry & at work site. National safety council, safety organization, accidents, its cost, cause, types & preventions, losses during natural calamities, floods &fire, preventive measures. Safety equipment, Preparation of safety programmes for construction works.	**[06 Hrs.]**

VI Semester

CV2363- PE-II : Construction Management And Machinery

UNIT–4 : **Construction Equipment:** Introduction to Construction Equipment: Their contribution and importance in construction Industry. Classification of Equipment. **Money & Banking**: Functions Commercial & Central Banks. **Financial Management:** Objectives, Law of flow of funds. Financial Accounting Systems, Accounting methods- cash basis, Actual Basis, Percentage completion basis, Completed contract basis.	**[07 Hrs.]**
UNIT–5 : **Equipments for major projects**: Excavating machines such as Power shovels, Drag Line, Bulldozer, Scrapper, Drilling & blasting equipments, material transporting & handling equipment such as cranes, hoists, conveyer belts, dumpers, cableways, rail system (size, performance & limitations). **Concrete equipments**: Different types of mixers, vibrators, batch mixing plants, Transportation of concrete, concrete pumps & placers, Shotcreting, Guniting & its equipment.	**[07 Hrs.]**
UNIT–6 : **Economics**: Nature & scope of Economics & relationship with Engineering. Supply and Demand Mechanism. Application of MIS: System Development, Data processing, Flow-charting, DBM, Data communication System Developments, Data processing, Application in Civil Engineering Industry. Study of Introduction and Application of construction management software (any one) in civil engineering Industry.	**[06 Hrs.]**

Text Books :

1. Shrivastava U.K., Construction Planning and management, Galgotia publication.
2. Khanna O.P, Industrial Engineering & Management, Dhanpat Rai & Sons, New Delhi, 1992.
3. Verma Mahesh, Equipment Management, S.Chand &Sons
4. Punmia B.C. & Khandelwal K.K., Project Planning & Control with PERT&CPM, Laxmi Publications, New Delhi,1990.
5. BL Gupta, Amit Gupta, Construction Management & Machinery, Standard Publishers Distributors, 2010.

Reference Books :

1. Peurifoy, M.H, Construction Management, McGraw Hill, New York.
2. Srinath L, CPM & PERT, Affiliated East-West Press Pvt. Ltd., New Delhi.
3. P.S. Gahlot & B.M.Dhir, Construction Planning and Management, New Age International.
4. Chaudhary Roy, Project Management, Tata McGraw Hill, New Delhi.

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.

VI Semester
CV2370 - PE-II : Construction Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Construction project management processes. 2. Principles and Techniques of construction scheduling 3. Overview of construction cost estimating and cost control 4. Financial aspects involved in construction project management	Students will be able to 1. Analyze the construction project management processes. 2. Apply the knowledge of construction scheduling. 3. Apply the knowledge of construction cost estimating and cost control. 4. Explain the financial aspects involved in construction project management..
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10, 11, 12	

UNIT–1 : **Construction Project Management**: Course Overview, Construction Industry Overview, Project Delivery, Lean Project Delivery, Sustainability in the Construction Industry, Environment, Health and Safety of Construction Processes, Building Information Modeling and Technology Trends in Construction, International View of Construction Projects, Role of a Construction Manager, Introduction to Project Planning.	**[06 Hrs.]**
UNIT–2 : **Construction Scheduling I:** Introduction to Construction Scheduling, The Role of the Scheduler in Construction Management, Linear Construction Operations and Line of Balance, Technology Applications for Scheduling, Scheduling for Large Programs, Risk Allocation and Planning, Lean Design in Construction Scheduling.	**[06 Hrs.]**
UNIT–3 : **Construction Scheduling II:** Bar (Gantt) Charts, Activity Precedence Diagrams, Types of Construction Activity Relationships, Forward and Backward Pass Calculations, Critical Path, Activity Floats, Understanding Work Dates and Calendar Dates, Activity on Arrow, Program Evaluation & Review Technique (PERT) and Range Estimating.	**[07 Hrs.]**
UNIT–4 : Construction Cost Estimating and Cost Control I:Construction Cost Estimating and Cost Control Overview, Understanding Design in the Construction Industry, Introduction to the Types of Cost Estimates, Quantity Take-Off and Measurement, Pricing.	**[07 Hrs.]**
UNIT–5 : Construction Cost Estimating and Cost Control II: Building the Estimate Procurement, Post Contract and Cost Estimation within a Project, Construction cost Control methods, Earned Value Method (EVM), Close Out Period, Cost Estimation in Practice, Project Cash Flow, Technology Trends in Cost Estimating and Cost Control, Program Cost Estimating, Lean in Cost Control	**[07 Hrs.]**
UNIT–6 : Construction Finance: Introduction To The Construction Finance Course, The Mathematics of Money, Real Estate Finance for Development Projects, Financial Plans for Development Projects, Project Finance, Risk In Project Finance, Public - Private Partnerships.	**[06 Hrs.]**

VI Semester
CV2370 - PE-II : Construction Management

Text Books :

1. Construction Planning and Management – Purifoy
2. Construction Planning and Management – Dr U K Shrivastava, Galgotia Publ.
3. Project Planning & Management – B C Punmia
4. Laws related to buildings and engineering contracts in India- Gajaria G T, LexisNexis Butterworths India Publisher, 2000.
5. Punmia B.C. & Khandelwal K.K., Project Planning & Control with PERT&CPM, Laxmi Publications, New Delhi,1990.

Reference Books :

1. Construction Contracts- Jimmie Hinze McGraw Hill,
2. Contracts and the legal Environment for Engineers and Architects- Joseph T Bockrath, McGraw Hill,
3. Srinath L, CPM & PERT, Affiliated East-West Press Pvt. Ltd., New Delhi.
4. P.S. Gahlot & B.M. Dhir, Construction Planning and Management, New Age International.
5. Chaudhary Roy, Project Management, Tata McGraw Hill, New Delhi.

VII Semester
CV2412 - PE-III : Advanced R.C.C.

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand design methods of water tank 2. Understand different IRC loading and design of bridge and culverts 3. Understand design methods of multistoried building 4. Understand design methods of retaining walls	1. An Ability to know provisions of relevant IS codes and IRC code required for design of advanced concrete structures such as water tank, bridges ,multistoried building 2. An ability to design advanced concrete structures such as water tank , bridge and culvert 3. An ability to understand the various methods of design of multistoried buildings, retaining wall. 4. An ability to draw RCC detailing of structures.
Mapped Program Outcomes : 1,2,3,10	

UNIT-1 : Design of building frames subjected to vertical load up to two bay and up to four story, including Design of foundation by Using Limit state	**[07 Hrs.]**
Unit-2 : Analysis and design of building frame subjected to lateral forces by portal frame method and cantilever method.	**[06 Hrs.]**
UNIT–3 : Design of flat slab by various methods.	**[06 Hrs.]**
UNIT–4 : Design of circular and rectangular water tanks resting on ground. Design of circular elevated water tank. (Intz type only).	**[07 Hrs.]**
UNIT-5 : Introduction to for IRC loadings. Design of bridge deck slab for culvert and bridge.	**[07 Hrs.]**
UNIT – 6 : Design of cantilever Retaining walls and counter fort Retaining wall.	**[06 Hrs.]**

Text Books :

1. Bhavikatti S. S., Advanced R. C. C. Design Volume-II, New age international publisher, New Delhi, Ist edition – 2006.
2. Krishna Raju N, Advanced R. C. C. Design, CSB Publisher and Distributor, New Delhi, 2nd edition-2005

Reference Books :

1. Johnson and Victor, "Essentials of Bridge Engineering" Oxford and IBH publisher, 1980.
2. Jain O.P. and Jai Krishna, Plain and Reinforced concrete structures–Volume –II, Nemchand and brothers, 1987
3. Chen, W.F. and Duan, L. "Bridge engineering Handbook"

VII Semester
CV2415 - PE-III : Energy Conversion & Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Energy crisis and energy management, and the importance of energy conservation. 2. Techniques of energy analysis and the associated energy conversion technologies. 3. Energy management systems and their essential elements.	Students will be able to 1. Analyze energy crisis, and of environmental and sustainability concerns associated with the energy management. 2. Work on energy conservation and having the knowledge of energy conversion strategies and methods. 3. Understand the Energy Management Systems
Mapped Program Outcomes : 1,2,3,5,6,7,12	

UNIT–1 : Significance of Energy Conversion and Environment, Overview of Global and Indian Energy Scenario; Environmental Impacts of Energy Conversion, Principles of Waste Minimization and Energy Recovery.	**[07 Hrs.]**
UNIT–2 : Renewable and Non-Renewable Energy Sources; Estimation of Potential of Energy Recovery from various Sources, Energy economics.	**[06 Hrs.]**
UNIT–3 : Energy Conversion Methods: Thermal, hydro, nuclear, solar, wind, tidal etc. their principles and application.	**[07 Hrs.]**
UNIT–4 : Waste to Energy options: physical, thermochemical and bio chemical processes, Combustion, Gasification, pyrolysis; Fuels Derived anaerobic digestion, Biogas Technology, Future Technologies for Waste to Energy Systems.	**[06 Hrs.]**
UNIT–5 : Introduction to Microbial Fuel cell, Gas generations and collection in landfills, Measurements and Control; Energy and Resources Conservation Strategies and Policies.	**[07 Hrs.]**
UNIT–6 : Intelligent Green Building, Green Rating Systems Alternative Construction Materials& methods Testing and Verification.	**[06 Hrs.]**

Text Books :

1. D. O. Hall, G. W. Barnard and P. A. Moss, Biomass for Energy in the Developing Countries, Current Roles, Potentials, Problems, Prospects, Pergamon Press Ltd, 1st edition.
2. W. C. Turner, Energy Management Handbook Wiley New york 1st edition.
3. P. Meier, Energy System Analysis for Developing countries, Sringer Verlag 1st edition.
4. Dorthy J De Renzo, Energy from Bioconversion of Waste materials, Noyes data Corporation USA 1st edition.

Reference Books :

1. G.D. Rai, Non-Conventional Energy Source, Standard Publishers Distributors.
2. Fowler J. M. Energy and the Environment McGraw Hill New York 2nd edition.
3. B.H. Khan, Non-Conventional Energy Resources, 2nd Edition, McGraw Hill Companies.

VII Semester
CV2432 - PE-V : Project Planning & Management

COURSE OBJECTIVES	COURSE OUTCOMES
Student will able to 1. Study project planning and execution of different construction projects. 2. Learn principles of Construction Scheduling& Network Analysis. 3. Understand the Development of projects by managing Quality & safety measures. 4. To understand legal aspect in project management & various laws.	Student will able to:- 1. Achieve the knowledge of planning & Execution of construction projects. 2. Understand Construction Scheduling & Network Analysis. 3. Know the quality control aspect in planning & management with safety provisions. 4. Analyze the legal aspects & various laws in construction projects.
Mapped Program Outcomes : 1,2,6,7,9,11,12	

UNIT–1 : **Introduction to Construction Planning and Management** Various function of construction management, Resources, stages, project planning & team work, Classification of Civil Engineering Drawings.	**[06 Hrs.]**
UNIT–2 : **Introduction to Contracts Specification & Scheduling** Types of Contracts, Contract documents, Specification, condition of contract, stages of planning. **Network Analysis :** The Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT), Bar Chart.	**[07 Hrs.]**
UNIT–3 : **Manpower, Material And Machinery** **Manpower –** Requirement and methods of calculating Productivity, Staffing, planning, directing & controlling. Duties and Responsibility of Personal Manager **Material –** Requirement, Procuring, Storing & Delivery. Quality Checks, Inventory Control techniques, Construction Waste generation and Management. **Machinery –** Introduction to different type of construction equipment's and their applications.	**[07 Hrs.]**
UNIT–4 : **Quality And Safety Management** Concept of Total Quality Management, introduction Safety Provisions as per National Building Code of India, Safety Equipment's, MIS in Construction Project.	**[06 Hrs.]**
UNIT–5 : **Legal Aspects In Construction Projects** Town Planning Requirements, Acts and codes related to planning, Regional Town Planning, Housing Development act, Highway Act, Irrigation act etc.	**[06 Hrs.]**
UNIT–6 : **Different Laws in project management** Environmental (Protection) act, Forest Conservation (Protection) act - Water and air pollution prevention act Transfer of property act– sale, purchase, and lease. Land Acquisition and Rehabilitation act, Indian Contract act.	**[07 Hrs.]**

VII Semester
CV2434 - PE-V : Advanced Steel Design

COURSE OBJECTIVES	COURSE OUTCOMES
Students shall study the 1. Fundamental design philosophies of steel structures 2. Codal provision for design of steel structure 3. Relationship between structural analysis and design provisions.	Students will be able to 1. Calculate different types of loading with respect to structural parameters. 2. Identify the type of structure and its design methodology. 3. Utilize the application of Indian Standard code for design purpose.
Mapped Program Outcomes : 1,2,3 8,12 **PSO** : i	

UNIT–1 : Eccentric connection.	**[06 Hrs.]**
UNIT–2 : Moment Resistant Connection.	**[07 Hrs.]**
UNIT–3 : Plate Girder: Element of Plate Girder, Types of Section, Design Aspect, Stability of Webs, Design of Welded Plate Girder.	**[06 Hrs.]**
UNIT–4 : Roof truss: Types of roof truss, different loading on truss, components of truss and analysis for industrial shed.	**[07 Hrs.]**
UNIT–5 : Introduction to Bridge and bearings: Types of Bridges, Types of bearings	**[06 Hrs.]**
UNIT–6 : Design of Footbridge.	**[07 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, McGraw 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, McGraw Hill Education Private Limited, 2011
2. Design of Steel Structures, By P. Dayaratnam, S. Chand Publication, 2008

VII Semester
CV2438 - PE-V : Pavement Design

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand classification, analysis and design of various types of pavement. 2. Pavement testing and evaluation. 3. Strengthening of the pavement, maintenance and rehabilitation	1. The students will be able to; 2. Explain different design parameters and specifications for flexible and rigid pavements. 3. Analyze and design flexible and rigid pavements. 4. Evaluate pavement condition and Explain techniques for strengthening of the pavement.
Mapped Program Outcomes : 1,2,3	

UNIT–1 : Introduction to Various types of pavement: Flexible, semi flexible and rigid pavements, composite pavement, Introduction to Ultrathin thin white topping & perpetual pavement. Design Parameters: Standard Axle load, wheel assemblies for road vehicles, Type and contact pressure, contact area imprints, Computations of ESWL.	**[06 Hrs.]**
UNIT–2 : Analysis of Flexible and Rigid Pavements: Stress, strain, deflection analysis for single, two, three and multi layered flexible pavement systems, stress and deflections for rigid pavements due to load and temperature.	**[07 Hrs.]**
UNIT–3 : IRC, MORTH, ICAO, IAAI specification and standard for highway and airfield constructions. Pavement management system.	**[06 Hrs.]**
UNIT–4 : Highway Pavement Design: Flexible : IRC-37, Brumister, AASHO method of design. Rigid: IRC 58, rigid pavement joints and reinforcement.	**[07 Hrs.]**
UNIT–5 : Airfield Pavement Design: Flexible : US Corps of Engineering, CBR and FAA. Rigid: PCA, FAA & LCN. Cost Estimates : Cost evaluation and comparative study.	**[06 Hrs.]**
UNIT–6 : Pavement Evaluation: International roughness Index (IRI), rut depth, profilometers, Bump integrator, Benkelman Beam Deflection study. Strengthening of Pavements: Introduction to flexible, composite and rigid overlay design for flexible and rigid pavement, repair, maintenance and rehabilitation of pavement.	**[07 Hrs.]**

VII Semester
CV2438 - PE-V : Pavement Design

Text Books :

1. Pavement Design by R. Srinivasa Kumar
2. Principles And Practices Of Highway Engineering: (Including Expressways And Airport Engineering) by L.R. Kadiyali), N.B. Lal
3. N.J. Garber and L. A. Hoel, Traffic and Highway Engineering, Thomson Learning, Inc., 2002.
4. E.J. Yoder and M. W. Witczak, Principles of Pavement Design, John Willey, Inc., 1975.
5. F.L. Roberts, P. S. Kandhal, E. R. Brown, DY Lee, and T. W. Kennedy, Hot

References Books :

1. Association of State Highway and Transportation Officials (AASHTO) Specifications and Guides, 2002. Y. H. Huang, Pavement Analysis and Design, Prentice Hall, 1993.
2. Mix Asphalt Materials, Mixture Design and Construction, 2ndEdition, NAPA Research and Education Foundation, 1996.
3. R. Horonjeff and F. X. Mckelvey, Planning and Design of Airports, McGraw Hill, Inc., 4thEdition, 1994.
4. The Asphalt Institute (AI) Superpave Series No. 2 (SP 2), Superpave Mix Design, 1996.
5. The AI Manual Series No. 2 (MS 2), Mix Design Methods for Asphalt Concrete and Other Hot Mix Types, 1996.
6. The AI Manual Series No. 4 (MS 4), The Asphalt Handbook, 1989 Edition.

VII Semester

CV2440 - PE-V : Structural Engineering Practices

COURSE OBJECTIVE	COURSE OUTCOMES
1. To make the students aware about Structural Engineering Practices and pre-requisites in initiating structural design 2. To provide the students the knowledge about various standards and specifications frequently referred by Structural Engineers and their use in practice 3. 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 4. To design an RCC building and prepare structural drawings.	1. An Ability to understand structural engineering practices and pre-requisites. 2. An ability to understand relevant standards and software related to structural design. 3. An ability to understand important construction process related to structural members. 4. 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 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Mechanical Engineering

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 planer, Mechanism for planer: Driving mechanism, feeding mechanism, planer 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.

<u>**Unit1**</u> **[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.

<u>Syllabus</u>:

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]**

<u>List of Practical</u>:-

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

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: - 4^{td} 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	Course Outcome
a)The contents of syllabus intend to understand basic principles and physical phenomenon of Thermal Energy transfer and to understand heat transfer applications and formulate the problem. b) To apply experimental tools for analysis of heat transfer applications in engineering. c) To receive results from experimental and the mathematical tools and interpret the results to provide solutions for improvement. d)In all to generate interest in learning to develop intuitive understanding in Heat Transfer.**[a,e,k,l,m]**	***On completion of this course, the student will be able to:*** 1) Analyze and solve the problems of unidirectional steady state heat conduction 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. L inear 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	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 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	4^{th} Edition (1965)	Maleev, Hartman	International Textbook Co.
2	Machine Design	3^{rd} Edition (1968)	Black P.H	Tata McGraw Hill

3	Mechanical Engg. Design	8^{th} Edition (2008)	Shigley	Tata McGraw Hill
4	Design Data book	1^{st} Edition (2005)	Shiwalkar B.D	Central Techno Publication
5	Design of Machine Elements	Edition (Yr of publication)	Bhandari V. B	Publisher
6	Machine Design	2^{nd} edition	Norton	McGraw publication

Reference books:				
1	Hand book of Machine Design	3^{rd} 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	ME1407	**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.** **3.Students will be able to investigate suitable plastic Processing technique.** **4.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**

	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
Evaluation Scheme	**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	2^{nd} 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	2^{nd} 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,l]	(I) Student will learn basics of Rapid Prototyping.[d,l]
	(II)Student will learn the process of RP.[l]
	(III)Student will learn model slicing for RP [l]
	(IV)Student will learn Liquid and solid based RP systems [l]
	(V) Student will learn powder based RP system [l]
	(V) Student will learn RP tooling and manufacturing [d,l]

Unit 1 Introduction **[7 hrs]**
CAD-CAM and its integration, Development of CAD CAM., The importance of being Rapid, The nature of RP/T,The state of RP/T industry. Rapid Prototyping Defined. Time compression Technologies, Product development and its relationship with rapid prototyping. **[d,l]**

Unit 2 Process Chain for RP **[7 hrs]**
Data Preparation (Pre-processing), Part Building, Post Processing. CAD Model Preparation, Reverse Engineering and CAD model, Digitizing Techniques: Mechanical Contact Digitizing, Optical Non-contact Measurement, CT Scanning Method, Data Processing for Surface Reconstruction.
Data interface for Rapid Prototyping: STL interface Specification, STL data generation, STL data Manipulation, Advantages and limitations of STL file format. Open files. Repair of STL files. Alternative RP interfaces.
Part orientation and support generation: Factors affecting part orientation, various models for part orientation determination, the function of part supports, support structure design, Automatic support structure generation. **[d,l]**

Unit 3 Model Slicing and Contour Data Organization **[8 hrs]**
Model slicing and skin contour determination, Identification of external and internal contours, Contour data
organization, Direct and adaptive slicing: Identification of peak features, Adaptive layer thickness determination,
Skin contour computation. Tool path generation.
Part Building: Recoating, parameters affecting part building time, part quality.
Post Processing: Part removal, finishing, curing.
Other issues: Shrinkage, Swelling, Curl and distortion, Surface Deviation and accuracy, Build Style Decisions, **[d,l]**

Unit 4 LIQUID BASED AND SOLID BASED RP SYSTEMS **[8 hrs]**
Stereolithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies. **[d,l]**

Unit 5 POWDER BASED RP SYSTEMS [8 hrs] Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations – Case Studies.. **[d,l]**
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 (7^{th} 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:- I**nteger programming problems and solve them with cutting plane methods, or branch and bound method. **[a,k,m]** • **CO-III:-** Dynamic programming by Bellman's principle of optimality for problem solving. **[a,k,m]** • **CO-IV:-** Quadratic programming for K.T. condition and Wolfe's modified simplex method. **[a,k,m]** • **CO-V:-** Game theory to analyze real world systems. . **[a,k,m]** • **CO-VI:-** Non-linear programming for different optimization techniques that are appropriate for solving realistic engineering problems.. **[a,k,m]**

Unit 1: Linear Programming [7 Hrs]

- Liner programming: formulation of problems, solution of LPP by revised simplex methods. Two phase simplex method, sensitivity analysis. **[a,k,m] (CO-I)**

Unit 2: Advanced Linear Programming [7 Hrs]

- Pure & mixed integer programming, Zero-one and Goal programming and its application. **[a,k,m] (CO-II)**

Unit 3: Dynamic Programming [7 Hrs]

- Dynamic programming: Decision tree. Bellman‟s principle of optimality. Application in industry. **[a,k,m] (CO-III)**

Unit 4: Quadratic Programming [7 Hrs]

- Kuhn-tucker conditions, Wolfe's modified simplex method, Beale's method. **[a,k,m] (CO-IV)**

Unit 5: Game Theory [7 Hrs]

- Decision making, decision theory, game theory. **[a,k,m] (CO-V)**

Unit 6: Non Linear Programming [7 Hrs]

- Non-liner programming: Fibonacci and golden section search: Powells pattern search algorithm, complimentary Pivot algorithm, optimizations by geometric programming. **[a,k,m] (CO-VI)**

Text Books :-

1. Gupta ,Swaroop," Operation Research"
2. Hira , Gupta," Operation Research Techniques"

Reference Books:

1. Ravindran, Phillips Solberg , "OR Principles & Practice "
2. Hiller Libermen, "OR (Operation Research)"
3. Taha ,"OR (Operation Research) "
4. S.S. Rao , " Optimization Techniques".
5.Linear and non linear optimization, Griva, Nash, Sofer.

7th Semester 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 l/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	5^{th} 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	13^{th} 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.

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
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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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2			

7	ME1470	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	6^{th}	Anthony Esposito	PEARSON Prentice Hall
Industrial Hydraulics	3^{rd} or above	J.J. Pipenger & T. G. Hicks	McGraw Hill Co.
Pneumatic Systems: Principles and Maintenance	16^{th} (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	2^{nd} 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	4^{th} edition 2003	Milton	McGraw-Hill,
5	Engineering Statistics	2^{nd} 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	5^{th} 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.

Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. EL-201

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	30	40	3 Hours
2	3	PC	EL2201	Analog Electronics	T	3	0	0	3	3	30	30	40	3 Hours
3	3	PC	EL2202	Lab. : Electronics Engineering Workshop	P	0	0	2	2	1		60	40	
4	3	PC	EL2203	Electrical Machines	T	4	0	0	4	4	30	30	40	3 Hours
5	3	PC	EL2204	Lab.:Electrical Machines	P	0	0	2	2	1		60	40	
6	3	PC	EL2205	Network Analysis	T	3	0	0	3	3	30	30	40	3 Hours
7	3	PC	EL2206	Lab.:Computer Programming	P	0	0	2	2	1		60	40	
8	3	PC	EL2207	Electrical Measurement & Instrumentation	T	3	0	0	3	3	30	30	40	3 Hours
9	3	PC	EL2208	Lab.:Electrical Measurement & Instrumentation	P	0	0	2	2	1		60	40	
					TOTAL	**16**	**0**	**8**	**24**	**20**				

SN	Sem	Type	Sub. Code	Subject	T/P	L	T	P	Hrs	Credits	MSEs*	TA**	ESE	ESE Duration Hours
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	30	40	3 Hours
2	4	PC	EL2251	Electrical Machines in Power System	T	3	0	0	3	3	30	30	40	3 Hours
3	4	PC	EL2252	Lab.:Electrical Machines in Power System	P	0	0	2	2	1		60	40	
4	4	PC	EL2253	Electrical Energy Generation System	T	3	0	0	3	3	30	30	40	3 Hours
5	4	PC	EL2254	Lab.:Renewable Energy System	P	0	0	2	2	1		60	40	
6	4	PC	EL2255	Electric & Magnetic Fields	T	3	0	0	3	3	30	30	40	3 Hours
7	4	PC	EL2256	Lab.:Electrical Engineering Workshop	P	0	0	2	2	1		60	40	
8	4	PC	EL2257	Microprocessor	T	3	0	0	3	3	30	30	40	3 Hours
9	4	PC	EL2258	Lab.:Microprocessor	P	0	0	2	2	1		60	40	
10	4	PC	EL2259	Signals & Systems	T	4	0	0	4	4	30	30	40	3 Hours
					TOTAL	**19**	**0**	**8**	**27**	**23**				

SN	Sem	Type	Sub. Code	Subject	T/P	L	T	P	Hrs	Credits
List of Audit Courses										
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	A	3	0	0	3	0

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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

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SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours L	T	P	Hrs	Credits	% Weightage MSEs*	TA**	ESE	ESE Duration Hours
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	T	3	0	0	3	3	30	30	40	3 Hours
2	5	PC	EL2301	Power Electronics	T	3	0	0	3	3	30	30	40	3 Hours
3	5	PC	EL2302	Lab.:Power Electronics	P	0	0	2	2	1		60	40	
4	5	PC	EL2303	Fundamentals of Power System	T	3	0	0	3	3	30	30	40	3 Hours
5	5	PC	EL2304	Electrical Drives	T	3	0	0	3	3	30	30	40	
6	5	PC	EL2305	Lab.:Electrical Drives	P	0	0	2	2	1		60	40	
7		OE		Open Elective - I *	T	3	0	0	3	3	30	30	40	3 Hours
8	5	OE		Open Elective - II *	T	3	0	0	3	3	30	30	40	3 Hours
					TOTAL	18	0	4	22	20				

Audit Courses											
1	5	IT	IT1121	Industrial Programmin Language	A	3	0	0	3	0	

Open Electives -I

1	5	OE	EL2311	OEI:Renewable Energy Generation System
2	5	OE	EL2312	OEI:Electrical Machines and their Applications
3	5	OE	EL2313	OEI:Testing and Maintenance of Electrical Machines

Open Electives -II

4	5	OE	EL2321	OEII:Electrical Energy Audit and Safety
5	5	OE	EL2322	OEII:Utilization of Electrical Energy
6	5	OE	EL2323	OEII:Power System Engineering

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

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TA = for Practical : MSPA will be 15 marks each**

[signature]	[signature]	June 2020	1.02	Applicable for AY 2020-21 Onwards
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SoE No. EL-201

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamental of Management	T	3	0	0	3	3	30	30	40	3 Hours
2	6	PC	EL2351	Control System	T	3	0	0	3	3	30	30	40	3 Hours
3	6	PC	EL2352	Lab.:Control System	P	0	0	2	2	1		60	40	
4	6	PC	EL2353	Power System Analysis	T	3	0	0	3	3	30	30	40	3 Hours
5	6	PE		**Professional Elective I**	T	3	0	0	3	3	30	30	40	3 Hours
6	6	PE	EL2354	Lab.:Simulation of Power Electronics & Power System	P	0	0	2	2	1		60	40	
7	6	OE		**Open Elective III ***	T	3	0	0	3	3	30	30	40	3 Hours
8	6	OE		**Open Elective IV ***	T	3	0	0	3	3	30	30	40	3 Hours
9	6	PC	EL2355	Lab.:Substation Design	P	0	0	2	2	1		60	40	
10	5/6	STR	EL2360	**Industry Visit and its report**	P	0	0	0	0	1		60	40	
					TOTAL	**18**	**0**	**6**	**24**	**22**				

Professional Electives -I

1	6	PE	EL2361	**PEI:**Advanced Power Electronics
2	6	PE	EL2362	**PEI:**Electrical Distribution in Power System
3	6	PE	EL2363	**PEI:**Illumination Engineering (MOOC)
4	6	PE	EL2364	**PEI:**Electric Vehicles
5	6	PE	EL2365	**PEI:**Electric Power Utilization

Open Electives -III

6	6	OE	EL2371	**OEIII**:Renewable Energy Generation System
7	6	OE	EL2372	**OEIII**:Electrical Machines and their Applications
8	6	OE	EL2373	**OEIII**:Testing and Maintenance of Electrical Machines

Open Electives -IV

9	6	OE	EL2381	**OEIV:**Electrical Energy Audit and Safety
10	6	OE	EL2382	**OEIV**:Utilization of Electrical Energy
11	6	OE	EL2383	**OEIV**:Power System Engineering

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TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.02**	**Applicable for AY 2020-21 Onwards**
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B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No.
EL-201

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EL2401	Switchgear & Protection	**T**	3	0	0	3	3	30	30	40	3 Hours
2	7	PC	EL2402	Lab.:Switchgear & Protection	**P**	0	0	2	2	1		60	40	
3	7	PC	EL2403	High Voltage Engineering	T	3	0	0	3	3	30	30	40	3 Hours
4	7	PC	EL2404	Lab.:High Voltage Engineering	**P**	0	0	2	2	1		60	40	
5	7	PE		**Professional Elective II**	**T**	3	0	0	3	3	30	30	40	3 Hours
6	7	PE		**Professional Elective III**	**T**	3	0	0	3	3	30	30	40	3 Hours
7	7	PE		**Professional Elective IV**	**T**	3	0	0	3	3	30	30	40	3 Hours
8	7	STR	EL2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EL2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -II

1	7	PE	EL2411	**PEII:** Fundamentals of Power Quality
2	7	PE	EL2412	**PEII:**Electrical Installation Design
3	7	PE	EL2413	**PEII:**Electrical Machine Design
4	7	PE	EL2421	**PEII:** Power System Operation and Control

Professional Electives -III

5	7	PE	EL2422	**PEIII**:FACTS Devices
6	7	PE	EL2423	**PEIII**:Electrical Energy Management And Audit
7	7	PE	EL2424	**PEIII:**Advanced Control System
8	7	PE	EL2425	**PEIII:**Artificial Intelligence Based System

Professional Electives -IV

9	7	PE	EL2431	**PEIV:**Advanced Electrical Drives
10	7	PE	EL2432	**PEIV**:Fundamentals of Smart Grid
11	7	PE	EL2433	**PEIV**:Computer Methods in Power System
12	7	PE	EL2434	**PEIV**:EHVAC-HVDC Transmission

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.02**	**Applicable for AY 2021-22 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

SoE No.
EL-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EL2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	EL2452	Extra curricular Activity Evaluation	P	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				

GRAND TOTAL	**86**	**0**	**46**	**132**	**163**	

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA** = for Practical : MSPA will be 15 marks each

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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

III SEMESTER

EL2201	Analog Electronics		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes
After taking this course, the student should be able to analyze, simulate, and design single and multistage amplifiers. Design of single, multistage, and op-amp amplifier are covered in detail including analysis of biasing techniques, frequency response compensation, feedback, stability, noise and nonlinearity	The student will be able: 1. To identify the basic structure, characteristics and various operating modes of BJT 2. To Explain and Describe the various small signal parameters and its applications 3. To demonstrate the knowledge to develop various power amplifier and oscillator circuit. 4. To analyse and evaluate the basic concept of Op-Amp circuit and its various applications.

UNIT-1: Bipolar Junction Transistors (BJT)
BJT, Theory of operation, characteristics, Biasing arrangements (CB, CE, CC modes), operating modes , Stability factor, Transistor as a switch.

UNIT-2: Small Signal Analysis
Small signal analysis of CE, CB, CCmodes and their comparison, AC equivalent circuit, transistor equivalent circuit-CE, Hybrid equivalent model, Analysis of a transistor using h-parameter, emitter follower, RC coupled amplifier, low frequency response of an RC coupled stage

UNIT-3 :Power & Feedback Amplifier
Introduction to Power Transistors, Power amplifiers- classification as A,B, AB, C, Push pull amplifiers, Cross over distortion, Positive and Negative amplifiers- classification, feedback amplifiers, advantages and applications.

UNIT-4:Oscillator Circuits
Basic principle of sinusoidal oscillator, R-C Phase Shift and Wein Bridge oscillators, Tuned oscillators- Collpits and Hartley; Crystal oscillator

UNIT-5 : Operational Amplifier (OA)
Simple linear circuit: Inverting, non-inverting , buffer amplifier, summer integrator , differentiator, log, antilog, Multiplier, instrumentation amplifier, grounding and shielding problem in instrumentation amplifier. Precision rectifier, RMS to DC conversion, constant current and voltage sources, Sinusoidal oscillator with frequency and amplitude stabilization elementary , idea of active filter with Butterworth second order filter design procedure.

UNIT-6: Applications of Operational Amplifier
Applications of Operational amplifier for clipping, clamping, comparator circuit with non-linear components, Multiplexers, Demultiplexer, Astable, Mononstable, Bistable multivibrator circuits using OpAmp, sample/ hold circuits,D/A and A/D conversion circuits.

III SEMESTER

EL2201	Analog Electronics		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Text Books:

SNo.	Title	Authors	Publisher
1	Electronic Principles,	A.P. Malvino,	Tata Mcgraw Hill Publications
2	Electronics : Analog & Digital	I. J. Nagrath	PHI Publication
3	Linear Application Handbook	National Semiconductors	
4	Operational Amplifiers	Dailey	Tata McGraw Hill
5	Introduction to Operational Amp	Wait	Tata McGraw Hill
6	Designing with Op- Amps	France	Tata McGraw Hill

Reference Books:

SNo.	Title	Authors	Publisher
1	Electronic devices and circuits	Jacob Millman, and C.C. Halkias	TMH Publications
2	Introduction to Semiconductor	M. S. Tyagi	John Wiley & Sons Inc
3	Materials and Devices		
4	Solid State Electronic Devices	Ben G. Streetman,	PHI, 5th Ed, 2001

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

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III SEMESTER

EL2203	Electrical Machines		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes
The course objective is to impart knowledge of • The basic principle of transfer of electrical power, operation, construction of 3-phase transformers, their classification, connections and phasor diagrams. • The basic principle, construction, operation, Performance characteristics, steady state analysis and applications of electrical motors andinduction generator.	Students will be able to 1. Demonstrate the knowledge of Operation of single phase and auto-transformer. Develop, analyse and evaluate vector diagrams and performance indices of single phase transformer. 2. Explain Construction, vector grouping, testing and examine the need of parallel operation of three phase transformers 3. Explain and examine principle, construction, types, operation, speed control, characteristic and applications of DC machines and evaluate performance parameters of d.c.machines 4. .Explain and examine principle, construction, operation, starting, speed control ,applications and evaluate the performance indices of induction motors.
Mapped program outcomes:1,2,3	

UNIT 1: ELECTRO MAGNETISM: (6)

Magnetic Field, Magnetic Flux, Magnetic Flux Density, Permeability, Relation between magnetic flux density and field intensity, magnetic field due to current carrying conductor and a coil, Right hand grip rule, Force on a current carrying conductor placed in a magnetic field, Flemings Left hand Rule, Magnetomotive Force, Magnetic Field Strength, Reluctance, Magnetization curves of magnetic materials, Magnetic hysteresis and hysteresis loss, Eddy current and loss, leakage flux and fringing, Faraday's laws of electromagnetic induction, Lenz's Law, Flemings's Right hand rule, Types of induced EMF.

UNIT-2: SINGLE PHASE TRANSFORMER (10)

Phasor diagram of transformer on no load and on load, Load Test, Open circuit and short circuit test on 1 phase transformer, equivalent circuit of transformer, Efficiency and condition for maximum efficiency, Regulation and Efficiency using O.C. & S.C. data, Autotransformer operation, kVA rating of autotransformer.

UNIT-3: THREE PHASE TRANSFORMER (08)

Types of 3 phase transformers, Construction, Labelling of terminals, Vector Groups, Polarity marking & Test, Transformer connections and their comparative features, Open Delta Connection, parallel operation of single and three phase transformers, All day efficiency

UNIT-4 D.C. GENERATOR: (08)

Construction, Magnetic structure, Field and Armature systems, Field and Armature windings (Both Lap and Wave Types),EMF Equation, Characteristics and applications of different types of D.C. Generators, Building of Emf in D.C. Shunt generator, Armature reaction, commutation, straight line commutation, inter-poles, compensating winding.

III SEMESTER

EL2203	Electrical Machines		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

UNIT 5: D.C. MOTOR: (08)

Principle, Torque Equation, Characteristics and applications of various types of D.C. Motors, Starting of D.C. Motors, Speed control of Series and Shunt motors, Power flow in DC machines, Losses and Efficiency in D.C. machines,

UNIT 6 :THREE PHASE INDUCTION MOTOR (10)

Equivalent circuit, No load and blocked rotor tests and determination of parameters of equivalent circuit, Losses and efficiency. Starting, Speed control, Crawling and cogging, Double cage induction motor: principle, construction, torque slip characteristics. Induction Generator: principle, isolated operation, double fed induction generator, applications

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Electrical Machines	2nd -1993	Dr. P. K. Mukherjee and S. Chakravarti	Dhanpat Rai Publications (P) Ltd
2	Electrical Machines	3rd -2010	I.J.Nagrath and Dr. D.P.Kothari	Tata McGraw Hill
3	Electric Machines		Ashfaq Husain	Dhanpat Rai Publications (P) Ltd.

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	D.C. Machines		Langsdorf	
2	Electrical Machines and Transformers		Nasser Syed	
3	Laboratory manual for Electrical machines		Dr. D.P. Kothari and Prof. Umre	.S. S.CHAND

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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.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

BE SoE and Syllabus 2018

ELECTRICAL ENGINEERING

III SEMESTER

EL2205	Network Analysis		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes
The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn: • The fundamental principles of electrical circuit analysis and to be able to extend these principles into a way of thinking for problem solving in mathematics, science, and engineering • To become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the mesh - node method. • To appreciate the consequences of linearity, in particular the principle of superposition and Thevenin - Norton equivalent circuits. • To analyze analog circuits that include energy storage elements. • To utilize Laplace transforms for circuit analysis. • To analyze four terminal networks using two-port parameters.	Upon successful completion of this course, students should be able to: 1) Define basic concepts related to the course of network analysis. 2) 2) Select best possible method of circuit analysis for a given situation. 3) Apply a variety of circuit analysis methods including theorems and Laplace transform. 4) Design circuits for a given voltage, power, as well as for critical frequencies and two port parameters

Mapped program outcomes							

UNIT 6 :THREE PHASE INDUCTION MOTOR **(10)**

Equivalent circuit, No load and blocked rotor tests and determination of parameters of equivalent circuit, Losses and efficiency. Starting, Speed control, Crawling and cogging, Double cage induction motor: principle, construction, torque slip characteristics. Induction Generator: principle, isolated operation, double fed induction generator, applications

UNIT-1: NODAL ANALYSIS OF ELECTRIC CIRCUITS

Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources - their types and characteristics, concept of equivalent sources, source transformation, concept of supernode and V – shift, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-2: : MESH ANALYSIS OF ELECTRIC CIRCUITS

Concept of supermesh and I – shift, mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-3 :NETWORK THEOREM

Superposition Theorem, Thevenin‟s Theorem, Norton‟s Theorem, Maximum Power Transfer Theorem.

(signature)	(signature)	June 2019	1.00	Applicable for AY 2019-20 Onwards
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III SEMESTER

EL2205	Network Analysis		L=3	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

UNIT-4: INITIAL AND FINAL CONDITIONS, IMPEDANCE FUNCTIONS AND CIRCUIT ANALYSIS WITH LAPLACE TRANSFORM

Concept of initial and final conditions, behavior of resistor, inductor and capacitor at t = 0- and at t = 0+, procedure for evaluating initial and final conditions, analytical treatment.

Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform.

UNIT-5:TRANSFORMS OF OTHER SIGNAL WAVEFORMS, NETWORK FUNCTIONS, POLES AND ZEROS OF NETWORK FUNCTIONS

Unit step, ramp and impulse functions with and without time delay, their Laplace transform, waveform synthesis and its application to electrical networks.

Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions, time domain behavior from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-6: TWO PORT PARAMETERS

Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, conditions for reciprocity and electrical symmetry in terms of two – port parameters, interconnections of two - port networks.

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Network Analysis	3rd Edition	M. E. Van Valkenburg	PHI Learning Private Limited
2	Engineering Circuit Analysis	8th Edition	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin	McGraw – Hill
3	Linear Circuit Analysis	2nd Edition	Decarlo, Lin	Oxford Univ. Press

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Schaum"s 3000 Solved Problems In Electric Circuits Book 1 & 2	1st Edition	Syed A. Nasar	McGraw - Hill
2	Schaum"s Outline Series: Theory and Problems of Electric Circuits	5th Edition	Joseph A. Edminister	McGraw - Hill
3	Basic Circuit Theory	3rd Edition	Lawrence P. Huelsman	PHI Learning Private Limited

III SEMESTER

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

III SEMESTER

EL2207	Electrical Measurement & Instrumentation		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes
Students will be able to understand the operation of different electrical instrument used for measurement of electrical and non-electrical parameters and measurement of resistance, inductance or capacitance using various bridges. CT and PT applications	Upon successful completion of this course, Students should be able to: 1) Explain the working of Electrical instruments and compute the value of Resistances, inductance and capacitance by using bridges. 2) Evaluate electrical power and energy in single phase and three phase circuits. 3) Explain and illustrate the concept of instrumentation system with different Transducers and Sensors. 4) Explain the construction, working principle and applications of Transducers. 5) Evaluate Power calculations and applications of Transducers.

UNIT - I: MEASURING INSTRUMENTS

Electrical Measurement :

Classification of Instruments , Deflection and null type instruments ,forces acting in Indicating instruments , PMMC and MI type instruments (Construction and working principle)

Measurement of Resistance :

Classification of Resistance, Wheatstone bridge , Kelvin's Double Bridge , Loss of charge method.

Megger (Construction and Operating principle, Measurement of Earth Resistance.

UNIT – II: POTENTIOMETERS AND AC BRIDGES

D.C. Potentiometer:

Basic Potentiometer circuit, Lab.Type Potentiometer voltage ratio box.

A.C. Potentiometer:--

Standardization of AC Potentiometer, Drysdale Polar potentiometer, Gall-Tinsley (Co-ordinate type) Potentiometer.

AC Bridges:

General equation of AC bridge balance, measurement of Inductance by Maxwell Inductance-capacitance Bridge, detectors used in AC Bridges, Measurement of Capacitance By High voltage Schering bridge , Measurement of Relative Permittivity by Schering bridge, Measurement of frequency By Wien's Bridge.

UNIT – III: MEASUREMENT OF POWER AND ENERGY

Wattmeter :

Electrodynamometer type wattmeter (construction and operation) , LPF Wattmeter, Measurement of power using instrument transformer, Blondal's Theorem , Measurement of three phase power By single wattmeter , Two wattmeter , and three wattmeter method , measurement of Reactive power for Balanced load using single wattmeter method.

Energy Measurement :

Induction type Energy meter (construction and operating principle)Errors and their compensation , Two element energy meter , maximum demand energy meter , phantom Loading (Merz – price).

Power factor Meter : Three phase Electrodynamometer type power factor meter.

III SEMESTER

EL2207	Electrical Measurement & Instrumentation		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

UNIT – IV: INSTRUMENT TRANSFORMERS
Instrument Transformer :
Use of instrument transformer , ratios in instrument transformer , burden , characteristics of CT , Effect of secondary open in CT.
Potential transformer : Difference between CT and PT , Errors in PT , Reduction of errors in PT , characteristics of PT

UNIT – V: DIGITAL INSTRUMENTS AND TRANSDUCERS
Digital Voltmeters, Digital Ammeters:
Ramp type digital Voltmeter and Ammeter, Integrating type digital voltmeter and ammeter.
Digital Frequency Meter: Basic circuit, Time base , start and stop Gate circuit for measurement of frequency. Electrical resonance type frequency meter , Weston frequency meter
Transducers: Introduction , Types (Piezoelectric Transducer , Active , Passive transducers)

UNIT – VI: ANALOG TRANSDUCERS
Transducers :
Transducers required for the measurement of (Non electrical quantities)
Linear displacement ,(LVDT), Strain , (Strain gauge, Un bounded metal Strain gauge, semi conductor Strain gauge),Pressure , (Bourden Tube,Bellows, Pirani Gauge),Torque ,
Linear velocity, Angular Velocity, Temperature,(Thermocouples ,First and Second Law of Thermocouple, Thermistors , Bimetallic Thermocouples), Flow (Electromagnetic Flow meter), Acceleration : LVDT Accelerometer.
Digital Encoding transducers – Contacting or Brush type, Shaft encoder.

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Electrical Measurement And Instrumentation	Eighteenth Revised and Enlarged Edition , 2007)	A.K.Sawhney	
2	Electrical Measurement :		J. Singh	
3	Electrical Measurement and Measuring Instrument.			Tata McGraw Hills

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Electrical And Electronics Measurement	19th Edition	A.K.Sawhney	

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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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)**

IV Semester
GE2204 - Advanced Mathematical Techniques

Text Books:

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

Reference Books:

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

IV SEMESTER

EL2251	Electrical Machines in Power System		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes
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

UNIT-1: Three Phase Synchronous Generator (07)
Introduction, Constructional features of cylindrical and salient pole rotor machines, Full pitch coil, short pitched coil, Coil span factor, concentrated winding, distributed winding, distribution factor, introduction to armature winding and field winding, MMF of armature winding, induced EMF with and without harmonics.

UNIT-2: Steady State Operation of Three phase synchronous generators (07)
Effect of loading on terminal voltage, Armature reaction, Effect of load power factor on armature reaction, concept of synchronous reactance, Phasor diagram on load, regulation by Direct loading, Emf method, Load characteristics, External Characteristic, Zero power factor characteristics (ZPFC), construction of Potier triangle.

UNIT-3: Parallel Operation (06)
Conditions of synchronization of generator with another generator and or Infinite busbars, Parallel operation, Load sharing between parallel connected generators. Effect of variable excitation and power input on generator operation.

UNIT-4: Synchronous Motor (06)
Principle of operation, Methods of starting, phasor diagram, expression for torque, Excitation Emf, load/torque angle, Effect of variable excitation and load on motor operation, V and inverted V curves, Concept of synchronous condenser,
Introduction to Reluctance and Hysteresis motor

UNIT 5: Synchronous Machine Connected to Infinite Bus (08)
Power Angle Characteristic of Synchronous machines with and without armature resistance. Expression for electrical and electromechanical power developed, losses and efficiency in synchronous machines.

UNIT-6: Transient Behaviour (06)
Short circuit ratio, unbalanced Loading, Sequence Component, Sudden 3-phase short circuit, Constant flux linkage theorem, Transient and sub–transient reactances, Time constants and equivalent circuit diagram, role of damper winding in both generator and motor operation. Experimental determination of steady state & transient parameters

IV SEMESTER

EL2251	Electrical Machines in Power System		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Text Books:

SN	Title	Edition	Authors	Publisher
1	Electrical Machines	2nd -1993	Dr. P. K. Mukherjee and S. Chakravarti	Dhanpat Rai Publications (P) Ltd
2	Electrical Machines	3rd -2010	I.J.Nagrath and Dr. D.P.Kothari	Tata McGraw Hill
3	Alternating Current Machines	1st -1983	M.G. Say	CBS Publishers
4	Electrical Machinery	7TH -2008	P.S.Bhimbra	
5	Electrical Machinery	1ST-1985	A.E.Fitzgerald, C.Kingsley, S.D.Umens	Mc Graw Hill
6	Electric Machines	2nd -2008	Ashfaq Husain	Dhanpat Rai Publications (P) Ltd.

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

EL2253	Electrical Energy Generation System		L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	

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

Course Objective	Course Outcomes

Unit I: Introduction to generation systems (7)
Importance of Electrical Energy, Generation of Electrical Energy, Relationships among Energy units, Calorific value of fuels.
Sources of Electrical energy- Coal, oil and natural gas, hydro, solar, wind and nuclear energy.
Different factors associated with a generating station : connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity and utilization factor, load curve and load duration curveload survey, base load and peak load station, advantages of interconnection.
Tariff-: Definition, Objective, Characteristics of tariff, Types of Tariff (Numerical), economical choice of tariff.

Unit II: Solar Energy (7)
Solar radiation & its Measurement: - Solar constant, Solar radiation at earth's surface, Solar radiation geometry, Solar radiation on tilted surfaces, Solar radiation measurement, Solar Energy Collectors: - Physical principles of the conversion of solar radiation into heat, flat plate collectors. Applications of Solar energy: Solar Dryer, Solar Still, Solar cooker
Solar Photovoltaic Cell: Principle of solar photovoltaic energy conversion, Equivalent circuit of solar cell,

Unit III: Wind Energy (7)
Principle of wind energy conversion, Power in the wind, Cut In, Cut Off Wind Speed ,Site selection considerations, Basic components of wind energy conversion systems(WECS),Classification of WEC systems, Advantages and Limitations of WECS,,Types of wind Machines(HAWT and VAWT), Application of wind energy.

Unit IV: Hydro Power Station (6 or7)
Schematic arrangement of Hydroelectric Power Station, Constituents of Hydroelectric power plant, Advantages and Limitations of Hydro-electric Plants ,Hydrology, stream flow, flow duration curve, power duration curve, mass curve, reservoir capacity, Water Power equation (Numerical), type of hydro power plants and their field of use, pumped storage plant and their utility, surge tanks. General study of Hydro Turbine, Introduction to Small hydro plants.

Unit V: Thermal Power Station (7)
Introduction, Site selection, size and number of units, general layout, major equipment, auxiliaries, electric supply to auxiliary, cost of generation ,effect of different factors on costs.
General study of steam Turbine.
Condenser: Different types of condensers. Construction and Working principle of Condenser

Unit VI: Nuclear Power Plant and Biomass Energy (7)
A)Site selection for nuclear power plant, introduction to nuclear physics, chain reaction, Working Principle of nuclear Power Plant, Components of a nuclear reactor, types of nuclear reactor, material for moderator and control rods, control of nuclear reactors, , economics of nuclear power generation.
B)Biogas production from waste biomass, classification of biogas plants, operational parameters, availability of raw material and gas yield.

IV SEMESTER

EL2253	Electrical Energy Generation System	L=3	T=0	P=0	Credits=3

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

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

Course Objective	Course Outcomes

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Textbook on Power System Engineering	2nd edition 2014	M.L.Soni,P.V.Gupta,U.S.Bhatnagar	Dhanpat Rai and Co.
2	Principles of Power System	2nd edition 2008	V.K.Mehta, Rohit Mehta	S.Chand
3	Generation of Electrical Energy	5th edition 2007	B.R.Gupta	S.Chand
4	Non-Conventional Energy Sources	5th edition 2011	G. D. Rai	Khanna

Text Books:

SN	Title	Edition	Authors	Publisher
1	Power System Analysis	1st edition 2007	T.K. Nagsarkar, M.S. Sukhija	Oxford
2	Electrical Power System	5th edition 2007	Ashfaque Hussain	CBS
3	Non-Conventional Energy Resources	2nd edition 2010	B. H. Khan	Tata McGraw-Hill

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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IV SEMESTER

EL2255	Electric and Magnetic Fields			L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment		TA	ESE	Total		ESE Duration
	30		10	60	100		3 Hours

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

Course Objective	Course Outcomes
To educate the student in static electric and magnetic fields. To make them aware about various laws of electromagnetic & electrostatic fields.	The student will be able to : 1. Remember, Understand and Analyze the properties of electrostatic field. 2. Apply electrostatics on different mediums and analyze the boundary characteristics. 3. Remember and Understand and Apply the properties of electromagnetic field. 4. Understand the electromagnetic waves and analyze them over different medium.

UNIT-1:Vector Analysis

Scalars and vectors, vector algebra, the Cartesian coordinate system , the scalar and vector field, the dot product, the cross product, Cylindrical coordinate system, Spherical coordinate system.

UNIT-2:Coulomb's Law and Electric Field Intensity: Electric Flux Density, Gauss's Law, and Divergence

Coulomb‟s Law, electric field intensity, types of charge distributions, electric field due to line charge density, surface charge density, and volume charge density, streamlines and sketches of fields. Concept of electric flux, electric flux density, Gauss‟s Law, application of Gauss‟s Law to symmetrical charge distributions, application of Gauss‟s law to differential volume element, divergence, Maxwell‟s first equation in electrostatics, the vector operator and the Divergence theorem.

UNIT-3Energy and Potential: Conductors, Dielectrics, and Capacitance

Energy expended in moving a point charge in an electric field, potential difference and potential, the potential field of a point charge, line charge density and surface charge density, the potential field of a system of charges, potential gradient, the dipole, energy density in the electrostatic field, Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, the method of images, semiconductors, the nature of dielectric materials, boundary conditions for perfect dielectric materials, capacitance, several capacitance examples.

UNIT-4:Poisson's and Laplace's Equations

Poisson‟s and Laplace‟s equations, Uniqueness theorem, examples of the solution of Laplace‟s equation (involving one variable only).

UNIT-5 Steady Magnetic Field: Magnetic Forces, Materials, and Inductance

Biot – Savart law, magnetic field due to infinitely long current filament, finite length current filament, Ampere‟s circuital law, magnetic field due to coaxial cable, uniform sheet of surface current, solenoid, toroid, curl and its physical interpretation, Stoke‟s theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, Force on a moving charge, force on a differential current element, force between differential current elements, force and torque on a closed circuit, nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, potential energy and forces on magnetic materials, inductance and mutual inductance.

IV SEMESTER

EL2255	Electric and Magnetic Fields	L=3	T=0	P=0	Credits=3

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

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

Course Objective	Course Outcomes
To educate the student in static electric and magnetic fields. To make them aware about various laws of electromagnetic & electrostatic fields.	The student will be able to : 1. Remember, Understand and Analyze the properties of electrostatic field. 2. Apply electrostatics on different mediums and analyze the boundary characteristics. 3. Remember and Understand and Apply the properties of electromagnetic field. 4. Understand the electromagnetic waves and analyze them over different medium.

UNIT-6: Time-Varying Fields and Maxwell's Equations, Uniform Plane Wave

Faraday"s Law, derivation of Maxwell"s equations in point form and integral form, displacement current and its physical interpretation, concept of retarded potentials, Maxwell"s equations in phasor form, wave equations, uniform plane waves, solution of wave equation in free space, perfect dielectric, lossy dielectrics and good conductor, skin effect and skin depth, Poynting vector.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Engineering Electromagnetics	7th Edition	W.H. Hayt J. A. Buck	McGraw Hill Publication.
2	Schaum"s Outline Series Theory and Problems of Electromagnetics	2nd Edition	Joseph A. Edminister	Schaum"s outline Series of Engineering
3	Principles of Electromagnetics	4th-2007	Matthew N.O.Sadiku	Oxford University Press

Reference books:

SN	Title	Edition	Authors	Publisher
1	Applied Electromagnetic	1978	Plonus M. A.	MGH
2	Electromagnetics	1998	Kraus J. D.	MGH
3	Fundamentals of Electromagnetics with MATLAB	2nd Edition	Karl E. Lonngren, Sava V. Savov, Randy J. Jost	Scitech Publishing Inc.

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.

IV SEMESTER

EL2257	Microprocessors			L=3	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration		
	30	10	60	100	3 Hours		

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

Course Objective	Course Outcomes
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

UNIT-1: **Memory devices**
Memory devices, RAM, ROM, Introduction to Intel"s 8085 Architecture, Flag register, Instruction set, Addressing modes, assemblers, hand coding (7 Hours)

UNIT-2: Programming Instructions
Branching instruction, Simple programmes, stack, PUSH, POP Instructions, CALL/RETURN instruction & Subroutines- simple & nested programmes, Programmes using Subroutines. (8 Hours)

UNIT-3: Timing Diagrams
Timing Diagrams, Timing Diagram of instruction. Delay programmes, Serial data transfer, Interrupts - concept and structure in 8085 Interrupt service routine, advanced instructions & Programming of 8085A. (7 Hours)

UNIT-4: Interfacing of Microprocessor
Complete signal description of 8085, interfacing memory devices interfacing I/O devices. Methods of data transfer-serial, parallel synchronous and asynchronous. IN/OUT instructions. Hardware considerations bus contention, slow memory interfacing. (8 Hours)

UNIT-5: Hardware interfacing and Handshaking
Simple hardware interface to 8085 of standard latches & buffers as I/O ports. Architecture and interface of 8255 & 8085. Handshaking concepts. Interfacing of multiplexed keyboard/ display interface and assembler directives. Interfacing of ADC & DAC, stepper motor Interface with 8085. (8 Hours)

UNIT-6: Architecture and Interface
Architecture and interface of 8253 with & 8085, Different modes of 8253. Architecture and interface of 8257 with & 8085, Different modes of operation of 8257, Application of microcontroller. (7 Hours)

Text Books:

SN	Title	Edition	Authors	Publisher
1	Programming and Interfacing 8085		Gaonkar	
2	Programming of 8085		D.V. Hall	

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor & Interfacing Manual , Intel Perpheral		Barry Brey	

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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.

IV SEMESTER

EL2259	Signals & Systems	L=4	T=0	P=0	Credits=4

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

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

Course Objective	Course Outcomes
To make the student conversant with the analysis of the signal and how to represents the periodic and non-periodic signals.	The student will be able : 1) To classify signals and systems and analyze continuous and discrete time signals. To understand the properties of LTI system 2) To Interpret periodic signals and representing them by using Fourier series.ToInterpret continuous and discrete time signals in frequency domain and to summaries properties of Fourier transform. 3) To do the time and frequency characterization of signals and systems. 4) to understand the Laplace and Z-transform

Mapped Program Outcomes	1	2	3	12

UNIT-1: Signals and Systems
Continuous-Time and Discrete-Time Signals. Transformations of the Independent Variable. Exponential and Sinusoidal Signals. The Unit Impulse and Unit Step Functions. Continuous-Time and Discrete-Time Systems. Basic System Properties.

Linear Time - Invariant Systems
Discrete-Time LTI Systems: The Convolution Sum. Continuous-Time LTI Systems: The Convolution Integral. Properties of Linear Time-Invariant Systems. Causal LTI Systems Described by Differential and Difference Equations. Singularity Functions.

UNIT-2: Fourier Series Representation of Periodic Signals
The Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous-Time Periodic Signals. Convergence of the Fourier Series. Properties of Continuous-Time Fourier Series. Fourier Series Representation of Discrete-Time Periodic Signals. Properties of Discrete-Time Fourier Series. Fourier Series and LTI Systems. Filtering. Examples of Continuous-Time Filters Described by Differential Equations. Examples of Discrete- Time Filters Described by Difference Equations.

UNIT-3 : The Continuous-Time Fourier Transform
Representation of Aperiodic Signals: The Continuous-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Continuous-Time Fourier Transform. The Convolution Property. The Multiplication Property. Systems Characterized by Linear Constant-Coefficient Differential Equations.
The Discrete-Time Fourier Transform
Representation of Aperiodic Signals: The Discrete-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Discrete-Time Fourier Transform. The Convolution Property. The Multiplication Property. Duality. Systems Characterized by Linear Constant-Coefficient Difference Equations.
:
UNIT-4: Time & Frequency Characterization of Signals and Systems
The Magnitude-Phase Representation of the Fourier Transform. The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Time-Domain Properties of Ideal Frequency-Selective Filters. Time-Domain and Frequency-Domain Aspects of Non - ideal Filters. First-Order and Second-Order Continuous-Time and Discrete- Time Systems.

IV SEMESTER

EL2259	Signals & Systems			L=4	T=0	P=0	Credits=4
Evaluation Scheme	Continuous Assessment	TA	ESE	Total	ESE Duration		
	30	10	60	100	3 Hours		

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

Sampling
Representation of a Continuous-Time Signal by Its Samples: The Sampling Theorem. Reconstruction of a Signal from Its Samples Using Interpolation. The Effect of Under - sampling : Aliasing. Discrete-Time Processing of Continuous- Time Signals. Sampling of Discrete - Time Signals.

UNIT-5 : The Laplace Transform
The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. System Function Algebra and Block Diagram Representations. The Unilateral Laplace Transform.

UNIT-6: The Z-Transform
The z-Transform. The Region of Convergence for the z-Transform. The Inverse z-Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the z-Transform. Analysis and

Characterization of LTI Systems Using z-Transforms. System Function Algebra and Block Diagram Representations. The Unilateral z-Transform.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Signals and Systems	2nd Edition, 2013	Alan V. Oppenheim, Alan S. Willsky, with S. Hamid	PHI Learning Private Limited.

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Signals & Systems	2nd Edition., 2005	Simon Haykin and Van Veen	Wiley
2	Signals, Systems and Transforms	3rd Edition, 2004	C. L. Philips, J.M.Parr and Eve A.Riskin	Pearson education
3	Schaum's Outlines of Signals and Systems	3rd Edition, 2002	Hwei P. Hsu	McGraw Hill
4	Linear Systems and Signals	2nd Edition	B.P. Lathi	Oxford University Press

V Semester

GE 2312 - Fundamental of Economics

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

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. **(8 Hours)**

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation. **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination. **(7 Hours)**

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation. **(5 Hours)**

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.
(7 Hours)

V Semester

GE 2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

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

Text Books

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

Reference Books

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

V Semester

EL 2301 - Power Electronics

Objective	Course Outcome
The student should be able to) understand the basics of power electronics. 2)understand SCR"s, MOSFET, UJT, IGBT, Concept of rectification, inversion and commutation .	**On completion of this course, the student will be able to** 1) Demonstrate the learnings of various power semiconductor devices with their protection and apply them for various applications. 2) Analyse different Power Electronics Converter circuits and choose them for suitable applications. 3) Demonstrate the knowledge of chopper circuits, analyse and utilise them for different applications. 4) Analyse inverter circuits with different modulation techniques and identify their applications.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Demonstrate the learnings of various power semiconductor devices with their protection and apply them for various applications.	1											1	1	
CO2	Analyse different Power Electronics Converter circuits and choose them for suitable applications.	1	3	2									1	1	
CO3	Demonstrate the knowledge of chopper circuits, analyse and utilise them for different applications.	1	3	2									1	2	
CO4	Examine inverter circuits with different modulation techniques and identify their applications	1	3	2									1	2	
CO5	Develop practical aspects of power semiconductor devices, converters, inverters and chopper circuits.	1	1	2									1	2	

V Semester

EL 2301 - Power Electronics

Unit No.	Contents	Max. Hrs.
1	**Power Semiconductor Devices** SCR and its characteristics, Gate characteristics, SCR turn off, ratings, Triggering circuits and opto-couplers	6
2	**Single Phase Line Commutated Converters** Series and parallel connections of SCRs, Single phase line commutated converters, single pulse converter, two pulse mid-point converter, single phase bridge converter, effect of source inductance, effect of freewheeling diode, single phase half controlled rectifier cyclo converter (single phase)	5
3	Three **Phase Line Commutated Converters** Three phase three pulse converter, three phase bridge converter, speed control of dc motors (with single phase rectifier).	5
4	**Forced Commutated Semiconductor Devices and Protection** Characteristic and working of MOSFET, Gate turn off thyristor and insulated gate bipolar transistor, protection of SCR, gate circuit protection, over voltage and over current protection, snubber circuit design.	5
5	**D.C. Choppers** Principles of step down chopper, step up chopper classification, Control strategies, time ratio control and current limit control Impulse commutated and resonant pulse choppers, Multiphase choppers, Application of choppers.	6
6	**Single Phase and Three Phase Bridge Inverters** Single phase and three phase bridge inverters, Output voltage control, Harmonics in output voltage waveforms, Harmonic attenuation by filters, Harmonic reduction by pulse width modulation techniques, analysis of single pulse width modulation, working of current source inverters, applications.	6

V Semester
EL 2301 - Power Electronics

Text books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics Circuit"s Devices and Applications	3rd Edition,2004	M.H.Rashid	Prentice Hall Limited
2	Power Electronics		D.Y.Shingare	Electrotech Publication Engineering Series

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics	1981	C.W.Lander	McGraw Hill
2	Thyristors and their Applications	2nd Edition 2002	Dr.M.Ramamoorty	East West Press
3	Thyristors and their Applications		Dr.G.K.Dubey, Doralda Sinha and Joshi	New Age International
4	Power Electronics	1989	Ned Mohan, T.M.Undeland, and W.P.Robbins	John Wiley and Sons

V Semester
EL 2302 - Power Electronics Lab

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

V Semester

EL 2303 - Fundamentals of Power System

Objective	Course Outcome
The student should be able to Calculate the basic parameters of transmission line of power systems. To know the power flow through transmission lines under different circumstances.	**On completion of this course, the student will be able to** 1) Define and explain basic components of power system and representation of its elements in terms of per unit. 2) Analyze and evaluate the transmission line parameters which limits the transmission capacity of a line. 3) Classify, evaluate and determine the performance of distribution and transmission system. 4) Choose, Compare and select the type of insulators and underground cables and improve the performance of system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Define and explain basic components of power system and representation of its elements in terms of per unit.	2	2											1	
CO2	Analyze and evaluate the transmission line parameters which limits the transmission capacity of a line.	2	2	2										2	
CO3	Classify, evaluate and determine the performance of distribution and transmission system.	2	3	2	2								1	2	
CO4	Choose, Compare and select the type of insulators and underground cables and improve the performance of system.	2	2	2										1	

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V Semester
EL 2303 - Fundamentals of Power System

Unit No.	Contents	Max. Hrs.
1	**Introduction to power system** Structure of Electrical Power System, use of high voltage, idea about substation, classification, Indoor, outdoor substation, symbols for equipment used in substation, concept of real, reactive and complex power. Per unit system: Representation of power system elements, models and parameters of generator, transformer and transmission lines, Numericals.	6
2	**Inductance of transmission line** Constants of transmission line, flux linkages, inductance of single phase two wire line, inductance of 3 phase overhead line, self GMD and mutual GMD,Numericals	5
3	**Capacitance of transmission line** Electric Potential, Capacitance of single phase 2 wire line, capacitance of 3 phase overhead line, Symmetrical and unsymmetrical spacing, Numericals.	5
4	**Distribution system and Load flow analysis** Types of distribution system, comparison, Feeders and distributors, Numericals on DC and AC distribution Y Bus formation, Illustration of active and reactive power transmission, Introduction to load flow studies in multi bus system (SLFE).	5
5	**Insulators and Cables** Types, Potential distribution over suspension insulator string, String efficiency, Numericals on string efficiency. CABLES: Construction, classification, insulation resistance, capacitance, Dielectric stress, economical size, Grading of cables, Numericals.	6
6	**Transmission Systems** Short, medium (Nominal T and Nominal Π method) and Long line, Voltage regulation & efficiency of power transmission lines using simple series equivalent representation, ABCD parameters of transmission lines.	6

V Semester

EL 2303 - Fundamentals of Power System

Text books:				
1	Power System		S.Chand	V.K.Mehta
2	Electrical Power Systems	5th edition	CBS	Ashfaq Hussain
3	Modern Power System Analysis	3rd -2008	Tata McGraw Hill	I. J. Nagrath and D.P. Kothari

Reference books:				
1	Elements of Power system analysis	4th - 1982	MGH	W. D. Stevenson
2	Electrical Power system	3rd -2005	New Age International	C.L Wadhwa

V Semester

EL 2304 - Electrical Drives

Objective	Course Outcome
The student should be able to After studying Electrical machines this subject elaborates applications of different machines in industry. Characteristics under starting, running braking and speed control of different motors are explained. Programmable logic controller, contactors, tractions is also explained.	**On completion of this course, the student will be able to** 1) Classify and compare characteristics of AC and DC motors to interpret application of motors in electrical drives. 2) Apply Selection criteria for electrical drives by adapting electrical and mechanical characteristics of motor. 3) Categorize and compare contactors and relays for application of control circuit. 4) Explain the applications of PLCs in electrical drives and compare and assess control of electrical drive. 5) Estimate and adapt different motors for traction work.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify and compare characteristics of AC and DC motors to interpret application of motors in electrical drives.	3	3												
CO2	Apply Selection criteria for electrical drives by adapting electrical and mechanical characteristics of motor	3	3												
CO3	: Categorize and compare contactors and relays for application of control circuit.	3												1	
CO4	Explain the applications of PLCs in electrical drives and compare and assess control of electrical drive.	3				3							1		1
CO5	Estimate and adapt different motors for traction work	3	3										1		

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V Semester
EL 2304 - Electrical Drives

Unit No.	Contents	Max. Hrs.
1	**Introduction to Drives and Speed Control** Definition of a Drive, Classification of Drives, Brief idea about drives commonly used in industries, Speed-torque characteristics of common drive motors (DC and AC), Characteristics of Drives under starting and running, Types of braking, Speed Control of AC and DC motors.	6
2	**Selection of motors** Selection of motors and bearings of motor: Power capacity for continuous and intermittent periodic duties, Flywheel effect, Duty cycles of motor, transmission, enclosure systems for drives.	5
3	**AC and DC contactor and relays** AC and DC contactor and relays: Limit Switches, Lock out contactor, magnetic structure, operation, arc interruption, Contactor rating, H.V. Contactor, control circuit for automatic starting and braking of DC motor and three phase induction motor, Control panel design for Motor Control Centre(MCC).	5
4	**Programmable Logic Controllers** Programmable Logic Controllers (PLC), programming methods, Ladder programming with few examples, Applications of PLC"s in electrical drives.	5
5	**Traction motors** Traction motors: Motors use in AC/DC traction and their performance and desirable characteristics, requirement and suitability of motor for traction duty, Speed time characteristics of train, Traction motor control. Series parallel control with numerical method, Starting and braking of traction motor.	6
6	**Digital speed control of Electric motors** Digital speed control of Electric motors, comparison with Analog method of speed control, Block Diagram arrangement for microprocessor based speed control of AC/DC motor, Flowcharts and algorithms for speed control and speed reversal of motor. Digital signal processors (DSP"s) for drive control.Variable frequency Drive(VFD)	6

V Semester
EL 2304 - Electrical Drives

Text Books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	A Course in Electrical Power	**1st-2005**	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Magnetic control of motors	Industrial New York 1947	Heumann	Chapman and Hall
3	Introduction to Programmable Logic Controllers	3rd Edition, 2008.	Gary Dunning	Cengage Learning

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Modern Electric Traction	**4th -2005**	H. Pratap	Dhanpat Rai and Company
2	Modern utilization of traction motor	2003	J.B. Gupta	
3	A Textbook of Electrical Technology Volume III Transmission, Distribution, Utilization		B.L.Theraja, A.K.Theraja	S.Chand

V Semester

EL 2305 - Electrical Drives Lab

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

V Semester

EL 2311 - OE I : Renewable Energy Generation Systems

Objective	Course Outcome
This subject introduce the different renewable energy sources to the students. Students get knowledge of Electric Power generation by wind, solar, small hydro.	**On completion of this course, the student will be able to** 1) Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context. 2) Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator. 3) Demonstrate, Classify and utilize geothermal and biomass energy. 4) Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context.	1		1			1	1							
CO2	Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator.	1	2	1	1	1		2	1			1			
CO3	Demonstrate, Classify and utilize geothermal and biomass energy.	1		1		1	1	2	1			1			1
CO4	Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.	1		1		1		1				1		1	1

V Semester

EL 2311 - OE I : Renewable Energy Generation Systems

Unit No.	Contents	Max. Hrs.
1	**Introduction** Fundamentals of Renewable / Non-renewable Energy Sources, Renewable Energy sources, Renewable Energy Potential in India, Renewable Energy Sources and their sustainable development. Storage methods for renewable energy sources.	6
2	Solar Energy Principles, scope and applications, solar radiation, its measurement & prediction, flat plate collectors-design & theory, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Solar cells, thermal storage, street lighting, solar power generation.	5
3	Wind Energy Introduction, Historical development, Wind energy resources, sites identification, blade element theory, aero-foil design, component of wind energy conversion system, wind turbine generator classification, and windmill and wind electrical generator, Advantages, disadvantages, economics and present status of wind energy generation systems, grid connection of wind energy.	5
4	Geothermal Energy and Biomass Energy Introduction, history of geothermal resources, basics of geological process, dry rock and hot aquifer analysis, geothermal exploration, geothermal well drilling and fluid extraction, utilization of geothermal resources, geothermal heat pump, site of geothermal energy in India. Biomass energy resources and conversion processes, urban waste to energy conversion.	5
5	Mini & Micro hydro-plants Introduction, Classification of water turbines, hydroelectric system, essential components of hydroelectric system, system efficiency, advantages and disadvantages of hydroelectric system, present Indian power scenario of mini- micro hydro.	6
6	Ocean Energy Ocean thermal energy conversion (OTEC), Open cycle and closed cycle OTEC, Ocean wave energy conversion, tidal energy conversion. Introduction of Fuel cells.	6

V Semester

EL 2311 - OE I : Renewable Energy Generation Systems

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Non Conventional Sources of Energy	**4th edition**	G.D.Rai	Khanna Publisher
2	Energy Technology:Nonconventional Renewable and Conventional	,	S. Rao and B.B Parulekar	Khanna Publisher New Delhi

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Solar Energy : Principles of Thermal collection and storage	**3rd edition,1994**	S.P.Sukhatme,J.K.Nayak	Tata McGraw Hill
2	Wind and Solar Power System		M. R. Patel	CRC Press, New York
3	Renewable Energy Sources Basic Principles and Applications		G. N. Tiwari and M. K. Ghoshal	Narosa Publishing House,New Delhi

V Semester

EL 2312 - OE I : Electrical Machines and their Applications

Objective	Course Outcome
The student should be able to This subject introduce the applications of different machines and commonly used drives	**On completion of this course, the student will be able to** 1) To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors. 2) To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes. 3) To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers. 4) To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors	3													1
CO2	To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes	3	1					1							1
CO3	To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers	2	1												2
CO4	To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor	3													1

V Semester

EL 2312 - OE I : Electrical Machines and their Applications

Unit No.	Contents	Max. Hrs.
1	Introduction to Drives and Speed Control: Classification of Drives, brief idea about commonly used drives (AC and DC) drives in industry, speed- torque characteristics of different drive motors, their behaviour under starting and running conditions.	6
2	Need of starter, Starting methods, Braking and Speed Control of AC and DC motors.	5
3	Selection Criterion for Drive Motors: Criterion for selection of motors, Duty Cycle, Power Rating for Continuous and Intermittent Duty Cycles, Environment and Enclosures, Transmission System, Insulation Classes.	5
4	Single Phase transformer Review of Principle, constant flux machine, losses, efficiency etc., Operation on load (Phasor diagrams), Voltage regulation, effect of load power factor on regulation, Application of Single phase transformer in Electronic circuitry, autotransformer, welding transformer, furnace transformer.	5
5	Three Phase Transformer. Concept of three phase transformer, Comparison between unit and bank of single phase transformer, connections, All Day Efficiency, application in power system.	6
6	Special Machines: Brushless DC motor: - Principle, construction , operation, converter for BLDC, rotor position sensor (Hall Sensor), Stepper motor: types, slewing, torque-speed characteristics, stepper motor converter, Universal motor, applications Applications of three phase and single phase induction motors in cement industry, steel rolling mill, textile mill, etc.	6

V Semester

EL 2312 - OE I : Electrical Machines and their Applications

Text books				
S.N	**Title**	**Year/Edition**	**Author**	**Publisher**
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric Drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

Reference Books:

Sr. No.	Title	Year/Edition	Author	Publisher
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

V Semester

EL 2313 - OE I : Testing and Maintenance of Electrical Equipment's

Objective	Course Outcome
The student should be able to To adopt various testing and maintenance procedures for electrical equipments by providing effective insulation to enhance their life and working condition	**On completion of this course, the student will be able to** 1) Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock. 2) Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation. 3) Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance. 4) Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock.	1					2	1	3				3		1
CO2	Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation	1					2		1				1	2	
CO3	Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance.	1					2								
CO4	Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.	1					1		1				1	2	

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V Semester

EL 2313 - OE I : Testing and Maintenance of Electrical Equipment's

Unit No.	Contents	Max. Hrs.
1	Safety & Prevention of Accidents Definition of terminology used in safety; safety, hazards, accident, major accident hazard, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don‟ts for substation operators as listed in IS Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.	6
2	General Introduction Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing a) Direct, b) Indirect, c) Regenerative. Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.	5
3	Testing & maintenance of rotating machines Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992. Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968. Brake test on DC Series motor.	5
4	**Testing & maintenance of Insulation** Classification of insulating materials as per I.S. 8504(part III) 1994, factors affecting life of insulating materials, measurement of insulation resistance & interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot.	5
5	**Testing & maintenance of Transformer** Listing type test, routine test & special test as per I.S. 2026-1981. Procedure for conducting following tests: Measurement of winding resistance, no load losses, & no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028 (part-III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 & 3 phase transformer, load sharing calculations (numerical).	6
6	**Installation** Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992. Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.	6

V Semester

EL 2313 - OE I : Testing and Maintenance of Electrical Equipment"s

Text Books:

S. N.	Author	Title	Publisher
01.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol – I	Media Promotors & Publisher Ltd. Mumbai
02.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol – II	Media Promotors & Publisher Ltd. Mumbai

Reference Books:

S. N.	Author	Title	Publisher
01.	B. L. Theraja	Electrical Technology Vol I to IV	S. Chand & Co., New Delhi
02.	C. J. Hubert	Preventive Maintenance Hand Books & Journals	-----------------

V Semester

EL 2321 - OE II: Electrical Energy Audit and Safety

Objectives	Course Outcomes
The student should be able to Understand various operating characteristics of electrical equipments,its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving and its global impact	**On completion of this course, the student will be able to** 1) Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003. 2) Demonstrate, apply and evaluate different forms of electrical and thermal energy. 3) Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting. 4) Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003	1							1				1		
CO2	Demonstrate, apply and evaluate different forms of electrical and thermal energy.		1										1	1	
CO3	Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting.		2			1	1	2					1		1
CO4	Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures.	1									1		1		1

V Semester

EL 2321 - OE II: Electrical Energy Audit and Safety

Unit No.	Contents	Max. Hrs.
1	Energy Scenario Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.	6
2	Basics of Energy and its various forms Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.	5
3	Energy Management & Audit Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	5
4	Energy Monitoring and Targeting Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).	5
5	Global environmental concerns United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).	6
6	Electrical Safety Primary hazards associated with electricity. Control measures and safety-related work practices to minimize the risk associated with electrical hazards. Response procedures in the event of electrical shock or fire.	6

V Semester

EL 2321 - OE II: Electrical Energy Audit and Safety

Text Books:

S. N.	Author	Title	Publisher
01	Archie,W Culp	Principles of Energy Conversion	McGraw Hill
02	Wayne C Turner	Energy Management Handbook Bureau	John Willey and Sons
03		Bureau of Energy Efficiency Study Material for Energy Managersand Auditors Examination	Bureau of Energy Efficiency www.beeindia.in

Reference Books:

S. N.	Author	Title	Publisher
01.	Amit Kumar Tyagi	Handbook on Energy Audit and Management	TERI

V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Objectives	Course Outcomes
The student should be able to To understand the basic principle of electrical heating, welding, illumination, refrigeration and air conditioning, fans, pumps, compressors and digi sets.	**On completion of this course, the student will be able to** 1) Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose. 2) Demonstrate and apply electric energy to different types of welding 3) Explain how refrigeration system and air condition system works. 4) Analyse, determine and estimate proper economic generation.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose	3	2	2					2	1	1				1
CO2	Demonstrate and apply electric energy to different types of welding			1		1			1						
CO3	Explain how refrigeration system and air condition system works	1		1	1				1						
CO4	Analyse,determine and estimate proper economic generation	3	2	2	1		1		2	2	3	1		3	1

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V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Unit No.	Contents	Max. Hrs.
1	**Electric Heating:** i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat Types & application of electric heating equipment"s, transfer of heat. ii) Resistance Ovens: General constructions, design of heating elements, efficiency & losses, radiant heating. iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating. iv) Dielectric heating: Principle and application. v) Arc furnace: Direct & indirect arc furnace, power supply, characteristics & control.	6
2	**Electric Welding:** i) Importance, Advantages & Disadvantages of welding, classification of welding processes. ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding. iii) Electric arc welding: carbon arc welding, metal arc welding, submerged arc welding, Welding positions, Types of welding electrodes iv) Ultrasonic welding, electron beam welding, laser beam welding.	5
3	**Illumination:** Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.	5
4	**Refrigeration & Air conditioning:** Terminology, refrigeration cycle, refrigeration systems (Vapour compression, vapour absorption), domestic refrigerator, water cooler, desert cooler. Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.	5
5	**Electric Traction** Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipments (collector gear for overhead equipments, conductor-rail equipment)Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve	6
6	Economics of Power Generation, Electric Power Supply and Utilization Terms and Definitions, base load and peak load, selection of power plant equipment (boilers, prime-movers, size and number of generating units), economics in plant selection, economics of hydroelectric power plant, economics of combined hydro and steam power plant, performance and operating characteristics of power plants, power plant useful life, tariff for electrical energy, objective and requirements of tariff, general tariff forms, comparison between private generating plant and public supply.	6

V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
2	Art and Science of Utilization of Electrical Energy		H Pratap	Dhanpat Rai & Sons, Delhi
3	Utilization of Electrical Power		R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. Suryanarayana V.	Wiley Eastern Ltd, Age International New
3	Utilization of Electrical Energy		E.Openshaw Taylor	Orient Longman

V Semester

EL 2323- OE II: Power System Engineering

Objective	Course Outcome
The student should be able to :- (1) To comprehend the different issues related to overhead lines and underground cables. (2) To train the students with a solid foundation in power system concepts required to solve engineering problems. (3) To provide the knowledge about the system transients, sag and various issues related to cables and transmission lines. (4) To introduce the students to the general structure of the network for transferring power from generating stations to the consumers. (5) To expose the students to the different electrical & mechanical aspects of the power network along with its environmental and safety constraints	On completion of this course, the student will be able to (1) Articulate types of load and power system concepts required to engineering problems. (2) Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology. (3) Formulate A.C and D.C distribution networks for necessary variable calculation. (4) Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Articulate types of load and power system concepts required to engineering problems.	2				1		1			1			1	
CO2	Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology.	1	2	1				1				1	1	2	
CO3	Formulate A.C and D.C distribution networks for necessary variable calculation.	2	1					1						2	
CO4	Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.	1	1	2				1			1			1	

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

EL 2323- OE II: Power System Engineering

Unit No.	Contents	Max. Hrs.
1	**Introduction to Power System** Restructuring of power sector, Constituents of present day power system, sources of electrical energy, types and characteristics of generating stations: Thermal, hydro, nuclear , solar ,wind and other renewable, salient features of electricity act 2003.	6
2	**Load on Power Stations** Load, Important terms and factors, and Units generated per annum , Load duration curve , Types of loads, Load demand and diversity factors, Load curves and selection of generating units, Base load and peak load on Power station, Method of meeting the load ,Interconnected grid system.	5
3	**Transmission System I** Electric supply system, A.C power supply scheme, D.C transmission scheme, Comparison of AC and DC transmission system, advantages of A.C. transmission system, Comparison of various transmission system (Two wire dc system, Single phase two wire A.C system, Single phase three wire system , three phase three wire system, Three phase four wire system) Elements of transmission line, Economic choice of transmission voltage, requirements of satisfactory electric supply, Concept of HVDC transmission.	5
4	**Transmission System II** Line support insulators, types of insulators (pin type, suspension type, strain type, shackle type), Commonly used conductor material, concept of corona, factor affecting corona, advantages and disadvantages of corona, methods of reducing corona effect, Sag and its effects, Constants of transmission line (R, L and C) , Resistance of transmission line, skin effect , Classification of overhead transmission line and voltage regulation .	5
5	**Distribution System** Classification of distribution system, Types of distribution AC and DC, Overhead verses underground system, Requirements of distribution system, Design consideration of distribution system, AC distribution types, Voltage drop calculations in different distribution system , importance of voltage control, location of voltage control equipment and its methods, Tap changing transformer , Concept of tariff, desirable characteristics of tariff, types of tariff.	6
6	**Introduction to Switchgear** Essential features of switchgear, switchgear equipment's, switches, fuses, circuit breakers, relays, HRC fuses, Bus Bar arrangement (single bus system, One and half feeder ,Main and transfer bus system) , MCB, MCCB, ELCB Introduction to Instrument transformer Current Transformer (CT) and Potential transformer (PT).	6

V Semester

EL 2323- OE II: Power System Engineering

Text books:				
	Title	Edition	Author	Publication
1.	Power System Analysis	1st edition 2007	T.K. Nagsarkar, M.S. Sukhija	Oxford
2.	Principles of Power System	2nd edition 2005	V.K.Mehta, Rohit Mehta	S.Chand
3.	Electrical Power System	5th edition 2007	Ashfaque Hussain	CBS

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcomes 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

EL2351- Control System

Course Learning Objectives	Course Outcomes
This is a first course in feedback control of dynamic systems. The main goal is to introduce and familiarize students with dynamic systems modeling and analysis techniques that can be employed on a large variety of engineering systems. Being an interdisciplinary course, students will learn: 1 the role of a control engineer in multi- disciplinary teams. 2 to apply the knowledge gained in basic mathematics, physical sciences and engineering courses to derive mathematical models of typical engineering processes. 3 to use transfer function and state space models for control system analysis in time and frequency domain. 4 the basic concepts of proportional, integral, and derivative (PID) control. 5 the importance of stability in control systems and the various methods to determine it. 6 to construct root locus plot and frequency response plots such as polar plot, Bode plot, Nyquist plot etc.	The students will be able to: CO1: Classify, select types of control systems, interpret transfer function of the system and compare and evaluate electrical and mechanical systems. CO2: Illustrate the time response, develop and evaluate the controller. CO3: Demonstrate, apply and evaluate stability using transfer function and state variable approach. CO4: Demonstrate, construct and select design parameters using root locus and frequency domain methods Mapped program outcomes:1,2,3,12

UNIT I : Introduction to Control Systems: History of control system, Basic Components of Control System, Open loop control and close loop control with examples, classification of control systems.

Transfer Function, Block Diagram and Signal Flow Graph : Transfer function and gain, Order of a system, block diagram algebra & reduction techniques, signal flow graph, its constructions and Mason"s gain formula.

Mathematical Modelling of physical systems: Mathematical modelling of physical system such as – electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic etc., Analogous systems.

UNIT II: Characteristics of Feedback Control Systems : Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback.

UNIT III:Time Domain Analysis of Control Systems: Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (e_{ss}) analysis, static error constants and system type, dominant poles, Approximation of high order systems by low order systems, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

VI Semester
EL2351- Control System

UNIT IV: **Stability of Linear Control Systems :** Concept of stability, stable, unstable and marginally stable system, Absolutely stable and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh-Hurwitz stability criterion with special cases, relative stability analysis.

State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form, solution of state equations, state transition matrix, its properties and computation.

UNIT V: Root LocusTechnique : Definition, magnitude and angle criteria, properties of root locus, construction rules for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s)H(s).

UNIT VI: Frequency domain analysis of control systems: Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response, polar plot, inverse polar plot, bode plot, all pass and minimum – phase system, experimental determination of transfer function, log magnitude versus phase plot.

Stability in Frequency domain : Principle of argument, Nyquist stability criterion, Assessment of relative stability using Nyquist criterion, concept of gain margin and phase margin and its computation using polar plot and log magnitude versus phase plot. Constant M and constant N circles, Nicholas chart.

Text books:

1	Control system Engineering	5^{TH} Edition	I. J. Nagrath & M. Gopal	New Age International
2	Automatic control systems	7^{th} Edition	B. C. Kuo	PHI Learning Private Limited

Reference Books:

1	Sigma Series: Control Systems	1st Edition	Ashok Kumar	McGraw - Hill
2	Control systems :Principles and Design	4th Edition	M. Gopal	McGraw - Hill
3	Modern Control Engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited

VI Semester

EL2352- Lab.: Control System

Practical based on above syllabus are to be covered.

	TITLE
1	To study transient response of a second order system.
2	Study of Stepper Motor
3	Study of Potentiometer as an Error Detector.
4	To study the Speed Torque Characteristic of AC Servo Motor
5	To study the Frequency Response of RLC network
6	To study the Synchros a)To plot the characteristic of synchro transmitter. b)To plot the characteristic of synchro receiver
7	Study of synchro as an error detector
8	Study of DC Position Servo Mechanism
9	Verification of Root Locus using MATLAB
10	Verification of Bode Plot using MATLAB
11	To Study Effect of Type of System on Steady State Error
12	PID Controller

VI Semester
EL2353- Power System Analysis

Course Objective	Course Outcomes
After learning basic concepts of power system this subject explain functioning of power system with balance, unbalanced condition. Concept of faults, stability, grounding and economics of power system is also explained.	The student will be able to understand the 1) Symmetrical component transformation and sequence networks. 2) Symmetrical fault analysis with various faults with and without pre fault load currents. 3) Unsymmetrical fault analysis with and without fault impedance for various faults using symmetrical components. 4) Steady state and transient stability analysis of power system. 5) Economic operation of power system and representation of transmission loss using loss formula co-efficient. 6) Concept of Neutral grounding, shunt and series compensation of power system.
Mapped Program Outcomes:a,b,c,d,e,f,g,l,j	

UNIT-I: Symmetrical Fault Analysis

Define fault & its causes, effect of fault on power system, purpose of fault analysis, assumptions made for fault analysis, transient in a series R-L circuit, short circuit analysis on synchronous machine at no-load & loaded condition, selection of circuit breaker & its short circuit MVA calculation, current limiting reactors.

UNIT-II: Symmetrical Component:-

Introduction, α-operator, symmetrical components of an unbalanced Three phase system, symmetrical components of voltage & current phasors, zero sequence components of voltage & current, power in terms of symmetrical components, phase shift in star-delta transformers, sequence network for fault calculation, sequence impedances of transmission line & synchronous machines, zero sequence networks of transformers, assembly of sequence networks of power system.

UNIT-III: Unsymmetrical Fault Analysis

Assumptions made for unsymmetrical fault analysis, sequence voltages of a generator, sequence voltages at a fault point, general procedure for analysis of various fault with and without fault impedance for Line to Ground (L-G), L-L-G, L-L, Open conductors faults analysis using symmetrical components.

UNIT-IV: Power System Stability

Stability of power system:-Steady state, Dynamic and Transient stability definition, Dynamics of synchronous machine, swing equation, swing equation for machines swinging coherently and Non-Coherently. Power angle equation, Steady state stability studies.

VI Semester
EL2353- Power System Analysis

Transient stability studies: - Swing curve, Equal Area criterion for transient stability, Application of equal area criterion for different disturbances. Solutions of swing equation by point by point method. Methods of improving transient stability.

UNIT-V: Economic operation of power system

Introduction, incremental fuel cost, economic dispatch neglecting transmission losses, transmission loss as a function of plant generation, general loss formula, and optimum load dispatch considering transmission losses

UNIT-VI: System Neutral Grounding & Reactive Power Compensation

Neutral Grounding: - Introduction to neutral grounding, methods of neutral grounding, peterson coil grounding. Compensation: - Series & shunt compensation, location of series capacitors, protective schemes for series capacitors, problem associated with series capacitors, Static VAR system with its different schemes.

Text Books

	TITLE	EDITION	AUTHOR	PUBLICATION
	Electrical Power System	**5TH edition 2007**	Ashfaque Hussain	**CBS**

Reference books

	TITLE	EDITION	AUTHOR	PUBLICATION
	Elements of Power System Analysis	4th-1984	W. D. Stevenson	Tata McGraw Hill
	Modern Power System analysis	4th-2011	I. J. Nagrath & D. P. Kothari	Tata McGraw Hill
	Electrical Power System	3rd - 2005	C. L. Wadhawa	NEW AGE INTERNATIONAL

VI Semester

EL2354- Lab.: Simulation of Power Electronics & Power System

Course Objective	Course Outcomes
To understand Power electronics and Drives through various software available for power electronics.	Students shall be able to understand practically the 1) Use of semiconductor devices for realizing uncontrolled and controlled rectifiers. 2) The implementations of inverters without and with PWMs 3) The working and implementation of multilevel inverter and the modulation control 4) The inverter fed AC drive with open loop control.

Expt.No.	Name of Experiment
1	To study half wave uncontrolled rectifier
2	To study half wave controlled rectifier
3	To study full wave controlled rectifier
4	To study single phase H-bridge inverter(withoutPWM)
5	To study three phase bridge inverter(180 degree mode)
6	To study sinusoidal pulse width modulation(APOD,POD and IPD)
7	To study single phase H-bridge inverter using SPWM
8	Introduction to multilevel inverter and implementation of 3 and 5 level inverter
9	To study voltage sag on distribution system using symmetrical fault
10	To study inverter fed induction motor

VI Semester
EL2355- Lab. Substation Design

Course Objectives	Course Outcomes
The student will understand different aspects of substation design that is layout drawing, earthing Drawing, lighting drawing and cable wiring.	The students will be able to: CO1: Illustrate and Explain, single line diagram of substation with rating of different equipment's, types of relays required and their settings CO2: Construct plan of equipment's and panels mounted in a substation. CO3: Design earthing system of a substation.

Mapped Program Outcomes				4	

Practical based on following topics may be performed.

1) One Line diagram
2) Switchyard and control panel layout for 132 and 11 kV substation.
3) Lighting layout of substation and switchyard.
4) Substation earthing.

Text books:

1	Handbook of Electrical Power Distribution	2nd Edition	Gorti Ramamurthy	University Press
2	Electric Power Distribution	4th edition, 1997	A.S. Pabla	Tata Mc Graw-Hill Publishing Company

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).

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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

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
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

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

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.

VI Semester
EL2365- PEI: Electric Power Utilization

UNIT-4: Refrigeration & Air conditioning:

Terminology, refrigeration cycle, refrigeration systems (Vapor compression, vapor absorption), domestic refrigerator, water cooler, desert cooler.

Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective Temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.

UNIT-5: Fans & Pumps:

Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportunities.

Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system.

UNIT-6: Compressors and DG Sets:

Compressors: Compressor types, Compressor efficiency, Compressed air system components.

Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets.

Text books:				
1	Utilization of Electric Energy		E. Openshaw Taylor	Orient Longman
2	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
3	Art and Science of Utilization of Electrical Energy		H Partap	Dhanpat Rai & Sons, Delhi
4	Utilisation of Electrical power	1st Edition, 2006	R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:				
	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
	Utilization of Electrical Power		Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International

VI Semester

EL2371- OEIII: Renewable Energy Generation System

Course Objective	Course Outcomes
This subject introduce the different renewable energy sources to the students. Students get knowledge of Electric Power generation by wind, solar, small hydro.	1. Basic aspects of renewable energy supply presenting fundamental characteristics of the resource base (solar radiation, wind energy, geothermal, etc.) and principles of related technical systems (photovoltaic, wind, hydroelectric power generation, etc.).Fundamentals of fuel cells. 2. Solar radiation geometry , basic concepts of solar energy to heat conversion, different types of solar energy collectors with different applications. 3. Concepts of wind energy conversion system, types of WECS and their connection with the grid. 4. Basics of geological process, tapping geothermal energy, biomass energy resources and its conversion processes. 5. Basic concept of Mini & Micro hydro-plants with site selection criteria. 6. Basic concepts of energy from ocean including tidal and wave energy with focus on conversion cycles from ocean energy to electrical energy.

UNIT-1: Introduction

Fundamentals of Renewable / Non-renewable Energy Sources, Renewable Energy sources, Renewable Energy Potential in India, Renewable Energy Sources and their sustainable development. Storage methods for renewable energy sources

UNIT-2: Solar Energy

Principles, scope and applications, solar radiation, its measurement & prediction, flat plate collectors-design & theory, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Solar cells, thermal storage, street lighting, solar power generation.

UNIT-3: Wind Energy

Introduction, Historical development, Wind energy resources, sites identification, blade element theory, aero-foil design, component of wind energy conversion system, wind turbine generator classification, and windmill and wind electrical generator, Advantages, disadvantages, economics and present status of wind energy generation systems, grid connection of wind energy.

VI Semester
EL2371- OEIII: Renewable Energy Generation System

UNIT-4: Geothermal Energy and Biomass Energy

Introduction, history of geothermal resources, basics of geological process, dry rock and hot aquifer analysis, geothermal exploration, geothermal well drilling and fluid extraction, utilization of geothermal resources, geothermal heat pump, site of geothermal energy in India. Biomass energy resources and conversion processes, urban waste to energy conversion.

UNIT-5: Mini & Micro hydro-plants

Introduction, Classification of water turbines, hydroelectric system, essential components of hydroelectric system, system efficiency, advantages and disadvantages of hydroelectric system, present Indian power scenario of mini-micro hydro.

UNIT-6: Ocean Energy

Ocean thermal energy conversion (OTEC), Open cycle and closed cycle OTEC, Ocean wave energy conversion, tidal energy conversion. Introduction of Fuel cells.

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Non Conventional Sources of Energy	**4th edition**	G.D.Rai	Khanna Publisher
2	Energy Technology:Nonconventional Renewable and Conventional	,	S. Rao and B.B Parulekar	Khanna Publisher New Delhi

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Solar Energy : Principles of Thermal collection and storage	**3rd edition,1994**	S.P.Sukhatme,J.K.Nayak	Tata McGraw Hill
2	Wind and Solar Power System		M. R. Patel	CRC Press, New York
3	Renewable Energy Sources Basic Principles and Applications		G. N. Tiwari and M. K. Ghoshal	Narosa Publishing House,New Delhi

VI Semester
EL2372- OEIII: Electrical Machines and their Applications

Course Objective	Course Outcomes
This subject introduce the applications of different machines and commonly used drives.	1. To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors. 2. To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes. 3. To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers. 4. To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor

Unit 1: Introduction to Drives and Speed Control:

Classification of Drives, brief idea about commonly used drives (AC and DC) drives in industry, speed- torque characteristics of different drive motors, their behaviour under starting and running conditions.

Unit 2:

Need of starter, Starting methods, Braking and Speed Control of AC and DC motors.

Unit 3: Selection Criterion for Drive Motors:

Criterion for selection of motors, Duty Cycle, Power Rating for Continuous and Intermittent Duty Cycles, Environment and Enclosures, Transmission System, Insulation Classes.

Unit 4: Single Phase transformer

Review of Principle, constant flux machine, losses, efficiency etc., Operation on load (Phasor diagrams), Voltage regulation, effect of load power factor on regulation, Application of Single phase transformer in Electronic circuitry, autotransformer, welding transformer, furnace transformer.

Unit 5: Three Phase Transformer.

Concept of three phase transformer, Comparison between unit and bank of single phase transformer, connections,
All Day Efficiency, application in power system.

VI Semester
EL2372- OEIII: Electrical Machines and their Applications

Unit 6: Special Machines:

Brushless DC motor: - Principle, construction , operation, converter for BLDC, rotor position sensor (Hall Sensor), Stepper motor: types, slewing, torque-speed characteristics, stepper motor converter, Universal motor, applications Applications of three phase and single phase induction motors in cement industry, steel rolling mill, textile mill, etc.

Text books

S.N	Title	Year/Edition	Author	Publisher
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric Drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

Reference Books:

Sr. No.	Title	Year/Edition	Author	Publisher
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

VI Semester
EL2373 - OEIII: Testing and Maintenance of Electrical Machines

Course Objective	Course Outcomes
To adopt various testing and maintenance procedures for electrical equipment's by providing effective insulation to enhance their life and working condition	The students will be able to: CO1: Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock. CO2: Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation. CO3: Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance. CO4: Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.
Mapped program outcomes:1,6,7,8,12	

Unit 1: Safety & Prevention of Accidents

Definition of terminology used in safety; safety, hazards, accident, major accident hazard, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don"ts for substation operators as listed in IS Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.

Unit 2: General Introduction

Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing a) Direct, b) Indirect, c) Regenerative. Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.

Unit 3: Testing & maintenance of rotating machines

Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992. Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968. Brake test on DC Series motor.

VI Semester
EL2373 - OEIII: Testing and Maintenance of Electrical Machines

Unit 4: Testing & maintenance of Insulation

Classification of insulating materials as per I.S. 8504(part III) 1994, factors affecting life of insulating materials, measurement of insulation resistance & interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot.

Unit 5: Testing & maintenance of Transformer

Listing type test, routine test & special test as per I.S. 2026-1981. Procedure for conducting following tests:

Measurement of winding resistance, no load losses, & no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028 (part-III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 & 3 phase transformer, load sharing calculations (numerical).

Unit 6: Installation

Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992. Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.

Text Books:

S. N.	Author	Title	Publisher
01.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol - I	Media Promotors & Publisher Ltd. Mumbai
02.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol - II	Media Promotors & Publisher Ltd. Mumbai

Reference Books:

S. N.	**Author**	**Title**	**Publisher**
01.	B. L. Theraja	Electrical Technology Vol I to IV	S. Chand & Co., New Delhi
02.	C. J. Hubert	Preventive Maintenance Hand Books & Journals	-----------------

VI Semester
EL2381 - OEIV: Electrical Energy Audit and Safety

Course Objectives	Course Outcomes
Understand various operating characteristics of electrical equipments, its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving and its global impact	The students will be able to: CO1: Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003. CO2: Demonstrate, apply and evaluate different forms of electrical and thermal energy. CO3: Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting. CO4: Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures. 1) Mapped program outcomes:1,3,5,6,7,8,9,10,12

UNIT-1: Energy Scenario

Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.

UNIT-2: Basics of Energy and its various forms

Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT-3 : Energy Management & Audit

Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

UNIT-4: Energy Monitoring and Targeting

Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).

VI Semester
EL2381 - OEIV: Electrical Energy Audit and Safety

UNIT-5: Global environmental concerns

United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

UNIT-6: Electrical Safety

Primary hazards associated with electricity. Control measures and safety-related work practices to minimize the risk associated with electrical hazards. Response procedures in the event of electrical shock or fire.

Text Books:			
S. N.	**Author**	**Title**	**Publisher**
01	Archie,W Culp	Principles of Energy Conversion	McGraw Hill
02	Wayne C Turner	Energy Management Handbook Bureau	John Willey and Sons
03		Bureau of Energy Efficiency Study Material for Energy Managersand Auditors Examination	Bureau of Energy Efficiency www.beeindia.in

Reference Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	Amit Kumar Tyagi	Handbook on Energy Audit and Management	TERI

VI Semester

EL2382 - OE IV: Utilization of Electrical Energy

Course Objectives	Course Outcomes
To understand the basic principle of electrical heating, welding, illumination, refrigeration and air conditioning, fans, pumps, compressors and digi sets.	On completion of this course, students will be able to 1. understand working of various electric heating equipment 2. understand electric welding methods and its operation 3. understand nature of light and design various lighting schemes and fittings in use 4. Understand operation of refrigeration , AC system 5. figure-out the different schemes of traction schemes and its main components. Design a suitable scheme of speed control for the traction systems 1) understand economics of various power generating units, tariff

UNIT 1: Electric Heating:

i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat Types & application of electric heating equipment‟s, transfer of heat.
ii) Resistance Ovens: General constructions, design of heating elements, efficiency & losses, radiant heating.
iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating.
iv) Dielectric heating: Principle and application.
v) Arc furnace: Direct & indirect arc furnace, power supply, characteristics & control.

UNIT-2: Electric Welding:

i) Importance, Advantages & Disadvantages of welding, classification of welding processes.
ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding.
iii) Electric arc welding: carbon arc welding, metal arc welding, submerged arc welding, Welding positions, Types of welding electrodes
iv) Ultrasonic welding, electron beam welding, laser beam welding.

UNIT-3: Illumination:

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

UNIT-4: Refrigeration & Air conditioning:

Terminology, refrigeration cycle, refrigeration systems (Vapour compression, vapour absorption), domestic refrigerator, water cooler, desert cooler.

Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.

VI Semester
EL2382 - OE IV: Utilization of Electrical Energy

UNIT-5: Electric Traction

Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipments (collector gear for overhead equipments, conductor-rail equipment)Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve

UNIT-6: Economics of Power Generation, Electric Power Supply and Utilization

Terms and Definitions, base load and peak load, selection of power plant equipment (boilers, prime-movers, size and number of generating units), economics in plant selection, economics of hydroelectric power plant, economics of combined hydro and steam power plant, performance and operating characteristics of power plants, power plant useful life, tariff for electrical energy, objective and requirements of tariff, general tariff forms, comparison between private generating plant and public supply.

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
2	Art and Science of Utilization of Electrical Energy		H Pratap	Dhanpat Rai & Sons, Delhi
3	Utilization of Electrical Power		R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International
3	Utilization of Electrical Energy		E.Openshaw Taylor	Orient Longman

VI Semester
EL2383 - OEIV: Power System Engineering

Unit 1: Introduction to Power System

Restructuring of power sector, Constituents of present day power system, sources of electrical energy, types and characteristics of generating stations: Thermal, hydro, nuclear , solar ,wind and other renewable, salient features of electricity act 2003.

Unit 2: Load on Power Stations

Load, Important terms and factors, and Units generated per annum , Load duration curve , Types of loads, Load demand and diversity factors, Load curves and selection of generating units, Base load and peak load on Power station, Method of meeting the load ,Interconnected grid system.

Unit 3: Transmission System I

Electric supply system, A.C power supply scheme, D.C transmission scheme, Comparison of AC and DC transmission system, advantages of A.C. transmission system, Comparison of various transmission system (Two wire dc system, Single phase two wire A.C system, Single phase three wire system , three phase three wire system, Three phase four wire system) Elements of transmission line, Economic choice of transmission voltage, requirements of satisfactory electric supply, Concept of HVDC transmission.

Unit 4: Transmission System II

Line support insulators, types of insulators (pin type, suspension type, strain type, shackle type), Commonly used conductor material, concept of corona, factor affecting corona, advantages and disadvantages of corona, methods of reducing corona effect, Sag and its effects, Constants of transmission line (R, L and C) , Resistance of transmission line, skin effect , Classification of overhead transmission line and voltage regulation .

Unit 5: Distribution System

Classification of distribution system, Types of distribution AC and DC, Overhead verses underground system, Requirements of distribution system, Design consideration of distribution system, AC distribution types, Voltage drop calculations in different distribution system , importance of voltage control, location of voltage control equipment and its methods, Tap changing transformer , Concept of tariff, desirable characteristics of tariff, types of tariff.

Unit 6: Introduction to Switchgear

Essential features of switchgear, switchgear equipment's, switches, fuses, circuit breakers, relays, HRC fuses, Bus Bar arrangement (single bus system, One and half feeder ,Main and transfer bus system) , MCB, MCCB, ELCB Introduction to Instrument transformer Current Transformer (CT) and Potential transformer (PT).

VI Semester
EL2383 - OEIV: Power System Engineering

Text books:

	Title	Edition	Author	Publication
1.	Power System Analysis	1st edition 2007	T.K. Nagsarkar, M.S. Sukhija	Oxford
2.	Principles of Power System	2nd edition 2005	V.K.Mehta, Rohit Mehta	S.Chand
3.	Electrical Power System	5th edition 2007	Ashfaque Hussain	CBS

VII Semester
EL- 2401 Switchgear and Protection

Unit No.	Contents	Max. Hrs.
3	**Distance protection** High voltage line Protection: - Distance relays, carrier distance schemes, Generation of various distance relay characteristics using static comparators.	7
4	**Circuit Breaker** **Circuit breakers** Switchgear : Circuit breakers Arc interruption theory, recovery and Restriking voltage ,RRRV, breaking of inductive & capacitive currents, C. B. rating, different media of arc interruption, overview of oil circuit breakers, Air blast, SF6 and vacuum breakers.	6
5	**Equipment Protection** Equipment Protection: Principles of differential relaying, protection, transformers and busbars by differential relaying and other relays. Miniature circuit breakers, moulded case circuit breaker, release, earth leakage circuit breaker.	7
6	**Equipment Protection** **Protection of Generators** Various Faults and Abnormal Operating Conditions, Transverse Differential Protection, Rotor Faults, Abnormal Operating Conditions, Loss of Prime Mover **Protection of Induction Motors** Various Faults and Abnormal Operating , Inter-turn Faults, Abnormal Operating Conditions from Supply Side and Mechanical Side, Overload. Fuse (wire and HRC).	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Protection and Switchgear	2012	R.P.Maheshwari, Nilesh G.Chothani, Bhavesh Bhalija	Oxford University Press
2	Switchgear and Protection	2003	S.R.Bhide and Y.G. Paithankar	PHI
3	Power System Protection and Switchgear	2007	Badri Ram	TMH.
4	Switchgear and Protection	**1990**	S. S. Rao Khanna	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The Art and science of protective relaying	**1992**	Russel, Mason	Wiley Eastern
2	Computer relaying for power system	2009	Arun G. Phadke and JamesThorpe	S John Wiley

VII Semester
EL 2402 - Lab: Switchgear and Protection

Minimum 8 practicals to be performed

S.N	TITLE
1	Design a protection system to protect system for given fault currents & plot the characteristics of relay used *(IDMT)*
2	Design a protection system to protect system for fault direction & plot the characteristics of relay used
3	Design a protection system to protect system for Reactance fault only & plot the characteristics of relay used
4	Design a protection system to protect system for Impedance type fault & plot the characteristics of relay used
5	Plot the Characteristics of Numerical Relay L&T make *MC61C*
6	Study of Differential Protection Scheme
7	Study of Relay Test set & to verify Relay Characteristics of *ICM21N*
8	Identify Different Circuit Breaking Devices
9	To Study ANSI Device Numbers (ANSI - American National Standards Institute)
10	To study MICOM P430 distance protection relay.
11	To Study Minliec make SPPR & Overload Relay
12	To study Generator Protection Scheme*
13	To study Feeder Protection Scheme*
14	To Study Percentage biased Differential Protection

VII Semester
EL2403 - High Voltage Engineering

Objective	Course Outcome
The course objective is understanding of high-voltage phenomena, and the basics of high voltage insulation design with the analytical and modern numerical tools available to high-voltage equipment designers. The areas covered comprise a short but fundamental introduction to dielectric properties of materials, non-destructive tests applicable also to on-site monitoring of power equipment. The purpose of this is to provide information on transient and temporary over voltages and currents in end-user AC power systems	**On completion of this course, the student will be able to** 1) Explain Breakdown of various dielectrics and calculate their breakdown voltage. 2) Explain causes of overvoltage's due to lightning and switching and protective devices used for the same. 3) Explain propagation of travelling waves along with insulation coordination. 4) Explain generation and measurement of high voltage and current. 5) Explain Non-destructive and high voltage testing of electrical apparatus.

CO	Statement	Mapped PO												PSO	
		PO 1	PO	PO	PO	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
CO	Explain Breakdown of various dielectrics and calculate their breakdown voltage	2	3	1	1								1	2	
CO	Explain causes of overvoltage's due to lightning and switching and protective devices used for the same.	2	3	1	1								1	2	
CO	Explain propagation of travelling waves along with insulation coordination.	2	3	3	1								2	2	
CO	Explain generation and measurement of high voltage and current	2	3	3	1								2	2	
CO	Explain Non-destructive and high voltage testing of electrical apparatus.	2	3	3	1								2	2	

VII Semester

EL2403 - High Voltage Engineering

Unit No.	Contents	Max. Hrs.
1	**Breakdown Mechanism in Dielectrics** Ionisation process : Townsend"s criterion for breakdown, Break-down in electro-negative gases, Time -lag for breakdown, Streamer theory for breakdown in gases, Paschen's law, Breakdown in non-uniform fields, corona discharges and introduction of corona, post breakdown phenomenon and applications, practical considerations in using gases for insulation purposes, vacuum insulation, liquid as insulators, conduction and breakdown in pure and commercial liquids. Intrinsic electromechanical and thermal breakdown. Breakdown of solid dielectric in practice, breakdown in composite dielectric.	7
2	**Lightning and switching over voltages** Mechanism of lightning types of strokes, parameter and characteristics of lightning strokes, characteristics of switching surges; power frequency over voltages, control of over voltages due to switching. Protection of lines by ground wire, protection by Lightning Arrester (LA), gap type and gapless LA, selection of LA ratings, Surge absorbers.	7
3	**Travelling Waves and Insulation Co-ordination** Travelling waves on transmission lines, classifications of lines, attenuation and distortion of travelling waves, reflection and transmission of waves, behaviour of rectangular waves at transition points. Introduction to insulation co-ordination and associated terms, impulse wave-form, introduction to Basic Insulation Level (BIL), Reduced BIL and Switching Impulse Level (SIL).	6
4	**Generation of High Voltage and Currents** Generation of High D.C. voltages by rectifiers, voltage doubler and multiplier circuits (Derivation not required) electrostatic machines. Generation of high ac voltage by cascade transformers, resonant transformers. Generation of high impulse voltages: Standard impulse wave shapes, analyses of model and commercial impulse generation circuits, waveshape control, Marx Circuit, tripping and control of impulse generation, generation of switching surges, generation of impulse current.	7
5	**Measurement of High Voltage and Current** Measurement of high AC and DC voltages by micro ammeter, generating voltmeters, resistance and capacitance potential dividers, series impedance voltmeter, Capacitive Voltage Transformer (CVT), Magnetic type potential transformers, electrostatic voltmeter, peak reading AC voltmeters, sphere gap arrangement, measurement of impulse voltage by potential dividers and peak reading voltmeters. Measurement of High AC/DC currents: Measurement of high frequency and impulse current by resistive shunts (Bifilar strip shunt only).	7
6	**Non Destructive and High Voltage Testing of Electrical Apparatus** Non-destructive testing : Measurement of DC Resistivity, measurement of dielectric constant and loss-factor (low and power frequency only), Schering bridge for high voltage circuits, for high dissipation factor for three terminal measurements, transformer ratio arm bridges, partial discharge measurements by straight detector, balance detectors, calibration of detectors, discharge detection in power cables. High voltage testing: Testing of insulators, bushings, isolators, circuit breakers, cables, transformers, lightning arresters and power capacitors.	6

VII Semester

EL2401 : Switchgear and Protection

Objective	Course Outcome
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.	On completion of this course, the student will be able to 1) Explain and define the various basic principles of protection system 2) Compare & apply overcurrent protection Principle 3) Develop , Compare & Solve the problems of distance protection. 4) Explain , Justify and Compare the types of circuit breaker **5)** Explain, Determine and decide the Equipment Protection

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Explain and define the various basic principles of protection system	1						1							
CO2	Compare & apply overcurrent protection Principle	1	1	2				1		1		1	1	2	1
CO3	Develop , Compare & Solve the problems of distance protection.	1	1	2				1		1		1	1	2	1
CO4	Explain , Justify and Compare the types of circuit breaker	1		1				1					1	2	
CO5	Explain, Determine and decide the Equipment Protection	1	1	1				1		1		1	1	2	1

Unit No.	Contents	Max. Hrs.
1	**Introduction** General Philosophy of Protective Relaying:- Protective Zones. Primary Protection, Back up protection. Primary and Local Back Up. Desirable properties of relay. Introduction to Static relays: - Comparison of static and electro-mechanical relays, two input amplitude and phase comparators. Introduction to Numerical relays:- Basic elements of digital protection, Signal conditioning subsystem, Conversion system subsystem & Digital processing relay subsystem.	7
2	**Overcurrent Protection** Medium voltage Line Protection: Overcurrent relaying, directional overcurrent relays.	7

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VII Semester
EL2403 - High Voltage Engineering

Text books:

SN	Title	Edition	Author	Publisher
1	EHV AC Transmission	2nd	R.D.Begamudre	New Age international Publisher
2	High Voltage Engineering	3rd -2006	M. S. Naidu and V. Kamaraju	Mc GrawHill Publisher
3	High Voltage Engineering	1st -1994	C.L. Wadhwa	New Age international Publisher

Reference Books

SN	Title	Edition	Authors	Publisher
1	Advances in High Voltage Engineering	**2004**	M.Haddat and Warne	IET

VII Semester
EL2404 – Lab : High Voltage Engineering

Minimum 8 practicals to be performed

S.N	TITLE
1	Study of High Voltage Laboratory Equipments.
2	Calibration of Panel Voltmeter by Sphere Gap.
3	Study of Corona effect
4	Study of Movement of arc in horn gap
5	To determine Flash over voltage test: 11 kV pin type insulator.
6	Determination of string efficiency of suspension insulator
7	Determination of breakdown voltage for transformer oil sample
8	Determination of breakdown voltage for solid insulator
9	To study Cable Fault locator
10	Measurement of Resistivity of Transformer oil. .
11	Measurement of dielectric constant of transformer oil.
12	Measurement of Loss Angle of transformer oil
13	Study of 100 kV AC/ 140 kV DC test set and calibration of Panel Voltmeter by Sphere gap.
14	Study of 150 kV, 225 Joules Impulse Generator and test on Pin type Insulator.

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

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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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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)			

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

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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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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	

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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

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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	

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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
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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	

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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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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 of time.	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

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			

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

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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

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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	

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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

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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	

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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

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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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

VIII Semester
EL2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	On successful completion of the course students will be able to: 1. Demonstrate a sound technical knowledge of their selected project topic. 2. Undertake problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Communicate effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii,iii	

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

VIII Semester
EL2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develop creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 5,6,7,9,10,11	

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

Electronics Engineering

III Semester

EE2204: Lab: Programming Language

Course Objective	**Course Outcomes**
Students will understand Python is a useful scripting language for developers. Students will learn how to design and program Python applications	To **understand** syntax and semantics of language To **understand** and **apply** the basics of the programming language To **analyse** and **apply** special language features To **evaluate** and **create** functions for any application

Expt. No.	Name of Experiments
1	Installation of IDE and write first program in Python using "variables".
2.	To write Python programs using Data Types.
3.	To perform different operations on "Strings" in Python.
4.	To perform different operations with data types in Python.
5.	To learn and write program using "List" and "Tuple" in Python.
6.	To learn and write program using "Set" and "Dictionary" in Python.
7.	To learn and write program using Loop statements in Python.
8.	To learn "NumPy" of Python.
9.	To learn how to create a matrix using Python and perform different operation on it.
10.	To learn and write program using functions in Python.(Optional)
11.	To write program for fun games in Python.
12.	Certification through NPTEL course "Joy of Computing using Python".

IV Semester

EE2258: Lab: Workshp Lab

Course Objective	Course Outcomes
➢ Students will be acquaint with basic Electronics workshop practices like, identification of components, operate and control various machines, repair, troubleshooting, and Circuit Design Methods. ➢ Student will understand Project Implementation and testing with proper report writing.	**Understand** and identify Different Electronics Components. **Apply** the basic knowledge of Electronics Components to select the mini project. **Demonstrate** their practical Knowledge to do Artwork, printing, Etching & drilling of PCB for mini project. **Prepare** the mini project report and three minute video.

Expt No.	Experiment Name
1	Identification of Various electronic components used in electronics workshop
2	Identification of various equipment used in electronics workshop
3	Testing of various electronics components
4	Soldering and De-Soldering Practice
5	PCB Design using EDA Tools (Orcad Layout Plus /Allegro/ MultisimUltiboard / EasyEDA / Express PCB)
6	Etching and fabrication
7	Mini Project (Arduino / Node MCU / Raspberry Pi)
8	Report Writing

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	PS O1	PS O2
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

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

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:PreparingIot 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

VII Semester
EE2401 -Digital System Design

Objective	Outcome
Students should be able to 1. Expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design	Students will be able to 1. Understand hardware description language and able to design and simulate digital systems using different abstraction levels 2. Design and analyse combinational and sequential logic circuits. 3. Understand and apply timing issues in multiple contexts and design the circuit. 4. Understand programmable devices and able to design digital systems using modern design tools

UNIT-1: HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module ,Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Constants, Parameter, Verilog Data Operators.

UNIT-2:, Data Flow Modeling, Delay, Continuous Assignment, Delayed Continuous assignment Design entry in Verilog & Test bench, Combinational blocks design, Compilation and synthesis, Timing analysis resolving signal values

UNIT-3:, Structural Modeling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives.

UNIT-4: Behavioral Modeling, Initial, Always, Procedural Assignment, Blocking and Non- Blocking assignments, Sequential & Parallel Blocks, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, State Machine Coding ,Moore and Mealy Machines.

UNIT-5 :Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Latches and Flip Flops , Multi bit Adders examples like Ripple Carry Adder, Carry look ahead adder ,two bit and three bit Multiplier, CPU, Design Verification.

UNIT-6: 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.

Text Books:

	Title	Edition	Author	Publisher
1	Verilog HDL : A Guide to Digital Design and Synthesis	2nd Edition	Samir Palnitkar	2003

Reference Book:

	Title	Edition	Author	Publisher
1	Verilog Digital System Design	Second Edition	Zainalabedin Navabi	Tata McGraw Hill , 2009

VII Semester
EE2402 – Lab.: Digital System Design

Objectives	Outcomes
Students should be able to 1. Expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design	Students will be able to 1. Understand hardware description language and able to design and simulate digital systems using different abstraction levels 2. Design and analyse combinational and sequential logic circuits. 3. Understand and apply timing issues in multiple contexts and design the circuit. 4. Understand programmable devices and able to design digital systems using modern design tools

Expt. No.	Name of Experiment
1	Write Verilog Codes of basic gates using Bitwise Operator .Test it with test stimuli generated by test bench.
2	Write Verilog Codes of 2:1 and 4:1 Multiplexer using Bitwise Operator .Test it with test stimuli generated by test bench.
3	Write Verilog Codes of 2:4 and 3:8 Decoder using Bitwise Operator .Test it with test stimuli generated by test bench.
4	Write Verilog Codes of half and full adder using Bitwise Operator .Test it with test stimuli generated by test bench.
5	Write verilog code using conditional assignment statement. Test it with test stimuli generated by test bench.
6	Write a Structural Verilog code of full adder using half adder. Test it with test stimuli generated by test bench.
7	Write a Structural Verilog code of 4:1 multiplexer using 2:1 multiplexer. Test it with test stimuli generated by test bench.
8	Write a Structural Verilog code of 4-bit Ripple carry Adder using full adder. Test it with test stimuli generated by test bench.
9	Write a Behavioural Verilog code of multiplexers using if statements. Test it with test stimuli generated by test bench.
10	Write Verilog code for Mealy and Moore sequence detector.(using overlapping allowed and not allowed)

Text Books:

	Title	Edition	Author	Publisher
1	Verilog HDL : A Guide to Digital Design and Synthesis	2nd Edition	Samir Palnitkar	2003

Reference Book:

	Title	Edition	Author	Publisher
1	Verilog Digital System Design	Second Edition	Zainalabedin Navabi	Tata McGraw Hill , 2009

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

Electronics Telecommunication Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. ET-201

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	30	40	3 Hours
2	3	PC	ET2201	Electronic Devices and Circuits	**T**	3	1	0	4	4	30	30	40	3 Hours
3	3	PC	ET2202	Lab: Electronic Devices and Circuits	**P**	0	0	2	2	1		60	40	
4	3	PC	ET2203	Digital Circuits and Fundamentals of Microprocessor.	**T**	3	0	0	3	3	30	30	40	3 Hours
5	3	PC	ET2204	**Lab:** Digital Circuits and Fundamentals of Microprocessor.	**P**	0	0	2	2	1		60	40	
6	3	PC	ET2205	Electronic Measurement and Instrumentation	**T**	3	0	0	3	3	30	30	40	3 Hours
7	3	PC	ET2206	Lab: Electronic Measurement and Instrumentation	**P**	0	0	2	2	1		60	40	
8	3	PC	ET2207	Network Analysis	**T**	3	0	0	3	3	30	30	40	3 Hours
				TOTAL THIRD SEM		**15**	**1**	**6**	**22**	**19**				

SN	Sem	Type	Sub. Code	Subject	T/P	L	T	P	Hrs	Credits	MSEs*	TA**	ESE	ESE Duration Hours
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	**T**	3	0	0	3	3	30	30	40	3 Hours
2	4	PC	ET2251	Electromagnetic Fields	**T**	3	1	0	4	4	30	30	40	3 Hours
3	4	PC	ET2252	Microcontroller and Interfacing	**T**	3	0	0	3	3	30	30	40	3 Hours
4	4	PC	ET2253	Lab: Microcontroller and Interfacing	**P**	0	0	2	2	1		60	40	
5	4	PC	ET2254	Analog Communication	**T**	3	0	0	3	3	30	30	40	3 Hours
6	4	PC	ET2255	Lab: Analog Communication	**P**	0	0	2	2	1		60	40	
7	4	PC	ET2256	Control Systems	**T**	3	0	0	3	3	30	30	40	3 Hours
8	4	PC	ET2257	Lab.: Control Systems	**P**	0	0	2	2	1		60	40	
				TOTAL FOURTH SEM		**15**	**1**	**6**	**22**	**19**				

List of Audit Courses										
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	**A**	3	0	0	3	0

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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

SoE No. ET-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	30	40	3 Hours
2	5	PC	ET2301	Analog Integrated circuits	**T**	3	0	0	3	3	30	30	40	3 Hours
3	5	PC	ET2302	Lab: Analog Integrated circuits	**P**	0	0	2	2	1		60	40	
4	5	PC	ET2303	Fields & Radiating Systems	**T**	3	1	0	4	4	30	30	40	3 Hours
5	5	PC	ET2304	Signals & Systems	**T**	3	0	0	3	3	30	30	40	3 Hours
6	5	PC	ET2305	Lab. :Signals & Systems	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	30	40	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	30	40	3 Hours
9	5		ET2306	Lab.: Electronics Workshop	**P**	0	0	2	2	1		60	40	
10	**5/6**	**STR**	**ET2310**	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
TOTAL FIFTH SEM						**18**	**1**	**6**	**25**	**23**				

Audit Courses											
1	5	IT	IT1121	Industrial Programmin Language	**A**	3	0	0	3	0	

Open Electives -I

1	5	OE 1	ET2311	OE I : Microcontroller & Embedded Systems
2	5	OE 1	ET2312	OE I : Principles of Communication Engineering
3	5	OE 1	ET2313	OE I : Fundamentals of Image Processing

Open Electives -II

4	5	OE 2	ET2321	OE II : Soft computing
5	5	OE 2	ET2322	OE II : Industrial Instrumentation
6	5	OE 2	ET2323	OE II : Medical Electronics
7	5	OE 2	ET2324	OE II : Display Technology & Applications
7	5	OE 2	ET2325	OE II : PLCs and SCADA

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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

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B.E. SCHEME OF EXAMINATION 2018-19

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SoE No. ET-201

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours L	T	P	Hrs	Credits	% Weightage MSEs*	TA**	ESE	ESE Duration Hours
Sixth Semester														
1	6	HS	GE2311	Fundamental of Management	T	3	0	0	3	3	30	30	40	3 Hours
2	6	PC	ET2351	Digital Signal Processing	T	3	0	0	3	3	30	30	40	3 Hours
3	6	PC	ET2352	Lab: Digital Signal Processing	P	0	0	2	2	1		60	40	
4	6	PE		Professional Elective I	T	3	0	0	3	3	30	30	40	3 Hours
5	6	PE		Lab. : Professional Elective I	P	0	0	2	2	1		60	40	
6	6	PE		Professional Elective II	T	3	0	0	3	3	30	30	40	3 Hours
7	6	PE		Lab. : Professional Elective II	P	0	0	2	2	1		60	40	
8	6	OE		Open Elective - III **	T	3	0	0	3	3	30	30	40	3 Hours
9	6	OE		Open Elective - IV **	T	3	0	0	3	3	30	30	40	3 Hours
				TOTAL SIXTH SEM		**18**	**0**	**6**	**24**	**21**				

Professional Electives -I

1	6	PE I	ET2361	PE I : Object Oriented Programming
2	6	PE I	ET2362	PE I : Lab. Object Oriented Programming
3	6	PE I	ET2363	PE I : Discrete Structures
4	6	PE I	ET2364	PE I : Lab. Discrete Structures
5	6	PE I	ET2365	PE I : Microprocessors and Peripherals
6	6	PE I	ET2366	PE I : Lab. Microprocessors and Peripherals
7	6	PE I	ET2367	PE I : Electronic Instrumentation
8	6	PE I	ET2368	PE I :Lab Electronic Instrumentation
9	6	PE I	ET2371	PE I : Fundamentals of Computing
10	6	PE I	ET2372	PE I : Lab Fundamentals of Computing
11	6	PE I	ET2373	PE I : Algorithms and data structures
12	6	PE I	ET2374	PE I :Lab Algorithms and data structures

Professional Electives -II

1	6	PE II	ET2377	PE II : Antenna Theory & Design
2	6	PE II	ET2378	PE II : Lab. Antenna Theory & Design
3	6	PE II	ET2379	PE II : Digital system Design
4	6	PE II	ET2380	PE II : Lab. Digital system Design
5	6	PE II	ET2381	PE II : Internet of Things (IoT)
6	6	PE II	ET2382	PE II : Lab. Internet of Things (IoT)
7	6	PE II	ET2383	PE II : Optical Communication
8	6	PE II	ET2384	PE II : Lab. Optical Communication
9	6	PE II	ET2385	PE II :Principles of image processing
10	6	PE II	ET2386	PE II : Lab. Principles of image processing
11	6	PE II	ET2387	PE II : TV & Video Engineering
12	6	PE II	ET2388	PE II : Lab. TV & Video Engineering

Open Electives -III

1	6	OE 3	ET2391	OE III : Microcontroller & Embedded Systems
2	6	OE 3	ET2392	OE III : Principles of Communication Engineering
3	6	OE 3	ET2393	OE III : Fundamentals of Image Processing

Open Electives -IV

4	6	OE 4	ET2396	OE IV : Soft computing
5	6	OE 4	ET2397	OE IV : Industrial Instrumentation
6	6	OE 4	ET2398	OE IV : Medical Electronics
7	6	OE 4	ET2399	OE IV : Display Technology & Applications
7	6	OE 4	ET2400	OE IV : PLCs & SCADA

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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

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B.E. SCHEME OF EXAMINATION 2018-19
(Revised Scheme of Examination w.e.f. 2022-23 onward)

SoE No. ET-201.1

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	ET2401	RF & Microwave	T	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	ET2402	Lab: RF & Microwave	P	0	0	2	2	1		60	40	
3	7	PC	ET2403	Digital Communication	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	ET2404	Lab: Digital Communication	P	0	0	2	2	1		60	40	
5	7	PE		Professional Elective III	T	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Professional Elective IV	T	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective V	T	3	0	0	3	3	30	20	50	3 Hours
8	7	PE		Professional Elective VI	T	3	0	0	3	3	30	20	50	3 Hours
9	7	STR	ET2409	Mini Project	P	0	0	4	4	2		60	40	
10	7	STR	ET2410	Campus Recrutment Training (CRT)	P	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

Professional Electives -III

1	7	PE	ET2411	PE III : Power Electronics
2	7	PE	ET2412	PE III : Data Compression & Encryption
3	7	PE	ET2413	PE III : Analog VLSI
4	7	PE	ET2414	PE III : Error Correcting Codes
5	7	PE	ET2415	PE III : Wireless Mobile Communication Systems

Professional Electives -IV

6	7	PE	ET2421	PE IV : Satellite Communication & RADAR Engineering
7	7	PE	ET2422	PE IV : Embedded System
8	7	PE	ET2423	PE IV : Switching Theory
9	7	PE	ET2424	PE IV : Topics in Machine Learning
10	7	PE	ET2425	PE IV : Multimedia Communications

Professional Electives -V

11	7	PE	ET2431	PE V : Display Technology
12	7	PE	ET2432	PE V : Biomedical Instrumentation
13	7	PE	ET2433	PE V : Fuzzy Logic & Neural Network
14	7	PE	ET2434	PE V : Wireless Sensor Networks
15	7	PE	ET2435	PE V : RF Circuit Design

Professional Electives -VI

16	7	PE	ET2441	PE VI : CMOS VLSI Design
17	7	PE	ET2442	PE VI : Digital Image Analysis for Remote Sensing
18	7	PE	ET2443	PE VI : Microwave Integrated circuits
19	7	PE	ET2444	PE VI : Communication Networks
20	7	PE	ET2445	PE VI : Computer Architecture and Organization
20	7	PE	ET2446	PE VI : PLCs & SCADA

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.06	Applicable for AY 2022-23 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)

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2022-23 onward)

SoE No. ET-201.1

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	ET2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	ET2452	Extra curricular Activity Evaluation	P	0	0	0	0	1		100		
					TOTAL	0	0	12	12	10				

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.06	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
ET2412 – PE III: Data compression and encryption

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

Unit 1.Introduction to Data Compression

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

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

Unit2. Image Compression

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

Unit 3.Video and Audio Compression

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

Unit 4. Data Security

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

Unit 5. Number Theory and Asymmetric Key Cryptography

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

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

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

Unit 6. Network Security

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

VII Semester
ET2412 – PE III: Data compression and encryption

Text books:				
1	The Data Compression Book	Mark Nelson, Jean-Loup Gailly	2nd edition	BPB Publications
2	Cryptography and Network Security Principles and Practices	William Stallings	5th Edition	Pearson Education.
3	Introduction to Data Compression		2nd edition	Morgan Kaufmann

Reference books:				
1	Cryptography and Network Security, Tata McGraw-Hill.	BehrouzA. Forouzan	2nd edition	Tata McGraw-Hill.

VII Semester
ET 2413 –PE III : Analog VLSI Design

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

UNIT-1 Basic MOS Device Physics

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

(06 Hours)

UNIT-2: Single stage amplifiers

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

UNIT-3: Differential amplifiers

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

(06 Hours)

UNIT 4: Operational amplifiers

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

(06 Hours)

Unit 5: ADC converter and DAC converter

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

Unit 6: Sigma Delta Converter

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

(06 Hours)

VII Semester

ET 2413 –PE III : Analog VLSI Design

Text books:				
1	Design of Analog CMOS Integrated circuits	Ninteenth reprint 2010	BehzadRazavi	Mc-graw-Hill

Reference books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

VII Semester
ET 2414 – PE III: Error Correcting Code

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

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

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

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

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

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

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

VII Semester
ET 2414 – PE III: Error Correcting Code

Text books:				
1	Introduction to Error Control Codes	Gravano Salvatore	1st Ed., 2007.	Oxford University Press,
2	Error Correction Coding Mathematical Methods and Algorithms	Moon Tood K	, 1st Ed., 2006	Wiley- Interscience
3	Digital Communications - Fundamentals and Applications	Sklar Bernard	2nd Ed., 2009.	Pearson Education-LPE,

Reference books:				
1	Information Theory, Coding and Cryptography	Bose Ranjan	, 1st Ed., 2007.	Tata McGraw-Hill
2	Error Control Coding-Fundamentals and Applications	-Shu Lin, Daniel J. Costello		Prentice Hall, Inc.

VII Semester
ET 2423 – PE IV: Switching Theory

Course Objective	**Course Outcomes**
Students should be able to 1) Understand various sequential logic design methods, Analysis of logic circuits and optimization techniques to minimize gate count. 2) Learn fault diagnosis, Threshold logic, analysis and design of sequential machines.	Students will be able to 1) Design and Analyze multilevel logic Network and Threshold logic for nanotechnologies. 2) Analyze testing of combinational circuits, Fault Models 3) Design and analyze the synchronous and asynchronous sequential circuits. 4) Identify and test the sequential machines with experiments.

UNIT-1

Multi-level logic synthesis, Technology-independent synthesis: Factoring, Decomposition, Extraction, Substitution, and Technology mapping: steps in technology mapping **(06 Hours)**

UNIT-2:

Threshold logic for nanotechnologies, threshold elements, synthesis of threshold networks: Unate function, Identification & Realization of threshold function. **(06 Hours)**

UNIT-3:

Testing of combinational circuits, Fault models, Structural testing, IDDQ testing, Delay fault testing, Synthesis for testability, Testing for nanotechnologies. **(06 Hours)**

UNIT 4:

Synchronous sequential circuits and iterative networks, memory elements and their excitation functions, synthesis of synchronous sequential circuits, Moore and Mealy machines, finite state machine flow charts, tables **(06 Hours)**

Unit 5:

State-identification experiments and testing of sequential circuits, Experiments, Homing experiments, Distinguishing experiments, Machine identification, Checking experiments, Built-in self-test (BIST). ,New topic to be announced time to time **(06 Hours)**

Unit 6

Asynchronous sequential circuits, Modes of operation, Hazards, Synthesis of SIC fundamental-mode circuits. **(06 Hours)**

VII Semester
ET 2423 – PE IV: Switching Theory

Text books:				
1	Switching & Finite Automata Theory	Zvi Kohavi, Niraja K. Jha	Third Edition 2010	Cambridge University Press
2	Fundamentals of Digital Logic With VHDL Design	Stephen Brown	Second Edition, 2007	TMH

Reference books:				
1	Modern Switching Theory and Digital Design	Lee S.C		PHI Edition
2	Digital Logic and Computer Design	M.Morris Mano		PHI Edition

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

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

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

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

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

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

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

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

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

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

Reference books:				
1	Foundations of Data Science.	2017	Avrim Blum, John Hopcroft and Ravindran Kannan.	
2	Learning, Part II, http://www.deeplearningbook.org/	2016	Goodfellow, I., Bengio, Y., Courville, A.	MIT Press
3	Machine Learning: A Probabilistic Perspective	2012	Kevin P. Murphy	MIT Press

VII Semester
ET 2434 -PE V: Wireless Sensor Networks

Prerequisites	-----------
Course Objective Students should be able to: 1. To Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology 2. Understand the medium access control protocols and address physical layer issues 3. Learn key routing protocols,transport layer protocols for sensor networks, and design requirements 4. Understand the Sensor management ,sensor network middleware, operating systems.	**Course Outcome** Students will be able to: 1. Understand and explain common wireless sensor node architectures. 2. Carry out simple analysis and planning of WSNs. 3. Demonstrate knowledge of MAC protocols, routing protocols developed for WSN. 4. Demonstrate knowledge of mobile data-centric networking principles.

UNIT-1:

Characteristics Of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs,

(06 Hours)

UNIT-2:

Network architecture-optimization goal and figure of merit-design principles for WSN, service interface of WSN, Gateway concept challenges of WSN, comparison with other network.

(06 Hours)

UNIT-3

Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention- based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol

(06 Hours)

UNIT-4:

Routing And Data Gathering Protocols Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

(06 Hours)

VII Semester
ET 2434 -PE V: Wireless Sensor Networks

UNIT-5
Naming and addressing, Time synchronization, Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement.

(06 Hours)

UNIT-6:
Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking .

(06 Hours)

Text books:				
1	Protocols and architecture for Wireless sensor Networks Wiley	2007	Holger Karl, Andreas Willig,	Wiley Publications
2	Wireless Sensor Network Designs,	2003	Anna Hac	Wiley Publications
3	Handbook of Algorithms for Wireless Networking and Mobile Computing	2006	Azzedine Boukerche	Chapman & Hall/CRC Publications

Reference books:				
1	Wireless Sensor Networks : A systems perspective	August 2005	NirupamaBulusu and Sanjay Jha,	Artech House Publications
2	Wireless Sensor Networks : Architecture and Protocols	2003, 2003.	Jr., Edgar H. Callaway,	Auerbach Publications
3	Wireless Sensor Networks	2005 C.S.	Raghavendra, Krishna M. Sivalingam and TaiebZnati	Springer Publications

VII Semester
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)**

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

VII Semester

ET2442– PE VI: Digital Image Analysis for Remote Sensing

Text books:				
1	Remote Sensing: Models and Methods for Image Processing	Third Edition, 2007	Robert A. Schowengerdt	Elsevier
2	Remote Sensing Digital Image Analysis	4th Edition, 2006	John A. Richards, Xiuping Jia	Springer

Reference books:				
1	Introductory Digital Image Processing: A Remote Sensing Perspective	Fourth Edition, 2016	Jhon R. Jensen	Pearson Series
2	Physical Principles of Remote Sensing	Third Edition, 2012	W.G. Rees	Cambridge University Press

VII Semester
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	

Computer Technology

V Semester

CT2315- PE I: Advanced Web Technologies

Objective	Course Outcome
1. To learn basic aspects of Web services, Server side scripting, Advanced CSS 2. To introduce with AJAX 3. To learn Basics of Advanced Client side programming 4. To learn JavaScript	On completion of this course, the student will be able to: 1. Design Web pages using HTML5, CSS3 2. Perform various operations using AJAX 3. Use features of Client side programming 4. Develop Web pages using JavaScript

Unit No.	Contents	Max. Hrs.
1	Web Services: Overview of HTTP, FTP, SMTP Protocols, Web Servers, Server-side scripting, REST	6
2	Basics of Client side programming: Document Object Model (DOM), Overview of DOM Element Selector 6 (Examples in jQuery), Document ready function, HTML5, Audio and Video, Forms, CSS3 -Introduction to CSS3, What is CSS3? Differences between CSS3 and earlier CSS specifications, How browsers are handling CSS3? CSS3 Selectors- Selectors Overview, Explore specific selectors, Designing and Developing with CSS3-Background and color Typography, CSS3 Box Model, Page layout, Media Queries, Implementing CSS3, Best Practices, Advantages and limitations of working with CSS3.	8
3	Rich Internet Applications (RIA): Overview of Traditional Web Communication Processes and Technologies, Web 2.0, Introduction to AJAX-Create an XML Http Request Object, interacting with a Web Server, Processing Client Requests, Securing AJAX Applications, Progressive Web Apps, Form Factor detection, Browser detection, Feature detection	7
4	Advanced Client side programming: Semantic Elements, WebSockets, SSE, WebRTC, Web Graphics & Canvas, WebGL, WebWorkers, SVG. Libraries: Modernizer, Polyfills, Polymer	8
5	JavaScript: Functional programming, Asynchronous programming, Event driven systems, Debugging, Testing, Workflow optimization, and deployment pipelines, Web Components, Introduction to Web Frameworks-React, Node.js, Angular' JS	8
6	Server-Side Programming: Introduction to the server-side programming, Server-side web frameworks like Django, Express. etc.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX	2013	Kogent Learning Solutions Inc.	Dreamtech Press India Pvt. Ltd
2	Javascript Bible	7th	Danny Goodman Michael Morrison Paul Novitski Tia Gustaff Rayl	Wiley India Pvt Ltd

Reference Books

SN	Title	Edition	Authors	Publisher
1	Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML (With CD) and PHP	4th Revised Edition	Ivan Bayross	BPB Publication

V Semester

CT2316- PE I: Lab: Advanced Web Technologies

Sr. No.	Practical List
1	Write a JavaScript function that creates a table, accept row, column numbers from the user, and input row-column number as content (e.g. Row-0 Column-0) of a cell.
2	Create employee registration webpage using HTML5 form objects
3	Implement CSS3 for Online shopping system
4	Create a dynamic web page which displays arithmetic operations [addition, subtraction, division, multiplication and modulus] using HTML Frame
5	Write a suitable script which show methods of Server object [HTML Encode, URL Encode, Mappath, Execute and Transfer]
6	Write a script which creates and retrieves Cookies information
7	Create a dynamic web page which displays capabilities of a web browser using Browser Capabilities Component using JavaScript
8	Create a simple XMLHttpRequest and retrieve data from a TXT file.
9	Create a simple XMLHttpRequest and retrieve data from a TXT file.
10	Create a simple script to download Images Using AJAX,
11	Create a simple script to Auto-Populate Select Boxes using AJAX

VI Semester

CT2365 – PE II: Business Intelligence

Objective	Outcome
1. Understand the concept of business intelligence, digital data and the multidimensional data modeling 2. Have an appreciation of the process of building of multidimensional data model and various operations that can be performed on it 3. Gain an understanding of how to measure and present the business information 4. Develop an understanding of application of the business intelligence in the real-world scenario	Upon successful completion of the course, students will be able to 1. Reveal the knowledge of basic concepts of Business Intelligence and multidimensional modelling and able to compare digital data types. 2. Build and operate the multidimensional data model for the specific scenario to extract the information. 3. Analyze the business information to construct the reports from it. 4. Decide the mode / channel to implement the business intelligence solution for the specific problem.

Unit No.	Contents	Max Hrs.
1	Introduction to Business Intelligence: Introduction to digital data and its types – structured, semi-structured and unstructured, BI Definitions & Concepts, BI Framework, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices	6
2	Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP) Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, Data Warehousing concepts and its role in BI	6
3	Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data – types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle).	7
4	Identifying Dimension tables and fact table, designing of dimension and fact tables" schema, design of snowflake schema, query redirection. Aggregations: Why aggregate? designing Summary tables, which summaries to create	7
5	Introduction to business metrics and KPIs, creating cubes using Microsoft Excel, Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards	6
6	Case study: Overview and use of products from Pentaho and other open software. BI road Ahead: BI and mobility, BI and cloud computing, BI for ERP systems, Social CRM and BI	7

VI Semester

CT2365 – PE II: Business Intelligence

Text Books:

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

Reference Books:

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

VI Semester

CT2366 – PE II: Lab: Business Intelligence

Sr. No.	Practical List
1	Design a conceptual multidimensional model for the given data.
2	Create a table for Time dimension using existing data source
3	Extract the data from various sources and move it to backup area. Load the data from backup area tostaging area and then Load data in data warehouse from staging area.
4	Create a chart report, by considering module names on the X-axis, Percentage Scored in the VariousModules on Y-axis.
5	Create a table report to display Year, Quarter, Month, Module name of the assessment conducted in the current month, Assessment type of the module conducted in the current month. Enable drill down for "Year," "Quarter, and "Month."
6	Graph the percentage sales over time to see the trends using given dataset. Also Pivot the data to seetotal sales by quarter and category and analyze the data
7	Report the sales by category and the corresponding freight charges. Filtering should be enabled in the Year and Quarter columns, and the selected Year and Quarter need to be visible. Also Sort the Sales data in terms of Year, Quarter and Month.
8	Extract the data from various sources using PENTAHO and apply the transformation on the data.
9	Describe the characteristics of data imported in R by using R functions.
10	Consider a data set and visualize it using appropriate visualization technique in „R‟
11	Apply data transformation and represent the data model in Orange tool
12	Perform data visualization using Tableau

V Semester
CT2301 – Computer Networks

Objective	Outcome
1. The architecture and principles of today's computer networks 2. The protocols and their functionalities 3. The requirements for the future Internet and its impact on the computer network architecture.	On completion of this course, the student will be able to: 1. Identify appropriate design issues and explain network reference model. 2. Select appropriate protocol at various layers for the given application. 3. Solve problems in the networking domain. 4. Analyze the performance of network using different tools

Unit No.	Contents	Max. Hrs.
1	Introduction: The uses of computer networks, LAN's, MAN's, WAN's., protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference models, Critique of OSI model & protocols, critique of TCP/IP reference model.	6
2	Transmission Impairments, Transmission Media: Guided, unguided, Architecture of the Internet, Wireless LANs: IEEE 802.11, IEEE 802.16 , The Public Switched Telephone Network, Switching: circuit, packet and message switching, Modems	5
3	The Data Link Layer: Data link layer design issues- Framing, Error Control, Flow Control, Link Management, Error detection and Correction-Error-Correcting Codes, error-detecting codes, Elementary data link protocols-An Unrestricted simplex Protocol, A simplex stop and wait protocol, A simplex protocol for a noisy channel, Sliding window protocols- A one bit sliding window protocol, Go Back N protocol, Selective Repeat Protocol.	6
4	The Medium Access Sublayer: Static and Dynamic Channel allocation in LAN's and MAN's, Access Protocols-ALOHA, Persistent and Non Persistent CSMA, CSMA/CD, Collision free protocols, Binary countdown, Limited-connection protocol: The adaptive tree walk protocol/	6
5	The Network Layer: Network Layer design issues-services provided to the transport layer, Logical Addressing: Classbase and classless, Subnetting and Supernetting, Routing and Routing Algorithms-Flooding, Flow-Based, Distance Vector, Link State, Hierarchical. Congestion Control algorithms- Preallocation of buffers, Packet discarding, Choke packets, Load shedding, Jitter control. Leaky bucket algorithm, token bucket algorithm, IP header format (IPv4, IPv6).	6
6	The Transport Layer: Transport layer design issues-services provided to the session layer, Quality of service, transport service primitives, Elements of transport protocols-Addressing, Establishing and Releasing a connection, Flow control and Buffering, Multiplexing, Crash Recovery. Transmission Control Protocol (TCP). The Application Layer: DNS, SMTP, FTP, TFTP.	5

Text Books

SN	Title	Edition	Authors	Publisher
1.	Computer Networks		A.S. Tanenbaum	Pearson Publication
2.	Computer Networking		Behrouz A. Forouzan	McGraw-Hill Publication

V Semester
CT2302 – Lab: Computer Network

Sr. No.	Practical List
1	How to bring two computers in the network. Configure TCP/IP to configure Internet on your computer.
2	Use Network Utility Command like ping, ipconfig, netstat, tracert to observe the network details.
3	To implement Hamming Code using C and C++.
4	To implement Dijkstra's Routing algorithm using backtracking approach.
5	Use traffic monitoring tool Wireshark to observe network traffic with packet details.
6	Configure router. Configure network using Cisco Packet Tracer software and show packet transmission from source to destination.
7	Configure Virtual LAN using cisco packet tracer.
8	Use Openssl command to perform Asymmetric key encryption (RSA) and also implement RSA algorithm.
9	To study Wireless network of YCCE campus
10	Advance Practical: Introduction to NS2

Computer Technology

VI Semester

CT2369 – PE II: Customer Relationship Management

Objectives	Outcomes
1. To understand the concepts and principles of Salesforce CRM. 2. To appreciate the role and changing face of Salesforce CRM as an IT enabled function. 3. To implement a CRM using apex in aura framework by understanding the business case and importance of implementing such a systemin an organization.	Upon successful completion of this course, the student will be able to: 1. Apply the knowledge of customer-centered organization and implement the integral processes within an organization that are automated and how does the automation create predictability and efficiencies. 2. Design a customize a CRM application for organization to suit their business needs. 3. Analyze the result of developed CRM application from various perspectives for implementing it.

Unit No.	Contents	Max. Hrs.
1	Introduction to Cloud: Definition of Cloud Computing, Cloud Architecture, Cloud Types, Service models, Deployment models, Examining the Characteristics of Cloud Computing, Benefits of cloud computing, Disadvantages of cloud computing. CRM Concepts and its tools: Definition, History, Key Benefits, Service Level Agreements (SLAs), creating and managing effective SLAs. Architecture, Service Nature of Salesforce, Features, Products and its overviews, Traditional CRM vs. Salesforce CRM.	8
2	CRM Administration and Data Model Design: Lightning and classic UI and differences, Creation of org, Object Manager, App Manager, Setup, App creation, tabs, Types of Objects, Data Types, Sandboxes, Understanding Relationships and its limitations, Types of Relationship and their differences, Junction Object, formulas, Dependency picklist fields, Validation Rules.	7
3	Data Management with CRM Tool: Record details, List Views, Filters, Actions Page layouts, Compact Layouts, Introduction to Workflows, email templates, Limitation of workflows, approval processes, Process Builder, Lightning Flow, Community Creation, Reports and Dashboards.	7
4	Security Model: Introduction to Profiles and Permission Set, Overview of Data Security, Control access to org, object, field, record, OWD, Role and Roles Hierarchy, Sharing Rule, sharings Objects, Apex Sharing.	8
5	CRM Tool Development: Introduction to Apex, Collections, SOQL and SOSL, DML Operations, Controllers In APEX, Email Service Using Apex Class and Triggers, Asynchronous APEX, Batch APEX, Apex Test Classes.	7
6	Lightning Aura Component: Introduction to Aura component, attributes handling in aura component, handle action in controller, Parent and child component, Events handling in aura component, Server-side controller.	8

1. Salesforce Handbook Paperback – 20 Mar 2011 by Wes Nolte (Author), Jeff Douglas (Author) , Publisher: Lulu.com, ISBN-10: 1446108538 , ISBN-13: 978-1446108536
2. Salesforce CRM: The Definitive Admin Handbook Paperback – Import, 24 Jul 2013 by Paul Goodey, Publisher: Packt Publishing Limited; 2nd edition edition

3. Alok Kumar Rai, CUSTOMER RELATIONSHIP MANAGEMENT CONCEPT & CASES, Prentice Hall of India Private Limted,New Delhi. 20112
4. S. Shanmugasundaram, CUSTOMER RELA TIONSHIP MANAGEMENT, Prentice Hall of India Private Limted,New Delhi, 20083.
5. Kaushik Mukherjee, CUSTOMER RELATIONSHIP MANAGEMENT, Prentice Hall of India Private Limted,New Delhi, 20084.
6. Jagdish Seth, et al, CUSTOMER RELA TIONSHIP MANAGEMENT5.
7. V. Kumar & Werner J., CUSTOMER RELA TIONSHIP MANAGEMENT, Willey India, 2008

CRM Tool Links:- http://help.salesforce.com

VI Semester

CT2370 – PE II: Lab: Customer Relationship Management

Sr. No.	Practical List
1	Introduction to Salesforce CRM.
2	Creation of Custom Objects.
3	To create Look-up and Master Details Relationship with objects.
4	To implement formula field.
5	To form dependencies among fields.
6	To study different layouts.
7	To implement a workflow.
8	To Customize process flow using process builder.
9	To create clone user and assigned permissions.
10	To create an Email templates
11	A. Write an Apex code to perform the DML Operations on Standard or the custom objects created by the user. B. Write an Apex Code to display the list of books with its issuing Members with starting letters of Books
12	A. To Create a Hello world Aura Component B. To Create and Edit Aura Component
13	Write an aura component to display the addition of two integer numbers, define a button called submit. When a submit button is clicked the result will be displayed on the screen.
14	Case Study- Introduction about community cloud
15	Case Study- Creation of salesforce custom Domain.

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VI Semester
CT2351 - Design & Analysis of Algorithms

Objective	Outcome
1. Understand different asymptotic notations. 2. Have an appreciation of different mathematical principles of algorithm analysis 3. Gain an understanding and apply various algorithm design strategies like divide and conquer strategy, greedy strategy, dynamic programming strategy and backtracking strategy. 4. To understand various complexity classes like P, NP, NP-complete and NP-Hard.	Upon successful completion of the course, the student will be able to: 1. Compare different types of asymptotic notations and find the time complexity in terms of asymptotic notations 2. Solve recurrences using various techniques. 3. Implement divide and conquer strategy, greedy strategy, dynamic programming algorithms and backtracking strategy 4. Identify and differentiate between various types of complexity classes.

Applications of variouis alogorithm design strategies

Unit No.	Contents	Max Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, $\sum n$, $\sum n^2$, bound summations using integration, analyzing control structures, worst case and average case analysis, Asymptotic notations, sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, External Sorting, lower bound proof	5
2	Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.	5
3	Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	5
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.	5
5	Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen‟s problem, graph coloring, Hamiltonian cycles etc.	5
6	NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook‟s Theorem, decision and optimization problems, polynomial reduction.	5

Text Books:
1. “Computer Algorithms”, Horowitz, Sahni, Rajasekaran, Universities press
2. “Introduction to Algorithms”, Cormen ,Leiserson, Rivest, Stein, Prentice Hall of India
3. “Fundamentals of Algorithms”, Brassard, Bratley, Prentice Hall of India

VI Semester

CT2352 – Lab Design & Analysis of Algorithms

Sr. No.	Practical list
1	WAP to implement basic sorting algorithms.
2	WAP to implement basic sorting algorithms.
3	WAP to implement divide and conquer algorithms.
4	WAP to implement divide and conquer algorithms.
5	WAP to implement greedy algorithms.
6	WAP to implement greedy algorithms.
7	WAP to implement dynamic programming algorithms.
8	WAP to implement dynamic programming algorithms.
9	WAP to implement backtracking algorithms.
10	WAP to implement backtracking algorithms.

Computer Technology

VI Semester

CT2361– PE II: Digital Image Processing

Objectives	Outcomes
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description	Upon successful completion of the course, students will be able to: 1. Describe and understand Basic relationships between pixels. 2. Compare and Implement various image enhancement techniques in spatial domain and frequency domain. 3. Compare and illustrate different image compression techniques to understand the advantage of image compression 4. Identify and demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation. 5. Interpret and illustrate various representation techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception, Fundamentals of Image processing, A Simple Image Model, Sampling and Quantization, Some Basic Relationships. between Pixels, Image Geometry in 2D.	6
2	Image Enhancement in the Spatial Domain: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6
3	Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Discrete Cosine Transform, Typical Applications. Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering, Implementation	7
4	Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Fidelity criteria, Image compression models, compression standards, Basic compression methods, Huffman coding, colomb coding, arithmetic coding, LZW coding, runlength coding	7
5	Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	8
6	Image Representation: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models, introduction to image file formats: TIFF, JPEG, BMP, etc.	7

VI Semester

CT2361– PE II: Digital Image Processing

Text Books:
1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
2. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

Reference Books:
1. Fundamentals of Digital Image Processing by A.K.Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya &Ajoy K. Ray, Willey Inter-Science.

VI Semester

CT2362 – PE II: Lab: Digital Image Processing

Sr. No.	Practical List
1	Write a program in MATLAB for following Point processing techniques in spatial domain a. Negation of an image b. Thresholding of an image c. Contrast Stretching of an image
2	Write a Program in MATLAB to Create a Histogram of a given Image.
3	Write a program in MATLAB to perform following smoothing operations on an image a. Average filter b. Ordered Statistics filter
4	Write a program to sharp an image using Laplacian mask.
5	Write a program to compress an image using Huffman Coding
6	Write a program to segment an image using multilevel thresholding.
7	Write a program to apply split and merge algorithm on a given image.
8	Write a program to find the code chain of a given image.
9	Write a program to find the shape number of a given image.
10	Write a program to find Euler number of image a given image.

VI Semester

CT2363 – PE II: Internet of Things

Objectives	Outcomes
1. Get acquainted with various IOT environments. 2. Study IOT architecture and its enabling technologies. 3. Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, students will be able to: 1. Develop various IOT environments 2. Demonstrate IOT architecture and its enabling technologies 3. Analyze IOT environments using various communication technologies 4. Apply various IOT enabling technologies for creation of IOT environments

Unit No.	Contents	Max. Hrs.
1	Introduction: Concepts behind the Internet of Things, Characteristics of IoT, IoT enabling technologies, IoT Communication Model, IoT architecture, Applications of IoT, Transducers, Sensors, Sensor classes, Sensor types, Actuators and its types	6
2	IOT Protocols: Application layer: MQTT, COAP, XMPP, AMQP, Network Layer: IPv4, IPv6, 6LoWPAN, IoT Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID	7
3	Wireless Sensor networks: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.	6
4	Cloud Computing: Recent Trends in Computing, Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Case studies, Middleware for IoT	6
5	Machine to Machine Communication: Node types, IP and Non-IP based M2M network Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability	6
6	Software-Defined Networking: Current Network to SDN, SDN Architecture, Challenges, OpenFlow Protocol, APIs in SDN, Controller Placement, Recent Advances of SDN in IoT, Industrial internet of things, Case studies	6

Reference Book:

1. Internet of Things: A hands on approach by Arshdeep Bahga and Vijay K. Madisetti
2. NPTEL course material on Introduction to Internet of Things

VI Semester

CT2364 – PE II: Lab: Internet of Things

Sr. No.	Practical List
1	To study Arduino Uno IoT Kit with ATMega 328 Microcontroller
2	Design a sketch for running of LEDs
3	Design a sketch to monitor state of switch by establishing serial communication between Arduino and computer
4	Design a sketch to read analog value of potentiometer by establishing serial communication between arduino and computer.
5	Design a sketch for blinking LEDs without using delay.
6	Design a sketch to develop switch based binary LED counter. Also observe output on serial monitor.
7	Design a sketch to create a simple digital clock using LCD display.
8	Design a sketch to make use of EEPROM to control devices (LED).
9	To log data of temperature sensor over internet and analysis it.
10	Advance Practical: Study and setup of ESP -32 board

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. CT-201

Computer Technology

VI Semester

CT2371 – OE III: Introduction to DBMS

Objective	Outcome
To understand basic database concepts by students whose basic degree is not in Computer or IT.	Upon successful completion of this course, the student w be able to: Students should be able to design database forgiven situation, write appropriate queries for accessing database

Unit No.	Contents	Max. Hrs.
1	An Overview of the Database Management System: What is database? Why database?, databasesystem, database management system (DBMS), advantages of DBMS	6
2	An Architecture of the Database system: Three levels of architecture, mappings, role of databaseadministrator (DBA), E-R model, three approaches of DBMS relational, hierarchical and network.	6
3	Relational Database Management System (RDBMS): Introduction, RDBMS terminology, relationalmodel, base tables, key	5
4	The SQL Language: Introduction, Characteristics of SQL, data definition command	5
5	Data manipulation commands	5
6	Introduction to XML	6

Text Books:

1. Silberschatz A, Korth H.F and Sudarshan S, "Data base System Concepts", Fifth Edition, Tata McGraw-Hill.
2. R. Elmasri, S. B Navathe, "Fundamentals of Database System", Pearson Education.

Reference Books:

1. Leon A and Leon M, "Fundamentals of DBMS", Vijay Nicole & Tata McGraw-Hill.
2. Gill P.S, "DBMS", I.K. International.
3. Singh S.K, "Database Systems: Concepts, Design & Applications", Pearson Education.
4. Leon A and Leon M, "Database Management Systems", Vikas Publishing House.

V Semester

CT2317– PE I: Introduction to Geographical Information System

Objective	Course Outcome
1. Get an overview of fundamental concepts of GIS, applications and study. 2. Explore the Coordinate Systems, Map Projections metadata, spatial data, spatial analysis and new trends in GIS. 3. Comprehend the Making and sharing of maps.	On completion of this course, the student will be able to : 1. Demonstrate the fundamental concepts of GIS 2. Develop the apprehension of various concepts in GIS 3. Design and share maps.

Unit No.	Contents	Max. Hrs.
1	Introduction to GIS: Concepts of GIS, Applications currently used by Industry &Govt and their common usages. Fundamental concepts of GIS: GIS terminologies, various components of GIS software and types of GIS applications. The GIS Software Market, Role of GIS in smart cities.	6
2	Fundamentals of Coordinate Systems and Map Projections: History of Coordinate Systems, Geographic Coordinate Systems, Map Projections and Geo referencing.	7
3	Fundamentals of Spatial Data: Introduction to Spatial Data Formats, Creation of Vector data, Organization of Spatial Data and Displaying Spatial Data, metadata and spatial data standards.	7
4	Making Sharing Maps: Map Creation and Design, Sharing Maps as Services, Sharing Spatial Data and using shared Spatial Data.	6
5	Fundamentals of Spatial Analysis: Spatial Analysis, analyzing Vector and Raster data, overview of analysis tools, analyzing Spatial Relationships and sharing Analysis Results	7
6	New trends in GIS: GIS Trends Changing the World, Machine learning in GIS, Geospatial big data, Integration of GIS with different technologies, GIS with LiDar data.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	An Introduction to Geographical Information Systems	3rd t Edition (2006)	D. Ian Heywood, Sarah Cornelius & Steve Carver	Pearson Prentice Hall

Reference Books

SN	Title	Edition	Authors	Publisher
1	Getting to Know ArcGIS	4th Edition (2015)	Michael Law & Amy Collins	Esri Press
2	Mathematical Modeling in Geographical Information System global Positioning System and Digital Cartography	4th Edition (2006)	H. S. Shrama, D. R. Ram, Rama Prasad & P. R. Binda	Concept Publishing Company

V Semester

CT2318 – Lab - PE I: Introduction to Geographical Information System

Sr. No.	Practical List
1	To explore different proprietary GIS and Open GIS software.
2	To study the installation of GIS Desktop Software and explore various components of the GIS Desktop Software.
3	To explore various coordinate systems. Download any shape file and explore its coordinate system and change the existing coordinate system.
4	To create Geodatabase, layer files and shape files from the scratch.
5	To explore data formats using GIS Desktop Software and vector data points such as points, lines and polygon and create the map using simple vector data structure.
6	To create map in data view and layout view.
7	To install GIS Server, creating web services out of GIS maps or data, sharing maps, using GIS web services.
8	Geoprocessing tools
9	Model builder
10	Project

VI Semester

CT2367 – PE II: Introduction to Natural Language Processing

Objectives	Outcomes
1. To understand basic aspects of Natural languages used in processing of text. 2. To get acquainted with the basic concepts and algorithmic description of the main levels of language levels: morphology, syntax, semantics, and pragmatics. 3. To Learn the mathematical and linguistic foundations 4. To appreciate underlying approaches for the various areas in NLP.	Upon successful completion of this course, the student will be able to: 1. Describe linguistic phenomena with formal grammars. 2. Illustrate and test algorithms for NLP problems 3. Examine NLP applications 4. Devise real world NLP applications using NLP techniques

Applications of AI in the field of linguistics

Unit No.	Contents	Max. Hrs.
1	Introduction: History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP	5
2	Morphology fundamentals: Morphological Diversity of Indian Languages, Morphology Paradigms, Shallow Parsing, Named Entities, Maximum Entropy Models, Random Fields. Word Level Analysis, Morphology analysis –survey of English and Indian language Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.	8
3	Structures: Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents, Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.	7
4	Meaning: Lexical Knowledge Networks, Wordnet Theory, Indian Language Wordnets and Multilingual Dictionaries, Semantic Roles, Word Sense Disambiguation, WSD and Multi-linguality. Semantic Analysis: Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, Robust Word Sense Disambiguation (WSD), Dictionary based approach.	8
5	Pragmatics Discourse: Coreferences, reference resolution, reference phenomenon, syntactic and semantic constraints on co reference.	7
6	Natural language Processing applications (preferably for Indian regional languages): Sentiment Analysis, Text Entailment, Robust and Scalable Machine Translation, Question Answering in Multilingual Setting, Cross Lingual Information Retrieval (CLIR).	7

Text Books:

1. Jurafsky, Daniel, and James H. Martin, Speech and Language Processing:An Introduction to Natural Language Processing, Speech Recognition,and Computational Linguistics, PrenticeHall, 2000.
2. Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing. Cambridge, MIT Press, 1999.

VI Semester

CT2367 – PE II: Introduction to Natural Language Processing

Reference Books:
1. James Allen, Natural Language Understanding, Benjamin/Cummings, 2ed, 1995.
2. Eugene Charniak, Statistical Language Learning, MIT Press, 1996.
3. Martin Atkinson, David Britain, Harald Clahsen, Andrew Redford, Linguistics, Cambridge University Press, 1999.

VI Semester

CT2368 – PE II: Lab: Introduction to Natural Language Processing

Sr. No.	Practical List
1	Implement Linguistic features of Language: Write a Program to tokenize words and sentences of given paragraph
2	Morphological features: 2.1 Write a program to perform lemmatization of language words using wordnet. 2.2 Write a program to return morphological features of input text in any Indian language Morphological Analyzer.
3	Write a program to demonstrate usage of Regular expression.
4	Identify ambiguity present in the given text. (Use a tool to check ambiguity)
5	Write a program to create parse tree for given text in given paragraph.
6	Illustrate utility of NLTK: 6.1 Write a program to remove stop words using NLTK 6.2 Implement NLTK features
7	Write a program to get Antonyms for given word from Wordnet for Indian languages.
8	Write a program to design a spam mail recognition system.
9	Create a spellchecking application for Indian Language.
10	Create Mini application based on NLP domains.

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V Semester
CT2313 – PE1: Mobile Operating System

Objective	Course Outcome
1. Understand different Mobile Operating Systems and to learn the Android platform architecture. 2. To have basic requirement & different controls for design & development of mobile app. 3. Gain an understanding data management & inter application communication. 4. To learn application configuration & publishing.	On completion of this course, the student will be able to: 1. Compare different flavors of mobile operating system and their specific features. 2. Create an application using different controls. 3. Prepare a project which can manage data and can communicate with native application 4. Publish the designed application which can handle multiple devices with different configurations

Unit No.	Contents	Max. Hrs.
1	Mobility Technology Trends, Mobile Ecosystem Overview, Mobile Devices Overview, Mobile Development, Methodology, Wireless Networks Overview, Proximity Technologies	5
2	Introduction to Android: Android Overview, Introduction to activities/Fragments, Introduction to services, broadcast receivers and content providers, Android Application Structure, Source Files, Resources, Assets and Manifest. IDE Usage: Basic IDE Operation (Eclipse), Project Creation and Handling (App Creation through Wizard), Running App on AVD and Device, DDMS and Debugging. User Interface Designing-1: Layout Overview, Linear Layout, Relative Layout, Frame Layout, Widgets (UI Controls) Overview and Text View, Image View, Button.	6
3	User Interface Designing-2: Notification Bar, Toast and DSialog, Listview, and Adapter, View Reusability, Spinner and Comples View. Broadcast Receivers: Broadcast receivers overview, Manifest Registration vs Component Registration, Unregistration, SMS Event Receiver, Boot Event Receiver and NetworkEvent Receiver. Service: Service Overview, Service Lifecycle, Service Usage Applicability and Message Binder, Action Bar and Context Menu.	5
4	Data Management: Data Storage Overview, Persistent v/s Local, Shared Preferences, Internal Storage and SQLite Database, Threads and Processes: Thread, Process overview, Async Task, Loaders, Handlers, Intent: Intent, Intent Filters and Intent Resolution, Component Activations: Activity Stack, Launch Modes and Activity Flags	6
5	Inter Application Communication: Inter app Communication requirement overview and Intents Based. Communication with Native application: Gallery, Camera, SMS App and Contacts, Content Providers: Content Provider Overview, Need and Usage, Content Provider Structure. Network Communication: Network Communication basics and Connecting to server/request creation, Response Formats XML/JSON and Rest/Web Services. URI Permissions, Views, Triggers	5
6	User Interface Designing-3: Style and Themes, View and Layout animation Application Configuration: Localization, Orientation and Config Change Handling, Handling multiple resolution devices, Device and Tablet consideration, Support Library. Application Publishing: Application Signing, Application Distribution, Application Publishing, Google Play	5

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Professional Android Application Development	–	Reto Meier	Wiley Publishing Inc

V Semester
CT2314 – PE1: Lab: Mobile Operating System

Sr. No.	Practical List
1	Create a dialog box having login functionality.
2	Create an application which has following features: • Show list of numbers on screen along with the type. • Bottom of the screen there should be a row that contains three elements: i. Spinner (Show the predefined phone number type like home, office, mobile, etc) ii. Text box to enter actual number iii. Button saying "Add" - Clicking on this should take the input from the first two items and add a new row item to the list. • On pressing back key (exiting from the application), it should show a confirmation dialog with appropriate title, message and two action buttons "OK" and "Cancel"
3	Create an application which has following features: • Clicking on "Cancel" should show a toast message "We are happy to be with you." and close the dialog. • Clicking on "OK" should close the dialog, exit from the application and generate a notification that says "Press me to go back to application". Then clicking on the notification should restart the application.
4	Create an application which has following features: • Launch phone contacts, display the selected contact in your application. • Try to launch Camera, Gallery & SMS application.
5	Create an application using Listview, Services, Navigation drawer & tab view
6	Create an application for changing background color based on selection from list view
7	Create an application for applying different themes on text views.
8	Create an application using Launch Modes.
9	Create an application displaying any animation.

V Semester
CT2328 - Operating System Concepts

Objectives	Outcomes
1. To understand the concepts of Linux and its potential. 2. To get a knowledge of shells	Upon successful completion of the course, the student will be able to: 1. Use LINUX operating system. 2. Write Shell scripts

Unit No.	Contents	Max. Hrs.
1	Introduction: History of Linux and Unix, Linux Overview, Linux releases, open linux	6
2	Linux Commands and Filters : Mkdir, CD, rmdir, pwd, ls, who, whoami, cat, more, fail, head, concept of, mv, chmod, grep,wc, comm., split, sort, diff, kill, write, wall, merge, mail, news	5
3	Shell: The command line special characters and file arguments, standard input/output and redirection, pipes, redirecting and piping with standard errors, shell scripts, jobs.	5
4	Linux file Structure: Linux files, file structure, listing displaying and printing files, managing directories, file and directory operations.	5
5	Vi Editor: Vi editing commands advanced Vi editing commands, line editing commands, options in Vi.	6
6	System Administration: System management, managing users, installing and managing devices, floppy disk management, file system administration, backups.	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	Linux – The Complete Reference		Richard Peterson	Tata McGraw Hill, New Delhi
2	Linux – Install and Configuration Black Book		Die Annleblanc and Issac Yates	IDG Books India Private Ltd., Delhi
3	Unleashed Linux			Tech Media Publishers

VI Semester

CT2355 – Software Engineering

Objective	Outcome
1. Study software engineering best practices and different strategies applicable for software development, software requirement and its design activity. 2. Explore the various testing types and its strategies. 3. Understand configuration management, version control and change control process of Software development. 4. Understand project management, planning, scheduling, risk management, project and process metrics. 5. Get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re-engineering and Reverse engineering.	Upon successful completion of the course, the student will be able to: 1. Choose appropriate software engineering process model, requirement engineering principles and software designing fundamentals for a given project. 2. Select appropriate testing strategy and apply testing principles for testing a given application. 3. Apply basics of software configuration management, version control and change control in software development. 4. Evaluate cost estimation, effort and severity of software risk for given application. 5. Perform basic operations on Sub-version for software version control.

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Engineering, A Generic View of process, Process models: Water fall Model, RAD Model, Prototyping Model, Component Development Model, Agile Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation	6
2	Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.	7
3	Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White-Box Testing, Basis Path testing: Flow Graph Notation, Independent Program Paths, Control Structure Testing, Black Box Testing, Introduction to object oriented testing.	7
4	Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards.	5
5	Project Management, Metrics for Process and Projects, Project Estimation, Risk Management: Reactive vs. Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection.	7
6	Advanced Topics in Software Engineering: Re engineering Computer aided software engineering, Open source SE tools introduction, Example-Subversion: Overview, Typical subversion usage and work flow.	5

VI Semester

CT2355 – Software Engineering

Text Books:

1. Software Engineering–A Practitioner's Approach (Sixth Edition) by Roger S. Pressman– McGraw Hill.
2. Object Oriented Software Engineering by Leth Bridge, Pearson Edu.

Reference Books:

1.Software Engineering, 9th Edition, Ian Sommerville, University of St Andrews, Scotland, ©2011 , Pearson

VI Semester

CT2356 – Lab : Software Engineering

S. No	Practical List
1	Introduction to Software Engineering fundamentals, UML and RATIONAL ROSE Interface.
2	To study and create Software Requirement Specification document for given case study
3	To study and draw UML Use Case diagram for the given case study.
4	To study and draw UML Class diagram for given Case Study.
5	To study and draw UML Activity diagram for given Case Study.
6	To study and draw UML Sequence Diagram for given Case Study.
7	To study and draw State Diagram for given Case Study.
8	Write a Program to find out the Estimation (cost and effort) by using COCOMO model.
9	To Perform Manual and Automated testing using CASE tool for given Case Study
10	To Study and execute Version Control using Subversion

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.

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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

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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).

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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

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

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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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
CT2256- Lab: Mathematical Foundations for Data Analysis

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

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

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

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.

UNIT I **[05 Hrs]**

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

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

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	[signature]	Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)	[signature]	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 y T. 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

Chairperson	[signature]	Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)	[signature]	Date of Release	May 2017	

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

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8th Semester

CT1450	Object Oriented Modeling				L=4	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
1. To distinguish between procedure oriented and Object Oriented Methodology. 2. To understand the features of Object Oriented Programming. 3. To Understand the basic building blocks of C++ language. 4. To Understand the Utility and difference of various Data Structure. 5. To Understand the need of Exception. 6. Exception Handling Mechanisms of OOP Methodology using C++. 7. To study the concept of Templates . 8. To Understand the OOP methodology and relate to it day to day applications. 9. To relate various practical examples with the OOP Methodology.	1. Compare different types of Programming Languages 2. Describe Real World object, Structure and Class. 3. Implement the Programming Examples. 4. Implement the Concept of abstract class Concept of Interface. 5. Define and classify Data Structure. 6. Implement the Mechanisms and Concept of Exception , Types of Exception 7. Define stream, the Concept of File, Opening and Closing of File
PO, PSO MAPPING: a,c,e,g,i,j,k,l,m	

UNIT I

Introduction: object orientation, Object Oriented development, modeling as a design technique, Class modeling:- the three models, object, classes, links and associations, navigation of class models, aggregation, abstract classes, metadata, packages.

UNIT II

State Modeling: events & states, transitions and conditions, state diagrams behavior, concurrency advanced state modeling concepts, nested state diagrams, concurrency, relation of class & state models. Interaction modeling: Use case. Sequence and activity models, relationships among the models.

UNIT III

System Analysis: Development life cycle and development style, system conception, domain analysis application analysis

UNIT IV

System Design: Overview, estimating performance, making are use plan, breaking into sub systems, identifying concurrency, allocation of sub systems, management of data storage, handling global resources, choosing software control strategy, handling boundary conditions, setting trade off priorities, common architectural styles.

UNIT V

Class Design, implementation modeling, object oriented languages.

UNIT VI

Databases: implementing structures basic and advanced, implementing functionality, object oriented databases. Object oriented programming style, reusability, extensibility, robustness.

TEXT BOOKS:

1. Object oriented modeling and design with UML by James Rumbaugh, Michal Blaha, Pearson Prentice Hall Second Edition.

REFERENCE BOOKS:

1. Practical Object Oriented Design with UML by Mark Priestley TMH 2nd Edition
2. The Unified Modeling Language user guide by Booch , Rumbaugh, Jacobson Addison Wesley 2nd Edition

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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 Dellhi, 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	PE V : Internet of Things				L=4	T=0	P=0	Credits=4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
	15	15	10	60	100	3Hrs		

OBJECTIVES	OUTCOMES
To provide the details about the IoT(Internet of Things) and let understand and implements the emerging concepts about Internet of things	Students should be able to use, implements various platform from IoT and proficient to design and development of Smart Cites concepts.
PO, PSO MAPPING :- a,b,c,e,h,k,l,	

UNIT I APPLICATION DEVELOPMENT

Introduction – Concepts behind the Internet of Things.

The IoT paradigm, Smart objects, Bits and atoms, Goal orientation, Convergence of technologies, In IoT architectures, IoT enabling technologies, IoT Big Data Analytics, IoT security and privacy concerns. Computing paradigms: Virtualization Vulnerabilities, Hypervisor Security-Related Issues, Side Channel Attacks, Data Segregation, ubiquitous, grid, cloud, pervasive, green, ad hoc (*mobile*, *vehicular*, *flying*) networks.

UNIT II

Governance of Inter of things, Bodies subjects to Governing principal, substantive Principe of IoT Governance IoT Infracture Governance, Future Governance Issue, implementation of Smart city and smart villages projects , challenges and issues in SMART Projects

UNIT III cloud computing enable technology

Radio frequency Identification technology

Radio frequency Identification technology overview, Principle of RFID, Components of RFID technology Overview, Wireless sensosor network tencnology overview, connecting node, networking securing communication, Power line communication technology overview, PLC Technology standard, archecture of home technology overview, RFID Research and related issue

UNIT IV Advance Cloud computing

Internet of things and cloud computing, IoT integration with Enterprise system, (XaaS) Everthing As a Services, Distributed business process in IoT, Distributed business processs in IoT, ubiquitous technology in cloud, middlewae for IoT, standards for SCDA, Standards for M2M, Unified mult tire WoT Architecture, SOA/EAI verus SODA MAI, Mobile cloud computing, four technology pillar, WoT Portal and Business Architectural

UNIT V ADVANCED SOCKETS-I

Routing sockets – Datalink socket address structure – Reading and writing – sysctl operations –get_ifi_info function – Interface name and index functions- Key Management sockets – Reading and writing – Dumping Security Association Database – Creating static Security Association – Dynamically maintaining SA's – Broadcasting – Broadcast addresses – Unicast versus Broadcast – (Client) Application development for broadcasting – Race conditions – Multicasting – Multicast addresses- Multicasting versus Broadcasting on a LAN – Multicasting on a WAN – Source specific Multicast – Multicast socket options – mcast_join, (Client) Application development for multicasting – Receiving IP multicast infrastructure session announcements – Sending and receiving.

UNIT VI Case Study and Projects

Introduction to Raspberry Pi, Setup and operate the Raspberry Pi ,Understand the basics of the Linux OS used on the Pi ,Understand the basics of the X Windows System (the GUI environment) , Program the Pi for a simple GUI-based game , Program the Pi to access a network, Raspberry Pi ARM ARM Architecture, ARM 11 future, Ardunio Basics Project and case study based on Ardunio and Pi

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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.

			1.00	Applicable for AY2019-20 Onwards
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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**

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	

			1.00	Applicable for AY2019-20 Onwards
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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 V I :** 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

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

III SEMESTER

IT2208	Lab: Software Lab		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration	
	--	40	60	100	--	

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.

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

III SEMESTER

IT2208	Lab: Software Lab		L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration	
	--	40	60	100	--	

Sr. .	Topics to be Covered	Sample Problem Statement
1.	Demonstration of Build-in Data types: Data type & Variables, Python numbers	Write a Python program to compute the roots of a quadratic equation
2.	Demonstration of Python Lists.	Write a Python program to perform following operations: **i)** Insertion of element in a given list **ii)** Deletion of element from the given list
3.	Demonstration of different Statements: Assignment statement, import statement, print statement, input statement	Write a Python program to find square root of a number
4.	Demonstration of control statements: if, if – else, elif statements	Write a Python program to enter day number (1-7) and print the corresponding day of week name using if else. (e.g 5 then Friday)
5.	Demonstration of Loop statements: For, while, break, continue	Write a Python program to print all prime numbers from 1 to 100 (using nested loops, break and continue)
6.	Demonstration of try and except statement, raise, with statements, case statement	Write a Python program which take character as input and determine about vowels and consonants using case statement.
7.	Demonstration of Python Functions: The def statement, returning values, parameters, arguments	Write a Python program using user defined function to find the sum of following series. 1/1! + 2/2! + 3/3! + ……1/N!
8.	Demonstration of Python Mathematical Function	Write a Python Program to implement some mathematical functions
9.	Demonstration of Python File Handling	Write a Python program to read data from "Input.txt" file using File Input Class and write output to "Output.txt" using File Output class.
10.	Demonstration of Python Object and Classes: A simple class, defining methods, member variables	Write a program to define a class Employee with four data members such as Emp_name, Emp_id, Salary and department_id. Define appropriate methods to initialize and display the values of data members. Also calculate Gross salary of employee based on Basic Salary, TA, DA and HRA of employee
11.	Demonstration Python inheritance	Create a class Account that stores the customer name, account, number and type of account. From this derive the classes Current-acct and Saving-acct to make them more specific to their requirement. Include necessary methods in order to achieve the following tasks: (a) Accept deposit from a customer and update the balance. (b) Display the balance (c) Compute and deposit interest. (d) Permit withdrawals (e) Check the minimum balance, impose penalty, if necessary and update the balance
12.	Demonstration of Python Exception Handling.	Write a program to implement Exception handling in Python.
13	Building Application	Develop some useful application in Python

IV SEMESTER

IT2251	Data Structures and Program Design-II		L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration	
	30	10	60	100	3 Hours	
Prerequisite Courses	Data Structures and Program Design-I, Programming Language C					

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

Objective	Course Outcome
• To understand the basic structure concept such as Abstract Data Types, Linear and Non Linear Data structures. • To understand the notations used to analyze the Performance of algorithms. • To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graph and their representations. • To choose the appropriate data structure for a specified application. • To understand and analyze various searching and sorting algorithms. • To write programs in C to solve problems using data structures such as array, linked lists, queues, trees, graphs, hash tables, search trees.	Upon successful completion of this course, students will be able to: 1. Understand data structures like Tree, Graph, Set, Hash table. 2. Apply appropriate data structures in problem solving. 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Unit No.	Contents	Max. Hrs.
1	Trees, binary trees: representation and traversals, Binary search Trees (BSTs), Height-balanced trees	5
2	Heap tree, Splay trees, B-trees, B+ trees. Applications of trees	7
3	Graphs: representation & traversals. Spanning trees, shortest path algorithm, topological sort	5
4	Sets: Representation and Operations. Sorting and searching	6
5	Pattern matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.	5
6	Hash table, File Organization, external sort	5

Text Books/Reference Book

Sr. No.	Title	Authors	Publisher
1	The C Programming Language	Brian W. Kernighan and Dennis M. Ritchie	Prentice Hall of India
2	Programming in ANSI C	E. Balaguruswamy	Tata McGraw-Hill
3	How to Solve it by Computer	R. G. Dromey	Pearson Education
4	Data Structures & Program Design in C	Robert Kruse, G. L. Tondo and B. Leung	PHI-EEE
5	Data Structures	Seymour Lipschutz	Tata McGraw-Hill
6	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	W. H. Freeman and Company.

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

IV SEMESTER

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								

IV SEMESTER

IT2253	Computer Networks			L=0	T=0	P=2	Credits=1
Evaluation Scheme	MSEs*	TA	ESE	Total	ESE Duration		
	30	10	60	100	3 Hours		
Prerequisite Courses							

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

Unit No.	Contents	Max. Hrs.
1	The use of computer networks, LAN"s, MAN"s, WAN"s. topologies and their characteristics, wireless networks, protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference model	05
2	Physical layer: theoretical basis for data communication, Guided transmission media, wireless transmission: electromagnetic spectrum, radio transmission, infrared transmission. Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	05
3	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA	07
4	Network layer: design issues, Classful and classless Internet Addresses, subnet addressing, implementation of subnet with mask, supernetting, Address block and CIDR notation, examples. Routing algorithms, congestion control algorithms, quality of service, internetworking, network layer in Internet: IP protocol, Internet control protocols, OSPF, BGP, Internet multicasting	09
5	**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. Performance issues: performance problems in networks, network performance measurement.	08
6	**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Network security: cryptography, introduction to symmetric and public key algorithms, digital signatures, authentication protocols, e-mail and web security.	06

IV SEMESTER

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)

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

		June 2020	1.01	Applicable for AY2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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

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

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

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	4^{th} edition	Behrouz Forouzan	Tata McGrawhill
Internetworking with TCP / IP	4^{th} edition (2000)	Douglas Comer	PHI
Reference Book			
Computer networks	4^{th} edition	Andrew S.Tanenbuam	PHI
TCP/IP illustrated Volume 2	2003	W.Richard Stevens	Pearson Education

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)

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												PS PO	
		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

Computer Science & Engineering

III Semester

CSE2201 : Computer Architecture and Organisation

Unit No.	Contents	Max. Hrs.
1	Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, Bus Structures, Software, processor clock and basic performance evaluation, number systems, and arithmetic operations, Memory Locations, addressing and encoding of information, instruction and instruction sequencing, branching, condition codes, zero, one and two address instructions, RISC vs CISC computers.	6
2	Addressing modes, Stacks, and Subroutines, Processing Unit, Some fundamental concepts, Execution of a complete instruction, One, two, and three bus organization, Sequencing of control Signals, Assembly language programming.	6
3	Processor Design, hardwired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, prefetching microinstructions.	7
4	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, Booth's Algorithm , fast Multiplication, Integer Division algorithms, Floating point numbers and operations, IEEE floating point standards	7
5	The Main Memory: Basic concepts, Memory Hierarchy, semiconductor RAM memories, Static RAM vs Dynamic RAM, semiconductor ROM memories, DDRAM, Memory system considerations, Speed , Size and Cost. Cache Memory: cache memory mapping techniques, secondary storage devices, HDD vs SSD, Performance Considerations.	6
6	Computer Peripherals, I/O modules and I/O Devices, I/O transfers : program controlled, memory mapped and I/o mapped I/O, Interrupt handling and Interrupt driven I/O, DMA. Pipelining: Basic Concepts, Data Hazards and Instruction Hazards. Introduction to GPU and GPU Computing.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Organization	5th edition	V. Carl Hamacher, Zvonko Vranesic,	McGraw Hill Publications.
2	Computer Architecture: A Quantitative approach	6th edition	John L. Hennessy, David A. Patterson	MK series in computer architecture and design

Reference Books

SN	Title	Edition	Authors	Publisher

1	Computer Organization and Architecture	6th edition	Willaiam Staliing	Pearson Education
2	Computer Architecture & Organization	3rd edition	J.P. Hayes	McGraw Hill Publications

III Semester
CSE2202 : Object Oriented Programming

Unit No.	Contents	Max. Hrs.
1	Introduction to object oriented programming paradigm, procedure oriented programming vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class. Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	8
2	Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	7
3	Arrays, Strings Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes	8
4	exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses. Introduction to multithreading, life cycle of Thread, Runnable interface and Thread class.	7
5	Collection Vector and Framework: Introduction to collection framework, Vectors, Array List, Linked list, Hashset, Treeset, Hashmap, Accessing a collection via Iterator, Comparators.	7
6	IO Steam: Introduction to stream classes, use of stream classes,I/O stream, bytes stream, character stream, predefined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files, transient and volatile modifiers, Introduction to AWT, Working with Windows, Graphics and Text, Introduction to Swings.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Java Complete Reference	7th	Herbert Schildt	McGraw-Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Thinking in Java	4th	Bruce Eckel	Prentice Hall

2	Programming with Java	-	E. Balagurusamy	TATA McGraw-Hill

III Semester

CSE2203 : Lab: Object Oriented Programming

Sr. No.	Experiments based on
1	Implement the concept of Class and its data members and member functions in Java
2	Implement the concept of method overloading in Java
3	Implement the concept of class constructor and its type in Java
4	Implement the concept of Abstraction in Java
5	Implement the concept of all types of inheritance in Java
6	Implement the concept of arrays in Java
7	Implement the concept of run time polymorphism in Java
8	Implement the concept of Files in Java
9	Implement the concept of exception in Java
10	Implement the concept of swing to prepare a web application in Java

III Semester

CSE2204 : Data Structures I

Objective	Course Outcome
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	1. To review programming concepts and understand fundamental concepts in data structures 2. To apply and analyse algorithms for performing operations on data structures 3. To Evaluate the performance of data structures and its applications. 4. Simulate the algorithms for performing operations on data structures.

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	6
2	Overview of arrays and array based algorithms - searching and sorting: mergesort, quick sort, Sparse matrices.	7
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.	6
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	File organisation, examples of using file, file access methods , Hashing and collision resolution techniques	6

TEXT BOOKS:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures and Program Design in C	Robert Kruse, G. L. Tondo andB. Leung	latest edition	PHI-EEE
2	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	latest edition	W. H. Freeman and Company.
3	How to Solve it by Computer	R. G. Dromey	latest edition	Pearson Education

Reference books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures with C	Seymour Lipschutz	Latest	TMH

III Semester

CSE2205 : Lab.: Data Structures I

Sr. No.	Name of Practical	
1	Write a C Program for counting number of digits in a random number taken as input	MSPA1
2	Write a C Program for generating list of random numbers and print them in words (for eg: random number generated is 124 then it should print one two four)	
3	Write a C function to print Pascal's triangle	
4	Write a C function for Removing repeated digits in a given number	MSPA2
5	Write a C Program for finding : a) GCD of two numbers using recursion. Also, print number of recursive calls b) Sum of first 20 natural numbers using recursion	
6	Write a C Program for sorting single dimensional array using quick sort and merge sort	
7	Write a C Program for allocating memory dynamically for single dimensional array and sort it using quick sort and merge sort	MSPA3
8	Write a C Program for allocating memory dynamically for two-dimensional array printing it in spiral manner.	
9	Write a C Program to create linked list of cell phone with any 3 attributes as data fields and print it.	
10	Creation of stack using array and performing operations on it :push, pop , display	MSPA4
11	Creation of queue using array and performing operations on it :insert , delete, display	
12	Write a C Program to create file for storing details of all the items needed for playing various games of your choice also perform display operation, insertion of new item at any location, deletion of any item	

III Semester

CSE2206 : Lab: Software Lab-I

Unit No.	Contents	Max. Hrs.
1	Introduction: Build-in Data types: Data type & Variables,, 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, statements, Loop statements: For, while, continue and break, try and except statement, raise, with statements.	4
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.	3
3	Python Object and Classes: defining classes and creating classes, member variables, Doc strings for classes, Private members, Python Operator Overloading, Python inheritance and polymorphism, Exception Handling, Python Modules and packages.	2
4	Developing applications in Python using built in and customized modules and packages.	1

BOOKS:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1.	Learn Python Programming	Fabrizio Romano, Heinrich Kruger	Third Edition, 2020	PACKT Publishing
2.	Introduction to Computation and Programming Using Python	John V. Guttag	Second Edition,2016	PHI EEE(MIT Press)

IV Semester

CSE2251– Operating Systems

Unit No.	Contents	Max. Hrs.
1	Introduction to OS: evolution of OS, basic hardware support necessary for modern operating systems, Layered Structural of OS, process concept, process state transitions , Services provided by OS, system calls, privileged instructions, Dual mode of operation, I/O bound and CPU bound processes, concept of multiprogramming and multiprocessing.	5
2	Process management: process control block, process context switch, process versus threads, CPU scheduling, goals of scheduling, CPU scheduling algorithms, Algorithmic evaluation of CPU scheduling algorithms, multi-queue scheduling, multithreading	6
3	Interprocess communication and Synchronization: Operations on processes, Interprocess communication, process cooperation and synchronization, race condition, critical region, mutual exclusion and implementation, semaphores, classic problems of Synchronization using semaphores, other synchronization constructs.	7
4	Memory management techniques: -contiguous allocation, static and dynamic partitioning, non-contiguous allocation, paging, translation look aside buffer (TLB) and overheads, segmentation.	6
5	Virtual memory: demand paging, page replacement algorithms, thrashing, working set model. Deadlocks: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.	7
6	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.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Operating system Principles	9th Edition	A. Silberchatz and P.Galvin	John Wiley & Sons Inc.
2	Operating Systems Internals and Design Principles	2nd	William Staling	Pearson

Reference Books

SN	Title	Edition	Authors	Publisher
1	Operating Systems: A Design-Oriented Approach	-	-Charles Crowley	McGraw Hill
2	Operating system concepts and Design	2nd	Milan MilenKovic	Tata McGraw Hill

IV Semester

CSE2252 Lab.: Operating Systems

Expt. No.	Name of Experiment / Problem Statement	Topic	co Mapped
	Study of Window task manager(Exploring various tabs: applications, processes, services, networking, performance)	Windows	C0-1
2	Study of Advanced Linux shell commands (Process management, Memory management, Networking, etc.)	Linux Commands	C0-1
3	Write a program that illustrates the creation of child process using fork system call. Each child and parent Processes perform different task.	Process Control	C0-1
4	Write a multithreaded program to multiply two given matrices.	Threads	C0-1
5	Simulate a) any preemptive CPU Scheduling Algorithm b) any Non-preemptive CPU Scheduling Algorithm	CPU Scheduling	C0-4
6	Write a program to perform Inter-Process-Communication using shared memory or, pipes or message queues.	Inter-Process Communication	C0-4
7	Write a program that solves two process Producer - Consumer problem with bounded buffer using semaphores. OR Write a program that gives a deadlock and starvation free solution to the Dining philosophers problem using semaphores	Semaphore	C0-4
8	Simulate a) First Fit (Static Memory allocation algorithm) and b) Worst Fit (Dynamic Memory allocation algorithm)	Memory Allo cati	C0-4
9	Simulate any one of the following Page replacement algorithms: FIFO, LRU, Optimal	Page Replaceme nt	C0-4
10	Write a program to simulate Banker's Deadlock avoidance algorithm.	Deadlock	C0-4

IV Semester

CSE2253 – Data Structures II

Unit No.	Contents	Max. Hrs.
1	**Linked Lists**- Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list: traversal, addition, deletion of nodes, list reversal, Applications of lists in polynomial representation, multi-precision arithmetic. Multi linked structures, implementation of priority queues.	8
2	**Sets**: data structures for disjoint set representation and operations, sorting, searching	6
3	**Binary Trees:** binary trees, binary trees- basic algorithms and various traversals. Binary Search Trees (BSTs) and insertion, deletion in BSTs. Heaps and heap sort	8
4	**Balanced trees**: Height-balanced (AVL) trees, Splay tree, Red-black trees, Multi-way trees-B and B+ and applications	8
5	**Multidimensional trees :**Tries and Pattern matching algorithms	6
6	**Graphs Representation & traversals**: Spanning trees, topological sort, shortest path algorithm, all-pairs shortest paths	6

TEXT BOOKS:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures and Program Design in C	Robert Kruse, G. L. Tondo andB. Leung	latest edition	PHI-EEE
2	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	latest edition	W. H. Freeman and Company.
3	How to Solve it by Computer	R. G. Dromey	latest edition	Pearson Education

Reference books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures with C	Seymour Lipschutz	Latest	TMH

IV Semester
CSE2254 – Lab.: Data Structures II

Sr. No.	List of Experiment
1	Program/s based on operations on singly linked list
2	Program/s based on operations on doubly linked list
3	Program based on Binary trees- traversal
4	Programs based on Binary search tree
5	Programs based on Trees
6	Program based on Balanced trees
7	programs based on Graph operations - traversal

IV Semester
CSE2255 – Introduction to Data Analysis

Unit No.	Contents	Max. Hrs.
1	INTRODUCTION TO STATISTICS & PROBABILITY: The role of statistics. Grouping and displaying data. Measures of central tendency and dispersion, Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence.	6
2	PROBABILITY DISTRIBUTION: What is probability distribution, random variables, use of expected value in decision making, and various probability distributions :Binomial, Poisson, Uniform and Normal distributions.	6
3	SAMPLING DISTRIBUTION: Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. 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	7
4	TESTING OF HYPOTHESIS: Introduction, 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.	6
6	REGRESSION and CORRELATION: Estimation of regression line by least square method, linear regressions, Multivariate regression ,Correlation analysis,	6

Text Books:

Sr. No.	Title	Author	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
3	Probability and Statistics	Murray R. Spiegel, John J.Schiller, R AluSrinivasan	Third edition .	Mc Graw Hill education

Reference Book:

Sr. No.	Title	Author	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		

IV Semester

CSE2256– Lab: Introduction to Data Analysis

Sr. No.	List of Experiment
1.	Implement basic functionality of R
2.	Implement data import and export functionality in R
3.	Implement R functions to calculate basic statistics of data source
4.	Apply the visualization techniques in R to understand data
5.	Solve the problems using probability distributions in R
6.	Analyze the data using sampling technique
7.	Analyze the data to find out estimated value
8.	Analyze the data using hypothesis testing
9.	Implement integration of R and java using packages
10.	Case study on data analysis and visualization

IV Semester

CSE2257– Theory of Computation

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	8
2	Regular Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets, Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church"s hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machine	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive µ recursive function unbounded minimization and recursive function	6

Text Books

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

Reference Books

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

V Semester

GE2312 Fundamentals of Economics

GE 2312	Fundamentals of Economics			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

Unit No.	Contents	Max. Hrs.
1	**Introduction to Economics and Consumers' Behaviours:** 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
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
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
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
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
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

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Modern Economics	13th Edition	H. L. Ahuja	S. Chand Publisher
2	Modern Economic Theory	3rd Edition	K. K. Devett	S. Chand Publisher

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Advance Economic Theory	17th Edition	H. L. Ahuja	S. Chand Publisher
2	International Trade	12th Edition	M. L. Zingan	Vindra Publication
3	Macro Economics	11th Edition	M. L. Zingan	Vindra Publication
4	Monitory Economics	1th Edition	M. L. Zingan	Himalaya Publisher
5	Economics of Development and Planning	12th Edition	S. K. Misra and V. K. Puri	Himalaya Publishing House
6	Economics		Samuelson	

V Semester

CSE2301– Database Management Systems

CSE 2301	**Database Management System**			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

Unit No.	Contents	Max. Hrs.
1	**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.	8
2	**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	6
3	**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.	8

4	**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	6
5	**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.	6
6	**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.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database System Concepts	6th Edition	Korth, Silberschatz	McGraw-Hill publication
2	Fundamentals of Database Systems	5th Edition	Elmasri, Navathe & Gupta	Pearson Education.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database Systems	3rd Edition	Connolly	Pearson Education
2	Database Systems	6th Edition	S. K. Singh,	Pearson Education

CSE2302– Lab.: Database Management Systems

Sr. No.	List of Experiment
1	To implement different basic Data Definition Language(DDL) & Data Manipulation Language(DML) Commands in SQL.
2	To design an ER Diagram.
3	To implement aggregate function & grouping commands.
4	To implement basic set operations in SQL
5	To apply BETWEEN…AND, NOT BETWEEN, IN, NOT IN, IS NULL, IS NOT NULL clause on created database.
6	To implement commands that involve constraints.
7	To implement commands for various joins.
8	To create and manipulate various database object of table using views.
9	To implement Transaction Control Language(TCL) commands.
10	To display file database connectivity using JDBC.

11	Write a program in PL/SQL to check given number is even or odd

V Semester

CSE2303 - Design & Analysis of Algorithms

Unit No.	Contents	Max. Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, Σn, Σn2, bound summations using integration, Analysis of algorithms, analyzing control structures, worst case and average case analysis, Asymptotic notations, Analysis of sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, external Sorting, lower bound proof.	6
2	Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.	7
3	Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method –basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.	6
5	Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen‟s problem, graph colouring, Hamiltonian cycles etc.	6
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.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Algorithms	Third	Horowitz, Sahani, Rajsekharan	Galgotia Publications Pvt. Ltd.
2	Introduction to Algorithms	Third	Thomas H. Cormen	Prentice Hall of India.
3	Algorithm design	Latest	Klienberg and Tardos	Pearson

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Algorithms	Second	Brassard and Bratley	Prentice Hall

V Semester

CSE2304 – Lab.: Design & Analysis of Algorithms

Sr. No.	List of Experiment
1	Implement and analyze time complexity of different sorting algorithms.
2	To implement Divide and Conquer algorithm for different number of inputs.
3	To implement Greedy Method for different number of inputs.
4	To implement minimum cost spanning trees for different number of inputs.
5	To implement dynamic programming for different number of inputs.
6	To implement backtracking for different number of inputs.

V Semester

CSE2311 – PE I: Business Intelligence

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	8
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

3	Principles of Dimensional modelling: 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.	7
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.	6
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	6
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	6

Text Books

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

Reference Books

SN	Title	Edition	Authors	Publisher
1	Data Warehousing in the real world A practical guide for building Decision Support System		Sam Anahory, Dennis Murray,	PEARSON

V Semester

CSE2312 – PE I: Lab: Business Intelligence

Sr. No.	Name of Practical
1	Exploring HR schema of Oracle, Implementation of queries based on range, relational operators, sorting, concatenation.
2	Implementation of queries based on character matching, aggregate functions, set operations
3	Implementation of queries based on Joins (joining 2 or more tables), sub queries.
4	a. Design a multidimensional data cube for given data Using EXCEL b. Perform OLAP- slicing operation on it
5	Creation Of Dashboard Using EXCEL
6	Exploring TABLUE OR/ MICROSTRATEGY ANALYTIC DESKTOP (MSTR) : Installation tool,Importing Data from file, Data Wrangling (Editing Data).
7	Visualization Of Data Using different visualizations in Tableau/ MSTR analytic desktop, Filtering data, and delivering Insights from data
8	Create reports and Dashboard with defined insights /requirements in Tableau/MSTR analytic desktop. (Sample Data to be provided)

V Semester

CSE2313 – PE I: Web Technologies

Unit No.	Contents	Max. Hrs.
1	**Web Essentials**: Clients, Servers, and Communication, Overview of Internet, Intranet, Basic Internet Protocols (HTTP, FTP, SMTP), WWW, HTTP: HTTP Request and Response message, Client Side Scripting, Server Side Scripting.	6 Hours
2	**Hyper Text Markup Language (HTML5):** Structure of an HTML Program, Basic HTML Tags (Headings, Paragraph, Division, Text formatting, Image element, Anchors), HTML Lists (Ordered Lists, Unordered Lists, Description Lists), HTML Links (Href Attribute, Target Attribute), HTML colors, Table handling in HTML, HTML Layout Elements (Semantic Elements), HTML Style Attribute, HTML class and id Attribute, HTML Forms, HTML Media(video, audio, YouTube).	6 Hours
3	**Cascading Style Sheets (CSS3):** Introduction to CSS3, Differences between CSS3 and earlier CSS specifications, Inserting CSS: Inline, Internal, External, CSS3 selectors, CSS3- Colors, Backgrounds, Borders, Text, Font, List, CSS3 Box Model, CSS3 Navigation Bar (Vertical, Horizontal), Media Queries, Basics of Responsive Web Designs, Introduction to Bootstrap.	6 Hours
4	**Client Side Scripting with JavaScript**: Introduction to JavaScript, Variables and Data Types, Operators and Expressions in JavaScript, Functions In JavaScript, Arrays, Loops and control statement, RegExp, Dialog Boxes, JavaScript Events. Event Handling and Form Validation, Error Handling, Handling Cookies, XML, JSON. Introduction to Web Frameworks- React JS, Angular JS.	6 Hours
5	**Advanced Client side programming**: WebSockets, Server-Sent Event (SSE), WebRTC, Web Graphics & Canvas, WebGL, WebWorkers, SVG. Libraries: Modernizr, Polyfills, Polymer.	6 Hours
6	Server Side Programming: Introduction to the server-side programming, Server-side web frameworks like Node JS/Express JS, Django. etc.	6 Hours

Text Books

SN	Title	Edition	Authors	Publisher
	Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX			Kogent Learning Solutions Inc.

Reference Books

SN	Title	Edition	Authors	Publisher
1	HTML & CSS: The Complete Reference	Fifth Edition	Thomas A. Powell	The McGraw-Hill Companies, Inc.
2	Web Technologies		Ivan Bayross	BPB Publication

V Semester

CSE2314 – PE I: Lab: Web Technologies

Sr. No.	List of Experiment
1	Write a JavaScript function that creates a table, accept row, column numbers from the user, and input row-column number as content (e.g. Row-0 Column-0) of a cell.
2	Create employee registration webpage using HTML5 form objects
3	Implement CSS3 for any webpage
4	Create a dynamic web page which displays arithmetic operations [addition, subtraction, division, multiplication and modulus] using HTML Frame
5	Write a suitable scripts which show methods of Server object [HTML Encode, URL Encode, Mappath, Execute and Transfer]
6	Write a script which creates and retrieves Cookies information
7	Create a dynamic web page which displays capabilities of a web browser using Browser Capabilities Component using JavaScript
8	Create a simple XMLHttpRequest and retrieve data from a TXT file.
9	Create a simple script to download Images Using AJAX
10	Create a simple script to Auto-Populate Select Boxes using AJAX

V Semester

CSE2315 – PE I: Introduction to Geographical Information System

CSE 2315	**Introduction to Geographical Information System**			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

Objective	Course Outcomes
1) Get overview of fundamental concepts of GIS, applications and study. 2) Explore the Coordinate Systems, Map Projections metadata, spatial data, spatial analysis and new trends in GIS. 3) Comprehend the Making and sharing of maps.	**On completion of this course, the student will be able to:** 1) Demonstrate the fundamental concepts of GIS and relate the various GIS applications used by industries and government organization 2) Develop the apprehension of Coordinate Systems, Map Projections, metadata, spatial data, spatial analysis and new trends in GIS. 3) Design and share maps

Unit No.	Contents	Max. Hrs.
1	**Introduction to GIS:** Concepts of GIS, Applications currently used by Industry &Govt and their common usages. Fundamental concepts of GIS: GIS terminologies, various components of GIS software and types of GIS applications. The GIS Software Market, Role of GIS in smart cities.	6
2	**Fundamentals of Coordinate Systems and Map Projections**: History of Coordinate Systems, Geographic Coordinate Systems, Map Projections and Geo referencing.	7
3	**Fundamentals of Spatial Data:** Introduction to Spatial Data Formats, Creation of Vector data, Organization of Spatial Data and Displaying Spatial Data, metadata and spatial data standards.	7
4	**Making Sharing Maps:** Map Creation and Design, Sharing Maps as Services, Sharing Spatial Data and using shared Spatial Data.	6
5	**Fundamentals of Spatial Analysis:** Spatial Analysis, analyzing Vector and Raster data, overview of analysis tools, analyzing Spatial Relationships and sharing Analysis Results	7
6	**New trends in GIS:** GIS Trends Changing the World, Machine learning in GIS, Geospatial big data, Integration of GIS with different technologies, GIS with LiDar data.	7

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	An Introduction to Geographical Information Systems	3rd Edition(2006)	D. Ian Heywood, Sarah Cornelius & Steve Carver	Pearson Prentice Hall

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Getting to Know ArcGIS	4th Edition(2015)	Michael Law & Amy Collins	Esri Press
2	Mathematical Modeling in Geographical Information System global Positioning System and Digital Cartography	4th Edition(2006)	H. S. Shrama, D. R.Ram, Rama Prasad & P. R. Binda	Concept Publishing Company

V Semester

CSE2316 – PE I: Lab: Introduction to Geographical Information System

Sr. No.	Aim of Practical
1	To explore different proprietary GIS and Open GIS software.
2	To study the installation of GIS Desktop Software and explore various components of the GIS Desktop Software.
3	To explore various coordinate systems. Download any shape file and explore its coordinate system and change the existing coordinate system.
4	To create Geodatabase, layer files and shape files from the scratch.
5	To explore data formats using GIS Desktop Software and vector data points such as points, lines and polygon and create the map using simple vector data structure.
6	To create map in data view and layout view.
7	To install GIS Server, creating web services out of GIS maps or data, Sharing maps, using GIS web services.
8	Geoprocessing tools
9	Model builder

10	Project

V Semester

CSE2317 – PE I: Mobile Operating system

Unit No.	Contents	Max. Hrs.
1	**Introduction to Mobile Programming:** Mobility Technology Trends, Mobile Ecosystem Overview, Mobile Devices Overview, Mobile Development, Methodology, Wireless Networks Overview, Proximity Technologies.	5
2	**Introduction to Android :**Android Overview, Basic building blocks, Introduction to Activities/Fragments, Introduction to Services, broadcast receivers, content providers, Android Application Structure, Source Files, Resources, Assets, Manifest, Basic IDE Operation (Android Studio), Project Creation and Handling (App Creation through Wizard), Running App on AVD and Device, DDMS and Debugging, Layout Overview, Linear Layout, Relative Layout, Frame Layout, Widgets (UI Controls) Overview, Text View, Image View, button.	6
3	**User Interface Designing** : Data Storage Overview, Persistant v/s Local, Shared Preferences, Internal Storage, SQLite Data Base, Thread, process overview, Async Task, Loaders, Handlers, Intent and Intent Filters, Broadcast receiver Overview, Manifest Registration vs Component Registration, Unregistration, SMS, Boot, Network etc., Action Bar and Context Menu.	6
4	**Data Management:** Data Storage Overview, Persistant v/s Local, Shared Preferences, Internal Storage, SQLite Data Base, Thread, process overview, Async Task, Loaders, Handlers, Intent and Intent Filters, Broadcast receiver Overview, Manifest Registration vs Component Registration, Unregistration, SMS, Boot, Network etc., Action Bar and Context Menu.	6
5	**Inter - Application Communication** : Inter app communication requirement overview, Intents Based, Gallery, Camera, SMS App, Contacts, Content provider Overview ,Need and Usage, Content Provider structure, URI Permissions, Views, triggers, Network communication basics, Connecting to server/ request creation, Response Formats XML/JSON, Rest / Web Services.	6
6	**Advanced User Interface Designing** : Style and Themes, View and layout animation, Localization, Orientation and Config Change Handling, Handling multiple resolution devices, Device and Tablet consideration, Support Library, Application Signing, Application Distribution, Application Publishing,	7

	Google Play, Query solving topics, Recycling view adapter, SQLite DB, Drawer, Tab Layout (view Pager 2), http request using retrofit, Navigation Drawer, Android Application Architecture and Unit Testing, Introduction to Jetpack, Introduction to Daggers, Introduction to AndroidX.	

Text Books

SN	Title	Edition	Authors	Publisher
1	Mobile Design and Development	2009	Brian Fling	O'Reilly Media, Inc
2	Android Programming: The Big Nerd Ranch Guide	2nd edition, 2015	Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano	Big Nerd Ranch LLC

Reference Books

SN	Title	Edition	Authors	Publisher
1	Programming the Mobile Web	2nd ed., 2013	Maximiliano Firtman	O'Reilly Media, Inc.

V Semester

CSE2318 PE I: Mobile operating system Lab

Sr. No.	Experiments based on
1	Study of Mobile devices & their history.
2	Study of Mobile Apps Architecture.
3	Installation of Android Studio.
4	Modification to AndroidManifest File.
5	Develop an app making use of Android layout.
6	Develop an app based on Android widgets.
7	Design & Develop an app making use of Event Handling.
8	Develop an app to demonstrate fragment manager.
9	Design & Develop an app making use of mobile database.
10	Design & Develop an app based on inter application communication.

V Semester

CSE2331 – OE I: Database System Essentials

CSE 2331	Database System Essentials			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

Objective	Course Outcome
To understand basic database concepts by students whose basic degree is not in Computer or IT.	Upon successful completion of the course the students will be able to 1. Understand the basics concepts of Database System and its modelling, compare SQL and NoSQL databases. 2. Solve queries based on SQL and procedures using PL-SQL, & Analyse data dependencies & normalization. 3. Understand Query Processing and evaluate queries. 4. Understand ACID Properties and database system Architecture.

Unit No.	Contents	Max. Hrs.
Unit:1	**Database system Essentials**: Purpose of Database systems, Example of Database Applications, Basic Terminologies, Data Models, Entity–Relationship Model, Relational Model.	6 Hours
Unit:2	**Relational Databases:** Introduction, SQL, DDL, DML, DCL, Database Integrity and Security, Relational–Database Design, database constraints, functional dependencies and normalization.	7 Hours
Unit:3	**Data Storage and Querying:** Storage and File Structure, Indexing and Hashing, Data Retrieval, Query Processing, data-access techniques, query-evaluation.	6 Hours
Unit:4	**Transaction Management:** Introduction, transaction atomicity, consistency, isolation, and durability, concurrency control, serializability, locking, time stamping, Deadlock issues.	6 Hours
Unit:5	**Database System Architecture:** Centralized systems, client–server systems, parallel and distributed architectures, and network types.	6 Hours
Unit :6	**PL-SQL and No SQL**: Introduction to Pl-SQL, Block Structure: Variables, Decision Structures & Loops, Basic Pl-SQL programming. Overview of NoSQL Databases, SQL Vs NO SQL, Types of NoSQL Database	6 Hours

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Database System Concepts	Silberschatz–Korth–Sudarshan	McGraw–Hill, 2019
2	Fundamentals of Database Systems	Elmasri, Navathe & Gupta	Pearson Education
3	SQL/PLSQL	P. S. DESHPANDE	Dreamtech press

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Database Systems	S. K. Singh	Pearson Education

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs80/preview

V Semester

CSE2332 – OE I: Introduction to Image Processing

CSE 2332	**Introduction to Image Processing**			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

Objective	**Course Outcome**

This course will let the students understand the basic principles and methods of digital image processing. They will be able to formulate solutions to general image processing problems and have a comprehensive background in image filtering. This course explains how digital images are represented and manipulated in a computer, including reading and writing from storage, and displaying. It will make students conversant with the mathematical description of image processing techniques and know how to go from the equations to code. The students will be able to apply principles and techniques of digital image processing in applications related to digital imaging system design and analysis. It will also be useful for advanced image analysis topics such as computer vision systems, biomedical image analysis, and multimedia processing & retrieval.	**Upon successful completion of the course the students will be able to** CO1: Understand basic principles of image processing. CO2: Analyze images using processing algorithms/Techniques. CO3: Apply the concepts to implements basic image processing algorithms/operations.

Unit No.	Contents	Max. Hrs.
Unit:1	**Fundamentals of Image Processing**: Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Arithmetic and logic operation on images	6 Hours
Unit:2	**Image Processing in spatial domain**: Image Enhancement in the Spatial Domain: Basic Grey Level Transformations, Histogram Processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6 Hours
Unit:3	**Color Image Processing:** Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening.	5 Hours
Unit:4	**Image Segmentation**: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.	6 Hours
Unit:5	**Image Compression:** Fundamentals, Some Basic Compression Methods -Run Length Coding, Huffman Coding, Arithmetic Coding, Bit Plane Coding, Block Truncation Coding. JPEG Compression.	6 Hours
Unit :6	**Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, Hit or Miss Transformation, Some Basic Morphological Algorithms, Grey Scale Morphology.	5 Hours

Text Books

SN	Title	Edition	Authors	Publisher

1	Digital Image Processing, (DIP/3e)	Latest	Gonzalez and Woods	Prentice Hall - 2008

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Digital Image Processing	Latest	Kenneth R Castleman	Pearson Education
2	Fundamentals of Digital image Processing	Latest	Anil Jain.K	Prentice Hall of India
3	Digital Image Processing	Latest	S Jayaraman	Mc Graw Hill India 2017

V Semester

CSE2333 – OE I: Programming with Python

CSE 2333	**Programming with Python**			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

Course Outcome
Upon successful completion of 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. Apply the concepts of functions modules and packages and write programs using them. 3. Design and develop classes in Python.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to Python**: Build-in Data types & variables, arithmetic operators, assignment statement, print & input function, relational and logical operators, if, if – else & nested if- else statements, writing simple programs.	7 Hours
Unit:2	**Data Structures:** Built in data structures: Lists, Dictionaries, Tuples, Sets, and Arrays. Programs based on the built in data structures	6 Hours
Unit:3	**Looping: Loop statements:** For, while, continue and break statements, list comprehension. Bitwise operators, Real world problem solving based on loops.	6 Hours
Unit:4	**Functions:** Library functions in Python standard library, user defined Functions, returning values, local & global variables , global statement, doc strings for functions, developing useful functions, Modules and Packages, import statement.	6 Hours
Unit:5	**Introduction to Object oriented programming in Python:** Features of object oriented programming, Python Object and Classes: defining classes, member variables, doc strings for classes, Private members, Operator Overloading, inheritance and polymorphism.	7 Hours
Unit :6	**Application Development:** Developing applications using libraries and packages, File handling, Exception handling, developing applications using Python	5 Hours

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Learn Python Programming	Third Edition	Fabrizio Romano, Heinrich Kruger	PACKT Publishing

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Computation and Programming Using Python	Second Edition	John V. Guttag	PHI EEE (MIT Press)

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc20_cs70/preview
2	https://onlinecourses.nptel.ac.in/noc20_cs83/preview

V Semester

CSE2341 – OE II: Software Testing for Beginners

Objective	Course Outcome
1. Understand Software testing fundamentals / principles. 2. Learn systematic approach to software testing using strategies. 3. Explore Methods and tools of testing software.	Upon successful completion of this course, the student will be able to: 1. Formulate problem by following Software testing life cycle. 2. Design Manual Test cases for Software Project. 3. Demonstrate utilization of testing automation though testing tool.

Unit No.	Contents	Max. Hrs.
1	**Software Testing Basics:** Basic concepts of Testing: Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.	6
2	**Unit Testing:** Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing.	6
3	**Control Flow Testing:** Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage.	7
4	**Integration Testing:** Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.	7
5	**System Testing:** System Testing: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.	6
6	**Test Cases:** Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.	6

Text Books

S.No	Title	Edition	Authors	Publisher
1	Software Testing and Quality Assurance		Kshirsagar Naik and PriyadarshiniTripathi	Wiley Publication
2	Software Testing Principles, Techniques and Tools		M.G. Limaye	McGraw Hills

Reference Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	Foundations of Software Testing		Aditya P. Mathur	Pearson Education
2	Software Testing Tools		Dr. K. V. K. K. Prasad	Dream Tech

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs13/preview
2	https://onlinecourses.nptel.ac.in/noc19_cs71/preview

V Semester
CSE2342 – OE II: Introduction to Cloud Computing

CSE2342	OE II: Introduction to Cloud Computing			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

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Understand Cloud Computing Models. 2. Apply Cloud Concepts & Technologies. 3. Analyse Cloud Services & Platforms 4. Use MapReduce to process Big Data on Apache Hadoop.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to Cloud Computing:** Definition of Cloud Computing, Characteristics of Cloud Computing, Cloud Models (Service & Deployment), Cloud Services Examples (IaaS, PaaS, SaaS), Cloud-	6 Hours

	based Services and Applications (Cloud computing for Healthcare, Manufacturing Industry and Education).	
Unit:2	**Cloud Concepts &Technologies:** Virtualization, Load balancing, Scalability & Elasticity, Monitoring, Identity & Access Management, Service Level Agreements	6 Hours
Unit:3	**Cloud Services & Platforms:** Compute Services (Amazon Elastic Compute Cloud, Google Compute Engine, Windows Azure Virtual Machines), Storage Services (Amazon Simple Storage services, Google Cloud Storage, Windows Azure Storage), Database Services (Amazon Relational Data Store, Google Cloud SQL, Windows Azure SQL Database), Application Services (Application Runtimes & Frameworks) Identity & Access Management Services (Amazon Identity & Access Management, Windows Azure Active Directory).	6 Hours
Unit:4	**Hadoop & MapReduce:** Apache Hadoop, Hadoop MapReduce Job Execution, NameNode, Secondary NameNode, JobTracker, TaskTracker, DataNode.	6 Hours
Unit:5	**Cloud Application Design:** Design Considerations for Cloud Applications, Scalability, Reliability & Availability, Security, IaaS, SaaS Services for Cloud Applications.	6 Hours
Unit :6	**Cloud Security:** Introduction, CSA Cloud Security Architecture, Authentication, Single Sign On (SSO), Authorization.	6 Hours

Text Books

S.No	Title	Edition	Authors	Publisher
1	CLOUD COMPUTING A Hands -on Approach		Arshdeep Bahga & Vijay Madisetti	Wiley Publication

Reference Books

S.No	Title	Edition	Authors	Publisher
1	CLOUD COMPUTING	18th edition	Michael Miller	PEARSON PUBLICATION
2	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance		Tim Mather, Subra Kumaraswamy, and Shahed Latif	O'Reilly
3	Cloud Computing Bible		Barrie Sosinsky	John Wiley & Sons

MOOCs Links and additional reading, learning, video material

1	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2	https://www.simplilearn.com/

V Semester

CSE2343 – OE II: Introduction to Web Technology

CSE 2343	Introduction to Web Technology			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

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Design Web pages using HTML5
2. Build an interactive website with CSS3
3. Develop basic programming skills using JavaScript
4. Create XML documents and Schemas.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to internet:** Overview of Internet, Intranet, WWW, Internet Protocols (HTTP, FTP, SMTP), Email, broadband.	6 Hours
Unit:2	**Introduction to HTML5:** Web server, Web Client/Browser, Structure of an HTML Program, Basic HTML Tags(Headings, Paragraph, Division, Text formatting, Image, Anchors), HTML Lists (Ordered Lists, Unordered Lists, Description Lists), HTML Attributes, HTML Links (Href Attribute, Target Attribute).	6 Hours
Unit:3	**Table handling in HTML and Creating Forms:** Table handling in HTML: width and border attribute, CELLPADDING attribute, CELLSPACING attribute, COLSPAN and ROWSPAN attributes, background color attribute, HTML Forms: Elements to Capturing Form Data, Properties of Form Elements, HTML Layout Elements(Semantic Elements), HTML style attribute, HTML class and id attribute.	6 Hours

Unit:4	**Cascading Style Sheets (CSS3):** Introduction to CSS, Differences between CSS3 and earlier CSS specifications, CSS Syntax, CSS selectors, Inserting CSS: Inline, Internal, External, CSS properties: Background, Text, Font, Border, Margin, Padding, List, Dimension, and Classification.	6 Hours
Unit:5	**Java Script:** Introduction to Java Script, Functions of Javascript, Variables and Data Types, Operators, Loops and control statement: if Statement, if...else Statement, else if Statement, JavaScript Switch Statement, JavaScript Functions, JavaScript Loops: for loop, while loop, do...while loop, Dialog Boxes, JavaScript Events.	6 Hours
Unit :6	**Introduction to XML:** What is XML?, Features of XML, XML Syntax and Structure Rules(Start tags, End tags, Empty elements, XML tag attributes),XML Document Type Declaration(DTD, Internal DTD's, External DTD's.	6 Hours

Text Books

S No	Title	Edition	Authors	Publisher
1	Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX			Kogent Learning Solutions Inc.

Reference Books

S No	Title	Edition	Authors	Publisher
1	HTML & CSS: The Complete Reference	Fifth Edition	Thomas A. Powell	The McGraw-Hill Companies, Inc
2	Web Technologies		Ivan Bayross	BPB Publication

MOOCs Links and additional reading, learning, video material

1	https://nptel.ac.in/courses/106105084
2	https://www.youtube.com/watch?v=uUhOEj4z8Fo
3	https://www.youtube.com/watch?v=mU6anWqZJcc

First Year

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

Hingna Road, Wanadongri,Nagpur

Department of Applied Mathematics & Humanities

Report on Activity: Extempore

Activity -**Extempore** was conducted for section-D on 22July2022 to enhance oral presentation. Various topics of general interest like- Employment in India, Globalization, Impact of Social Media, Women Empowerment were given to students. Students were individually called and asked to pica chit with the topic written on it. They were given two minutes time to think about the key points. Students actively participated in this activity. About 55 students participated in this activity. This activity was taken with the objective of on the spot thinking skills and oral skills. Students found it very interesting.

Mrs.N.K,Thakre
Subject Teacher

Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering Nagpur
(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur Univers
Hingna Road, Wanadongri, Nagpur-441 110
NAAC Accredited with 'A++' Grade

ACADEMIC SESSION 2021-2022(Even)

Activity: Extempore

Date: 22/07/2022

Section: D

S.n.	Ennr.N.	Roll	Name of Student	Good	Very Good	Satisfactory	signature
1	21070621	1	AHIRKAR AASTHA RAMESH			✓	Ahirkar
2	21070382	2	DHARNE ADITI MANOJ				
3	21070566	3	SHRIRAME ANUSHKA PRABHAKAR	✓			[illegible]
4	21070614	4	BHIWAPURKAR ASTHA VIJAYRAO	✓			[illegible]
5	21070594	5	INGOLE BHAGYASHREE GOVIND		✓		[illegible]
6	21070557	6	GEDAM BHUMIKA CHANDRASHEKHAR	✓			Bhumika
7	21070612	7	CHOUDHARI HIMANSHI SANJAYRAO			✓	[illegible]
8	21070623	8	JANHAVI ARVIND PILLEWAN				
9	21070611	9	AKNURWAR KHUSHI VIJAY	✓			[illegible]
10	21070554	10	BAGDE MAHEK BHUSHAN			✓	MBagde
11	21070592	11	HUMNE NAYANI SEWAKDAS			✓	NHumne
12	21070619	12	RAUT PARUL SURESH	✓			Parul
13	21070568	13	GATHIBANDHE RITIKA VINOD	✓			Ritika
14	21070588	14	RUNISHKA RUPESH PATIL	✓			[illegible]
15	21070627	15	GULHANE SHREYA RAMESHWAR	✓			S.R. Gulhane
16	21070593	16	DOIFODE SHRUTI SUSHIL	✓			[illegible]
17	21070599	17	SIMRAN DHANRAJ KATKAR	✓			Simran
18	21070574	21	AADITYA AMAR	✓			
19	21070597	22	BHOYAR AALHAD MAHENDRA	✓		✓	[illegible]
20	21070579	23	WAGHMARE ABHISHEK DEVESH				
21	21070564	24	MEGHE ANIRUDDHA DILIP				
22	21070613	25	SATHE ANUBHAV ANIL			✓	Anubhav
23	21070571	26	HANDE ANURAG SACHIN	✓			Ahurag
24	21070572	27	VISHWAKAR ARADHYA NITIN		✓		[illegible]
25	21070587	28	HARDAS ARNAV SHEKHAR		✓		[illegible]
26	21070605	29	SAWATKAR ARTH VIJAY	✓			[illegible]
27	21070591	30	CHAWARE ARYAN PRAKASH	✓			Chaware
28	21070625	31	NIGHOT ATHARVA SANJAY	✓			[illegible]
29	21070565	32	CHANDEKAR AYUSH MADAN	✓			[illegible]
30	21070552	33	PIPRODE DARSHAN SUDHIR				
31	21070569	34	PISE DEEPANSHU KAMLAKAR	✓			DuPise
32	21070602	35	LAMBAT DHRUV SACHIN		✓		[illegible]
33	21070590	36	DIXIT HARSH NIRMALSINGH	✓			Dixit

Scanned with OKEN Scanner

34	21070589	37	DESHMUKH HIMANSHU PRADIP			✓	
35	21070477	38	ADE HIMANSHU RAMESH				
36	21070555	39	SAPKOTA HIMANSHU HEMANT				
37	21070563	40	BOBADE HIMANSHU SANJAY	✓	✓	✓	
38	21070607	41	SHETE HIMANSHU BHUSHAN	✓			
39	21070608	42	NAGRALE KARTIK KAILASH			✓	Kartik
40	21070553	43	PALANDUKAR KISHOR RAVI	✓			
41	21070549	44	WASADE KULDEEP ANIL	✓			
42	21070567	45	SHRIVAS KUNAL KUNDAN				
43	21070596	46	DOYE MAYANK SANTOSHKUMAR				
44	21070600	47	RATHOD MEETANSHU MUKESH		✓		
45	21070585	48	MISHRA MIHIR BHARAT				
46	21070632	49	TADAS NIKHIL MANGESH	✗	✓	✗	
47	21070575	50	DESHMUKH OM RAVINDRA				
48	21070604	51	NIMBALKAR PRANAV PURUSHOTTAM			✓	
49	21070499	52	NAIK PRATHAM VAIBHAV			✓	
50	21070624	53	BONDRE PRATHMESH MANOHAR	✓			
51	21070578	54	NIRWAN PRATYUSH NILKANTH				
52	21070577	55	KUMBHARE RAJ DASHARATH				
53	21070580	56	CHOUDHARI RATNASH SUBHASH				
54	21070556	57	BHALAWE ROHIT SHANKARRAO				
55	21070576	58	SHRIMANKAR RONIT BHAVESH				
56	21070561	59	DEWAIKAR RUGVED NAGESH			✓	
57	21070609	60	RUSHIKESH RAVIKUMAR SARATE		✓		K. K. S
58	21070622	61	TOPRE SAMAY BHARAT			✓	
59	21070562	62	SHEIKH SAMEER SHERUSHAHA				
60	21070630	63	DARADE SANCHIT MAHADEV				
61	21070618	64	DESHPANDE SANKET SANJAY		✓		
62	21070586	65	THAKARE SANKET RAJENDRA		✓		
63	21070620	66	LALE SANMAY JAGJIWAN		✓	✓	
64	21070559	67	NASHIKWAR SARVESH YOGIRAJ				
65	21070606	68	RAMTEKE SHANTANU RAMESH		✓		
66	21070629	69	JOSHI SHREYAS MANISH				
67	21070582	70	YADAV SUJAL KRISHNAKANT				
68	21070573	71	KATIYAR VED SANTOSH				
69	21070628	72	KOLHE YASH ARVIND				

N.K. Thakre
Name & Signature of Faculty

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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Hingna Road, Wanadongri,Nagpur

Department of Applied Mathematics & Humanities

Report on Activity: Buzz Group

Activity -**Buzz Group** was conducted for section-D non 25July2022 to enhance oral presentation. In the subject social science, topics-Industrial Democracy and Industrial Psychology etc. were given to students. The class was divided into 3 groups .Students were asked to go through the details and gather all the points related to the topics. Students discussed the topic amongst them, The selected students were asked to present the points orally. Audience students asked questions to the presenters. It was an interesting method and way of presenting the topic as all the students were given the task of finding the details of the topic. Students actively participated in this activity. About 58 students participated in this activity.

Mrs.N.K,Thakre
Subject Teacher

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Hingna Road, Wanadongri, Nagpur-441 110
NAAC Accredited with 'A++' Grade

ACADEMIC SESSION 2021-2022(Even)

Activity: Buzz Group. **Date:** 25/07/2022

Section: D

S.n.	Ennr.N.	Roll	Name of Student	Good	Very Good	Satisfactory	signature
1	21070621	1	AHIRKAR AASTHA RAMESH			✓	Aastha
2	21070382	2	DHARNE ADITI MANOJ				
3	21070566	3	SHRIRAME ANUSHKA PRABHAKAR	✓			[illegible]
4	21070614	4	BHIWAPURKAR ASTHA VIJAYRAO	✓			[illegible]
5	21070594	5	INGOLE BHAGYASHREE GOVIND		✓		[illegible]
6	21070557	6	GEDAM BHUMIKA CHANDRASHEKHAR				
7	21070612	7	CHOUDHARI HIMANSHI SANJAYRAO			✓	[illegible]
8	21070623	8	JANHAVI ARVIND PILLEWAN				
9	21070611	9	AKNURWAR KHUSHI VIJAY	✓			[illegible]
10	21070554	10	BAGDE MAHEK BHUSHAN	✓			M. Bagde
11	21070592	11	HUMNE NAYANI SEWAKDAS			✓	NHumne
12	21070619	12	RAUT PARUL SURESH	✓		✓	Parul
13	21070568	13	GATHIBANDHE RITIKA VINOD		✓		[illegible]
14	21070588	14	RUNISHKA RUPESH PATIL	✓			[illegible]
15	21070627	15	GULHANE SHREYA RAMESHWAR	✓		✓	S.R. Gulhane
16	21070593	16	DOIFODE SHRUTI SUSHIL			✓	[illegible]
17	21070599	17	SIMRAN DHANRAJ KATKAR	✓		✓	Simran
18	21070574	21	AADITYA AMAR		✓		[illegible]
19	21070597	22	BHOYAR AALHAD MAHENDRA	✓		✓	[illegible]
20	21070579	23	WAGHMARE ABHISHEK DEVESH				
21	21070564	24	MEGHE ANIRUDDHA DILIP				
22	21070613	25	SATHE ANUBHAV ANIL			✓	[illegible]
23	21070571	26	HANDE ANURAG SACHIN		✓		[illegible]
24	21070572	27	VISHWAKAR ARADHYA NITIN		✓		[illegible]
25	21070587	28	HARDAS ARNAV SHEKHAR		✓		[illegible]
26	21070605	29	SAWATKAR ARTH VIJAY				[illegible]
27	21070591	30	CHAWARE ARYAN PRAKASH	✓			Chawar
28	21070625	31	NIGHOT ATHARVA SANJAY	✓			AN
29	21070565	32	CHANDEKAR AYUSH MADAN	✓			
30	21070552	33	PIPRODE DARSHAN SUDHIR				
31	21070569	34	PISE DEEPANSHU KAMLAKAR	✓			DnPise
32	21070602	35	LAMBAT DHRUV SACHIN		✓		[illegible]
33	21070590	36	DIXIT HARSH NIRMALSINGH	✓			Dixit

34	21070589	37	DESHMUKH HIMANSHU PRADIP			✓	
35	21070477	38	ADE HIMANSHU RAMESH				
36	21070555	39	SAPKOTA HIMANSHU HEMANT				
37	21070563	40	BOBADE HIMANSHU SANJAY	✓		✓	
38	21070607	41	SHETE HIMANSHU BHUSHAN	✓			
39	21070608	42	NAGRALE KARTIK KAILASH			✓	
40	21070553	43	PALANDUKAR KISHOR RAVI			✓	
41	21070549	44	WASADE KULDEEP ANIL			✓	
42	21070567	45	SHRIVAS KUNAL KUNDAN				
43	21070596	46	DOYE MAYANK SANTOSHKUMAR				
44	21070600	47	RATHOD MEETANSHU MUKESH		✓		
45	21070585	48	MISHRA MIHIR BHARAT	✓			
46	21070632	49	TADAS NIKHIL MANGESH	✓		✓	
47	21070575	50	DESHMUKH OM RAVINDRA	✓			
48	21070604	51	NIMBALKAR PRANAV PURUSHOTTAM			✓	
49	21070499	52	NAIK PRATHAM VAIBHAV			✓	
50	21070624	53	BONDRE PRATHMESH MANOHAR		✓		
51	21070578	54	NIRWAN PRATYUSH NILKANTH				
52	21070577	55	KUMBHARE RAJ DASHARATH		✓		
53	21070580	56	CHOUDHARI RATNASH SUBHASH				
54	21070556	57	BHALAWE ROHIT SHANKARRAO				
55	21070576	58	SHRIMANKAR RONIT BHAVESH				
56	21070561	59	DEWAIKAR RUGVED NAGESH			✓	
57	21070609	60	RUSHIKESH RAVIKUMAR SARATE		✓		
58	21070622	61	TOPRE SAMAY BHARAT			✓	
59	21070562	62	SHEIKH SAMEER SHERUSHAHA		✓		
60	21070630	63	DARADE SANCHIT MAHADEV				
61	21070618	64	DESHPANDE SANKET SANJAY		✓		
62	21070586	65	THAKARE SANKET RAJENDRA		✓		
63	21070620	66	LALE SANMAY JAGJIWAN		✓		
64	21070559	67	NASHIKWAR SARVESH YOGIRAJ				
65	21070606	68	RAMTEKE SHANTANU RAMESH		✓		
66	21070629	69	JOSHI SHREYAS MANISH				
67	21070582	70	YADAV SUJAL KRISHNAKANT				
68	21070573	71	KATIYAR VED SANTOSH				
69	21070628	72	KOLHE YASH ARVIND				

N.K. Thakre

Name & Signature of Faculty

Nagar YuwakShikshanSanstha's
YeshwantraoChavan College of Engineering
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Report on UHV Interactive Activity sessions

These days students are blindly coping the western society and moving away from traditional Indian Joint family system, even in the syllabus of UHV framed for first year lots of information about Joint family system has been given, so I planned an activity in both J and S sections in which nearly 140 students participated. Students expressed their views on both Joint family system and Nuclear Family system enthusiastically and gave a great response. As I had given this as an assignment students not only participated in **Interactive Activity sessions** but also submitted written assignments about it.

Ajali
Subject teacher
Prof Mrs Anjali Chitale

HOD Maths and Humanities
Dr.Malabika Adak

Head, Department of Applied Mathematics and Humanities
Yeshwantrao Chavan College of Engineering, Nagpur

Name- Naincy Pande
Rollno- J60
Reg.no- 21071235
Year_sec - I-J
Branch- AIML (CSE).

Page No.
Date

Activity (UHV)

* Joint family :-

(1) Advantages :-

a) A child in a joint family is never lonely :-
If there is a working mom ~~on~~ in a joint family, she needs not worry about the child while on work. She can be chilled about who will take care of the child, as there are many people in a joint family.

b) Happiness doubles :-
If a person lives in a joint family even small happiness doubles up.

c) One learns to respect :-
Growing up in a joint family with so many elders one learns to respect everyone. This also helps in shaping the personality of the person. A person who respects others is always admired.

d) Feeling of togetherness :-
In a joint family one can never be alone and can not feel lonely. One will never be deprived of friends (cousins are always there). There are also people ~~whith~~ with whom we can share

all our problems.

(2) Disadvantages :-

(a) Privacy is compromised :-
Lack of privacy is always a concern with people living in joint families. One is always surrounded with many people and cannot spend or have quality 'ME' time.

(b) A small decision runs by everyone -
Living in a joint family : a small decision has to be passed by every single member of the family. A decision is not made until it gets a green signal by every member.

(c) Financial responsibility :-
In a joint family, it is about 'us'. When it comes to financial responsibility, usually the head of the family bears all the financial responsibilities.

(d) Interference in parenting :-
Living in a joint family sometimes deprives one of taking right decisions for one's children.
As a mother one might not get the ~~tw~~ right to take decisions for the children because the other family members might always give

one parenting tips.

(c) Woes of a common kitchen :
Generally in joint families all the female members cook together and for all. But every person has his/her own preferences and tastes, and hence catering to everyone's choices is often tiring.

* ## Nuclear family

(1) Advantages :

(a) Possibility of reduced conflicts :-
Conflicts are bound to happen in every family joint or nuclear. But the possibility of conflicts is reduced in nuclear families as the number of members are less.

(b) Personal responsibilities :-
There is no division of responsibilities in nuclear family. Parents are obliged to accept responsibility of their children on their own.

(c) Harmony and peace :-
For a pleasant family relationship, peace and harmony & prosperity are crucial. Misunderstandings are bound to exist, however as the number of members are fewer there is possi

Page No.
Date

-bility of reduction in misunderstandings amongst each other.

e) Good status of women :-
Women of nuclear families get sufficient time to take care of her kids as well as herself. They also can organise their homes according to their wish.

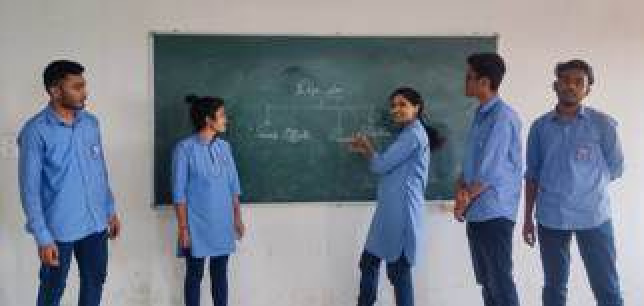
* Disadvantages :-

a) Children feel insecure :-
With both the parents working children might feel neglected. They may feel anxious

(b) Economic disadvantage -
The head of the family mostly has to bear all the expenses of the family. There is no economic advantage or support.

(c) Agency to develop bad qualities -
As there is no social control of seniors. Children become more vulnerable to bad influence and can deviate easily. They also become unsocial.

(d) Lonliness -
Feeling of lonliness is a major drawback of nuclear families.



Nagar Yuwak Shikshan Sanstha's

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Department of Applied Mathematics and Humanities, YCCE

Azadi Ka Amrit Mahotsav

Date: 1st September 2022

To,
The Principal,
YCCE, Nagpur

Subject: Statement for Settlement of **SDP (Essay Competition)** on the occasion of **"Azadi ka Amrit Mohotsav"** for first year student.

Respected Sir,

The actual expenditure for SDP for the students of first year on 17th August 2022 as follow:

S.No.	Particulars	Quantity	Amount (in Rs.)
2	Certificates	4 (25/- per certificate)	100
3	Prize	Top 3 Students 1st Prize: 1000/- 2nd Prize: 700/- 3rd Prize: 500/-	2200
6	Miscellaneous	Tea (5*10), Water (5*10), Snacks (5*20)	200
		Total	**2500**

I humbly request you to give your approval for the same.

OK

Yours sincerely,

Dr. Malabika Adak
Head, Dept. of Applied Mathematics and Humanities
YCCE, Nagpur

02-09

Dr. U. P. Waghe
Principal,
YCCE, Nagpur

AL

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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Department of Applied Mathematics and Humanities, YCCE

Azadi Ka Amrit Mahotsav

Report On

ESSAY COMPETITION

B.TECH. FIRST YEAR/ II SEM (2021-22)

Date of program: 17th August 2022

Department of Applied Sciences and Humanities, YCCE has conducted **Essay Competition,** over the topic **"Envisioning India @2047"** on the occasion of **Azadi Ka Amrit Mahotsav** as a part of Student Development Program on 17th August 2022. Total 40students were participated in the competition, among them three student were selected as 1st, 2nd and 3rd winner. Winners were felicitated by the hand of Dr. M. P. Gandhi, FYC, YCCE, Dr. Malbika Adak, HOD, Department of Applied Mathematics and Humanities with Certificate and Cash Prize. DIVYANSHU NINAVE, SEC-S, ROLL NO. 41, secured 1st Prize; AISHWARYA MORONEY, SEC-K, ROLL NO-2, secured 2nd Prize and ANUSHRI JAMAR, SEC-N, ROLL NO-1, secured 3rd Prize. Program was coordinated by Dr. Arvinder Kour, Prof. V. D. Bhandarkar and Prof. M. S. Dani.

Program Coordinators:

Dr. Arvinder Kour	**Prof. Vishakha Bhandarkar**	**Prof. M. S. Dani**	**Dr. Malabika Adak**
Assistant Professor Mathematics	**Assistant Professor**	**Associate Professor**	**HOD, Applied and Humanities.**



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NAAC Accredited with 'A+' Grade

Department of Applied Mathematics and Humanities, YCCE

75 Azadi Ka Amrit Mahotsav

Notice

On the occasion of *"Azadi ka Amrit Mahotsav"*, Department of Applied Mathematics and Humanities, YCCE is organizing

ESSAY COMPETITION

On

Envisioning India@2047

***Date*: 17th August, 2022**

***Venue*: Room No. 201, Old Science Building, YCCE, Nagpur**

***Time*: 12 pm to 1 pm**

Registration Link-
All those who are interested may register their name by following the link:

https://forms.gle/UPPAmCbXQiBaX5z89

Best Three Essay will be rewarded with Certificate and memento.

Dr. Arvinder Kour	Prof. V. D. Bhandarkar	Prof. M. S. Dani	Dr. Malabika Adak
Assistant Professor YCCE, Nagpur	Assistant Professor YCCE, Nagpur	Assistant Professor YCCE, Nagpur	HoD, Applied Mathematics and Humanities

ESSAY COMPETITION HELD ON 17TH AUGUST, 2022 ON "ENVISIONING INDIA@2047" AT ROOM NO. ____ AT OLD SCIENCE BULDING CONDUCTED BY APPLIED MATHEMATICS AND HUMANITIES

ATTENDANCE SHEET

SR. NO	NAME OF THE PARTICIPANT	ROLL NO.	SEM	SEC	PHONE NO.	EMAIL ID	SIGNATURE
1.	Abhijeet Konar	25	2nd	N	9665053466	abhijeetkonar03@gmail.com	Abhijeet Konar.
2.	Aishwarya Moroney	2	2nd	K	7262972445	aishmoroney@gmail.com	[illegible]
3.	Janhavi Thosar	7	2nd	E	9685583963	janhavithosar32@gmail.com	J.Thosar
4.	Saifiya Anjar	14	2nd	S	9665078128	saifiyaanzar@gamail.com	[illegible]
5.	Saloni Tejraj Dhengre	19	2nd	N	9552815983	ldhengre@gmail.com	[illegible]
6.	Anushri V. Jamar	1	2nd	N	9146239610	shrijamar@gmail.com	[illegible]
7.	Rushikesh Karodbhajne	51	2nd	G	8390226481	21071039@ycce.in	[illegible]
8.	Jauhari Alam	05	2nd	G	9370941768	jauharialam.14@gmail.com	[illegible]
9.	Manaswi Padole	08	2nd	A	726288773	manaswipadole76@gmail.com	Padole
10.	Varsha Bramhankar	18	2nd	G	808094600S	varshabramhankar94@gmail.com	[illegible]
11.	Ayush Ojha	31	2nd	I	7715941535	ayushbalor@gmail.com	[illegible]
12.	Ayush Bhendarkar	30	2nd	I	9130855598	21070768@ycce.in	[illegible]
13.	Shweta Nasare	21	2nd	N	9373779008	21070762@ycce.in	Nasare
14.	Divyani Thakare	4	2nd	N	9145754461	21071096@ycce.in	Thakare
15.	Diksha Dandekar	3	2nd	N	9175946586	21070787@ycce.in	D.R. Dandekar
16.	Pracheta Khadgi	11	2nd	N	8806233652	21070677@ycce.in	[illegible]
17.	Mohit V. Kulmate	47	2nd	R	9764073187	mohitkulmate@gmail.com	Mohit

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SR. NO	NAME OF THE PARTICIPANT	ROLL NO.	SEM	SEC	PHONE NO.	EMAIL ID	SIGNATURE
1	Abhay. O. verma	25	II	S	8767704905	abhayverma200804 @gmail.com	Averma
2.	Aditya Kawadkar	27	II	S	9406579938	adityakawadkar7 @gmail.com	[illegible]
3	Divyanshu Ninawe	41	II	S	9422125499	divyanshuninawe 20377@gmail.com	[illegible]
4.	Satyam Mahajan	64	II	S	9309721787	mahajansatyam2003 @gmail.com	[illegible]
5.	Vedant Gawrkar	66	II	M	8080954069	vedantgawrkar@ gmail.com	Ved
6)	Prince Yadav	51	II	S	9112445714	prince28284203@gmail.com	[illegible]
7.	PRUTHA DAIWATKAR	06	II	R	9022543316	Pdaiwatkar14 @gmail.com	[illegible]
8.	Gauri Kaple	03	II	R	8805452203	gaurikaple 610@gmail.com	Gaurikaple
9.	Nayan Mudewar	49	II	R	8766959612	nayanmudewar 2002@gmail.com	[illegible]
10.	Khushal Mahalle	41	II	R	7558672833	khushalmahalle93 @gmail.com	Khushal
11	Aniket. Bhati	30	II	R	9307467318	aniketbhati @gmail.com	Abhati
12	Anurag Gaddam-war	31	II	S	8080172824	gaddamwar anuraj@gmail.com	Gaddamwar
13.	Madhur Natekar	41	II	R	9881843967	madhurnatekar@ gmail.com	Madhur.
14.	Shahnawaz Khan	61	II	C	9112933134	00.shxnz @gmail.com	[illegible]
15	Siya Mundhada	16	II	R	9403566911	siyamundhada14 @gmail.com	Siya
16	Aman Gupta	27	II	R	8446179486	amanmgupta614 @gmail.com	[illegible]

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S. NO	NAME OF THE PARTICIPANT	ROLL NO.	SEM	SEC	PHONE NO.	EMAIL ID	SIGNATURE
01.	Abhijeet B. Sahu	26	II	N ✓	9322509022	abhijeetsahu037@gmail.com	Abhijeet Sahu
02.	Kunal P. Parkhade	46	II	N ✓	9307507914	kunalparkhade@gmail.com	Kunal
03	Omkar Kawadghare	52	II	N ✓	8482971368	omkarkawadghareok682@gmail.com	[illegible]
04	Prajakta Kokate	13	II	N ✓	9764797966	prajaktakokate0@gmail.com	PrajaktaK
05	Vijaya C. Moje	19	V	A ✓	9307726451	vijayamoje01@gmail.com	V.moje
06	VIDHI M. SATPUTE	21	II	C ✓	9730306507	vidhisatpute123@gmail.com	[illegible]
07	Pallavi. G. Patil	12	II	S ✓	8806407832	pallavigpatil2003@gmail.com	Pallavi

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 2021-22

Objectives	Outcomes
The objective of the syllabus is to ➢ To make students aware about basic concepts and strategies of technical communication ➢ To introduce the basic concepts of phonetics so as to convey thoughts effectively ➢ To prepare students to stretch beyond their comfort zone in order to become good team members and leaders in the industry. ➢ To develop skills of expressing ideas in simple, concise and direct language so that they can contribute more productively in the organization.	**Students will be able to** ➢ To explain the basic of communication process as well as identify the barriers in communication ➢ To classify and describe the different speech sounds of English language ➢ To apply different strategies & techniques of presentation, Interview and group skills. ➢ To prepare and draft reports, memos and emails with apt content.

Unit 1:- Basics of Communication

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

Classification of Barriers (Intrapersonal, Interpersonal, Organizational)

Unit 2- Effective speaking skills

Organs of speech, Consonants and vowels sounds of English language, Phonetic translation, word and sentence stress, vocal cues (Activity of reading phonetic translation in lab), General and technical vocabulary.

Unit 3- Effective Presentation

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

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

Unit 4 – Interview Skills

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

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

Unit 5- Group Skills

Purpose, types and difference between group and team

GD- Purpose, Organizational GD & GD as a past of selection process, approach to topic and case study, Meeting- Purpose, Preparation and procedure of meeting, follow up

Symposium and seminar

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

Unit 6- Reports and Memo

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

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

Email etiquettes.

Text Book-

1) Raman & Sharma," Technical communication", Oxford University Press.
2) T. Balsubramaniam, " Textbook of English Phonetics for Indian Students", Macmillan India LTD.

Reference books :-

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

Dr.M.P Gandhi,

BOS Chairman,

General Engineering

Yeshwantrao Chavan College of Engineering,

Nagpur.

Dr. Manjusha P. Gandhi
First Year Coordinator
Yeshwantrao Chavan College Of Engineering
Nagpur

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Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Semester I
Course Code: AIDS2104/CSD2154/IIOT2156/AIML2102

Credits: 3 (3 Lecture Per Week)
Course Name: Technical Communication

Objectives	Course Outcome
1. To Explain the fundamentals of communication 2. To Classify the different speech sounds of English 3. To Apply Different components of oral communication 4. To Draft technical documents	Upon completion of the course, students will have the ability to, 1. Apply different modes for effective communication 2. competently use the phonology of English language 3. Apply nuances of LSRW skills 4. Communicate through different channels

Unit No.	Contents	Max. Hrs.
1	**Basics of Communication** Language as a tool of communication & characteristics of language Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Classification of Barriers (Intrapersonal, Interpersonal, Organizational).	6
2	English Phonetics Speech Mechanism, Organs of speech, Consonant and Vowels sounds, Worde stress rules	6
3	Interview Skills Purpose , expectations of employer and preparation for Interview, Types, Types of Questions & Answering Techniques, Telephonic Interviews – preparation and guidelines, Reading Techniques (Exercise based on Complex Unseen passages	5
4	Oral Skills Group Communication- (Purpose, Different types of Group Communication, Organizational GD, GD as a part of selection process), Meeting (purposes, preparation, procedure and minutes of meeting), Listening Skills -definition types and traits	6
5	Presentation & Visual Communication Presentation and audience analysis, Organizing content, Nuances of presentation, Visual Communication – Introduction & importance, Role & Psychology of color	6

	in visual communication.	
6	Technical Written Communication Memo, Email, Report -Types, Characteristics, prewriting aspects of report and preparing writing aspects of report), Types of paragraphs.	6

Text Books :
1. Technical Communication, Raman & Sharma, Oxford University Press 2. Textbook of English Phonetics for Indian Students, T. Balasubramaniam, Macmillan India Ltd

Reference Books :
1. How to Develop Self – Confidence & Influence People by Public Speaking, Dale Carnegie 2. Communication Skills, Asha Kaul 3. Body Language, Allen Peas 4. Gerson's Gerson – Technical Communication

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

Dr. Manjusha P. Gandhi
First Year Coordinator
Yeshwantrao Chavan College Of Engineering
Nagpur

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering Nagpur

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NAAC Accredited with 'A++' Grade

OFFICE OF FIRST YEAR COORDINATOR,

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

	Introduction to Japanese 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 Japanese language and civilization and is therefore of an elementary level. At the end of the 40 hours course, the student is expected to acquire the following skills: 1) Elementary communication skills, based on oral and written comprehension of common words and simple sentences in Japanese. 2) Simple oral and written expression.	a) Understand simple words and expressions spoken slowly and distinctly in Japanese and used in day-to-day situations related to the student's immediate environment. b) Read and understand common words and sentences in Japanese. c) Say a few words in Japanese in conversations related to simple day-to-day situations.

Unit-I : Grammar I – 10 hours

- Frist Script - Hiragana
- Reading and Writing

Unit-II : Grammar II – 10 hours

- Basic Introduction
- Basic Sentences

Unit-III : Vocabulary – 6 hours

- Numbers (1-10000)
- Days of the week
- Months of the year
- Daily Greeting

Unit-IV : Communication skills I – 6 hours

- Interrogation relating to everyday situations
- Replying to simple questions

Unit-V : Communication skills II – 4 hours

- Day to day life, eg.
- Classroom
- Friends
- Family
- School
- Vacations

Unit-VI : Civilization – 4 hours

- History
- Geography

Text book recommended:

1) Minna no Nihongo , by JF .
2) Marugoto by JF
3) Fujichan , By Mandar Sugwekar

Dr. Manjusha P. Gandhi
Chairman-Board of Studies-General Engineering

Dr. Manjusha P. Gandhi
First Year Coordinator
Yeshwantrao Chavan College Of Engineering
Nagpur

I Semester
AIDS2104: Technical Communications

Objective	Course Outcome
1. To Explain the fundamentals of communication 2. To Classify the different speech sounds of English 3. To Apply Different components of oral communication 4. To Draft technical documents	Upon completion of the course, students will have the ability to, 1. Apply different modes for effective communication 2. competently use the phonology of English language 3. Apply nuances of LSRW skills 4. Communicate through different channels

Unit No.	Contents	Max. Hrs.
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2. Textbook of English Phonetics for Indian Students, T. Balasubramaniam, Macmillan India Ltd

Reference Books :

1. How to Develop Self – Confidence & Influence People by Public Speaking, Dale Carnegie
2. Communication Skills, Asha Kaul
3. Body Language, Allen Peas
4. Gerson's Gerson – Technical Communication

I Semester
AIDS2105: Lab.: Technical Communications

Objective	**Course Outcome**
1. To Explain the fundamentals of communication 2. To Classify the different speech sounds of English 3. To Apply Different components of oral communication 4. To Draft technical documents	Upon completion of the course, students will have the ability to, 1. Apply different modes for effective communication 2. competently use the phonology of English language 3. Apply nuances of LSRW skills 4. Communicate through different channels

Sr. No.	List of Experiment
1	Hands on for Consonants and vowel sounds
2	Grooming session for effective use of body language
3	Mock Sessions for Interview
4	Group Discussion
5	Creation of Visual Media – preparing poster boards, advertisements, banners and flyers
6	Official Report writing
7	Official Mail composing
8	Mail Merge
9	Exporting data from excel to Word

Text Books :

1. Technical Communication, Raman & Sharma, Oxford University Press
2. Textbook of English Phonetics for Indian Students, T. Balasubramaniam, Macmillan India Ltd

Reference Books :

1. How to Develop Self – Confidence & Influence People by Public Speaking, Dale Carnegie
2. Communication Skills, Asha Kaul
3. Body Language, Allen Peas
4. Gerson's Gerson – Technical Communication

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Hingna Road, Wanadongri, Nagpur - 441 110
NAAC Accredited with 'A++' Grade
Ph.: 07104-242919, 242623, 242588
Website : www.ycce.edu E-mail : principal@ycce.edu

Declaration by Head of Institute

I hereby declared that the data, information and support documents attached herewith are genuine and correct to my knowledge.

Y. C. COLLEGE OF ENGINEERING
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NAGPUR

Principal
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road,
NAGPUR - 441110