**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**BASIC GEOTECHNICAL ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV54** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
4. Assesstheimprovementinmechanicalbehaviourbydensificationofsoildeposits using compaction.
5. Model and measure strength-deformation characteristics of soils.

**Module-1**

**Introduction:** Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships.
Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis(sieve and Hydrometer analysis)
Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).

**Module-2**

Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering

**Compaction of Soils:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

**Module -3**

**Flow through Soils:** Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.

**Seepage Analysis:** Laplace equation, assumptions, limitation sand its derivation. Flow nets-characteristics and applications. Flow nets for sheet piles and below the dam section.
Unconfined flow, phreaticline (Casagrande's method–with and without toe filter), flow through dams, design of dam filters.

**Effective Stress Analysis:**
Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.

**Module -4**

**Shear Strength of Soil:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.

**Module-5**

**Consolidation of Soil:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidationtheory-assumptionsandlimitations.GoverningdifferentialEquation and solution (No derivation).
Consolidation characteristics of soil ($C_c$, $a_v$, $m_v$ and $C_v$). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils.

Determination of consolidation characteristics of soils- compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

**Course outcomes:** On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India.


**Reference Books:**


1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, “Geotechnical Engineering”, Universities Press.,
5. Malcolm D Bolton, “A Guide to soil mechanics”, Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**HYDROLOGY AND IRRIGATION ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV63** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

**Module -1**

**Hydrology:** Introduction, Importance of hydrology, Global distribution of water and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

**Precipitation:** Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

**Module -2**

**Losses: Evaporation:** Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control.

**Evapo-transpiration:** Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation.

**Infiltration:** Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

**Module -3**

**Runoff:** Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.

**Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.

**Module -4**

**Irrigation:** Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation.

**Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

**Module -5**

**Canals:** Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.

**Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.

**Course outcomes:** After studying this course, students will be able to:

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.

4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
3. Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.


**Reference Books:**


1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N "Water Resources and Water Power Engineering"-. Standard book house, Delhi.
5. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications, New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**ALTERNATE BUILDING MATERIALS**

| | | | |
|---|---|---|---|
| Course Code | **18CV643** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This Course will enable students to:

1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

**Module -1**

**Introduction:** Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.

**Module -2**

**Elements of Structural Masonry :** Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

**Structural Masonry Mortars:** Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar.

Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

**Module -3**

**Alternate Building Materials:** Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.

**Module -4**

**Alternate Building Technologies:** Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications.

Top down construction, Mivan Construction Technique.

**Alternate Roofing Systems:** Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

**Module -5**

**Equipment for Production of Alternate Materials:** Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

**Course Outcomes:** After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers.


**Reference Books:**


1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**DESIGN OF RC STRUCTURAL ELEMENTS**

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|---|---|---|---|
| Course Code | **18CV53** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability and durability.
4. Provide knowledge in analysis and design of RC elements.

**Module-1**

**Introduction to working stress and limit State Design:** Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method.

Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

**Module-2**

**Limit State Analysis of Beams:**
Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.

**Module-3**

**Limit State Design of Beams:** Design of singly and doubly reinforced beams, Design of flanged beams, design for combined bending, shear and torsion as per IS-456.

**Module-4**

**Limit State Design of Slabs and Stairs:** Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.

**Module-5**

**Limit State Deign of Columns and Footings:** Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.

**Course outcomes:** After studying this course, students will be able to:

1. Understand the design philosophy and principles.
2. Solve engineering problems of RC elements subjected to flexure, shear and torsion.
3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
4. Owns professional and ethical responsibility.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

- The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper.

**Textbooks:**


1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi
2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.


**Reference Books:**

1. P C Varghese, “Limit State design of reinforced concrete” , PHI, New Delhi.
2. W H Mosley, R Husle, J H Bungey, “Reinforced Concrete Design”, MacMillan Education, Palgrave publishers.
3. Kong and Evans, “Reinforced and Pre-Stressed Concrete”, Springer Publications.
4. A W Beeby and Narayan R S, “Introduction to Design for Civil Engineers”, CRC Press.
5. Robert Park and Thomas Paulay, “Reinforced Concrete Structures”, John Wiley & Sons, Inc.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**HIGHWAY ENGINEERING**

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|---|---|---|---|
| Course Code | **18CV56** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.

**Module -1**

**Principles of Transportation Engineering:** Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute.

**Highway Development and Planning:** Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.

**Highway Alignment and Surveys**: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.

**Module -2**

**Highway Geometric Design of horizontal alignment elements:** Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Radius of curve, Transition curve, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves.

**Module -3**

**Pavement Materials:** Sub grade soil - desirable properties-HRB soil classification-determination of CBR and modulus of sub grade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.

**Module -4**

**Pavement Construction:** Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base iii) WMM base,iv) Bituminous Macadam v) Dense Bituminous Macadam vi) Bituminous Concrete,vii) Dry Lean Concrete sub base and PQC viii) concrete roads.

**Module -5**

**Highway Drainage:** Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

**Highway Economics:** Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.

**Course Outcomes:** After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K. P.Subramanium, "Transportation Engineering", SciTech Publications, Chennai.


**Reference Books:**


1. Relevant IRC Codes.
2. Specifications for Roads and Bridges-MoR T&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

**BUILDING MATERIALS AND CONSTRUCTION**

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|---|---|---|---|
| Course Code | **18CV34** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will develop a student;

1. To recognize good construction materials based on properties.
2. To investigate soil properties and design suitable foundation.
3. To understand the types and properties of masonry materials and supervise masonry construction.
4. To gain knowledge of structural components like lintels, arches, staircase and roofs.
5. To understand the finishes in construction like flooring, plastering, paining.

**Module-1**

**Building Materials**: Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.

Cement Concrete blocks, Autoclaved Aerated Concrete Blocks, Sizes, requirement of good blocks.

Timber as construction material.

Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.

Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

**Module-2**

**Foundation:** Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation

**Masonry:** Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls.

**Module-3**

**Lintels and Arches**: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.

**Floors and roofs:** Floors; Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring, Cladding of tiles.

Roof: Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

**Module-4**

**Doors, Windows and Ventilators**: Location of doors and windows, technical terms, Materials for doors and windows: PVC, CPVC and Aluminum. Types of Doors and Windows: Paneled, Flush, Collapsible, Rolling shutter, Paneled and glazed Window, Bay Window, French window. Steel windows, Ventilators. Sizes as per IS recommendations.

**Stairs:** Definitions, technical terms and types of stairs: Wood, RCC, Metal. Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.

**Formwork:** Introduction to form work, scaffolding, shoring, under pinning.

**Module-5**

**Plastering and Pointing:** Mortar and its types. Purpose, materials and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, defects in plastering . Water proofing with various thicknesses.

**Damp proofing**- causes, effects and methods.

**Paints**- Purpose, types, technical terms, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

**Course outcomes:** After a successful completion of the course, the student will be able to:

1. Select suitable materials for buildings and adopt suitable construction techniques.
2. Decide suitable type of foundation based on soil parameters
3. Supervise the construction of different building elements based on suitability
4. Exhibit the knowledge of building finishes and form work requirements

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

**Textbooks:**


1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015,StandardPublishers
2. Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.


**Reference Books:**


1. S. K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2. P C Vergese, "Building Materials", PHI Learning Pvt.Ltd
3. Building Materials and Components, CBRI, 1990,India
4. Jagadish. K.S, "Alternative Building Materials Technology", New Age International,2007.
5. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**APPLIED GEOTECHNICAL ENGINEERING**

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|---|---|---|---|
| Course Code | **18CV62** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geo-technology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

**Module-1**

**Soil Exploration:** Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

**Module-2**

**Stress in Soils**: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart.
**Foundation Settlement**: Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

**Module-3**

**Lateral Earth Pressure**: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction.
**Stability of Slopes :**Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts.

**Module-4**

**Bearing Capacity of Shallow Foundation:** Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.

**Module-5**

**Pile Foundations:** Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).

**Course outcomes:** On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

**Question paper pattern:**

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Distributors, New Delhi.
3. P C Varghese, Foundation Engineering, PHI India Learning Private Limited, New Delhi.
4. Punmia B C, Soil Mechanics and Foundation Engineering-(2017), 16thEdition, Laxmi Publications co., New Delhi.


**Reference Books:**


1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, “Geotechnical Engineering”, Universities Press.,
5. Malcolm D Bolton, “A Guide to soil mechanics”, Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.
7. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP**

| | | | |
|---|---|---|---|
| Course Code | **18CV51** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (2:2:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties.

**Module -1**

**Management:** Characteristics of management, functions of management, importance and purpose of planning process, types of plans.

**Construction Project Formulation:** Introduction to construction management, project organization, management functions, management styles.

**Construction Planning and Scheduling:** Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, PERT method, concept of activity on arrow and activity on node.

**Module -2**

**Resource Management:** Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.

**Construction Equipments:** classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance

**Materials:** material management functions, inventory management.

**Module -3**

**Construction Quality , safety and Human Values:**

Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management

**HSE: Introduction** to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.

**Ethics :** Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

**Module -4**

**Introduction to engineering economy:** Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.

**Interest and time value of money:** concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.

**Comparison of alternatives:** Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.

**Module -5**

**Entrepreneurship:** Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.

Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC.

**Business Planning Process:** Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.

**Course Outcomes:** After studying this course, students will be able to:

1. Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence.
2. Understand labour output, equipment efficiency to allocate resources required for an activity / project to achieve desired quality and safety.
3. Analyze the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value.
4. Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. P C Tripathi and P N Reddy, “Principles of Management”, Tata McGraw-Hill Education
2. Chitkara, K.K, “Construction Project Management: Planning Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , “Entrepreneurship Development and Small Business Enterprise”, Dorling Kindersley (India) Pvt. Ltd., Licensees of PearsonEducation
4. Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:


**Reference Books:**


1. Robert L Peurifoy, Clifford J. Schexnayder, AviadShapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-HillEducation
2. Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, NewDelhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell
4. Mike Martin, Roland Schinzinger, “Ethics in Engineering”, McGraw-HillEducation
5. Chris Hendrickson and Tung Au, “Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall,Pitsburgh
6. James L.Riggs, David D. Bedworth , Sabah U. Randhawa “ Engineerng Economics” 4

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VIII**

**PAVEMENT DESIGN**

| | | | |
|---|---|---|---|
| Course Code | **18CV825** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas ) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

**Module -1**

**Introduction**: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement

Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.

**Module -2**

**Design Factors:** Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.

Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above.

**Module -3**

**Flexible Pavement Failures, Maintenance and Evaluation:** Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflecto meter, GPR method. Design factors for runway pavements, Design methods for

Airfield pavement and problems on above.

**Module -4**

**Stresses in Rigid Pavement** : Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above.

**Design of Rigid Pavement**: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above.

**Module -5**

**Rigid Pavement Failures, Maintenance and Evaluation:** Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints.

**Course outcomes:** After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky.


**Reference Books:**


1. Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.
2. SubhaRao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design", University Press.
4. Relevant recent IRC codes

**CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - IV**

**CONCRETE TECHNOLOGY**

| | | | |
|---|---|---|---|
| Course Code | **18CV44** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to:

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

**Module-1**

**Concrete Ingredients** Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice huskash.

**Module-2**

**Fresh Concrete** Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

**Module-3**

**Hardened Concrete** Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

**Module-4**

**Concrete Mix Proportioning**

Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.

**Module-5**

**Special Concretes**

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications, materials, requirements, mix proportion and properties of Geo polymer Concrete, High Strength Concrete and High Performance Concrete.

**Course outcomes:** After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behavior based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
4. Adopt suitable concreting methods to place the concrete based on requirement.
5. Select a suitable type of concrete based on specific application.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Neville A.M. "Properties of Concrete"-4th Ed., Longman.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014
4. A.R. Santha Kumar, "Concrete Technology", Oxford Un iversity Press, New Delhi (NewEdition).


**Reference Books:**


1. M L Gambir, "Concrete Technology", McGraw Hill Education,2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, "Concrete Technology", CENGAGE Learning,2015.
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC.
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

**Course Title: Environmental Engineering Laboratory**
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VII

| | | | |
|---|---|---|---|
| Subject Code | 15CVL76 | IA Marks | 20 |
| Number of Lecture Hours/Week | 1I+2P | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |
| | **CREDITS –02** | **Total Marks- 100** | |

**Course objectives:** This course will enable students,
1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

| Experiments | Teaching Hours | Revised Bloom's Taxonomy (RBT) Level |
|---|---|---|
| 1. Determination of pH, Acidity and Alkalinity | 02 Class | L1,L2,L3 |
| 2. Determination of Calcium, Magnesium and Total Hardness. | 02 Class | L1,L2,L3 |
| 3. Determination of Dissolved Oxygen.<br>4. Determination of BOD. | 02 Class | L1,L2,L3 |
| 5. Determination of Chlorides | 01 Class | L1,L2,L3 |
| 6. Determination of percentage of available chlorine in bleaching powder, Determination of Residual Chlorine | 01 Class | L1,L2,L3 |
| 7. Determination of Solids in Sewage:<br>I) Total Solids,<br>II) Suspended Solids,<br>III) Dissolved Solids,<br>IV) Volatile Solids, Fixed Solids,<br>V) Settle able Solids.<br>8. Determination of Turbidity by Nephelometer<br>9. Determination of Optimum Dosage of Alum using Jar test apparatus. | 02 Class | L1,L2,L3 |
| 10. Determination of sodium and potassium using flame photometer. | 01 Class | L1,L2,L3 |
| 11. Determination Nitrates by spectrophotometer.<br>12. Determination of Iron & Manganese. | 01 Class | L1,L2,L3 |
| 13. Determination of COD. | Demonstration | L1,L2,L3 |
| 14. Air Quality Monitoring (Ambient, stack monitoring , Indoor air pollution) | Demonstration | L1,L2,L3 |
| 15. Determination of Sound by Sound level meter at different location | Demonstration | L1,L2,L3 |

**Course Outcomes:** After studying this course, students will be able to:
1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.
3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental stream.

**Program Objectives:**
1. Evaluation of the test results and assesses the impact on water and waste water treatment.
2. Train student to undertake student project work in $8^{th}$ semester in the field of environmental engineering.

**Question paper pattern:**
Two experiments shall be asked from the above set
One experiment to be conducted and for the other student should write detailed procedure.

**Reference Books:**

1. Lab Manual, ISO 14001 Environmental Management, Regulatory Standards for Drinking Water and Sewage disposal
2. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science" , McGraw-Hill Series in Civil and Environmental Engineering

**TITLE OF THE COURSE: Concrete Technology B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]**

| | | | |
|---|---|---|---|
| **Course Code** | **17 CV44** | **CIE Marks** | **40** |
| **Number of Lecture Hours/Week** | **04** | **SEE Marks** | **60** |
| **Total Number of Lecture Hours** | **50 (10 Hours per Module)** | **Exam Hours** | **03** |

**Credits – 04**

**Course objectives:** This course will enable students to:

1. Recognize the importance of material characteristics and their contributions to strength development in Concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

**Module-1**

**Concrete Ingredients**

Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash.

L1, L2, L3

**Module-2**

**Fresh Concrete**

Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

L1, L2, L3

**Module-3**

**Hardened Concrete** Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per

IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

L1, L2, L3

**Module-4**

**Concrete Mix Proportioning**

Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262

L1, L2, L3, L4

**Module-5**

**Special Concretes**

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and aplications

L1, L2, L3 L4

**Course outcomes:**

After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behaviour based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.

**Text Books:**


1. Neville A.M. “Properties of Concrete”-4th Ed., Long man.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro “Concrete-Mi crostructure, Property and Materials”, 4th Edition, McGraw Hill Education, 201 4
4. A.R. Santha Kumar, “Concrete Technology”, Oxford Un iversity Press, New Delhi (New Edition)

1. M L Gambir, “Concrete Technology”, McGraw Hill Educ ation, 2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, “Concrete Technology”, CENGAGE Learning , 2015
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete]Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House

# ADVANCED STRUCTURAL ANALYSIS

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – II**

| | | | |
|---|---|---|---|
| Subject Code | **20CSE11** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 4:0:0 | SEE Marks | 60 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS – 04**

**Prerequisites:**

- Strength of Materials
- Structural Analysis

**Course objectives:**

Students will be given provided with the knowledge of mathematics, science, and engineering in the in the analysis of following structural systems curved beams, Beams on elastic foundation, shear centre and unsymmetrical bending and buckling of non-prismatic columns and beam column.

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| **Module-1** | | |
| **Curved Beams**<br>Curved beams, Introduction, assumptions, derivation of WINKLER BACH equation, Radius to the neutral surface of simple geometric figures, Limitation, Stress distribution in open curved members such as Hooks and chain links, Stress distribution in closed rings and chain links. Deformations of open and closed rings. | **10 Hours** | |
| **Module-2** | | |
| **Beams on Elastic Foundations**<br>Governing differential equation for elastic line, Interpretation of constants, Infinite beam with point load, moment & UDL with problems. Semi-infinite beams with point load and moment UDL with problems over fixed and hinged support conditions. | **10 Hours** | |

| | | |
|---|---|---|
| **Module -3** | | |
| **Shear Centre**<br>Concept of shear center in torsion induced bending of beams, expression to the Shear Centre for Symmetrical and Unsymmetrical Sections, Derivation of shear centre for angles, channel, semicircular and built-up sections with numerical problems | **10 Hours** | |
| **Module -4** | | |
| **Unsymmetrical Bending (Asymmetrical Bending)**<br>Theory behind unsymmetrical bending, Assumptions, obtaining the stresses in beams, simply supported and cantilever unsymmetrical beams subjected to inclined loading, Deflections of unsymmetrical simply supported and cantilever beams with numerical problems. | **10 Hours** | |
| **Module -5** | | |
| **Buckling of Non Prismatic Columns and Beam-Column**<br>Principle behind Euler's theory of buckling, Governing differential equation applied to buckling of columns and evaluation of constants for various boundary conditions, Obtaining the characteristic equation for the buckling load of non-prismatic compound columns, Analysis of Beam-column, conceptual theory of magnification stresses and deformations subjected to axial and different types of lateral loads with numerical problems. | **10 Hours** | |

**Course Outcomes:** Students will be able to

- Apply Winkler Bach and Strain Energy principles to obtain stresses and deformation in curved members
- Derive the expressions to Foundation pressure, Deflection, Slope, BM and SF of infinite and semi-infinite Beams resting on Elastic Foundation
- Obtain the equations for the shear centre for symmetrical and unsymmetrical from fundamental.
- Extrapolate the bending theory to calculate the stresses and deformations in unsymmetrical bending.
- Develop the characteristic equation for the buckling load of compound column and stresses and deformations in beam-column

**Question paper pattern:**

The question paper will have ten questions; each question carries equal marks, there will be two full questions or with a maximum of four sub questions from each module, students will have to attend five full questions from each module.

**Text Books**

1) Krishna Raju N & Gururaj D R "Advanced mechanics of solids and structures", NAROSA Publishers Company Delhi.
2) Srinath L.S. "Advanced Mechanics of Solids", Tenth Print, Tata McGraw Hill publishing company. New Delhi, 1994.

**Reference Books**

1) Vazirani V N and Ratwani M M "Advanced theory of structures and Matrix Method". 5th Edition, Khanna publishers, Delhi 1995.
2) HetenyiM."Beams on elastic foundation" 3rd printing, University of Michigan, USA, 1952.
3) Alexander Chatjes "Principles of Structural stability theory", Prentice – Hall of India, New Delhi, 1974.
4) Sterling Kinney "Indeterminate Structural Analysis", Oxford & IBH publishers

# MECHANICS OF DEFORMABLE BODIES

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – I**

| | | | |
|---|---|---|---|
| Subject Code | **20CSE14** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 3:0:2 | SEE Marks | 60 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS – 04**

**Prerequisites:**

**Basics of Mathematics, Strength of Materials**

**Course objectives:**

Course objectives: The objective of this course is to make students to learn principles of Analysis of Stress and Strain, To predict the stress-strain behaviour of continuum. To evaluate the stress and strain parameters and their inter relations of the continuum

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| **Module-1** | | |
| Theory of Elasticity: Introduction: Definition of stress and strain and strain at a point, components of stress and strain at appoint of Cartesian and polar coordinates. Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases. | **8 Hours** | **L1, L2** |
| **Module-2** | | |
| Transformation of stress and strain at a point,Principal stresses and principal strains, invariants ofstress and strain, hydrostatic and deviatric stress,spherical and deviatric strains max. shear strain. | **8 Hours** | **L2, L3** |
| **Module -3** | | |
| Plane stress and plane strain: Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams. Solution of axisymmetric problems, stress concentration due to the presence of a circular hole in plates. | **8 Hours** | **L2, L3** |
| **Module -4** | | |

| | | |
|---|---|---|
| Elementary problems of elasticity in three dimensions, stretching of a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy, Propagation of waves in solid media. Applications of finite difference equations in elasticity. | **8 Hours** | **L2, L3, L4** |
| **Module -5** | | |
| Theory of Plasticity: Stress – strain diagram in simpletension, perfectly elastic, Rigid – Perfectly plastic, Linear work – hardening, Elastic Perfectly plastic, Elastic Linear work hardening materials, Failure theories, yield conditions, stress – space representation of yield criteria through Westergard stress space, Tresca and Von-Mises criteria of yielding | **8 Hours** | **L1, L2** |

**Course outcomes:**

On completion of this course, students are able to:

- Achieve Knowledge of design and development of problem solving skills.
- Understand the principles of stress-strain behaviour of continuum
- Design and develop analytical skills.
- Describe the continuum in 2 and 3- dimensions
- Understand the concepts of elasticity and plasticity

**Question paper pattern:**

The question paper will have ten questions; each question carries equal marks, there will be two full questions or with a maximum of four sub questions from each module, students will have to attend five full questions from each module.

**Reference Books:**


1. Timoshenko &Goodier, “Theory of Elasticity”, McGraw Hill
2. Srinath L.S., Advanced Mechanics of Solids, 10th print, Tata McGraw Hill Publishing company, New Delhi, 1994.
3. Sadhu Singh, “Theory of Elasticity”, Khanna Publishers
4. Verma P.D.S, “Theory of Elasticity”, Vikas Publishing Pvt. Ltd
5. Chenn W.P and Hendry D.J, “Plasticity for Structural Engineers”, Springer Verlag
6. Valliappan C, “Continuum Mechanics Fundamentals”, Oxford IBH Publishing Co.Ltd.
7. Sadhu Singh, “Applied Stress Analysis”, Khanna Publishers
8. Xi Lu, “Theory of Elasticity”, John Wiley.

# EARTHQUAKE RESISTANT STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – II**

| | | | |
|---|---|---|---|
| Subject Code | **20CSE23** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 3:0:2 | SEE Marks | 60 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS – 04**

**Prerequisites:**

- Structural Dynamics

**Course objectives:**

The objective of this course is to make students to learn principles of engineering seismology, To design the reinforced concrete buildings for earthquake resistance. To evaluate the seismic response of the structures

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| **Module-1** | | |
| Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devises, base isolation systems. | **8 Hours** | **L1, L2** |
| **Module-2** | | |
| The Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storied buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893. | **8 Hours** | **L2, L3, L4, L5** |
| **Module -3** | | |

| | | |
|---|---|---|
| Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions. | **8 Hours** | **L2, L4, L5** |
| **Module -4** | | |
| Design of Reinforced concrete buildings for earthquake resistance-Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS1893. Structural behavior, design and ductile detailing of shear walls. | **8 Hours** | **L2, L4, L5** |
| **Module -5** | | |
| Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures. | **8 Hours** | **L2, L5, L6** |

**Course Outcome:** On completion of this course, students are able to:

- Achieve Knowledge of design and development of problem solving skills.
- Understand the principles of engineering seismology
- Design and develop analytical skills.
- Summarize the Seismic evaluation and retrofitting of structures.
- Understand the concepts of earthquake resistance of reinforced concrete buildings.

**Question paper pattern:**

The question paper will have ten questions; each question carries equal marks, there will be two full questions or with a maximum of four sub questions from each module, students will have to attend five full questions from each module.

**Reference Books:**

1. Dynamics of Structures – Theory and Application to Earthquake Engineering- 2nd ed. – Anil K. Chopra, Pearson Education.

2. Earthquake Resistant Design of Building Structures, Vinod Hosur, WILEY (india)

3. Earthquake Resistant Design of Structures, Duggal, Oxford University Press.

4. Earthquake resistant design of structures - Pankaj Agarwal, Manish Shrikande - PHI India.

5. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993

6. Design of Earthquake Resistant Buildings, Minoru Wakabayashi, McGraw Hill Pub.

7. Seismic Design of Reinforced Concrete and Masonry Buildings, T Paulay and M J N Priestley, John Wiley and Sons.

# FINITE ELEMENT METHOD OF ANALYSIS

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – II**

| | | | |
|---|---|---|---|
| Subject Code | **20CSE22** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 3:0:2 | SEE Marks | 60 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS – 04**

**Prerequisites:**

- Computational structural Mechanics
- Theory of Elasticity

**Course objectives:**

- To provide the fundamental concepts of the theory of the finite element method
- To develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results) to realistic engineering problems through the use of softwares

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| **Module-1** | | |
| Basic concepts of elasticity, Kinematic and Static variables for various types of structural problems, approximate methods of structural analysis–Rayleigh–Ritz method, Finite difference method, Finite element method. Variation method and minimization of Energy approach of element formulation, Principles of finite element method, advantages and disadvantages, Finite element procedure, Finite elements used for one, two and three dimensional problems, C0, C1 and C2 type elements, Element aspect ratio, Mesh refinement vs. higher order elements, Numbering of nodes to minimize bandwidth. | **8 Hours** | **L1, L2** |
| **Module-2** | | |
| Nodal displacement parameters, Convergence criterion, Compatibility requirements, Geometric invariance, Shape function, Polynomial form of displacement function, Generalized and Natural coordinates, Lagrangian interpolation function, shape functions for one, two &three | **8 Hours** | **L1, L2, L4, L5** |

| | | |
|---|---|---|
| dimensional elements. | | |
| **Module -3** | | |
| Isoparametric elements, Internal nodes and higher order elements, Serendipity and Lagrangian family of Finite Elements, Sub-parametric and Super- parametric elements, Condensation of internal nodes, Jacobian transformation Matrix, Development of strain-displacement matrix and stiffness matrix, consistent load vector, numerical integration. | **8 Hours** | **L1, L2, L4, L5** |
| **Module -4** | | |
| Application of Finite Element Method for the analysis of one & two dimensional problems: Analysis of plane trusses and beams, Application to plane stress/strain, Axisymmetric problems using CST and Quadrilateral Elements | **8 Hours** | **L1, L2, L3, L4, L5** |
| **Module -5** | | |
| Application to Plates and Shells, Non-linearity: material, geometric and combined non- linearity, Techniques for Non-linear Analysis. | **8 Hours** | **L1, L2** |

**Course Outcome:**

After successful completion of this the course, students shall be able to:

- Explain the basic theory behind the finite element method.
- Formulate force-displacements relations for 2-D elements
- Use the finite element method to analyze real structures.
- Use a Finite Element based program for structural analysis

**Question paper pattern:**

The question paper will have ten questions; each question carries equal marks, there will be two full questions or with a maximum of four sub questions from each module, students will have to attend five full questions from each module.

**Reference Books:**


- Zeinkeiwich, O.C. and Tayler, R.L., The Finite Element Method for Solid and Structural Mechanics, Butterworth-Heinemann,2013
- Krishnamoorthy,C.S., Finite Element Analysis: Theory and programming, Tata McGraw Hill Publishing Co. Ltd., 2017
- Desai, C., and Abel, J. F., Introduction to the Finite Element Method: A Numerical method for Engineering Analysis, East West Press Pvt. Ltd.,1972
- Cook, R.D., Malkas, D.S. and Plesha., M.E., Concepts and applications of Finite Element Analysis, John Wiley and Sons., 2007
- Reddy, J., An Introduction to Finite Element Methods, McGraw Hill Co., 2013
- Bathe K J, Finite Element Procedures in Engineering Analysis, Prentice Hall
- Shames,I.H. and Dym,C.J., Energy and Finite Element Methods in Structural Mechanics, McGraw Hill, New York,1985

# ADVANCED DESIGN OF RC STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – I**

| | | | |
|---|---|---|---|
| Subject Code | **20CSE13** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 3:0:2 | SEE Marks | 60 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS – 04**

**Prerequisites:** An undergraduate course on reinforced concrete.

**Course objectives:**

The objective of this course is to make students to learn principles of Structural Design, to design different types of structures and to detail the structures. To evaluate performance of the structures

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| **Module-1** | | |
| • Design of R C slabs by yield line method<br>• Design of flat slabs | **8 Hours** | **L1, L2, L3, L4, L5** |
| **Module-2** | | |
| • Design of grid or coffered floors<br>• Design of continuous beams with redistribution of moments | **8 Hours** | **L1, L2, L3, L4, L5** |
| **Module -3** | | |
| • Design of R C Chimneys | **8 Hours** | **L1, L2, L3, L4,** |
| **Module -4** | | |
| • Design of R C silos<br>• Design of R C bunkers | **8 Hours** | **L1, L2, L4, L5** |
| **Module -5** | | |
| **Formwork:**<br>Introduction, Requirements of good formwork, Materials for forms, choice of formwork, Loads on formwork, Permissible stresses for timber, Design of formwork, Shuttering for columns, Shuttering for slabs and beams, Erection of Formwork, Action prior to and during concreting, Striking of forms. Recent developments in form work. | **8 Hours** | **L1, L2** |

**Course outcomes:**

On completion of this course, students are able to:

1. Achieve Knowledge of design and development of problem solving skills
2. Understand the principles of Structural Design.
3. Design and develop analytical skills.
4. Summarize the principles of Structural Design and detailing
5. Understands the structural performance.

**Question paper pattern:**

The question paper will have ten questions; each question carries equal marks, there will be two full questions or with a maximum of four sub questions from each module, students will have to attend five full questions from each module.

**Reference Books:**


1. Hsu T. T. C. and Mo Y. L., "Unified Theory of Concrete Structures", John Wiley & Sons, 2010
2. Krishnamurthy, K.T., Gharpure S.C. and A.B. Kulkarni – "Limit design of reinforced concrete structures",Khanna Publishers, 1985
3. Lin T Y and Burns N H., "Reinforced Concrete Design". Wiley, 2004
4. Park & Paunlay.,"Reinforced Concrete Structures". Wiley, 2004
5. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive RCC Design", Laxmi Publications, New Delhi
6. Purushothaman. P., "Reinforced Concrete Structural Elements : Behaviour Analysis and Design", TataMc Graw Hill, 1986
7. Sinha. N.C. and Roy S.K., "Fundamentals of Reinforced Concrete", S. Chand and Company Limited, NewDelhi, 2003
8. Unnikrishna Pillai and Devdas Menon., "Reinforced concrete Design', Tata McGraw Hill PublishersCompany Ltd., New Delhi, 2006
9. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, 2007
10. Varghese. P. C., "Advanced Reinforced Concrete Design", Prentice-Hall of India, New Delhi, 2000


**Recommended Reading:**


1. Krishna Raju. N., "Advanced Reinforced Concrete Design", CBS Publishers & Distributors
2. Pillai S. U. and Menon D., "Reinforced Concrete Design", Tata McGraw-Hill, 3rd Ed, 1999
3. Relevant IS Code Books
4. Shah.H.J, "Reinforced Concrete", Vol-1 and Vol-2, Charotar, 8th Edition – 2009 and 6th Edition – 2012 respectively.
5. Gambhir.M.L, "Design of Reinforced Concrete Structures", PHI Pvt. Ltd, New Delhi, 2008

**STRUCTURAL ENGINEERING LAB-1**
[As per Choice Based Credit System (CBCS) scheme]
**SEMESTER – I**

| | | | |
|---|---|---|---|
| Subject Code | **20CSEL16** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 1:3:0 | SEE Marks | 60 |
| Total Number of Lecture Hours | 42 | Exam Hours | 03 |

**CREDITS – 02**

**Prerequisites:** Concrete Technology, Special Concrete, Structural Analysis, Structural Dynamics

**Course objectives:**
The objective of this course is to make students to learn principles of design of experiments, To investigate the performance of structural elements. To evaluate the different testing methods and equipments.

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| 1. Experiments on Concrete, including Mix design | **12 Hrs** | **L1, L2, L3, L4, L5, L6** |
| 2. Testing of beams for deflection, flexure and shear | **12 Hrs** | |
| 3. Experiments on vibration of multi storey frame models for Natural frequency and modes. | **12 Hrs** | |
| 4. Use of Non destructive testing (NDT) equipments – Rebound hammer, Ultra sonic pulse velocity meter and Profometer | **06Hrs** | |

**Course outcomes:**On complete of this course the students will able to

- Achieve Knowledge of design and development of experimenting skills.
- Understand the principles of design of experiments
- Design and develop analytical skills.
- Summarize the testing methods and equipment's.

# STRUCTURAL DYNAMICS

[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

| Subject Code | **20CSE15** | CIE Marks | 40 |
|---|---|---|---|
| Teaching Hours/Week (L:P:SDA) | 3:0:2 | SEE Marks | 60 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS – 04**

**Course objectives:**

The objective of this course is to make students to learn principles ofStructural Dynamics, To implement these principles through different methods and to apply the same for free and forced vibration of structures. To evaluate the dynamic characteristics of thestructures

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| **Module-1** | | |
| Introduction: Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principleof virtual displacement and energy principles .<br><br>Dynamics of Single degree-of-freedom systems: Mathematical models of Single-degree-of-freedom systems system, Free vibration response of damped and undamped systems including methods for evaluation of damping. | **8 Hours** | **$L_1$, $L_2$, $L_5$** |
| **Module-2** | | |
| Response of Single-degree-of-freedom systems to harmonic loading including support motion, vibration isolation, transmissibility.<br>Numerical methods applied to Single-degree-of-freedom systems – Duhamel integral.<br>Principle of vibration measuring instruments– seismometer and accelerometer. | **8 Hours** | **$L_3$, $L_4$, $L_5$** |
| **Module -3** | | |
| Dynamics of Multi-degree freedom systems: Mathematical models of multi-degree-of-freedom systems, Shear building concept, free vibration of undamped multi-degree-of-freedom systems – Natural frequencies and mode shapes – Orthogonality of modes. | **8 Hours** | **$L_1$, $L_2$, $L_4$, $L_5$** |

| | | |
|---|---|---|
| **Module -4** | | |
| Response of Shear buildings for harmonic loading without damping using normal mode approach. Response of Shear buildings for forced vibration for harmonic loading with damping using normal mode approach. | **8 Hours** | **$L_3$, $L_4$, $L_5$** |
| **Module -5** | | |
| Approximate methods: Rayleigh's method, Dunkarley's method, Stodola's method.<br>Dynamics of Continuous systems: Flexural vibration of beams with different end conditions.<br>Stiffness matrix, mass matrix (lumped and consistent). | **8 Hours** | **$L_2$, $L_4$** |

**Course outcomes:**

On completion of this course, students are ableto:

- AchieveKnowledgeofdesignanddevelopmentofproblemsolvingskills.
- Understand the principles of StructuralDynamics
- Design and develop analyticalskills.
- Summarize the Solution techniques for dynamics of Multi-degree freedom systems
- Understand the concepts of damping instructures.

**Question paper pattern:**

The question paper will have ten questions; each question carries equal marks, there will be two full questions or with a maximum of four sub questions from each module, students will have to attend five full questions from each module.

**Reference Books:**


1. Dynamics of Structures – "Theory and Application toEarthquakeEngineering"- 2nd ed., Anil K. Chopra, Pearson Education.
2. Earthquake Resistant Design ofBuildingStructures,Vinod Hosur, WILEY (India)
3. Vibrations, structural dynamics- M. Mukhopadhaya : Oxford IBH
4. Structural Dynamics- Mario Paz: CBS publishers.
5. Structural Dynamics- Clough & Penzien: TMH
6. Vibration Problems in Engineering Timoshenko, S, Van-Nostrand Co.

## Matrix methods of Structural Analysis

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – I**

| | | | |
|---|---|---|---|
| Subject Code | **20CSE12** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 3:0:2 | SEE Marks | 60 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS – 04**

**Prerequisites:**

- Engineering Mechanics
- Strength of Materials
- Structural Analysis
- Matrix Algebra

**Course objectives:**

- To understand basic concepts of Matrix Methods of Structural Analysis
- To analyse the behavior of plane trusses, continuous beams, and portal frames

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| **Module-1** | | |
| **Basic concepts of structural analysis and methods of solving simultaneous equations:** Introduction, Types of framed structures, Static and Kinematic Indeterminacy, Equilibrium equations, Compatibility conditions, Principle of superposition, Energy principles, Equivalent joint loads, Methods of solving linear simultaneous equations- Gauss elimination method, Cholesky method and Gauss-Siedal method. | **8 Hours** | **L1,L2, L3,L4** |
| **Module-2** | | |
| **Fundamentals of Flexibility and Stiffness Methods:** Concepts of stiffness and flexibility, Local and Global coordinates, Development of element flexibility and element stiffness matrices for truss, beam and grid elements, Force-transformation matrix, Development of global flexibility matrix for continuous beams, plane trusses and 1rigid plane frames, Displacement-transformation matrix, Development of global stiffness matrix for continuous | **8 Hours** | **L1,L2, L3,L4** |

| | | |
|---|---|---|
| beams, plane trusses and rigid plane frames. | | |
| **Module-3** | | |
| **Analysis using Flexibility Method:** Continuous beams, plane trusses and rigid plane frames | **8 Hours** | **L2,L3, L4,L5** |
| **Module-4** | | |
| **Analysis using Stiffness Method:** Continuous beams, plane trusses and rigid plane frames | **8 Hours** | **L2,L3, L4,L5** |
| **Module-5** | | |
| **Direct Stiffness Method:** Stiffness matrix for truss element in local and global coordinates, Analysis of plane trusses, Stiffness matrix for beam element, Analysis of continuous beams and orthogonal frames. | **8 Hours** | **L2,L3, L4,L5** |

**Course outcomes:**

Upon completing this course, the students will be able to:

- Formulate force displacement relation by flexibility and stiffness method
- Analyze the plane trusses, continuous beams and portal frames by transformation approach
- Analyse the structures by direct stiffness method

**Question paper pattern:**

The question paper will have ten questions; each question carries equal marks, there will be two full questions or with a maximum of four sub questions from each module, students will have to attend five full questions from each module.

**Reference Books:**


1. Weaver, W., and Gere, J.M., ***Matrix Analysis of Framed Structures***, CBS Publishers and distributors Pvt. Ltd., 2004.
2. Rajasekaran, S., and Sankarasubramanian, G., ***Computational Structural Mechanics***, PHI, New Delhi, 2001.
3. Martin, H, C., ***Introduction to Matrix Methods of Structural Analysis***, McGraw-Hill, New York, 1966.
4. Rubinstein, M.F., ***Matrix Computer Analysis of Structures*****,** Prentice-Hall, Englewood Cliffs, New Jersey, 1966.
5. Beaufait, F.W., Rowan, W. H., Jr., Hoadely, P. G., and Hackett, R. M., ***Computer Methods of Structural Analysis***, Prentice-Hall, Englewood Cliffs, New Jersey, 1970.
6. Kardestuncer, H., ***Elementary Matrix Analysis of Structures***, McGraw-Hill, New York, 1974.

# ADVANCED DESIGN OF STEEL STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – II**

| | | | |
|---|---|---|---|
| Subject Code | **20CSE21** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 3:0:2 | SEE Marks | 60 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS – 04**

**Prerequisites:**

- Engineering Mechanics
- Strength of Materials
- Structural Analysis
- Design of Steel structures

**Course objectives:** This course will enable students to

1. Understand the background to the design provisions for hot-rolled and cold-formed steel structures, including the main differences between them.
2. Proficiency in applying the provisions for design of columns, beams, beam-columns
3. Design structural sections for adequate fire resistance

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| **Module-1** | | |
| **Laterally Unrestrained Beams:**<br>Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Design Approach. Lateral buckling strength of Cantilever beams, continuous beams, beams with continuous and discrete lateral restraints ,Mono-symmetric and non-uniform beams – Design Examples. Concepts of -Shear Center, Warping, Uniform and Non-Uniform torsion. | **8 Hours** | |
| **Module-2** | | |
| **Beam- Columns in Frames:**<br>Behaviour of Short and Long Beam - Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, Effective Length of Columns-, Methods in IS 800 - Examples | **8 Hours** | |

| | | |
|---|---|---|
| **Module -3** | | |
| **Steel Beams with Web Openings:**<br>Shape of the web openings, practical guide lines, and Force distribution and failure patterns. Analysis of beams with perforated thin and thick webs, Design of laterally restrained castellated beams for given sectional properties. Vierendeel girders (design for given analysis results) | **8 Hours** | |
| **Module -4** | | |
| **Cold formed steel sections:**<br>Techniques and properties, Advantages, Typical profiles, Stiffened and unstiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions-numerical examples, beam design, column design. | **8 Hours** | |
| **Module -5** | | |
| **Fire resistance:**<br>Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance Ratings.<br>Numerical Examples. | **8 Hours** | |

**Course outcomes:**

After studying this course, students will be able to:

- Able to understand behavior of Light gauge steel members
- Able to understand design concepts of cold formed/unrestrained beams
- Able to understand Fire resistance concept required for present days.
- Able to analyze beam column behavior

**Question paper pattern:**

IS 800: 2007, IS 801-2010, IS811-1987 and BS5950 – part 8 to be allowed along with Steel Tables in Exam.
The question paper will have ten questions; each question carries equal marks, there will be two full questions or with a maximum of four sub questions from each module, students will have to attend five full questions from each module.

**Reference Books:**


1. N. Subramanian, "Design of Steel Structures", Oxford, IBH
2. Duggal,S.K. Design of Steel Structures, Tata McGraw-Hill
3. IS 800: 2007, IS 801-2010 , IS 811-1987
4. BS5950 Part- 8,
5. INSDAG Teaching Resource Chapter 11 to 20:www.steel-insdag.org
6. SP 6 (5)-1980

**STRUCTURAL ENGINEERING LAB-2**

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – II**

| | | | |
|---|---|---|---|
| Subject Code | **20CSEL26** | CIE Marks | 40 |
| Teaching Hours/Week (L:P:SDA) | 1:3:0 | SEE Marks | 60 |
| Total Number of Lecture Hours | 42 | Exam Hours | 03 |

**CREDITS – 02**

**Prerequisites:**

**Course objectives:**

The objective of this course is to make students

To analyze the structure using FE based Software

To learn principles of design

To investigate the performance of structural elements.

To design the structural components using excel sheets

| **Modules** | **Teaching Hours** | **RBT Level** |
|---|---|---|
| 1. Static and Dynamic analysis and design of Multistory Building structures using any FE based software | **12 Hrs** | **L1, L2, L3, L4, L5, L6** |
| 2. Design of RCC and Steel Tall structures using any FE based software | **12 Hrs** | |
| 3. Analysis of folded plates and shells using any FE software. | **06 Hrs** | |
| 4. Preparation of EXCEL sheets for structural design | **12 Hrs** | |

**Course outcomes:** On complete of this course the students will able to

- Achieve Knowledge of design and development of programming skills.
- Understand the principles of structural analysis and design
- Design and develop analytical skills.
- Summarize the performance of structures for static and dynamic forces.

| SOFTWARE ENGINEERING<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – III | | | |
|---|---|---|---|
| **Course Code** | **18CS35** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course (18CS35) will enable students to:

- Outline software engineering principles and activities involved in building large software programs.Identify ethical and professional issues and explain why they are of concern to software engineers.
- Explain the fundamentals of object oriented concepts
- Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation. Differentiate system models, use UML diagrams and apply design patterns.
- Discuss the distinctions between validation testing and defect testing.
- Recognize the importance of software maintenance and describe the intricacies involved in software evolution.Apply estimation techniques, schedule project activities and compute pricing.
- Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved.

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|---|---|
| **Module 1**<br>**Introduction**: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies.<br>**Software Processes**: Models: Waterfall Model **(Sec 2.1.1)**, Incremental Model **(Sec 2.1.2)** and Spiral Model **(Sec 2.1.3)**. Process activities.<br>**Requirements Engineering**: Requirements Engineering Processes **(Chap 4)**. Requirements Elicitation and Analysis **(Sec 4.5).** Functional and non-functional requirements **(Sec 4.1)**. The software Requirements Document **(Sec 4.2)**. Requirements Specification **(Sec 4.3)**. Requirements validation **(Sec 4.6)**. Requirements Management **(Sec 4.7)**.<br>**RBT: L1, L2, L3** | 08 |
| **Module 2** | |
| What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. **Introduction, Modelling Concepts and Class Modelling:** What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models;<br>**Textbook 2: Ch 1,2,3.**<br>**RBT: L1, L2 L3** | 08 |
| **Module 3** | |
| **System Models**: Context models **(Sec 5.1)**. Interaction models **(Sec 5.2)**. Structural models **(Sec 5.3)**. Behavioral models **(Sec 5.4)**. Model-driven engineering **(Sec 5.5)**.<br>**Design and Implementation**: Introduction to RUP **(Sec 2.4)**, Design Principles **(Chap 7)**. Object-oriented design using the UML **(Sec 7.1)**. Design patterns **(Sec 7.2)**. Implementation issues **(Sec 7.3)**. Open source development **(Sec 7.4)**.<br>**RBT: L1, L2, L3** | 08 |

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|---|---|
| **Module 4**<br>**Software Testing: Development testing (Sec 8.1), Test-driven development (Sec 8.2), Release testing (Sec 8.3), User testing (Sec 8.4). Test Automation (Page no 212).**<br>**Software Evolution: Evolution processes (Sec 9.1). Program evolution dynamics (Sec 9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4).**<br>**RBT: L1, L2, L3** | |
| **Module 5**<br>**Project Planning: Software pricing (Sec 23.1). Plan-driven development (Sec 23.2). Project scheduling (Sec 23.3): Estimation techniques (Sec 23.5). Quality management: Software quality (Sec 24.1). Reviews and inspections (Sec 24.3). Software measurement and metrics (Sec 24.4). Software standards (Sec 24.2)**<br>**RBT: L1, L2, L3** | |

**Course Outcomes:** The student will be able to :

- Design a software system, component, or process to meet desired needs within realistic constraints.
- Assess professional and ethical responsibility
- Function on multi-disciplinary teams
- Use the techniques, skills, and modern engineering tools necessary for engineering practice
- Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005.

**Reference Books:**

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Effective from the academic year 2018 -2019) SEMESTER – IV**

| | | | |
|---|---|---|---|
| **Course Code** | **18CS42** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:2:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 50 | **Exam Hours** | 03 |
| **CREDITS –4** | | | |

**Course Learning Objectives:** This course (18CS42) will enable students to:

- Explain various computational problem solving techniques.
- Apply appropriate method to solve a given problem.
- Describe various methods of algorithm analysis.

| **Module 1** | **Contact Hours** |
|---|---|
| **Introduction:** What is an Algorithm? **(T2:1.1),** Algorithm Specification **(T2:1.2),** Analysis Framework **(T1:2.1), Performance Analysis**: Space complexity, Time complexity **(T2:1.3)**. **Asymptotic Notations:** Big-Oh notation ($O$), Omega notation ($\Omega$), Theta notation ($\Theta$), and Little-oh notation ($o$), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples **(T1:2.2, 2.3, 2.4). Important Problem Types:** Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. **Fundamental Data Structures:** Stacks, Queues, Graphs, Trees, Sets and Dictionaries. **(T1:1.3,1.4).**<br><br>**RBT: L1, L2, L3** | 10 |
| **Module 2** | |
| **Divide and Conquer**: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum **(T2:3.1, 3.3, 3.4)**, Merge sort, Quick sort **(T1:4.1, 4.2)**, Strassen"s matrix multiplication **(T2:3.8)**, Advantages and Disadvantages of divide and conquer. **Decrease and Conquer Approach:** Topological Sort. **(T1:5.3).**<br><br>**RBT: L1, L2, L3** | 10 |
| **Module 3** | |
| **Greedy Method:** General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines **(T2:4.1, 4.3, 4.5). Minimum cost spanning trees:** Prim"s Algorithm, Kruskal"s Algorithm **(T1:9.1, 9.2)**. **Single source shortest paths:** Dijkstra's Algorithm **(T1:9.3)**. **Optimal Tree problem:** Huffman Trees and Codes **(T1:9.4)**. **Transform and Conquer Approach:** Heaps and Heap Sort **(T1:6.4)**.<br><br>**RBT: L1, L2, L3** | 10 |
| **Module 4** | |
| **Dynamic Programming:** General method with Examples, Multistage Graphs **(T2:5.1, 5.2)**. **Transitive Closure:** Warshall"s Algorithm, **All Pairs Shortest Paths:** Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem **((T1:8.2, 8.3, 8.4)**, Bellman-Ford Algorithm **(T2:5.4)**, Travelling Sales Person problem **(T2:5.9)**, Reliability design **(T2:5.8)**.<br><br>**RBT: L1, L2, L3** | 10 |
| **Module 5** | |
| **Backtracking:** General method **(T2:7.1)**, N-Queens problem **(T1:12.1)**, Sum of subsets problem **(T1:12.1)**, Graph coloring **(T2:7.4)**, Hamiltonian cycles **(T2:7.5)**. **Programme and Bound:** Assignment Problem, Travelling Sales Person problem **(T1:12.2)**, **0/1 Knapsack problem (T2:8.2, T1:12.2):** LC Programme and Bound solution **(T2:8.2)**, FIFO Programme and Bound solution **(T2:8.2)**. **NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes **(T2:11.1)**.<br><br>**RBT: L1, L2, L3** | 10 |

**Course Outcomes:** The student will be able to :

- Describe computational solution to well known problems like searching, sorting etc.
- Estimate the computational complexity of different algorithms.
- Devise an algorithm using appropriate design strategies for problem solving.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

**Reference Books:**

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education).

## DATA COMMUNICATION
## (Effective from the academic year 2018 -2019) SEMESTER – IV

| | | | |
|---|---|---|---|
| **Course Code** | **18CS46** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |

**CREDITS –3**

**Course Learning Objectives:** This course (18CS46) will enable students to:

- Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
- Explain with the basics of data communication and various types of computer networks;
- Demonstrate Medium Access Control protocols for reliable and noisy channels.
- Expose wireless and wired LANs.

| | |
|---|---|
| **Module 1**<br>**Introduction:** Data Communications, Networks, Network Types, Internet History, Standards and Administration, **Networks Models**: Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer-1:** Data and Signals**,** Digital Signals, Transmission Impairment, Data Rate limits, Performance.<br>**Textbook1: Ch 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6**<br>**RBT: L1, L2** | **Contact Hours 8** |
| **Module 2** | |
| **Digital Transmission**: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).<br>**Physical Layer-2:** Analog to digital conversion (only PCM), Transmission Modes,<br>**Analog Transmission**: Digital to analog conversion.<br>**Textbook1: Ch 4.1 to 4.3, 5.1 RBT: L1,**<br>**L2** | 08 |
| **Module 3** | |
| **Bandwidth Utilization**: Multiplexing and Spread Spectrum,<br>**Switching**: Introduction, Circuit Switched Networks and Packet switching.<br>**Error Detection and Correction**: Introduction, Block coding, Cyclic codes, Checksum,<br>**Textbook1: Ch 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.4 RBT: L1,**<br>**L2** | 08 |
| **Module 4** | |

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|---|---|
| **Data link control**: DLC services, Data link layer protocols, Point to Point protocol (Framing, Transition phases only).<br>**Media Access control**: Random Access, Controlled Access and Channelization,<br>**Introduction to Data-Link Layer:** Introduction, Link-Layer Addressing, ARP **IPv4**<br>**Addressing and subnetting:** Classful and CIDR addressing, DHCP, NAT **Textbook1: Ch 9.1, 9.2, 11.1, 11.2 11.4, 12.1 to 12.3, 18.4**<br>**RBT: L1, L2** | 08 |
| **Module 5** | |
| **Wired LANs Ethernet**: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet,<br>**Wireless LANs:** Introduction, IEEE 802.11 Project and Bluetooth.<br>**Other wireless Networks**: Cellular Telephony | 08 |
| **Textbook1: Ch 13.1 to 13.5, 15.1 to 15.3, 16.2**<br>**RBT: L1, L2** | |

**Course Outcomes:** The student will be able to :

- Explain the various components of data communication.
- Explain the fundamentals of digital communication and switching.
- Compare and contrast data link layer protocols.
- Summarize IEEE 802.xx standards

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013.

**Reference Books:**

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

| **DATABASE MANAGEMENT SYSTEM<br>(Effective from the academic year 2018 -2019) SEMESTER – V** | | | |
|---|---|---|---|
| **Course Code** | **18CS53** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:2:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 50 | **Exam Hours** | 03 |
| **CREDITS –4** | | | |
| **Course Learning Objectives:** This course (18CS53) will enable students to: | | | |

| | |
|---|---|
| • Provide a strong foundation in database concepts, technology, and practice.<br>• Practice SQL programming through a variety of database problems.<br>• Demonstrate the use of concurrency and transactions in database<br>• Design and build database applications for real world problems. | |
| **Module 1** | **Contact Hours** |
| **Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization.<br>**Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10**<br>**RBT: L1, L2, L3** | 10 |
| **Module 2** | |
| **Relational Model**: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping. **SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.<br>**Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5**<br>**RBT: L1, L2, L3** | 10 |
| **Module 3** | |
| **SQL : Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. **Internet Applications:** The three-Tier application architecture, The presentation layer, The Middle Tier<br>**Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.**<br>**RBT: L1, L2, L3** | 10 |
| **Module 4** | |
| **Normalization: Database Design Theory** – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms<br>**Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6 RBT: L1, L2, L3** | 10 |
| **Module 5** | |

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|---|---|
| **Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. **Introduction to Database Recovery Protocols:** Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures<br>**Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.**<br>**RBT: L1, L2, L3** | 10 |

**Course Outcomes:** The student will be able to :

- Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS.
- Use Structured Query Language (SQL) for database manipulation.
- Design and build simple database systems
- Develop application to interact with databases.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

**Reference Books:**

1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

**APPLICATION DEVELOPMENT USING PYTHON**
**[(Effective from the academic year 2018 -2019)**
**SEMESTER – V**

| | | | |
|---|---|---|---|
| **Course Code** | **18CS55** | **IA Marks** | 40 |
| **Number of Lecture Hours/Week** | 03 | **Exam Marks** | 60 |
| **Total Number of Lecture Hours** | 40 | **Exam Hours** | 03 |

**CREDITS – 03**

**Course Learning Objectives:** This course (18CS55) will enable students to

- Learn the syntax and semantics of Python programming language.
- Illustrate the process of structuring the data using lists, tuples and dictionaries.
- Demonstrate the use of built-in functions to navigate the file system.
- Implement the Object Oriented Programming concepts in Python.
- Appraise the need for working with various documents like Excel, PDF, Word and Others.

| **Module – 1** | **Teaching Hours** |
|---|---|

| | |
|---|---|
| **Python Basics**, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program,**Flow control,** Boolean Values, Comparison Operators, Boolean Operators,Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules,Ending a Program Early with sys.exit(), **Functions,** def Statements with Parameters, Return Values and return Statements,The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number<br>**Textbook 1: Chapters 1 – 3**<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| **Lists,** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples,References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup<br>**Textbook 1: Chapters 4 – 6**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 3** | |
| **Pattern Matching with Regular Expressions,** Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions,More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE, Project: Phone Number and Email Address Extractor, **Reading and Writing Files,** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates,Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE's Debugger.<br>**Textbook 1: Chapters 7 – 10** | 08 |
| **RBT: L1, L2, L3** | |
| **Module – 4** | |
| **Classes and objects,** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example,The init method, The __str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation,**Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation<br>**Textbook 2: Chapters 15 – 18 RBT: L1, L2, L3** | |
| **Module – 5** | |

**Web Scraping,** Project: MAPIT.PY with the webbrowser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML, Parsing HTML with the BeautifulSoup Module, Project: "I'm Feeling Lucky" Google Search,Project: Downloading All XKCD Comics, Controlling the Browser with the selenium Module, **Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module, Project: Removing the Header from CSV Files, JSON and APIs, The json Module, Project: Fetching Current Weather Data

**Textbook 1: Chapters 11 – 14 RBT: L1, L2, L3**

**Course Outcomes:** After studying this course, students will be able to

- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file system.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Determine the need for scraping websites and working with CSV, JSON and other file formats.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. Al Sweigart,**"Automate the Boring Stuff with Python",** 1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 18)
2. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist",** 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above links)

**Reference Books:**

1. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

## WEB TECHNOLOGY AND ITS APPLICATIONS
## (Effective from the academic year 2018 -2019) SEMESTER – VI

| | | | |
|---|---|---|---|
| **Course Code** | **18CS63** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:2:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 50 | **Exam Hours** | 03 |
| **CREDITS –4** | | | |

**Course Learning Objectives:** This course (18CS63) will enable students to:

| | |
|---|---|
| • Illustrate the Semantic Structure of HTML and CSS<br>• Compose forms and tables using HTML and CSS<br>• Design Client-Side programs using JavaScript and Server-Side programs using PHP<br>• Infer Object Oriented Programming capabilities of PHP<br>• Examine JavaScript frameworks such as jQuery and Backbone | |
| **Module 1** | **Contact Hours** |
| Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.<br>**Textbook 1: Ch. 2, 3**<br>**RBT: L1, L2, L3** | 10 |
| **Module 2** | |
| HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.<br>**Textbook 1: Ch. 4,5**<br>**RBT: L1, L2, L3** | 10 |
| **Module 3** | |
| JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions<br>**Textbook 1: Ch. 6, 8**<br>**RBT: L1, L2, L3** | 10 |
| **Module 4** | |
| PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling<br>**Textbook 1: Ch. 9, 10**<br>**RBT: L1, L2, L3** | 10 |
| **Module 5** | |
| Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone | 10 |
| MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.<br>Textbook 1: Ch. 13, 15,17<br>RBT: L1, L2, L3 | |
| **Course Outcomes:** The student will be able to : | |

- Adapt HTML and CSS syntax and semantics to build web pages.
- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Randy Connolly, Ricardo Hoar, **"Fundamentals of Web Development",** 1st Edition, Pearson Education India. (**ISBN:**978-9332575271)

**Reference Books:**

1. Robin Nixon, **"Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5",** 4th Edition, O'Reilly Publications, 2015. (**ISBN:**978-9352130153)
2. Luke Welling, Laura Thomson, **"PHP and MySQL Web Development",** 5th Edition, Pearson Education, 2016. (**ISBN:**978-9332582736)
3. Nicholas C Zakas, **"Professional JavaScript for Web Developers",** 3rd Edition, Wrox/Wiley India, 2012. (**ISBN:**978-8126535088)
4. David Sawyer Mcfarland, **"JavaScript & jQuery: The Missing Manual",** 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014

**Mandatory Note:**

Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessmen

**Maintain a copy of the report for verification during LIC visit.**

**Posssible list of practicals:**

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
   a. Parameter: A string
   b. Output: The position in the string of the left-most vowel

## CLOUD COMPUTING AND ITS APPLICATIONS
## (Effective from the academic year 2018 -2019) SEMESTER – VI

| | | | |
|---|---|---|---|
| **Course Code** | **18CS643** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |

| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
|---|---|---|---|
| **CREDITS –3** | | | |
| **Course Learning Objectives:** This course (18CS643) will enable students to:<br>• Explain the fundamentals of cloud computing<br>• Illustrate the cloud application programming and aneka platform<br>• Contrast different cloud platforms used in industry | | | |
| **Module 1** | | | **Contact Hours** |
| Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka<br>Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V<br>**Textbook 1: Ch. 1,3**<br>**RBT: L1, L2** | | | 08 |
| **Module 2** | | | |
| Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects<br>Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools<br>**Textbook 1: Ch. 4,5**<br>**RBT: L1, L2** | | | 08 |
| **Module 3** | | | |
| Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent.<br>High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, | | | 08 |

Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.

**Textbook 1: Ch. 6, 7**

**RBT: L1, L2**

**Module 4**

Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application

**Textbook 1: Ch. 8**

**RBT: L1, L2**

**Module 5**

Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.

Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.

**Textbook 1: Ch. 9,10**

**RBT: L1, L2**

**Course Outcomes:** The student will be able to :

- Explain cloud computing, virtualization and classify services of cloud computing
- Illustrate architecture and programming in cloud
- Describe the platforms for development of cloud applications and List the application of cloud.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education

**Reference Books:**

1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.

**MOBILE APPLICATION DEVELOPMENT (OPEN ELECTIVE)**
**(Effective from the academic year 2018 -2019) SEMESTER – VI**

| | | | |
|---|---|---|---|
| **Course Code** | **18CS651** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |

**CREDITS –3**

**Course Learning Objectives:** This course (18CS651) will enable students to:

| | |
|---|---|
| • Learn to setup Android application development environment<br>• Illustrate user interfaces for interacting with apps and triggering actions<br>• Interpret tasks used in handling multiple activities<br>• Identify options to save persistent application data<br>• Appraise the role of security and performance in Android applications | |
| **Module – 1** | **Teaching Hours** |
| Get started, Build your first app, Activities, Testing, debugging and using support libraries<br>**Textbook 1: Lesson 1,2,3**<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| User Interaction, Delightful user experience, Testing your UI<br>**Textbook 1: Lesson 4,5,6**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| Background Tasks, Triggering, scheduling and optimizing background tasks<br>**Textbook 1: Lesson 7,8**<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders<br>**Textbook 1: Lesson 9,10,11,12**<br>**RBT: L1, L2** | 08 |
| **Module – 5** | |
| Permissions, Performance and Security, Firebase and AdMob, Publish//<br>**Textbook 1: Lesson 13,14,15**<br>**RBT: L1, L2** | 08 |
| **Course outcomes:** The students should be able to: | |
| • Create, test and debug Android application by setting up Android development environment<br>• Implement adaptive, responsive user interfaces that work across a wide range of devices.<br>• Infer long running tasks and background work in Android applications<br>• Demonstrate methods in storing, sharing and retrieving data in Android applications<br>• Analyze performance of android applications and understand the role of permissions and security<br>• Describe the steps involved in publishing Android application to share with the world | |
| **Question Paper Pattern:** | |
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks | |

| **PROGRAMMING IN JAVA<br>(OPEN ELECTIVE)<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VI** | | | |
|---|---|---|---|
| **Course Code** | **18CS653** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |

| **Course Learning Objectives:** This course (18CS653) will enable students to: | |
|---|---|
| • Learn fundamental features of object oriented language and JAVA<br>• Set up Java JDK environment to create, debug and run simple Java programs.<br>• Learn object oriented concepts using programming examples.<br>• Study the concepts of importing of packages and exception handling mechanism.<br>• Discuss the String Handling examples with Object Oriented concepts | |
| **Module – 1** | **Teaching Hours** |
| An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings<br>**Text book 1: Ch 2, Ch 3**<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java‟s Selection Statements, Iteration Statements, Jump Statements.<br>**Text book 1: Ch 4, Ch 5**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.<br>**Text book 1: Ch 6, Ch 7.1-7.9, Ch 8.**<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java‟s Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions. | 08 |
| **Text book 1: Ch 9, Ch 10**<br>**RBT: L1, L2** | |
| **Module – 5** | |

| | |
|---|---|
| Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.<br>**Text book 1: Ch 12.1,12.2, Ch 13, Ch 15**<br>**RBT: L1, L2** | 08 |

**Course outcomes:** The students should be able to:

- Explain the object-oriented concepts and JAVA.
- Develop computer programs to solve real world problems in Java.

Develop simple GUI interfaces for a computer program to interact with users

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)

**Reference Books:**

1. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.
2. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.

## ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
## (Effective from the academic year 2018 -2019) SEMESTER – VII

| | | | |
|---|---|---|---|
| **Course Code** | **18CS71** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 4:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 50 | **Exam Hours** | 03 |

**CREDITS –4**

**Course Learning Objectives:** This course (18CS71) will enable students to:

- Explain Artificial Intelligence and Machine Learning
- Illustrate AI and ML algorithm and their use in appropriate applications

| **Module 1** | **Contact Hours** |
|---|---|
| What is artificial intelligence?, Problems, problem spaces and search, Heuristic search techniques<br>**Texbook 1: Chapter 1, 2 and 3**<br>**RBT: L1, L2** | 10 |
| **Module 2** | |

| | |
|---|---|
| Knowledge representation issues, Predicate logic, Representaiton knowledge using rules.<br>Concpet Learning: Concept learning task, Concpet learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm.<br>**Texbook 1: Chapter 4, 5 and 6**<br>**Texbook2: Chapter 2 (2.1-2.5, 2.7)**<br>**RBT: L1, L2, L3** | 10 |
| **Module 3** | |
| Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems, ID3 algorith.<br>Aritificil Nueral Network: Introduction, NN representation, Appropriate problems, Perceptrons, Backpropagation algorithm.<br>**Texbook2: Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.5)**<br>**RBT: L1, L2, L3** | 10 |
| **Module 4** | |
| Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Navie Bayes classifier, BBN, EM Algorithm<br>**Texbook2: Chapter 6**<br>**RBT: L1, L2, L3** | 10 |
| **Module 5** | |
| Instance-Base Learning: Introduction, k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function, Case-Based reasoning.<br>Reinforcement Learning: Introduction, The learning task, Q-Learning.<br>**Texbook 1: Chapter 8 (8.1-8.5), Chapter 13 (13.1 – 13.3)**<br>**RBT: L1, L2, L3** | 10 |
| **Course Outcomes:** The student will be able to : | |
| • Appaise the theory of Artificial intelligence and Machine Learning.<br>• Illustrate the working of AI and ML Algorithms.<br>• Demonstrate the applications of AI and ML. | |
| **Question Paper Pattern:** | |
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks | |

| **USER INTERFACE DESIGN**<br>**(Effective from the academic year 2018 -2019)**<br>**SEMESTER – VII** | | | |
|---|---|---|---|
| **Course Code** | **18CS734** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |
| **Course Learning Objectives:** This course (18CS734) will enable students to: | | | |
| • To study the concept of menus, windows, interfaces<br>• To study about business functions<br>• To study the characteristics and components of windows andthe various controls for the windows.<br>• To study about various problems in windows design with color, text, graphics a<br>• nd To study the testing methods | | | |
| **Module 1** | | | **Contact Hours** |

| | |
|---|---|
| The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design<br>**Textbook 1: Ch. 1,2**<br>**RBT: L1, L2** | 08 |
| **Module 2** | |
| The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.<br>**Textbook 1: Part-2**<br>**RBT: L1, L2** | 08 |
| **Module 3** | |
| System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu**,** Selecting menu choices, Navigating menus, Kinds of graphical menus.<br>**Textbook 1: Part-2**<br>**RBT: L1, L2** | 08 |
| **Module 4** | |
| Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.<br>**Textbook 1: Part-2**<br>**RBT: L1, L2** | 08 |
| **Module 5** | |
| Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.<br>**Textbook 1: Part-2**<br>**RBT: L1, L2** | 08 |
| **Course Outcomes:** The student will be able to : | |
| • Design the User Interface, design, menu creation, windows creation and connection between menus and windows | |
| **Question Paper Pattern:** | |
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks | |
| • There will be 2 full questions (with a maximum of four sub questions) from each module.<br>• Each full question will have sub questions covering all the topics under a module.<br>• The students will have to answer 5 full questions, selecting one full question from each module. | |
| Textbooks: | |
| 1. Wilbert O. Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, Second Edition 2002. | |
| Reference Books: | |
| 1. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.<br>2. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002 | |
| **PYTHON APPLICATION PROGRAMMING (OPEN ELECTIVE)**<br>**(Effective from the academic year 2018 -2019) SEMESTER – VI** | |

| | | | |
|---|---|---|---|
| **Course Code** | **18CS752** | **IA Marks** | 40 |
| **Number of Lecture Hours/Week** | 3:0:0 | **Exam Marks** | 60 |
| **Total Number of Lecture Hours** | 40 | **Exam Hours** | 03 |

**CREDITS – 03**

**Course Learning Objectives:**This course (18CS752) will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programmingin Python.

| **Module – 1** | **Teaching Hours** |
|---|---|
| Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions<br>**Textbook 1: Chapters 1 – 4**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 2** | |
| Iteration, Strings, Files<br>**Textbook 1: Chapters 5– 7**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 3** | |
| Lists, Dictionaries, Tuples, Regular Expressions<br>**Textbook 1: Chapters 8 - 11**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 4** | |
| Classes and objects, Classes and functions, Classes and methods<br>**Textbook 2: Chapters 15 – 17**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 5** | |
| Networked programs, Using Web Services, Using databases and SQL<br>**Textbook 1: Chapters 12– 13, 15**<br>**RBT: L1, L2, L3** | 08 |

**Course Outcomes:**After studying this course, students will be able to

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf )
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist”, 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)

Reference Books:


1. Charles Dierbach, "Introduction to Computer Science Using Python",1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
2. Gowrishankar S, Veena A, “Introduction to Python Programming”, 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372
3. Mark Lutz, “Programming Python”,4th Edition, O‟Reilly Media, 2011.ISBN-13: 978-9350232873
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, “Data Structures and Algorithms in Python”,1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
5. Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford university press, 2017. ISBN-13: 978-0199480173


**INTERNET OF THINGS**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VIII**

| | | | |
|---|---|---|---|
| **Course Code** | **18CS81** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |

**CREDITS –3**

**Course Learning Objectives:** This course (18CS81) will enable students to:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.
- Identifysensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

| **Module 1** | **Contact Hours** |
|---|---|
| What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.<br>**Textbook 1: Ch.1, 2**<br>**RBT: L1, L2, L3** | 08 |
| **Module 2** | |
| Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.<br>**Textbook 1: Ch.3, 4**<br>**RBT: L1, L2, L3** | 08 |
| **Module 3** | |

| | |
|---|---|
| IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.<br>**Textbook 1: Ch.5, 6**<br>**RBT: L1, L2, L3** | 08 |
| **Module 4** | |
| Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment<br>**Textbook 1: Ch.7, 8**<br>**RBT: L1, L2, L3** | 08 |
| **Module 5** | |
| IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT | 08 |
| Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.<br>**Textbook 1: Ch.12**<br>**Textbook 2: Ch.7.1 to 7.4, Ch.8.1 to 8.4, 8.6**<br>**RBT: L1, L2, L3** | |

**Course Outcomes:** The student will be able to :

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**


1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,**"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** 1st Edition, Pearson Education (Cisco Press Indian Reprint). (**ISBN:** 978-9386873743)
2. Srinivasa K G, **"Internet of Things",**CENGAGE Leaning India, 2017


**Reference Books:**


1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1st Edition, VPT, 2014. (**ISBN:** 978-8173719547)
2. Raj Kamal, **"Internet of Things: Architecture and Design Principles",** 1st Edition, McGraw

Hill Education, 2017. (**ISBN:** 978-9352605224)

**Mandatory Note:**

Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessment

**Maintain a copy of the report for verification during LIC visit.**

**Posssible list of practicals:**

1. Transmit a string using UART
2. Point-to-Point communication of two Motes over the radio frequency.
3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).
4. I2C protocol study
5. Reading Temperature and Relative Humidity value from the sensor

**WEB TECHNOLOGY AND ITS APPLICATIONS**
**[As per Choice Based Credit System (CBCS) scheme]**
**(Effective from the academic year 2017 - 2018)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| Subject Code | 17CS71 | IA Marks | 40 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 60 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS – 04**

| **Module – 1** | **Teaching Hours** |
|---|---|
| Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. | **10 Hours** |
| **Module – 2** | |
| HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks. | **10 Hours** |
| **Module – 3** | |
| JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions | **10 Hours** |
| **Module – 4** | |
| PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling | **10 Hours** |
| **Module – 5** | |
| Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services. | **10 Hours** |

**Course Outcomes:** After studying this course, students will be able to

- Define HTML and CSS syntax and semantics to build web pages.
- Understand the concepts of Construct , visually format tables and forms using HTML using CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- List the principles of object oriented development using PHP
- Illustrate JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

**Question paper pattern:**

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**


1. Randy Connolly, Ricardo Hoar, **"Fundamentals of Web Development"**, 1st Edition, Pearson Education India. (**ISBN:**978-9332575271)


**Reference Books:**


1) Robin Nixon, **"Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5"**, 4th Edition, O'Reilly Publications, 2015. (**ISBN:**978-9352130153)
2) Luke Welling, Laura Thomson, **"PHP and MySQL Web Development"**, 5th Edition, Pearson Education, 2016. (**ISBN:**978-9332582736)
3) Nicholas C Zakas, **"Professional JavaScript for Web Developers"**, 3rd Edition, Wrox/Wiley India, 2012. (**ISBN:**978-8126535088)
4) David Sawyer Mcfarland, **"JavaScript & jQuery: The Missing Manual"**, 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (**ISBN:**978-9351108078)
5) Zak Ruvalcaba Anne Boehm, **"Murach's HTML5 and CSS3"**, 3rd Edition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016. (**ISBN:**978-9352133246)

| ADVANCED COMPUTER ARCHITECTURES<br>[As per Choice Based Credit System (CBCS) scheme]<br>(Effective from the academic year 2017 - 2018)<br>SEMESTER – VII | | | |
|---|---|---|---|
| Subject Code | 17CS72 | IA Marks | 40 |
| Number of Lecture Hours/Week | 4 | Exam Marks | 60 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| **CREDITS – 04** | | | |

| **Module – 1** | **Teaching Hours** |
|---|---|
| Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer ,Multivector and SIMD Computers ,PRAM and VLSI Models, Program and Network Properties ,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches. | **10 Hours** |
| **Module – 2** | |
| Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology. | **10 Hours** |
| **Module – 3** | |
| Bus, Cache, and Shared Memory ,Bus Systems ,Cache Memory Organizations ,Shared Memory Organizations ,Sequential and Weak Consistency Models ,Pipelining and Superscalar Techniques ,Linear Pipeline Processors ,Nonlinear Pipeline Processors ,Instruction Pipeline Design ,Arithmetic Pipeline Design (Upto 6.4). | **10 Hours** |
| **Module – 4** | |
| Parallel and Scalable Architectures: Multiprocessors and Multicomputers ,Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers ,Message-Passing Mechanisms ,Multivector and SIMD Computers ,Vector Processing Principles ,Multivector Multiprocessors ,Compound Vector Processing ,SIMD Computer Organizations (Upto 8.4),Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures. | **10 Hours** |
| **Module – 5** | |
| Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers ,Dependence Analysis of Data Arrays ,Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism ,Computer Architecture ,Contents, Basic Design Issues ,Problem Definition ,Model of a Typical Processor ,Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder Buffer, Register Renaming ,Tomasulo's Algorithm ,Branch Prediction, Limitations in Exploiting Instruction Level Parallelism ,Thread Level Parallelism. | **10 Hours** |
| **Course outcomes:** The students should be able to: | |

- Understand the concepts of parallel computing and hardware technologies
- Illustrate and contrast the parallel architectures
- Recall parallel programming concepts

**Question paper pattern**
The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015

**Reference Books:**

1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013

**MACHINE LEARNING**
**[As per Choice Based Credit System (CBCS) scheme]**
**(Effective from the academic year 2017 - 2018)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| Subject Code | 17CS73 | IA Marks | 40 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 60 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS – 04**

| **Module – 1** | **Teaching Hours** |
|---|---|
| **Introduction:** Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.<br>**Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.<br>**Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7** | **10 Hours** |
| **Module – 2** | |
| **Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.<br>**Text Book1, Sections: 3.1-3.7** | **10 Hours** |
| **Module – 3** | |
| **Artificial Neural Networks:** Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.<br>**Text book 1, Sections: 4.1 – 4.6** | **08 Hours** |
| **Module – 4** | |
| **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm<br>**Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12** | **10 Hours** |
| **Module – 5** | |
| **Evaluating Hypothesis:** Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.<br>**Instance Based Learning:** Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,<br>**Reinforcement Learning:** Introduction, Learning Task, Q Learning<br>**Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3** | **12 Hours** |

**Course Outcomes:** After studying this course, students will be able to

- Recall the problems for machine learning. And select the either supervised, unsupersvised or reinforcement learning.
- Understand theory of probability and statistics related to machine learning
- Illustrate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,

**Question paper pattern:**

The question paper will have ten questions.
There will be 2 questions from each module.

| |
|---|
| Each question will have questions covering all the topics under a module.<br>The students will have to answer 5 full questions, selecting one full question from each module. |
| **Text Books:** |
| 1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education. |
| **Reference Books:** |
| 1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.<br>2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press. |

# ARM MICROCONTROLLER & EMBEDDED SYSTEMS

**B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering**

[As per Choice Based Credit System (CBCS) scheme]

**ARM MICROCONTROLLER & EMBEDDED SYSTEMS**

**B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering**

**[As per Choice Based Credit System (CBCS) Scheme]**

| | | | |
|---|---|---|---|
| **Course Code** | **15EC62** | **IA Marks** | **20** |
| **Number of Lecture Hours/Week** | **04** | **Exam Marks** | **80** |
| **Total Number of Lecture Hours** | **50 (10 Hours / Module)** | **Exam Hours** | **03** |

**CREDITS – 04**

**Course objectives:** This course will enable students to:

- Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3.
- Program ARM Cortex M3 using the various instructions and C language for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

**Module-1**

**ARM-32 bit Microcontroller:** Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 1: Ch 1, 2, 3) **L1, L2**

**Module-2**

**ARM Cortex M3 Instruction Sets and Programming:** Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) **L1, L2, L3**

**Module-3**

**Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.
(Text 2: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). **L1, L2, L3**

**Module-4**

**Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded

Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language).
(Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only) **L1, L2, L3**

**Module-5**

**RTOS and IDE for Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques
(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)
**L1, L2, L3**

**Course outcomes:** After studying this course, students will be able to:

- Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

**Text Books:**

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.

2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

# DIGITAL IMAGE PROCESSING

**B.E., VII Semester, Electronics & Communication Engineering**

[As per Choice Based Credit System (CBCS) scheme]

| | | | |
|---|---|---|---|
| Subject Code | 15EC72 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 (10 Hours / Module) | Exam Hours | 03 |
| CREDITS – 04 | | | |

**Course Objectives:** The objectives of this course are to:

- Understand the fundamentals of digital image processing
- Understand the image transform used in digital image processing
- Understand the image enhancement techniques used in digital image processing
- Understand the image restoration techniques and methods used in digital image processing
- Understand the Morphological Operations and Segmentation used in digital image processing

| **Module-1** | **RBT Level** |
|---|---|
| **Digital Image Fundamentals**: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.<br>[Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2] | L1, L2 |
| **Module-2** | |
| **Spatial Domain:** Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters<br>**Frequency Domain**: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.<br>[Text: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10] | L1, L2, L3 |
| **Module-3** | |
| **Restoration:** Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.<br>[Text: Chapter 5: Sections 5.2, to 5.9] | L1, L2, L3 |
| **Module-4** | |

| | |
|---|---|
| **Color Image Processing:** Color Fundamentals, Color Models, Pseudocolor Image Processing.<br>**Wavelets:** Background, Multiresolution Expansions.<br>**Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.<br>[Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5] | L1, L2, L3 |
| **Module-5** | |
| **Segmentation**: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds.<br>**Representation and Description:** Representation, Boundary descriptors.<br>[Text: Chapter 10: Sections 10.2, to 10.5 and Chapter 11: Sections 11.1 and 11.2] | L1, L2, L3 |

**Course Outcomes:** At the end of the course students should be able to:

- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
- Conduct independent study and analysis of Image Enhancement techniques.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

**Text Book:**

**Digital Image Processing**- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

**Reference Books:**

1. **Digital Image Processing**- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014.
2. **Fundamentals of Digital Image Processing**-A. K. Jain, Pearson 2004.

**CONTROL SYSTEMS**
**SEMESTER – IV (EC/TC)**
**[As per Choice Based Credit System (CBCS) Scheme]**

| | | | |
|---|---|---|---|
| **Course Code** | **17EC43** | **CIE Marks** | **40** |
| **Number of Lecture Hours/Week** | **04** | **SEE Marks** | **60** |
| **Total Number of Lecture Hours** | **50(10 Hours per Module)** | **Exam Hours** | **03** |

**CREDITS – 04**

**Course objectives:** This course will enable students to:

- Understand the basic features, configurations and application of control systems.
- Understand various terminologies and definitions for the control systems.
- Learn how to find a mathematical model of electrical, mechanical and electro-mechanical systems.
- Know how to find time response from the transfer function.
- Find the transfer function via Masons' rule.
- Analyze the stability of a system from the transfer function.

**Module -1**

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs. **L1, L2, L3**

**Module -2**

Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). **L1, L2, L3**

**Module -3**

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci. **L1, L2, L3**

**Module -4**

**Frequency domain analysis and stability:**
Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function.
Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded)
Introduction to lead, lag and lead-lag compensating networks (excluding design).
**L1, L2, L3**

**Module -5**

**Introduction to Digital Control System:** Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diaganolisation.

**L1, L2, L3**

**Course Outcomes:** At the end of the course, the students will be able to

- Develop the mathematical model of mechanical and electrical systems
- Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method
- Determine the time domain specifications for first and second order systems
- Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
- Determine the stability of a system in the frequency domain using Nyquist and bode plots
- Develop a control system model in continuous and discrete time using state variable techniques

**Text Book:**

J.Nagarath and M.Gopal, " Control Systems Engineering", New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.

**Reference Books:**


1. "Modern Control Engineering," K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7.
2. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. "Feedback and Control System," Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007.

## ARM MICROCONTROLLER & EMBEDDED SYSTEMS

**B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering**
**[As per Choice Based Credit System (CBCS) Scheme]**

| | | | |
|---|---|---|---|
| **Course Code** | **17EC62** | **CIE Marks** | **40** |
| **Number of Lecture Hours/Week** | **04** | **SEE Marks** | **60** |
| **Total Number of Lecture Hours** | **50 (10 Hours / Module)** | **Exam Hours** | **03** |

**CREDITS – 04**

**Course objectives:** This course will enable students to:

- Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3.
- Program ARM Cortex M3 using the various instructions and C language for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

**Module-1**

**ARM-32 bit Microcontroller:** Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 1: Ch 1, 2, 3) **L1, L2**

**Module-2**

**ARM Cortex M3 Instruction Sets and Programming:** Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) **L1, L2, L3**

**Module-3**

**Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.
(Text 2: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). **L1, L2, L3**

**Module-4**

**Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language).
(Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only) **L1, L2, L3**

**Module-5**

**RTOS and IDE for Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques
(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)
**L1, L2, L3**

**Course outcomes:** After studying this course, students will be able to:

- Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

**Text Books:**


1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.

2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

## EMBEDDED CONTROLLER LAB

**B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering**
**[As per Choice Based Credit System (CBCS) Scheme]**

| | | | |
|---|---|---|---|
| **Course Code** | **17ECL67** | **CIE Marks** | **40** |
| **Number of Lecture Hours/Week** | **01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03** | **SEE Marks** | **60** |
| **RBT Levels** | **L1, L2, L3** | **Exam Hours** | **03** |

**CREDITS – 02**

**Course objectives:** This course will enable students to:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

**Laboratory Experiments**

**PART-A:** Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

**PART-B:** Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display “Hello World” message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.

4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

**Course outcomes:** After studying this course, students will be able to:

- Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
- Develop assembly language programs using ARM Cortex M3 for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

**Conduction of Practical Examination:**

1. PART-B experiments using Embedded-C are only to be considered for the practical examination. PART-A ALP programs are for study purpose and can be considered for Internal Marks evaluation.

2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.

3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

# ANALOG CIRCUITS

| | |
|---|---|
| Course Code : **18EC42** | CIE Marks : 40 |
| Lecture Hours/Week : 03 + 2 (Tutorial) | SEE marks : 60 |
| Total Number of Lecture Hours : 50 (10 Hrs / Module) | Exam Hours : 03 |
| **CREDITS : 04** | |

**Course Learning Objectives:** This course will enable students to:

- Explain various BJT parameters, connections and configurations.
- Design and demonstrate the diode circuits and transistor amplifiers.
- Explain various types of FET biasing, and demonstrate the use of FET amplifiers.
- Construct frequency response of FET amplifiers at various frequencies.
- Analyze Power amplifier circuits in different modes of operation.
- Construct Feedback and Oscillator circuits using FET.

## Module -1

**BJT Biasing: Biasing in BJT amplifier circuits**: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor.
**Small signal operation and Models**: Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid Π model.
**MOSFETs: Biasing in MOS amplifier circuits:** Fixing $V_{GS}$, Fixing $V_G$, Drain to Gate feedback resistor.
**Small signal operation and modeling**: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance.
**[Text 1: 3.5(3.5.1, 3.5.3), 3.6(3.6.1 to 3.6.6), 4.5(4.5.1, 4.5.2, 4.5.3), 4.6(4.6.1 to 4.6.6) ]** **L1, L2,L3**

## Module -2

**MOSFET Amplifier configuration:** Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance $R_s$, Source follower.
**MOSFET internal capacitances and High frequency model:** The gate capacitive effect, Junction capacitances, High frequency model.
**Frequency response of the CS amplifier**: The three frequency bands, high frequency response, Low frequency response.

**Oscillators:** FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation)

**[Text 1: 4.7(4.7.1 to 4.7.4, 4.7.6) 4.8(4.8.1, 4.8.2, 4.8.3), 4.9, 12.2.2, 12.3.1, 12.3.2] L1, L2, L3**

**Module -3**

**Feedback Amplifier:** General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis).

**Output Stages and Power Amplifiers:** Introduction, Classification of output stages,, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier.

**[Text 1: 7.1, 7.2, 7.3, 7.4.1, 7.5.1, 7.6 (7.6.1 to 7.6.3), 13.1, 13.2, 13.3 (13.3.1, 13.3.2, 13.3.3, 13.4, 13.7)] L1, L2, L3**

**Module -4**

**Op-Amp with Negative Feedback and general applications**

Inverting and Non inverting Amplifiers – Closed Loop voltage gain, Input impedance, Output impedance, Bandwidth with feedback. DC and AC Amplifiers, Summing, Scaling and Averaging Amplifiers, Instrumentation amplifier, Comparators, Zero Crossing Detector, Schmitt trigger.

**[Text 2: 3.3(3.3.1 to 3.3.6), 3.4(3.4.1 to 3.4.5) 6.2, 6.5, 6.6 (6.6.1), 8.2, 8.3, 8.4] L1, L2, L3**

**Module -5**

**Op-Amp Circuits**: DAC - Weighted resistor and R-2R ladder, ADC- Successive approximation type, Small Signal half wave rectifier, Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters.

**555 Timer and its applications:** Monostable and a stable Multivibrators.

**[Text 2: 8.11(8.11.1a, 8.11.1b), 8.11.2a, 8.12.2, 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9, 9.4.1, 9.4.1(a), 9.4.3, 9.4.3(a)] L1, L2, L3**

**Course Outcomes:**At the end of this course students will demonstrate the ability to

1. Understand the characteristics of BJTs and FETs.
2. Design and analyze BJT and FET amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of linear ICs.
5. Design of Linear IC based circuits.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th Edition, Oxford, 2015. ISBN:978-0-19-808913-1
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition. Pearson Education, 2000. ISBN: 8120320581


**Reference Books:**


1. Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education, 2013, ISBN: 978-93-325-4260-0.
2. Fundamentals of Microelectronics, Behzad Razavi, 2nd Edition, John Weily, 2015, ISBN 978-81-265-7135-2
3. J.Millman & C.C. Halkias—Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5

# CONTROL SYSTEMS

| | | |
|---|---|---|
| Course Code | : **18EC43** | CIE Marks : 40 |
| Lecture Hours/Week : 3 | | SEE Marks : 60 |
| Total Number of Lecture Hours : 40(8 Hrs/Module) | | Exam Hours: 03 |
| **CREDITS – 03** | | |

**Course Learning Objectives**: This course will enable students to:

- Understand the basic features, configurations and application of control systems.
- Understand various terminologies and definitions for the control systems.
- Learn how to find a mathematical model of electrical, mechanical and electro- mechanical systems.
- Know how to find time response from the transfer function.
- Find the transfer function via Masons' rule.
- Analyze the stability of a system from the transfer function.

**Module – 1**

**Introduction to Control Systems:** Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems –Mechanical Systems, Electrical Systems, Electromechanical systems, Analogous Systems.

**L1, L2, L3**

**Module – 2**

**Block diagrams and signal flow graphs:** Transfer functions, Block diagram algebra and Signal Flow graphs.

**L1, L2, L3**

**Module – 3**

**Time Response of feedback control systems:** Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). **L1, L2, L3**

**Module – 4**

**Stability analysis:** Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion.

Introduction to Root-Locus Techniques, The root locus concepts, Construction of rootloci.

**Frequency domain analysis and stability:** Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function.

**L1, L2, L3**

**Module – 5**

Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded)

Introduction to lead, lag and lead- lag compensating networks (excluding design).

**Introduction to State variable analysis:** Concepts of state, state variable and state models for electrical systems, Solution of state equations.

**L1, L2, L3**

**Course Outcomes:** At the end of the course, the students will be able to

1. Develop the mathematical model of mechanical and electrical systems.
2. Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method.
3. Determine the time domain specifications for first and second order systems.
4. Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
5. Determine the s stability of a system in the frequency domain using Nyquist and bode plots.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. J. Nagarath and M. Gopal, "Control Systems Engineering", New Age International(P) Limited, Publishers, Fifth edition- 2005, ISBN: 81 - 224 - 2008-7.

**Reference Books:**


1. "Modern Control Engineering", K. Ogata, Pearson Education Asia/ PHI, 4th Edition, 2002. ISBN 978 - 81 - 203 - 4010 - 7.
2. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. "Feedback and Control System," Joseph J Distefano III et. al., Schaum's Outlines, TMH, 2nd Edition 2007.

## MICROCONTROLLER

| | | |
|---|---|---|
| Course Code | : **18EC46** | CIE Marks : 40 |
| Lecture Hours/Week : 03 | | SEE Marks : 60 |
| Total Number of Lecture Hours : 40 (8 Hours / Module) | | Exam Hours:03 |

**CREDITS – 03**

**Course Learning Objectives:** This course will enable students to:

- Understand the difference between a Microprocessor and a Microcontroller and embedded microcontrollers.
- Familiarize the basic architecture of 8051 microcontroller.
- Program 8051microprocessor using Assembly Level Language and C.
- Understand the interrupt system of 8051 and the use of interrupts.
- Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051.
- Interface 8051 to external memory and I/O devices using its I/O ports.

### Module-1

**8051 Microcontroller:** Microprocessor vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

**L1, L2**

### Module -2

**8051 Instruction Set:** Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.

**L1, L2**

### Module-3

**8051 Stack, I/O Port Interfacing and Programming:** 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops.

Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status. **L1, L2, L3**

### Module -4

**8051 Timers and Serial Port:** 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode-2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS-232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. **L1, L2, L3**

**Module -5**

**8051 Interrupts and Interfacing Applications:** 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming.

**L1, L2, L3**

**Course outcomes:** At the end of the course, students will be able to:

1. Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
2. Write 8051 Assembly level programs using 8051 instruction set.
3. Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051.
4. Write 8051 Assembly language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.
5. Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/ Cengage Learning.

**Reference Books:**

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

# MICROCONTROLLER LABORATORY

| | | |
|---|---|---|
| Laboratory Code : **18ECL47** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week : 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Levels : L1, L2, L3 | | Exam Hours : 03 |
| **CREDITS 02** | | |

**Course Learning Objectives:** This laboratory course enables students to

- Understand the basics of microcontroller and its applications.
- Have in-depth knowledge of 8051 assembly language programming.
- Understand controlling the devices using C programming.
- The concepts of I/O interfacing for developing real time embedded systems.

**Laboratory Experiments**

**I. PROGRAMMING**

1. Data Transfer: Block Move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX.
7. Programs to generate delay, Programs using serial port and on-Chip timer/counter.

**II. INTERFACING**

1. Interface a simple toggle switch to 8051 and write an ALP to generate an interrupt which switches on an LED (i) continuously as long as switch is on and (ii) only once for a small time when the switch is turned on.
2. Write a C program to (i) transmit and (ii) to receive a set of characters serially by interfacing 8051 to a terminal.
3. Write ALPs to generate waveforms using ADC interface.
4. Write ALP to interface an LCD display and to display a message on it.
5. Write ALP to interface a Stepper Motor to 8051 to rotate the motor.
6. Write ALP to interface ADC-0804 and convert an analog input connected to it.

**Course Outcomes:** On the completion of this laboratory course, the students will be able to:

1. Enhance programming skills using Assembly language and C.
2. Write Assembly language programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051.
3. Interface different input and output devices to 8051 and control them using Assembly language programs.
4. Interface the serial devices to 8051 and do the serial transfer using C programming.
5. Develop applications based on Microcontroller 8051.

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

# ANALOG CIRCUITS LABORATORY

| Laboratory Code : **18ECL48** | CIE Marks : 40 | SEE Marks : 60 |
|---|---|---|
| Lecture Hours/Week : 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Levels : L1, L2, L3 | | Exam Hours : 03 |
| **CREDITS 02** | | |

**Course Learning Objectives:** This laboratory course enables students to

- Understand the circuit configurations and connectivity of BJT and FET Amplifiers and Study of frequency response
- Design and test of analog circuits using OPAMPs
- Understand the feedback configurations of transistor and OPAMP circuits
- Use of circuit simulation for the analysis of electronic circuits.

**Laboratory Experiments**

**PART A : Hardware Experiments**

1. Design and setup the Common Source JFET/MOSFET amplifier and plot the frequency response.
2. Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances.
3. Design and set-up BJT/FET i) Colpitts Oscillator and ii) Crystal Oscillator
4. Design active second order Butterworth low pass and high pass filters.
5. Design Adder, Integrator and Differentiator circuits using Op-Amp
6. Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP values and obtain the hysteresis.
7. Design 4 bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.
8. Design Monostable and a stable Multivibrator using 555 Timer.

**PART-B : Simulation using EDA software** (EDWinXP, PSpice, MultiSim, Proteus, CircuitLab or any other equivalent tool can be used)

1. RC Phase shift oscillator and Hartley oscillator
2. Narrow Band-pass Filter and Narrow band-reject filter
3. Precision Half and full wave rectifier
4. Monostable and Astable Multivibrator using 555 Timer.

**Course Outcomes:** On the completion of this laboratory course, the students will be able to:

1. Analyze Frequency response of JFET/MOSFET amplifier.
2. Design BJT/FETs amplifier with and without feedback and evaluate their performance characteristics.
3. Apply the knowledge gained in the design of BJT/FET circuits in Oscillators.
4. Design analog circuits using OPAMPs for different applications.
5. Simulate and analyze analog circuits that uses ICs for different electronic applications.

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

**Reference Books:**

1. David A Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual, 5th Edition, 2009, Oxford University Press.

# DIGITAL SIGNAL PROCESSING

| | |
|---|---|
| Course Code : **18EC52** | CIE Marks : 40 |
| Lecture Hours/Week : 03 + 2 (Tutorial) | SEE marks : 60 |
| Total Number of Lecture Hours : 50 (10 Hrs / Module) | Exam Hours : 03 |
| **CREDITS : 04** | |

**Course Learning Objectives:** This course will enable students to

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Realization of FIR and IIR filters in different structural forms.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.
- Understand the architecture and working of DSP processor

**Module-1**

**Discrete Fourier Transforms (DFT):** Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution, Additional DFT properties.

**[Text 1], L1,L2,L3**

**Module-2**

**Linear filtering methods based on the DFT**: Use of DFT in Linear Filtering, Filtering of Long data Sequences.

**Fast-Fourier-Transform (FFT) algorithms:** Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms.

**[Text 1], L1,L2, L3**

**Module-3**

**Design of FIR Filters:** Characteristics of practical frequency –selective filters, Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR filters using windows - Rectangular, Hamming, Hanning, Bartlett windows. Design of FIR filters using frequency sampling method. Structure for FIR Systems: Direct form, Cascade form and Lattice structures.

**[Text1], L1, L2, L3**

**Module-4**

**IIR Filter Design:** Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Lowpass prototype transformation, Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT. Realization of IIR Filters in Direct form I and II.

**[Text 2],** **L1,L2,L3**

**Module-5**

**Digital Signal Processors:** DSP Architecture, DSP Hardware Units, Fixed point format, Floating point Format, IEEE Floating point formats, Fixed point digital signal processors, Floating point processors, FIR and IIR filter implementations in Fixed point systems.

**[Text 2],** **L1, L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Determine response of LTI systems using time domain and DFT techniques.
2. Compute DFT of real and complex discrete time signals.
3. Compute DFT using FFT algorithms and linear filtering approach.
4. Design and realize FIR and IIR digital filters.
5. Understand the DSP processor architecture.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60

**Text Book:**

1. Proakis & Manolakis, "Digital Signal Processing – Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
2. Li Tan, Jean Jiang, "Digital Signal processing – Fundamentals and Applications", Academic Press, 2013, ISBN: 978-0-12-415893.

**Reference Books:**


1. Sanjit K Mitra, "Digital Signal Processing, A Computer Based Approach", 4th Edition, McGraw Hill Education, 2013,
2. Oppenheim & Schaffer, "Discrete Time Signal Processing" , PHI, 2003.
3. D.Ganesh Rao and Vineeth P Gejji, "Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231

# DIGITAL SIGNAL PROCESSING LABORATORY

| Course Code : **18ECL57** | CIE Marks : 40 | SEE Marks : 60 |
|---|---|---|
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course Learning Objectives:** This course will enable students to

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

**Laboratory Experiments**

**Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:**

1. Verification of sampling theorem (use interpolation function).

2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.

3. Auto and cross correlation of two sequences and verification of their properties

4. Solving a given difference equation.

5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).

6. (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
   (ii) DFT computation of square pulse and Sinc function etc.

7. Design and implementation of Low pass and High pass FIR filter to meet the desired specifications (using different window techniques) and test the filter with an audio file. Plot the spectrum of audio signal before and after filtering.

8. Design and implementation of a digital IIR filter (Low pass and High pass) to meet given specifications and test with an audio file. Plot the spectrum of audio signal before and after filtering.

**Following Experiments to be done using DSP kit**

9. Obtain the Linear convolution of two sequences.
10. Compute Circular convolution of two sequences.
11. Compute the N-point DFT of a given sequence.
12. Determine the Impulse response of first order and second order system.
13. Generation of sine wave and standard test signals

**Course Outcomes:**

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

1. Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
2. Model the discrete time signals and systems and verify its properties and results.
3. Implement discrete computations using DSP processor and verify the results.
4. Realize the digital filters using a simulation tool and analyze the response of the filter for an audio signal.
5. Write programs using Matlab / Scilab/Octave to illustrate DSP concepts.

**Conduct of Practical Examination:**

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

**Reference Books:**

1. Vinay K Ingle, John G Proakis, Digital Signal Processing using MATLAB, Fourth Edition, Cengage India Private Limited, 2017.

## SEMESTER – VI
# DIGITAL COMMUNICATION

| | | |
|---|---|---|
| Course Code | : 18EC61 | CIE Marks : 40 |
| Lecture Hours/Week | : 03 + 2 (Tutorial) | SEE marks : 60 |
| Total Number of Lecture Hours : 50 (10 Hrs / Module) | | Exam Hours : 03 |
| **CREDITS : 04** | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the mathematical representation of signal, symbol, and noise.
- Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
- Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Compute performance parameters and mitigate channel induced impediments in corrupted channel conditions.

### Module-1

**Bandpass Signal to Equivalent Low pass**: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems **(Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).**

**Line codes:** Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities **(Text 1: Ch 6.10).**
Overview of HDB3, B3ZS, B6ZS **(Ref. 1: 7.2)**

**L1,L2,L3**

### Module-2

**Signaling over AWGN Channels**- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver **(Text 1: 7.1, 7.2, 7.3, 7.4).**

**L1,L2,L3**

### Module – 3

**Digital Modulation Techniques**: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM **(Relevant topics in Text 1 of 7.6, 7.7).**

Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability **(Relevant topics in Text 1 of 7.8).**
Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) **(Text 1: 7.11, 7.12. 7.13).**

**L1,L2,L3**

**Module-4**

**Communication through Band Limited Channels**: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI–The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol–by–Symbol detection of data with controlled ISI **(Text 2: 9.1, 9.2, 9.3.1, 9.3.2).**
Channel Equalization: Linear Equalizers (ZFE, MMSE), **(Text 2: 9.4.2).**

**L1,L2,L3**

**Module-5**

**Principles of Spread Spectrum:** Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 **(Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).**

**L1,L2,L3**

**Course Outcomes:** At the end of the course, the students will be able to:

1. Associate and apply the concepts of Bandpass sampling to well specified signals and channels.
2. Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels.
3. Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.

4. Demonstrate that bandpass signals subjected to corruption and distortion in a bandlimited channel can be processed at the receiver to meet specified performance criteria.
5. Understand the principles of spread spectrum communications.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.


**Reference Books:**


1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. Bernard Sklar and Ray, "Digital Communications - Fundamentals and Applications", Pearson Education, Third Edition, 2014, ISBN: 978-81-317-2092-9.

# EMBEDDED SYSTEMS

| | | |
|---|---|---|
| Course Code | : 18EC62 | CIE Marks : 40 |
| Lecture Hours/Week | : 03 + 2 (Tutorial) | SEE marks : 60 |
| Total Number of Lecture Hours : 50 (10 Hrs / Module) | | Exam Hours : 03 |
| **CREDITS : 04** | | |

**Course Learning Objectives:** This course will enable students to:

- Explain the architectural features and instructions of 32 bit microcontroller -ARM Cortex M3.
- Develop Programs using the various instructions of ARM Cortex M3 and C language for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

## Module 1

**ARM-32 bit Microcontroller:** Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence **(Text 1: Ch-1, 2, 3)**

**L1,L2**

## Module 2

**ARM Cortex M3 Instruction Sets and Programming:** Assembly basics, Instruction list and description, Thumb and ARM instructions, Special instructions, Useful instructions, CMSIS, Assembly and C language Programming **(Text 1: Ch-4, Ch-10.1 to 10.6)**

**L1,L2,L3**

## Module 3

**Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Differences between RISC and CISC, Harvard and Princeton, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only)

**(Text 2: All the Topics from Ch-1 and Ch-2 (Fig and explanation before 2.1) 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, selected topics of 2.4.1 and 2.4.2 only).**

**L1, L2**

**Module 4**

**Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language). **Text 2: Ch-3, Ch-4 (4.1, 4.2.1 and 4.2.2 only), Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)**

**L1,L2,L3**

**Module 5**

**RTOS and IDE for Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques **(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch-12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)**

**L1,L2,L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
2. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
3. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
4. Develop the hardware software co-design and firmware design approaches.
5. Explain the need of real time operating system for embedded system applications.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.


**Reference Books:**


1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0-471-72180-2.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd Ed. Man Press LLC ©2015 ISBN: 0982692633 9780982692639.
3. K.V. K. K Prasad, Embedded Real Time Systems, Dreamtech publications, 2003.
4. Rajkamal, Embedded Systems, 2nd Edition, McGraw hill Publications, 2010.

# EMBEDDED SYSTEMS LABORATORY

| Course Code : **18ECL66** | CIE Marks : 40 | SEE Marks : 60 |
|---|---|---|
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS–02** | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

**Laboratory Experiments**

Conduct the following experiments on an ARM CORTEX M3 evaluation board to learn ALP and using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

**PART A:**

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.
3. ALP to find the number of 0's and 1's in a 32 bit data
4. ALP to find determine whether the given 16 bit is even or odd
5. ALP to write data to RAM

**PART B:**

6. Display "Hello world" message using internal UART
7. Interface and Control the speed of a DC Motor.
8. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
9. Interface a DAC and generate Triangular and Square waveforms.
10. Interface a 4x4 keyboard and display the key code on an LCD.
11. Demonstrate the use of an external interrupt to toggle an LED On/Off.
12. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay.
13. Measure Ambient temperature using a sensor and SPI ADC IC.

**Course outcomes:** After studying this course, students will be able to:

1. Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
2. Develop assembly language programs using ARM Cortex M3 for different applications.
3. Interface external devices and I/O with ARM Cortex M3.
4. Develop C language programs and library functions for embedded system applications.
5. Analyze the functions of various peripherals, peripheral registers and power saving modes of ARM Cortex M3

**Conduction of Practical Examination:**

- One Question from PART A and one Question from PART B to be asked in the examination.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

## COMMUNICATION LABORATORY

| Course Code : **18ECL67** | CIE Marks : 40 | SEE Marks : 60 |
|---|---|---|
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course Learning Objectives:** This course will enable students to:

- Design and test the communication circuits for different analog modulation schemes.
- Design and demonstrate the digital modulation techniques
- Demonstrate and measure the wave propagation in microstrip antennas
- Characteristics of microstrip devices and measurement of its parameters.
- Understand the probability of error computations of coherent digital modulation schemes.

**Laboratory Experiments**

**PART-A: Expt. 1 to Expt. 5 have to be performed using discrete components.**

1. Amplitude Modulation and Demodulation: i) Standard AM, ii)DSBSC (LM741 and LF398 ICs can be used)
2. Frequency modulation and demodulation ( IC 8038/2206 can be used)
3. Pulse sampling, flat top sampling and reconstruction
4. Time Division Multiplexing and Demultiplexing of two bandlimited signals.
5. FSK and PSK generation and detection
6. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
7. Obtain the Radiation Pattern and Measurement of directivity and gain of microstrip dipole and Yagi antennas.
8. Determination of
    a. Coupling and isolation characteristics of microstrip directional coupler.
    b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
    c. Power division and isolation of microstrip power divider.

**PART-B: Simulation Experiments using SCILAB/MATLAB/Simulink or LabVIEW**

1. To Simulate NRZ, RZ, half-sinusoid & raised cosine pulses and generate eye diagram for binary polar signaling.
2. Pulse code modulation and demodulation system.

3. Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and compare them with their performance curves.
4. Digital Modulation Schemes i) DPSK Transmitter and Receiver, ii) QPSK Transmitter and Receiver.

**Course Outcomes:** On the completion of this laboratory course, the students will be able to:

1. Design and test circuits for analog modulation and demodulation schemes viz., AM, FM, etc.
2. Determine the characteristics and response of microwave waveguide.
3. Determine characteristics of microstrip antennas and devices & compute the parameters associated with it.
4. Design and test the digital and analog modulation circuits and display the waveforms.
5. Simulate the digital modulation systems and compare the error performance of basic digital modulation schemes.

**Conduct of Practical Examination:**

- All laboratory experiments are to be considered for practical examination.
- For examination one question from **PART-A** and one question from **PART-B or** only one question from **PART-B** experiments based on the complexity, to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

# DIGITAL IMAGE PROCESSING

| | | | |
|---|---|---|---|
| Course Code | : 18EC733 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40 (08 Hrs / Module) | | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to

- Understand the fundamentals of digital image processing.
- Understand the image transforms used in digital image processing.
- Understand the image enhancement techniques used in digital image processing.
- Understand the image restoration techniques and methods used in digital image processing.
- Understand the Morphological Operations used in digital image processing.

**Module1**

**Digital Image Fundamentals:** Whatis Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition.

**(Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.2, 2.6.2) L1,L2**

**Module-2**

**Image Enhancement in the Spatial Domain:** Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters

**(Text:Chapter2: Sections 2.3 to 2.62, Chapter3: Sections3.2 to 3.6), L1,L2**

**Module-3**

Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.

**(Text: Chapter4: Sections 4.2, 4.5 to 4.10), L1,L2**

**Module-4**

Restoration: Noise models, Restorationin the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations Estimating the Degradation Function, Inverse Filtering, Minimum

Mean Square Error(Wiener) Filtering, Constrained Least Squares Filtering.
**(Text: Chapter 5: Sections 5.2, to 5.9)** **L1,L2**

**Module-5**

**Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing.

**Image Processing:** Color Fundamentals, Color Models, Pseudo color Image Processing.

**(Text: Chapter 6: Sections 6.1 to 6.3 Chapter 9: Sections9.1to9.3)**

**L1,L2**

**Course Outcomes:** At the end of the course, students should be able to:

1. Describe the fundamentals of digital image processing.
2. Understand image formation and the role human visual system plays in perception of gray and color image data.
3. Apply image processing techniques in both the spatial and frequency (Fourier) domains.
4. Design and evaluate image analysis techniques
5. Conduct independent study and analysis of Image Enhancement and restoration techniques.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

- Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

**Reference Books:**


1. Digital Image Processing- S. Jayaraman, S. Esakkirajan,T. Veerakumar, Tata Mc Graw Hill 2014.
2. Fundamentals of Digital Image Processing- A. K. Jain, Pearson 2004.
3. Image Processing analysis and Machine vision with Mind Tap by Milan Sonka and Roger Boile, Cengage Publications, 2018.

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

**TRANSFORMERS AND GENERATORS**

| | | | |
|---|---|---|---|
| Subject Code | **18EE33** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To understand the concepts of transformers and their analysis.
- To suggest a suitable three phase transformer connection for a particular operation.
- To understand the concepts of generator and to evaluate their performance.
- To explain the requirement for the parallel operation of transformers and synchronous generators.

**Module-1**

**Single phase Transformers:** Operation of practical transformer under no-load and on-load with phasor diagrams. Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency-commercial and all-day efficiency. Voltage regulation and its significance.

**Three-phase Transformers:** Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation– star/star, delta/delta, star/delta, zigzag/star and V/V, comparative features. Phase conversion-Scott connection for three-phase to two-phase conversion. Labeling of three-phase transformer terminals, vector groups.

**Module-2**

**Tests, Parallel Operation of Transformer& Auto Transformer:** Polarity test, Sumpner's test, separation of hysteresis and eddy current losses

**Parallel Operation of Transformers:** Necessity of Parallel operation, conditions for parallel operation– Single phase and three phase. Load sharing in case of similar and dissimilar transformers. **Auto transformers and Tap changing transformers:** Introduction to autotransformer-copper economy, equivalent circuit, no load and on load tap changing transformers.

**Module-3**

**Three-Winding Transformers & Cooling of Transformers**: Three-winding transformers. Cooling of transformers.

**Direct current Generator:** Armature reaction, Commutation and associated problems,

**Synchronous Generators:** Armature windings, winding factors, e.m.f equation. Harmonics–causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit.

**Module-4**

**Synchronous Generators Analysis:** Alternator on load. Excitation control for constant terminal voltage. Voltage regulation. Open circuit and short circuit characteristics, Assessment of reactance-short circuit ratio, synchronous reactance, Voltage regulation by EMF, MMF and ZPF

**Module-5**

**Synchronous Generators (Salient Pole):** Effects of saliency, two-reaction theory, Parallel operation of generators and load sharing. Methods of Synchronization, Synchronizing power, Determination of $X_d$ & $X_q$ – slip test

**Performance of Synchronous Generators:** Power angle characteristic (salient and non salient pole), power angle diagram, reluctance power, Capability curve for large turbo generators. Hunting and damper windings.

**Course Outcomes:** At the end of the course the student will be able to:

- Understand the construction and operation of 1-phase, 3-Phase transformers and Autotransformer.
- Analyze the performance of transformers by polarity test, Sumpner's Test, phase conversion, 3-phase connection, and parallel operation.
- Understand the construction and working of AC and DC Generators.
- Analyze the performance of the AC Generators on infinite bus and parallel operation.
- Determine the regulation of AC Generator by Slip test, EMF, MMF, and ZPF Methods.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

| | | | | |
|---|---|---|---|---|
| **Text Books** | | | | |
| 1 | Electric Machines | D. P. Kothari, et al | McGraw Hill | 4th Edition, 2011 |
| 2 | Principals of Electrical Machines | V.K Mehta, Rohit Mehta | S Chand | 2nd edition, 2009 |
| **Reference Books** | | | | |
| 1 | Electric Machines | MulukuntlaS.Sarma,at el | Cengage | 1st Edition, 2009 |
| 2 | Electrical Machines, Drives and Power systems | Theodore Wildi | Pearson | 6th Edition, 2014 |
| 3 | Electric Machines | Ashfaq Hussain | Dhanpat Rai & Co | 2nd Edition, 2013 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - IV**

## TRANSMISSION AND DISTRIBUTION

| | | | |
|---|---|---|---|
| Course Code | **18EE43** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:2:0 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

- To understand the concepts of various methods of generation of power.
- To understand the importance of HVAC, EHVAC, UHVAC and HVDC transmission.
- To design insulators for a given voltage level.
- To calculate the parameters of the transmission line for different configurations and assess the performance of the line.
- To study underground cables for power transmission and evaluate different types of distribution systems. ■

**Module-1**

**Introduction to Power System:** Structure of electric power system: generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC. Interconnection. Feeders, distributors and service mains.

**Overhead Transmission Lines:** A brief introduction to types of supporting structures and line conductors-Conventional conductors; Aluminium Conductor steel reinforced (ACSR), All – aluminium alloy conductor (AAAC) and All –aluminium conductor (AAC). High temperature conductors; Thermal resistant aluminium alloy (ATI),Super thermal resistant aluminium alloy (ZTAI), Gap type thermal resistant aluminium alloy conductor steel reinforced (GTACSR), Gap type super thermal resistant aluminium alloy conductor steel reinforced (GZTACSR). Bundle conductor and its advantages. Importance of sag, Sag calculation – supports at same and different levels, effect of wind and ice. Line vibration and vibration dampers. Overhead line protection against lightening; ground wires.

**Overhead L ine Insulators:** A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency. Arcing horns. ■

**Module-2**

**Line Parameters:** Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines. ). Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Capacitance of composite – conductor, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines. ■

**Module-3**

**Performance of Transmission Lines:** Classification of lines – short, medium and long. Current and voltage relations, line regulation and Ferranti effect in short length lines, medium length lines considering Nominal T and nominal $\pi$ circuits, and long lines considering hyperbolic form equations. Equivalent circuit of a long line. ABCD constants in all cases. ■

**Module-4**

**Corona:** Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona.

**Underground Cable:** Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and DC cables. Limitations of cables. Specification of power cables. ■

**Module-5**

**Distribution:** Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems – Three phase 4 wire system and single phase 2 wire distribution, AC distributors with concentrated loads. Effect of disconnection of neutral in a 3 phase four wire system.

**Reliability and Quality of Distribution System:** Introduction, definition of reliability, failure, probability concepts, limitation of distribution systems, power quality, Reliability aids. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Explain transmission and distribution scheme, identify the importance of different transmission systems and types of insulators.
- Analyze and compute the parameters of the transmission line for different configurations.
- Assess the performance of overhead lines.
- Interpret corona, explain the use of underground cables.
- Classify different types of distribution systems; examine its quality & reliability.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

| | | | | |
|---|---|---|---|---|
| 1 | A Course in Electrical Power | Soni Gupta and | DhanpatRai | - |
| 2 | Principles of Power System | V.K. Mehta, Rohit Mehta | S. Chand | 1st Edition 2013 |

**Reference Books:**

| | | | | |
|---|---|---|---|---|
| 1 | Power System Analysis and Design | J. Duncan Gloverat el | Cengage Learning | 4th Edition 2008 |
| 2 | Electrical power Generation, Transmission | S.N. Singh | PHI | 2nd Edition,2009 |
| 3 | Electrical Power | S.L.Uppal | Khanna Publication | |
| 4 | Electrical power systems | C. L. Wadhwa | New Age | 5th Edition, |
| 5 | Electrical power systems | AshfaqHussain | CBS Publication | |
| 6 | Electric Power Distribution | A.S. Pabla | McGraw-Hill | 6th Edition,2012 |
| | *For* High temperature conductors refer www.jpowers.co.jp/english/product/pdf/gap_c1.pdfand Power | | | |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**MICROCONTROLLER**

| | | | |
|---|---|---|---|
| Course Code | **18EE52** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:2:0 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

- To explain the internal organization and working of Computers, microcontrollers and embedded processors.
- Compare and contrast the various members of the 8051 family.
- To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions.
- To explain in detail the execution of 8051 Assembly language instructions and data types
- To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions.
- To explain different addressing modes of 8051, arithmetic, logic instructions, and programs.
- To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic,

**Module-1**

**8051 Microcontroller Basics:** Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM.8051 Addressing Modes. ■

**Module-2**

**Assembly Programming and Instruction of 8051:** Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. ■

**Module-3**

**8051 Programming in C:** Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C

**8051 Timer Programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. ■

**Module-4**

**8051 Serial Port Programming in Assembly and C:** Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C.

**8051 Interrupt Programming in Assembly and C:** 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. ■

**Module-5**

**Interfacing:** LCD interfacing, Keyboard interfacing.
**ADC, DAC and Sensor Interfacing:** ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning.
**Motor Control: Relay, PWM, DC and Stepper Motor:** Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM.
**8051 Interfacing with 8255:** Programming the 8255, 8255 interfacing, C programming for 8255. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Outline the 8051 architecture, registers, internal memory organization, addressing modes.
- Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming.
- Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
- Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming.
- Program 8051 to work with external devices for ADC, DAC, Stepper motor control, DC motor control, Elevator control. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | The 8051 Microcontroller and Embedded Systems Using Assembly and C | Muhammad Ali Mazadi | Pearson | 2nd Edition, 2008. |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | The 8051 Microcontroller | Kenneth Ayala | Cengage Learning | 3rd Edition, 2005 |
| 2 | The 8051 Microcontroller and Embedded Systems | Manish K Patel | McGraw Hill | 2014 |
| 3 | Microcontrollers: Architecture, Programming, Interfacing and System Design | Raj Kamal | Pearson | 1st Edition, 2012 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**POWER ELECTRONICS**

| | | | |
|---|---|---|---|
| Course Code | **18EE53** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:2:0 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

- To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics.
- To explain power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
- To explain the techniques for design and analysis of single phase diode rectifier circuits.
- To explain different power transistors, their steady state and switching characteristics andimitations.
- To explain different types of Thyristors, their gate characteristics and gate control requirements.
- To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.

**Module-1**

**Introduction:** Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches.

**Power Diodes:** Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Freewheeling diodes ,Freewheeling diodes with RL load.

**Diode Rectifiers:** Introduction, Diode Circuits with DC Source connected to R and RL load, Single-Phase Full-Wave Rectifiers with R load , Single-Phase Full-Wave Rectifier with RL Load . ■ **T1 & R1**

**Module-2**

**Power Transistors:** Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers. ■ **T1**

**Module-3**

**Thyristors:** Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, *di/dt*Protection, *dv/dt*Protection, DIACs, Thyristor Firing Circuits, Unijunction Transistor. ■ **T1**

**Module-4**

**Controlled Rectifiers:** Introduction, Single phase half wave circuit with RL Load, Single phase half wave circuit with RL Load and Freewheeling Diode, Single phase half wave circuit with RLE Load, Single-Phase Full Converters with RLE Load, Single-Phase Dual Converters, Principle of operation of Three- Phase duel Converters.

**AC Voltage Controllers:** Introduction, Principle of phase control & Integral cycle control, Single-Phase Full-Wave Controllers with Resistive Loads, Single- Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers. ■ **T1 & R1**

**Module-5**

**DC-DC Converters:** Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification**.**

**DC-AC Converters**: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single phase inverters, Harmonic reductions, Current source inverters. ■ **T1**

**Course Outcomes:** At the end of the course the student will be able to:

- To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
- To explain the techniques for design and analysis of single phase diode rectifier circuits.
- To explain different power transistors, their steady state and switching characteristics and limitations.
- To explain different types of Thyristors, their gate characteristics and gate control requirements.
- To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

| | | | | |
|---|---|---|---|---|
| **Text Book** | | | | |
| 1 | Power Electronics: Circuits Devices and Applications | Mohammad H Rashid, | Pearson | 4th Edition, 2014 |
| **Reference Books** | | | | |
| 1 | Power Electronics | P.S. Bimbhra | Khanna Publishers | 5th Edition, 2012 |
| 2 | Power Electronics: Converters, Applications and Design | Ned Mohan et al | Wiley | 3rd Edition, 2014 |
| 3 | Power Electronics | Daniel W Hart | McGraw Hill | 1st Edition, 2011 |
| 4 | Elements of Power Electronics | Philip T Krein | Oxford | Indian Edition, 2008 |
| | | | | |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**POWER SYSTEM PROTECTION (Core Subject)**

| | | | |
|---|---|---|---|
| Course Code | **18EE72** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss performance of protective relays, components of protection scheme and relay terminology.
- To explain relay construction and operating principles.
- To explain Over current protection using electromagnetic and static relays and Over current protective schemes.
- To discuss types of electromagnetic and static distance relays, effect of arc resistance, power swings, line length and source impedance on performance of distance relays.
- To discuss pilot protection; wire pilot relaying and carrier pilot relaying.
- To discuss construction, operating principles and performance of various differential relays for differential protection.
- To discuss protection of generators, motors, Transformer and Bus Zone Protection.
- To explain the principle of circuit interruption and different types of circuit breakers.
- To describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse.
- To discuss protection Against Over voltages and Gas Insulated Substation (GIS). ■

**Module-1**

**Introduction to Power System Protection:** Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.

**Relay Construction and Operating Principles:** Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.

**Overcurrent Protection:** Introduction, Time – current Characteristics, Current Setting, Time Setting. ■

**Module-2**

**Overcurrent Protection (continued):**Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.

**Distance Protection:** Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges(Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays. ■

**Module-3**

**Pilot Relaying Schemes:** Introduction, Wire Pilot Protection, Carrier Current Protection

**Differential Protection**: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection.

**Rotating Machines Protection:** Introduction, Protection of Generators.

**Transformer and Buszone Protection:** Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection. ■

**Module-4**

**Circuit Breakers:** Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, $SF_6$ Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers. ■

**Module-5**

**Fuses:** Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination.

**Protection against Overvoltages:** Causes of Overvoltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydonograph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL).

**Modern Trends in Power System Protection:** Introduction, gas insulated substation/switchgear (GIS). ■

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss performance of protective relays, components of protection scheme and relay terminology over current protection.
- Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays.
- Discuss pilot protection, construction, operating principles and performance of differential relays and discuss protection of generators, motors, transformer and Bus Zone Protection.
- Explain the construction and operation of different types of circuit breakers.
- Outline features of fuse, causes of overvoltages and its protection, also modern trends in Power System Protection. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1 | Power System Protection and Switchgear | Badri Ram, D.N. Vishwakarma | McGraw Hill | 2nd Edition |
| 2 | Power System Protection and Switchgear | BhuvaneshOza et al | McGraw Hill | 1st Edition, 2010 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Protection and Switchgear | Bhavesh et al | Oxford | 1st Edition, 2011 |
| 2 | Power System Switchgear and Protection | N. Veerappan S.R. Krishnamurthy | S. Chand | 1st Edition, 2009 |
| 3 | Fundamentals of Power System Protection | Y.G.Paithankar S.R. Bhide | PHI | 1st Edition, 2009 |

## MICROCONTROLLER (Core Course)
## B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]

| | | | |
|---|---|---|---|
| Course Code | 17EE52 | CIE Marks | 40 |
| Number of Lecture Hours/Week | 04 | SEE Marks | 60 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 04**

**Course objectives:**

- To explain the internal organization and working of Computers, microcontrollers and embedded processors.
- Compare and contrast the various members of the 8051 family.
- To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions.
- To explain in detail the execution of 8051 Assembly language instructions and data types
- To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions.
- To explain different addressing modes of 8051, arithmetic, logic instructions, and programs.
- To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic, arithmetic operations and data conversion.

| **Module-1** | | **Teaching Hours** |
|---|---|---|
| **8051 Microcontroller Basics:** Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM.8051 Addressing Modes. | | **10** |
| **Revised Bloom's Taxonomy Level** | $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying, $L_4$ – Analysing. | |
| **Module-2** | | |
| **Assembly programming and instruction of 8051:** Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. | | **10** |
| **Revised Bloom's Taxonomy Level** | $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying, $L_4$ – Analysing. | |
| **Module-3** | | |
| **8051 programming in C:** Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C<br>**8051 Timer programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. | | **10** |
| **Revised Bloom's Taxonomy Level** | $L_2$ – Understanding, $L_3$ – Applying, $L_4$ – Analysing, $L_5$ – Evaluating. | |
| **Module-4** | | |
| **8051 serial port programming in assembly and C:** Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C.<br>**8051 Interrupt programming in assembly and C:** 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programmingin C. | | **10** |
| **Revised Bloom's Taxonomy Level** | $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying, $L_4$ – Analysing. | |

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)**
**CHOICE BASED CREDIT SYSTEM (CBCS)**
**SEMESTER – V**

**17EE52 MICROCONTROLLER (Core Course) (continued)**

| **Module-5** | | **Teaching Hours** |
|---|---|---|
| **Interfacing:** LCD interfacing, Keyboard interfacing.<br>**ADC, DAC and sensor interfacing:** ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning.<br>**Motor control: Relay, PWM, DC and stepper motor:** Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM.<br>**8051 interfacing with 8255:** Programming the 8255, 8255 interfacing, C programming for 8255. | | **10** |
| **Revised Bloom's Taxonomy Level** | $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying, $L_4$ – Analysing. ■ | |

**Course outcomes:**

At the end of the course the student will be able to:

- Discuss the history of the 8051 and features of other 8051 family members and the internal architecture of the 8051.
- Explains the use of an 8051 assembler, the stack and the flag register, loop, jump, and call instructions.
- Discuss 8051 addressing modes, accessing data and I/O port programming, arithmetic, logic instructions, and programs.
- Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and data serialization
- Discuss the hardware connection of the 8051 chip, its timers, serial data communication and its interfacing of 8051to the RS232.

**Graduate Attributes (As per NBA)**

Engineering Knowledge, Problem analysis.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

**Textbook**

| | | | | |
|---|---|---|---|---|
| 1 | The 8051 Microcontroller and Embedded Systems Using Assembly and C | Muhammad Ali Mazadi | Pearson | 2nd Edition, 2008. |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | The 8051 Microcontroller | Kenneth Ayala | Cengage Learning | 3rd Edition, 2005 |
| 2 | The 8051 Microcontroller and Embedded Systems | Manish K Patel | McGraw Hill | 2014 |
| 3 | Microcontrollers: Architecture, Programming, Interfacing and System Design | Raj Kamal | Pearson | 1st Edition, 2012 |

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)**
**CHOICE BASED CREDIT SYSTEM (CBCS)**
**SEMESTER - V**

**RENEWABLE ENERGY RESOURCES( Open Elective )**

| | | | |
|---|---|---|---|
| Subject Code | 15EE563 | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Hours | 03 |
| Total Number of Lecture Hours | 40 | Exam Marks | 80 |

**Credits - 03**

**Course objectives:**

- To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- To explain sun – earth geometric relationship, Earth – Sun Angles and their Relationships
- To discuss about solar energy reaching the Earth's surface and solar thermal energy applications.
- To discuss types of solar collectors, their configurations and their applications
- To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications.
- To discus benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages.
- To discuss wind turbines, wind resources, site selection for wind turbine
- To discuss geothermal systems, their classification and geothermal based electric power generation
- To discuss waste recovery management systems, advantages and disadvantages
- To discuss biomass production, types of biomass gasifiers, properties of producer gas.
- To discuss biogas, its composition, production, benefits.
- To discuss tidal energy resources, energy availability, power generation.
- To explain motion in the sea wave, power associated with sea wave and energy availability and the devices for harnessing wave energy.
- To discuss principles of ocean thermal energy conversion and production of electricity.■

| **Module-1** | **Teaching Hours** |
|---|---|
| **Introduction:** Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.<br>**Energy from Sun:** Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications. ■ | **08** |
| **Revised Bloom's Taxonomy Level** $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying. | |
| **Module-2** | |
| **Solar Thermal Energy Collectors:** Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects ofSolar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar pond.<br>**Solar Cells:** Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems.■ | **08** |
| **Revised Bloom's Taxonomy Level** $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying, $L_4$ – Analysing. | |
| **Module-3** | |
| **Hydrogen Energy:** Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.<br>**Wind Energy:** Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.<br>**Geothermal Energy:** Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects. | **08** |

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)**
**CHOICE BASED CREDIT SYSTEM (CBCS)**
**SEMESTER - V**

**15EE563 RENEWABLE ENERGY RESOURCES(Open Elective) (continued)**

| **Module-3 (continued)** | | **Teaching Hours** |
|---|---|---|
| **Solid waste and Agricultural Refuse:** Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics. ■ | | |
| **Revised Bloom's Taxonomy Level** | $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying, $L_4$ – Analysing. | |
| **Module-4** | | |
| **Biomass Energy:**Biomass Production, Energy Plantation,Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.<br>**Biogas Energy:** Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.<br>**Tidal Energy:**Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy.■ | | **08** |
| **Revised Bloom's Taxonomy Level** | $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying, $L_4$ – Analysing. | |
| **Module-5** | | |
| **Sea Wave Energy:**Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.<br>**Ocean Thermal Energy:**Introduction,Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. ■ | | **08** |
| **Revised Bloom's Taxonomy Level** | $L_1$ – Remembering, $L_2$ – Understanding, $L_3$ – Applying. | |

**Course outcomes:**

At the end of the course the student will be able to:

- Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- Discuss energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
- Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
- Discus generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
- Discuss production of energy from biomass, biogas.
- Discuss tidal energy resources, energy availability and power generation.
- Discuss power generation sea wave energy and ocean thermal energy. ■

**Graduate Attributes (As per NBA)**

Engineering Knowledge,Problem Analysis,Modern tool usage,Ethics.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

**COMPUTER AIDED MACHINE DRAWING**

| | | | |
|---|---|---|---|
| Course Code | **18ME36A/46A** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 1:4:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To acquire the knowledge of CAD software and its features.
- To familiarize the students with Indian Standards on drawing practices.
- To impart knowledge of thread forms, fasteners, keys, joints and couplings.
- To make the students understand and interpret drawings of machine components leading to preparation of assembly drawings manually and using CAD packages.
- To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.

**Part A**

**Part A**

**Introduction:**
Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. Conversion of pictorial views into orthographic projections of simple machine parts (with and without section). Hidden line conventions. Precedence of lines.
Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids). True shape of sections.
Conversion of pictorial views into orthographic projections of simple machine parts. Hidden line conventions. Precedence of lines.
Conversion of pictorial views into orthographic projections of simple machine parts (with section planes indicated on the part).
Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.
Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

**Part B**

**Keys:** Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.
**Joints:** Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.
**Couplings:** Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint)

**Part C**

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.
**Assembly Drawings: (Part drawings shall be given)**
**1. Plummer block (Pedestal Bearing)**
**2. Lever Safety Valve**
**3. I.C. Engine connecting rod**
**4. Screw jack (Bottle type)**
**5. Tailstock of lathe**
**6. Machine vice**
**7. Tool head of shaper**

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: Identify the national and international standards pertaining to machine drawing.

CO2: Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings

CO3: Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.

CO4: Interpret the Machining and surface finish symbols on the component drawings.

CO5: Preparation of the part or assembly drawings as per the conventions.

**Scheme of Examination:** Two questions to be set from each Part A, part B and Part C. Student has to answer one question each from Part A and Part B for 25 marks each and one question from Part C for 50 marks.

**INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A) EXAMINATION**

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C, 3D environment should be used for parts and assembly, and extract 2D views of assembly.
6. Part A and Part B
   25 Marks ( 15 marks for sketching and 10 marks for computer work)
7. Part C
   50 Marks ( 20 marks for sketching and 30 marks for computer modelling)

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook/s** | | | | |
| 1 | Machine Drawing | K.R. Gopala Krishna | Subhash Publication | 2005 |
| 2 | Machine Drawing | N.D.Bhat&V.M. Panchal | Charoratar publishing house | 2005 |
| **Reference Books** | | | | |
| 3 | A Text Book of Computer Aided Machine Drawing | S. Trymbaka Murthy | CBS Publishers, New Delhi | 2007 |
| 4 | Engineering drawing | P.S.Gill | S K Kataria and Sons | 2013 |
| 5 | Machine Drawing | N. Siddeshwar, P. Kanniah, V.V.S. Sastri | Tata McGraw Hill | 2006 |

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – III**

**MATERIAL TESTING LAB**

| | | | |
|---|---|---|---|
| Course Code | **18MEL37A/47A** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 0:2:2 | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:**

- To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
- To understand mechanical behaviour of various engineering materials by conducting standard tests.
- To learn material failure modes and the different loads causing failure.
- To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

| Sl. No. | Experiments |
|---|---|
| | **PART A** |
| 1 | Preparation of specimen for Metallographic examination of different engineering materials.<br>To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites. |
| 2 | Heat treatment: Annealing, normalizing, hardening and tempering of steel.<br>Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled, water cooled, air cooled, tempered steel.<br>Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen. |
| 3 | Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens. |
| 4 | To study the defects of Cast and Welded components using Non-destructive tests like:<br>a) Ultrasonic flaw detection<br>b) Magnetic crack detection<br>c) Dye penetration testing. |
| | **PART B** |
| 5 | Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine |
| 6 | Torsion Test on steel bar. |
| 7 | Bending Test on steel and wood specimens. |
| 8 | Izod and Charpy Tests on Mild steel and C.I Specimen. |
| 9 | To study the wear characteristics of ferrous and non-ferrous materials under different parameters. |
| 10 | Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine |
| 11 | Fatigue Test (demonstration only). |

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: Acquire experimentation skills in the field of material testing.

CO2: Develop theoretical understanding of the mechanical properties of materials by performing experiments.

CO3: Apply the knowledge to analyse a material failure and determine the failure inducing agent/s.

CO4: Apply the knowledge of testing methods in related areas.

CO5: Understand how to improve structure/behaviour of materials for various industrial applications.

**Conduct of Practical Examination:**

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.

**Scheme of Examination:**

| | |
|---|---|
| ONE question from part -A: | 30 Marks |
| ONE question from part -B: | 50 Marks |
| Viva -Voice: | 20 Marks |
| Total: | 100 Marks |

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – III**

**WORKSHOP AND MACHINE SHOP PRACTICE**

| | | | |
|---|---|---|---|
| Course Code | **18MEL38A/48A** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 0:2:2 | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:**

- To guide students to use fitting tools to perform fitting operations.
- To provide an insight to different machine tools, accessories and attachments.
- To train students into fitting and machining operations to enrich their practical skills.
- To inculcate team qualities and expose students to shop floor activities.
- To educate students about ethical, environmental and safety standards.

| | **Experiments** |
|---|---|
| **Sl. No** | **PART A** |
| 1 | Preparation of at least two fitting joint models by proficient handling and application of hand tools- V-block, marking gauge, files, hack saw drills etc. |
| | **PART B** |
| 2 | Preparation of three models on lathe involving - Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.<br>Exercises should include selection of cutting parameters and cutting time estimation. |
| | **PART C** |
| 3 | Cutting of V Groove/ dovetail / Rectangular groove using a shaper.<br>Cutting of Gear Teeth using Milling Machine.<br>Exercises should include selection of cutting parameters and cutting time estimation. |
| | **PART D (DEMONSTRATION ONLY)** |
| | Study & Demonstration of power tools like power drill, power hacksaw, portable hand grinding, cordless screw drivers, production air tools, wood cutter, etc., used in Mechanical Engineering. |

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: To read working drawings, understand operational symbols and execute machining operations.
CO2: Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc.
CO3: Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used.
CO4: Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations.
CO5: Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.
CO6:Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing and

**Conduct of Practical Examination:**

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

| | |
|---|---|
| **Scheme of Examination:** | |
| One Model from Part-A or Part-C: | 30 Marks |
| One Model from Part-B: | 50 Marks |
| Viva – Voce: | 20 Marks |
| TOTAL: | 100 Marks |

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - IV**

**FOUNDRY, FORGING AND WELDING LAB**

| | | | |
|---|---|---|---|
| Course Code | **18MEL38B/48B** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 0:2:2 | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:**

- To provide an insight into different sand preparation and foundry equipment.
- To provide an insight into different forging tools and equipment and arc welding tools and equipment.
- To provide training to students to enhance their practical skills in welding, forging and hand moulding.

| Sl. No. | Experiments |
|---|---|
| | **PART A** |
| 1 | **Testing of Molding sand and Core sand.**<br>**Preparation of sand specimens and conduction of the following tests:**<br>1. Compression, Shear and Tensile tests on Universal Sand Testing Machine.<br>2. Permeability test<br>3. Sieve Analysis to find Grain Fineness Number (GFN) of Base Sand<br>4. Clay content determination on Base Sand.<br>**Welding Practice:**<br>Use of Arc welding tools and welding equipment<br>Preparation of welded joints using Arc Welding equipment<br>L-Joint, T-Joint, Butt joint, V-Joint, Lap joints on M.S. flats |
| | **PART B** |
| 2 | **Foundry Practice:**<br>**Use of foundry tools and other equipment for Preparation of molding sand mixture.**<br>**Preparation of green sand molds kept ready for pouring in the following cases:**<br>4. Using two molding boxes (hand cut molds).<br>5. Using patterns (Single piece pattern and Split pattern).<br>6. Incorporating core in the mold.(Core boxes).<br>• Preparation of one casting (Aluminium or cast iron-Demonstration only) |
| | **PART C** |
| 3 | **Forging Operations:** Use of forging tools and other forging equipment.<br>• Calculation of length of the raw material required to prepare the model considering scale loss.<br>• Preparing minimum three forged models involving upsetting, drawing and bending operations. |

**Course Outcomes:** At the end of the course the student will be able to:

- Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
- Demonstrate skills in determining permeability, clay content and Grain Fineness Number of base sands.
- Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.

**Conduct of Practical Examination:**

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

**Scheme of Examination:**

1. One question is to be set from Part-A: 30 marks. (20 marks for sand testing+ 10 Marks for welding)
2. One question is to be set from either Part-B or Part-C: 50 Marks
3. Viva – Voce: 20 marks

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: Understand needs, functions, roles, scope and evolution of Management.

CO2: Understand importance, purpose of Planning and hierarchy of planning and also53nalyse its types.

CO3: Discuss Decision making, Organizing, Staffing, Directing and Controlling.

CO4: Select the best economic model from various available alternatives.

CO5: Understand various interest rate methods and implement the suitable one.

CO6: Estimate various depreciation values of commodities.

CO7: Prepare the project reports effectively.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the | Name of the Publisher | Edition and |
|---|---|---|---|---|
| **Textbook/s** | | | | |
| 1 | Mechanical estimation and costing | T.R. Banga & S.C. Sharma | Khanna Publishers | 17th edition 2015 |
| 2 | Engineering Economy | Riggs J.L | McGraw Hill | 4th |
| 3 | Engineering Economy | Thuesen H.G | PHI | 2002 |
| 4 | Principles of Management | Tripathy and Reddy | Tata McGraw Hill | 3rd edition 2006 |
| **Reference Books** | | | | |
| 1 | Management Fundamentals - Concepts, Application, Skill Development | Robers Lusier Thomson | Pearson Education | |
| 2 | Modern Economic Theory | Dr. K. K. Dewett& M. H. Navalur, | Chand Publications | |
| 3 | Economics: Principles of Economics | N Gregory Mankiw, | Cengage Learning | |
| 4 | Basics of Engineering Economy | Leland Blank & Anthony Tarquin | McGraw Hill Publication (India) Private Limited | |

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**DESIGN OF MACHINE ELEMENTS I**

| | | | |
|---|---|---|---|
| Course Code | **18ME52** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:2:0 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

- To understand the various steps involved in the Design Process.
- To explain the principles involved in design of machine elements, subjected to different kinds of forces, from the considerations of strength, rigidity, functional and manufacturing requirements.
- To understand and interpret different failure modes and application of appropriate criteria for design of machine elements.
- To learn to use national and international standards, standard practices, standard data, catalogs, and standard components used in design of machine elements.
- Develop the capability to design elements like shafts, couplings, welded joints, screwed joints, and power screws.

**Module-1**

**Introduction:** Design Process: Definition of design, phases of design, and review of engineering materials and their properties and manufacturing processes; use of codes and standards, selection of preferred sizes.
Review of axial, bending, shear and torsion loading on machine components, combined loading, two- and three dimensional stresses, principal stresses, stress tensors, Mohr's circles.
**Design for static strength:** Factor of safety and service factor.
Failure mode: definition and types. , Failure of brittle and ductile materials; even and uneven materials; Theories of failure: maximum normal stress theory, maximum shear stress theory, distortion energy theory, strain energy theory, Columba –Mohr theory and modified Mohr's theory. Stress concentration, stress concentration factor and methods of reducing stress concentration.

**Module-2**

**Impact Strength:** Introduction, Impact stresses due to axial, bending and torsion loads.
**Fatigue loading:** Introduction to fatigue failure, Mechanism of fatigue failure, types of fatigue loading, S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit.
Modifying factors: size effect, surface effect, Stress concentration effects Notch sensitivity, Soder berg and Goodman relationships, stresses due to combined loading, cumulative fatigue damage, and Miner's equation.

**Module-3**

**Design of shafts:** Torsion of shafts, solid and hollow shaft design with steady loading based on strength and rigidity, ASME and BIS codes for power transmission shafting, design of shafts subjected to combined bending, torsion and axial loading. Design of shafts subjected to fluctuating loads
**Design of keys and couplings** :Keys: Types of keys and their applications, design considerations in parallel and tapered sunk keys, Design of square and rectangular sunk keys.
Couplings: Rigid and flexible coupling-types and applications, design of Flange coupling, and Bush and Pin type coupling.

**Module-4**

**Design of Permanent Joints:** Types of permanent joints-Riveted and Welded Joints.
**Riveted joints:** Types of rivets, rivet materials, Caulking and fullering, analysis of riveted joints, joint efficiency, failures of riveted joints, boiler joints, riveted brackets.
**Welded joints:** Types, strength of butt and fillet welds, eccentrically loaded welded joints

**Module-5**

**Design of Temporary Joints:** Types of temporary joints- cotter joints, knuckle joint and fasteners. Design of Cotter and Knuckle Joint.
**Threaded Fasteners**: Stresses in threaded fasteners, effect of initial tension, design of threaded fasteners under static, dynamic and impact loads, design of eccentrically loaded bolted joints.

**Power screws:** Mechanics of power screw, stresses in power screws, efficiency and self-locking, design of power screws.

**Assignment:**

Course work includes a **Design project**. Design project should enable a group of students (maximum four in a group) to design a mechanical system (like couplings, screw jack, welded joints, bracket mounting using fasteners, etc.). Student should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report. Design project should be given due credit in internal assessment.

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: Apply the concepts of selection of materials for given mechanical components.

CO2: List the functions and uses of machine elements used in mechanical systems.

CO3: Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's catalogue.

CO4: Analyse the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure.

CO5: Demonstrate the application of engineering design tools to the design of machine components like shafts, couplings, power screws, fasteners, welded and riveted joints.

CO6: Understand the art of working in a team.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the | Edition and Year |
|---|---|---|---|---|
| **Textbook/s** | | | | |
| 1 | Shigley's Mechanical Engineering Design | Richard G. Budynas, and J. Keith Nisbett | McGraw-Hill Education | 10th edition, 2015. |
| 2 | Fundamentals of Machine Component Design | Juvinall R.C, and Marshek K.M. | John Wiley & Sons | Third Edition, 2007 student |
| 3 | Design of Machine Elements, | V B Bhandari | Tata McGraw Hill | 4th Ed., 2016. |
| 4 | Design of Machine Elements-I | Dr.M H Annaiah<br>Dr. J Suresh Kumar | New Age International (P) | 1s Ed., 2016 |
| **Reference Books** | | | | |
| 1 | Machine Design- an integrated approach | Robert L. Norton | Pearson Education | 2nd edition. |
| 2 | Design and Machine Elements | Spotts M.F., Shoup T.E | Pearson Education | 8th edition,2006 |
| 3 | Machine Component Design | Orthwein W | Jaico Publishing Co | 2003 |
| 4 | Machine Design | Hall, Holowenko, Laughlin (Schaum's Outline series) | Tata McGraw Hill Publishing | Special Indian Edition, 2008 |
| 5 | Elements of Machine Design | H.G.Patil, S.C.Pilli, R.R.Malagi, M.S.Patil | IK International | First edition,2019 |

| | | | | |
|---|---|---|---|---|
| 6 | Design of Machine Elements Volume I | T. Krishna Rao | IK international publishing house, | 2012 |
| 7 | Hand book of Mechanical Design | G. M. Maithra and L.V.Prasad | Tata McGraw Hill | 2nd edition, 2004. |

**Design Data Hand Book:**

[1] Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd edition, 2003.

[2] Design Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS publication.

[3] Design Data Hand Book, H.G.Patil, I. K. International Publisher, 2010

[4] PSG Design Data Hand Book, PSG College of technology, Coimbatore.

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**DESIGN OF MACHINE ELEMENTS II**

| | | | |
|---|---|---|---|
| Course Code | **18ME62** | CIE Marks | 40 |
| Teaching Hours /Week (L:T:P) | 3:2:0 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

- To understand various elements involved in a mechanical system.
- To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
- To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
- To design a mechanical system integrating machine elements.
- To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

**Module-1**

**Springs:** Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs; springs under fluctuating loads.
Leaf Springs: Stresses in leaf springs, equalized stresses, and nipping of leaf springs.
Introduction to torsion and Belleville springs.
**Belts:** Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.
Selection of flat and V belts- length & cross section from manufacturers' catalogues. Construction and application of timing belts.
**Wire ropes:** Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

**Module-2**

**Gear drives:** Classification of gears, materials for gears, standard systems of gear tooth, lubrication of gears, and gear tooth failure modes.
**Spur Gears:** Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.
**Helical Gears**: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

**Module-3**

**Bevel Gears:** Definitions, formative number of teeth, design based on strength, dynamic load and wear.
**Worm Gears:** Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

**Module-4**

**Design of Clutches:** Necessity of a clutch in an automobile, types of clutch, friction materials and its properties. Design of single plate, multi-plate and cone clutches based on uniform pressure and uniform wear theories.
**Design of Brakes:** Different types of brakes, Concept of self-energizing and self-locking of brakes. Practical examples, Design of band brakes, block brakes and internal expanding brakes.

**Module-5**

**Lubrication and Bearings:** Lubricants and their properties, bearing materials and properties; mechanisms of lubrication, hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated. Numerical examples on hydrodynamic journal and thrust bearing design.

**Antifriction bearings:** Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep grove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds;probability of survival.

**Assignment:**

Course work includes a **Design project**. Design project should enable the students to design a mechanical system (like single stage reduction gear box with spur gears, single stage worm reduction gear box, V-belt and pulley drive system, machine tool spindle with bearing mounting, C-clamp, screw jack, etc.) A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report. Design project should be given due credit in internal assessment.

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: Apply design principles for the design of mechanical systems involving springs, belts, pulleys, and wire ropes.
CO2: Design different types of gears and simple gear boxes for relevant applications.
CO3: Understand the design principles of brakes and clutches.
CO4: Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue.
CO6: Apply engineering design tools to product design.
CO7: Become good design engineers through learning the art of working in a team.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

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|---|---|---|---|---|
| **Textbook/s** | | | | |
| 1 | Shigley's Mechanical Engineering Design | Richard G. Budynas,and J. Keith Nisbett | McGraw-Hill Education | 10th Edition, 2015 |
| 2 | Fundamentals of Machine Component Design | Juvinall R.C, and Marshek K.M | John Wiley & Sons | Third Edition 2007 Wiley student edition |
| 3 | Design of Machine Elements | V. B. Bhandari | Tata Mcgraw Hill | 4th Ed 2016. |
| 4 | Design of Machine Elements-II | Dr.M H Annaiah Dr. J Suresh Kumar Dr.C N Chandrappa | New Age International (P) Ltd., | 1s Ed., 2016 |
| **Reference Books** | | | | |
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| 2 | Design and Machine Elements | Spotts M.F., ShoupT.E | Pearson Education | 8th edition, 2006 |

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|---|---|---|---|---|
| 3 | Machine design<br>Hall, Holowenko, Laughlin<br>(Schaum's Outline Series | adapted by S.K.Somani | Tata McGraw Hill Publishing Company Ltd | Special Indian Edition, 2008 |
| 4 | Elements of Machine Design | H.G.Patil, S.C.Pilli, R.R.Malagi, M.S.Patil | IK International | First edition,2019 |
| 5 | Design of Machine ElementsVolume II | T. Krishna Rao | IK international publishing house | 2013 |
| 6 | Hand book of Mechanical Design | G. M. Maithra and L.V.Prasad | Tata McGraw Hill | 2nd edition,2004 |

**Design Data Hand Books:**

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[2] Design Data Hand Book, K.Mahadevan and Balaveera Reddy, CBS publication.
[3] Design Data Hand Book, H.G.Patil, I.K.International Publisher, 2010
[4] PSG Design Data Hand Book, PSG College of technology, Coimbatore

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**HEAT TRANSFER**

| | | | |
|---|---|---|---|
| Course Code | **18ME63** | CIE Marks | 40 |
| Teaching Hours /Week (L:T:P) | 3:2:0 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:**

- Study the modes of heat transfer.
- Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- Study the basic principles of heat exchanger analysis and thermal design.
- Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

**Module-1**

**Introductory concepts and definitions:** Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Types of boundary conditions. General three dimensional Heat Conduction Equation: Derivation of the equation in (i) Cartesian, coordinate only. Discussion of three dimensional Heat Conduction Equation in (ii) Polar and (iii) Spherical Co-ordinate Systems.

**Steady-state one-dimensional heat conduction problems in Cartesian System**: Steady-state one-dimensional heat conduction problems (i) without heat generation and (ii) constant thermal conductivity - in Cartesian system with various possible boundary conditions. Brief Introduction to variable thermal conductivity and heat generation [No numerical on variable thermal conductivity and heat generation] Thermal Resistances in Series and in Parallel. Critical Thickness of Insulation in cylinder and spheres Concept. Derivation

**Module-2**

**Extended Surfaces or Fins:** Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications

**Transient [Unsteady-state] heat conduction:** Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems, Heisler and Grober charts.

**Module-3**

**Numerical Analysis of Heat Conduction:** Introduction, one-dimensional steady conduction and one dimensional unsteady conduction, boundary conditions, solution methods.

**Thermal Radiation:** Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's displacement law, Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchhoff's Laws, View factor, Net radiation exchange between parallel plates, concentric cylinders, and concentric spheres, Radiation Shield.

**Module-4**

**Forced Convection:** Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions.

**Free convection**: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

**Module-5**

**Heat Exchangers:** Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts.

**Introduction to boiling:** pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation.

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: Understand the modes of heat transfer and apply the basic laws to formulate engineering systems.

CO2: Understand and apply the basic laws of heat transfer to extended surface, composite material and unsteady state heat transfer problems.

CO3: Analyze heat conduction through numerical methods and apply the fundamental principle to solve radiation heat transfer problems.

CO4: Analyze heat transfer due to free and forced convective heat transfer.

CO5: Understand the design and performance analysis of heat exchangers and their practical applications, Condensation and Boiling phenomena.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook/s** | | | | |
| 1 | Principals of heat transfer | Frank Kreith, Raj M. Manglik, Mark S. Bohn | Cengage learning | Seventh Edition 2011. |
| 2 | Heat transfer, a practical approach | Yunus A. Cengel | Tata Mc Graw Hill | Fifth edition |
| **Reference Books** | | | | |
| 1 | Heat and mass transfer | Kurt C, Rolle | Cengage learning | second edition |
| 2 | Heat Transfer A Basic Approach | M. NecatiOzisik | McGraw Hill, New York | 2005 |
| 3 | Fundamentals of Heat and Mass Transfer | Incropera, F. P. and De Witt, D. P | John Wiley and Sons, New York | 5th Edition 2006 |
| 4 | Heat Transfer | Holman, J. P. | Tata McGraw Hill, New York | 9th Edition 2008 |

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**HEAT TRANSFER LAB**

| | | | |
|---|---|---|---|
| Course Code | **18MEL67** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 0:2:2 | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

Course Learning Objectives:

- The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
- This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum.
- Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

| Sl. No. | Experiments |
|---|---|
| | **PART A** |
| 1 | Determination of Thermal Conductivity of a Metal Rod. |
| 2 | Determination of Overall Heat Transfer Coefficient of a Composite wall. |
| 3 | Determination of Effectiveness on a Metallic fin. |
| 4 | Determination of Heat Transfer Coefficient in free Convection |
| 5 | Determination of Heat Transfer Coefficient in a Forced Convention |
| 6 | Determination of Emissivity of a Surface. |
| | **PART B** |
| 7 | Determination of Stefan Boltzmann Constant. |
| 8 | Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers. |
| 9 | Experiments on Boiling of Liquid and Condensation of Vapour. |
| 10 | Performance Test on a Vapour Compression Refrigeration. |
| 11 | Performance Test on a Vapour Compression Air – Conditioner. |
| 12 | Experiment on Transient Conduction Heat Transfer. |
| | **PART C (OPTIONAL)** |
| 13 | Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package). |
| 14 | Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package). |

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: Determine the thermal conductivity of a metal rod and overall heat transfer coefficient of composite slabs.

CO2: Determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.

CO3: Evaluate temperature distribution characteristics of steady and transient heat conduction through solid cylinder experimentally.

CO4: Determine surface emissivity of a test plate and Stefan Boltzmann constant

CO5: Estimate performance of a refrigerator and effectiveness of a fin and Double pipe heat exchanger

**Conduct of Practical Examination:**

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made

**Scheme of Examination:**

One Question from Part A - 40 Marks

One Question from Part B - 40 Marks

Viva-Voce - 20 Marks

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**
**Professional Elective 3**

**MECHATRONICS**

| | | | |
|---|---|---|---|
| Course Code | **18ME744** | CIE Marks | 40 |
| Teaching Hours /Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To acquire a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.
- To understand the evolution and development of Mechatronics as a discipline.
- To substantiate the need for interdisciplinary study in technology education
- To understand the applications of microprocessors in various systems and to know the functions of each element.
- To demonstrate the integration philosophy in view of Mechatronics technology
- To be able to work efficiently in multidisciplinary teams.

**Module-1**

**Introduction:** Scope and elements of mechatronics, mechatronics design process, measurement system, requirements and types of control systems, feedback principle, Basic elements of feedback control systems, Classification of control system. Examples of Mechatronics Systems such as Automatic Car Park system, Engine management system, Antilock braking system (ABS) control, Automatic washing machine.
**Transducers and sensors:** Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, Potentiometers, LVDT, Capacitance sensors, force and pressure sensors, Strain gauges, temperature sensors, proximity switches and Hall Effect sensors.

**Module-2**

**Signal Conditioning:** Introduction – Hardware – Digital I/O, Analog to digital conversions, resolution, Filtering Noise using passive components – Registers, capacitors, amplifying signals using OP amps. Digital Signal Processing – Digital to Analog conversion, Low pass, high pass, notch filtering. Data acquisition systems (DAQS), data loggers, Supervisory control and data acquisition (SCADA), Communication methods.
**Electro Mechanical Drives:**Relays and Solenoids – Stepper Motors – DC brushed motors – DC brushless motors – DC servo motors – 4-quadrant servo drives, PWM's – Pulse Width Modulation.

**Module-3**

**Microprocessor & Microcontrollers:** Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.
Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor.

**Module-4**

**Programmable Logic Controller:** Introduction to PLCs, Basic structure of PLC, Principle of operation, input and output processing, PLC programming language, ladder diagram, ladder diagrams circuits, timer counters, internal relays, master control, jump control, shift registers, data handling, and manipulations, analogue input and output, selection of PLC for application.
**Application of PLC control:** Extending and retracting a pneumatic piston using latches, control of two pneumatic pistons, control of process motor, control of vibrating machine, control of process tank, control of conveyer motor etc.

**Module-5**

**Mechatronics in Computer Numerical Control (CNC) machines:** Design of modern CNC machines - Machine Elements: Different types of guide ways, Linear Motion guideways. Bearings: anti-friction bearings,

hydrostatic bearing and hydrodynamic bearing. Re-circulating ball screws. Typical elements of open and closed loop control systems. Adaptive controllers for machine tools.

**Mechatronics Design process: S**tages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Automatic car park barrier.

**Course Outcomes:** At the end of the course the student will be able to:

CO1: Illustrate various components of Mechatronics systems.

CO2: Assess various control systems used in automation.

CO3: Design and conduct experiments to evaluate the performance of a mechatronics system or component with

respect to specifications, as well as to analyse and interpret data.

CO4: Apply the principles of Mechatronics design to product design.

CO5: Function effectively as members of multidisciplinary teams.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook/s** | | | | |
| 1 | Mechatronics-Principles Concepts and Applications | Nitaigour Premchand Mahalik | Tata McGraw Hill | 1st Edition, 2003 |
| 2 | Mechatronics–Electronic Control Systems in Mechanical and Electrical Engineering, | W.Bolton | Pearson Education | 1stEdition, 2005 |
| **Reference Books** | | | | |
| 1 | Mechatronics | HMT Ltd | Tata Mc Graw Hill | 1st Edition, 2000 ISBN:978007 4636435 |
| 2 | Mechatronics: Integrated Mechanical Electronic Systems | K.P. Ramachandran, G.K. Vijayaraghavan, M.S. Balasundaram. | Wiley India Pvt. Ltd. New Delhi | 2008 |
| 3 | Introduction to Mechatronics and Measurement Systems | David G. Aldatore, Michael B. Histand | McGraw-Hill Inc USA | 2003 |
| 4 | Introduction to Robotics: Analysis, Systems, Applications. | Saeed B. Niku, | Person Education | 2006 |
| 5 | Mechatronics System Design | Devdas Shetty, Richard A. kolk | Cengage publishers. | second edition |

Scheme of Examination:
One question from Part A: 40 marks
One question from Part B: 40 Marks
Viva voce: 20 Marks
Total: 100 Marks

**B. E. MECHANICAL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VIII**

**ENERGY ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18ME81** | CIE Marks | 40 |
| Teaching Hours /Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- Understand energy scenario, energy sources and their utilization
- Learn about energy conversion methods
- Study the principles of renewable energy conversion systems.

**Module-1**

**STEAM GENERATORS** Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures, LaMount, Benson, Velox, Loeffer, Schmidt steam generators, Cooling towers and Ponds, Accessories such as Superheaters, De-superheater, Economizers, Air preheaters.

**Module-2**

**Solar Energy**: Introduction, Solar radiation at the earth's surface, Solar radiation measurements, Flat plate collectors, Focussing collectors, Solar pond, Solar electric power generation-Solar photovoltaics.
**Biomass Energy**: Photosynthesis, photosynthetic oxygen production, energy plantation. Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, Bio gas plants-KVIC, Janta, Deenbhandu models, factors affecting bio gas generation. Thermal gasification of biomass, updraft and downdraft

**Module-3**

**Geothermal Energy**: Forms of geothermal energy, Dry steam, wet steam, hot dry rock and magmatic chamber systems.
**Tidal Energy**: Tidal power, Site selection, Single basin and double basin systems, Advantages and disadvantages of tidal energy.
**Wind Energy**: Wind energy-Advantages and limitations, wind velocity and wind power, Basic components of wind energy conversion systems, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor, Applications of wind energy.

**Module-4**

**Hydroelectric plants**: Advantages & disadvantages of water power, Hydrographs and flow duration curves-numericals, Storage and pondage, General layout of hydel power plants- components such as Penstock, surge tanks, spill way and draft tube and their applications, pumped storage plants, Detailed classification of hydroelectric plants, water hammer.
**Ocean Thermal Energy**: Ocean thermal energy conversion, Principle and working of Rankine cycle, Problems associated with OTEC.

**Module-5**

**NUCLEAR ENERGY** Principles of release of nuclear energy-Fusion and fission reactions. Nuclear fuels used in the reactors, Chain reaction, Moderation, breeding, Multiplication and thermal utilization factors. General components of a nuclear reactor and materials, Brief description-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shielding, Nuclear waste, Radioactive waste disposal.

**Course Outcomes:** At the end of the course the student will be able to:
CO1: Understand the construction and working of steam generators and their accessories.

CO2: Identify renewable energy sources and their utilization.

CO3: Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, nuclear, hydel and tidal.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook/s** | | | | |
| 1 | Power Plant Engineering | P. K. Nag | Tata McGraw Hill Education Private Limited, New Delhi | Third Edition, 2012. |
| 2 | Power Plant Engineering | Arora and Domkundwar | Dhanpat Rai & Co. (P) Ltd. | Sixth Edition, 2012. |
| 3 | Non-conventional Sources of Energy | G.D.Rai | Khanna Publishers, New Delhi | Fifth Edition, 2015. |
| 4 | Non-conventional energy resources | B H Khan | McGraw Hill Education | 3rd Edition |
| **Reference Books** | | | | |
| 1 | Power Plant Engineering | R. K. Rajput | Laxmi publication New Delhi | |
| 2 | Principles of Energy conversion | A. W. Culp Jr | McGraw Hill | 1996 |
| 3 | Power Plant Technology | M.M. EL-Wakil | McGraw Hill International | 1994 |
| 4 | Solar Energy: principles of Thermal Collection and Storage | S.P. Sukhatme | Tata McGraw-Hill | 1984 |

# MATERIAL SCIENCE
## B.E, III Semester, Mechanical Engineering
## [As per Choice Based Credit System (CBCS) scheme]

| | | | |
|---|---|---|---|
| **Course Code** | **17ME32** | **CIE Marks** | **40** |
| **Number of Lecture Hours/Week** | **04** | **SEE Marks** | **60** |
| **Total Number of Lecture Hours** | **50(10 Hours per Module)** | **Exam Hours** | **03** |

**Credits – 04**

**Course Objectives:**

- **The foundation for understanding the structure and various modes of failure in materials common in mechanical engineering.**
- **Topics are designed to explore the mechanical properties of metals and their alloys, polymers, ceramics ,smart materials and composites.**
- **The means of modifying such properties, as well as the processing and failure of materials.**
- **Concepts of use of materials for various applications are highlighted.**

### Module - 1

**Basics, Mechanical Behavior, Failure of Materials**

Introduction to Crystal Structure – Coordination number, atomic packing factor, Simple Cubic, BCC, FCC and HCP Structures, Crystal imperfections – point, line, surface and volume imperfections, Atomic Diffusion: Phenomenon, Fick's laws of diffusion;Factors affecting diffusion.

**Mechanical Behavior**:

Stress-strain diagrams showing ductile and brittle behavior of materials, Engineering and true strains, Linear and non-linear elastic behavior and properties, Mechanical properties in plastic range. Stiffness, Yield strength, Offset Yield strength, Ductility, Ultimate Tensile strength, Toughness, Plastic deformation of single crystal by slip and twinning, Mechanisms of strengthening in metals

**Fracture:** Type I, Type II and Type III,

**Fatigue:** Types of fatigue loading with examples, Mechanism of fatigue, Fatigue properties, S-N diagram, Fatigue testing. **Creep:** Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation. Concept of fracture toughness.

### Module - 2

**Alloys, Steels, Solidification**

Concept of formation of alloys: Types of alloys, solid solutions, factors affecting solid solubility (Hume Rothery rules), Binary phase diagrams: Eutectic, and Eutectoid systems, Lever rule, Substitutional and interstitial solid solutions, Intermediate phases, Gibbs phase rule Effect of non- equilibrium cooling, Coring and Homogenization Iron-Carbon (Cementite) diagram: description of phases, Specifications of steels. Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, Crystal growth, Numerical on lever rule

### Module - 3

**Heat Treatment, Ferrous and Non-Ferrous Alloys**

Heat treating of metals: Time-Temperature-Transformation (TTT) curves, Continuous Cooling Transformation (CCT) curves, Annealing: Recovery, Recrystallization and Grain growth, Types of annealing, Normalizing, Hardening, Tempering, Martempering, Austempering, Concept of hardenability, Factors affecting it hardenability, surface hardening methods: carburizing, cyaniding, nitriding, flame hardening and induction hardening, Age hardening of aluminum-copper alloys

and PH steels. Ferrous materials: Properties, Compositions and uses of Grey cast iron, Malleable iron, SG iron and steel,

**Module - 4**

**Other Materials, Material Selection**

**Ceramics:** Structure types and properties and applications of ceramics. Mechanical / Electrical behavior and processing of Ceramics.

**Plastics:** Various types of polymers/plastics and their applications. Mechanical behaviors and processing of plastics, Failure of plastics.

**Other materials:**Smart materials and Shape Memory alloys, properties and applications.

**Module - 5**

**Composite Materials**

Composite materials - Definition, classification, types of matrix materials & reinforcements,Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber-reinforced composites, Fundamentals of production of composites, Processes for production of composites, Constitutive relations of composites, Numerical problems on determining properties of composites.

**Course outcomes:**

- **Describe the mechanical properties of metals, their alloys and various modes of failure.**
- **Understand the microstructures of ferrous and non-ferrous materials to mechanical properties.**
- **Explain the processes of heat treatment of various alloys.**
- **Understand the properties and potentialities of various materials available and material selection procedures.**
- **Know about composite materials and their processing as well as applications.**

**TEXT BOOKS:**


1. Smith, Foundations of Materials Science and Engineering, 4th Edition, McGraw Hill, 2009.
2. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.


**REFERENCE BOOKS**


1. V.Raghavan, Materials Science and Engineering, , PHI, 2002
2. Donald R. Askland and Pradeep.P. Phule, The Science and Engineering of Materials, Cengage Learning, 4lh Ed., 2003.
3. George Ellwood Dieter, Mechanical Metallurgy, McGraw-Hill.
4. ASM Handbooks, American Society of Metals.

# METAL CASTING AND WELDING
## B.E, III/IV Semester, Mechanical Engineering
## [As per Choice Based Credit System (CBCS) scheme]

| | | | |
|---|---|---|---|
| **Course Code** | **17ME35 A /45A** | **CIE Marks** | **40** |
| **Number of Lecture Hours/Week** | **04** | **SEE Marks** | **60** |
| **Total Number of Lecture Hours** | **50(10 Hours per Module)** | **Exam Hours** | **03** |

**Credits – 04**

**Course Objectives:**

- **To provide detailed information about the moulding processes.**
- **To provide knowledge of various casting process in manufacturing.**
- **To impart knowledge of various joining process used in manufacturing.**
- **To provide adequate knowledge of quality test methods conducted on welded and casted components.**

### Module - 1

**INTRODUCTION & BASIC MATERIALS USED IN FOUNDRY**

**Introduction:** Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy.

Introduction to casting process & steps involved. Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance.

**Sand molding:** Types of base sand, requirement of base sand. Binder, Additives definition, need and types

**Preparation of sand molds:** Molding machines- Jolt type, squeeze type and Sand slinger. Study of important molding process: Green sand, core sand, dry sand, sweep mold, CO2 mold, shell mold, investment mold, plaster mold, cement bonded mold.Cores: Definition, need, types. Method of making cores, concept of gating (top, bottom, parting line, horn gate) and risering (open, blind) Functions and types

### Module - 2

**MELTING & METAL MOLD CASTING METHODS**

**Melting furnaces:** Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace.

**Casting using metal molds:** Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes

### Module - 3

**SOLIDIFICATION & NON FERROUS FOUNDRY PRACTICE**

**Solidification**: Definition, Nucleation, solidification variables, Directional solidification-need and methods. Degasification in liquid metals-Sources of gas, degasification methods.

**Fettling and cleaning of castings:** Basic steps involved. Sand Casting defects- causes, features and remedies. Advantages & limitations of casting process

**Nonferrous foundry practice**: Aluminum castings - Advantages, limitations, melting of aluminum using lift-out type crucible furnace. Hardeners used, drossing, gas absorption, fluxing and flushing, grain refining, pouring temperature. Stir casting set up, procedure, uses, advantages and limitations.

## Module - 4

**WELDING PROCESS**

**Welding process:** Definition, Principles, Classification, Application, Advantages & limitations of welding. Arc welding: Principle, Metal arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW).

**Special type of welding:** Resistance welding principles, Seam welding, Butt welding, Spot welding and Projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and electron beam welding.

## Module - 5

**SOLDERING , BRAZING AND METALLURGICAL ASPECTS IN WELDING**

Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds& Residual stresses, Concept of electrodes, filler rod and fluxes. Welding defects- Detection, causes & remedy.

**Soldering, brazing, gas welding:** Soldering, Brazing, Gas Welding: Principle, oxy-Acetylene welding, oxy-hydrogen welding, air-acetylene welding, Gas cutting, powder cutting.

**Inspection methods:** Methods used for inspection of casting and welding. Visual, magnetic particle, fluorescent particle, ultrasonic. Radiography, eddy current, holography methods of inspection.

**Course outcomes:**

- **Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds.**
- **Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines.**
- **Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.**
- **Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.**
- **Explain the Solidification process and Casting of Non-Ferrous Metals.**
- **Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing.**
- **Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing.**
- **Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and joining process.**

**TEXT BOOKS:**


1. **"Manufacturing Process-I",** Dr.K.Radhakrishna, Sapna Book House,5th Revised Edition 2009.
2. **"Manufacturing & Technology"**: Foundry Forming and Welding,P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.


**REFERENCE BOOKS**


1. **"Process and Materials of Manufacturing**", Roy A Lindberg, 4th Ed.Pearson Edu. 2006.
2. **"Manufacturing Technology**", SeropeKalpakjian, Steuen. R. Sechmid,Pearson Education Asia, 5th Ed. 2006.
3. **"Principles of metal casting"**, Rechard W. Heine, Carl R. LoperJr., Philip C. Rosenthal, Tata McGraw Hill Education Private Limited Ed.1976.

# APPLIED THERMODYNAMICS

| Course | Code | Credits | L-T-P | Assessment | | Exam Duration |
|---|---|---|---|---|---|---|
| | | | | SEE | CIA | |
| Applied Thermodynamics | 15ME43 | 04 | 3-2-0 | 80 | 20 | 3Hrs |

**Courselearning objectives:**

- To have a working knowledge of basic performance of Gas power cycles.
- To Calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy
- To understand and evaluate the performance of steam power cycles their various Engineering applications
- To know how fuel burns and their thermodymic properties.
- To Understand mechanism of power transfer through belt, rope, chain and gear drives in I C Engines
- To determine performance parameters of refrigeration and air-conditioning systems.
- Evaluate the performance parameters of reciprocating air compressor as a function of receiver pressure.

## Module - I

**Gas Power Cycles :**Air standard cycles; Carnot, Otto, Diesel, Dual and Stirling cycles, p-v and T -s diagrams, description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles. Gas turbine (Brayton) cycle; description and analysis. Regenerative gas turbine cycle. Inter-cooling and reheating in gas turbine cycles.

Jet propulsion: Introduction to the principles of jet propulsion, turbojet, turboprop, Ramjet and turbofan engines and their processes . Principles of rocket propulsion, Introduction to rocket engine.10 Hours

## Module –II

**Vapour Power Cycles: Carnot** vapour power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T-s diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle. Characteristics of an Ideal working fluid in Vapour power cycles, Binary Vapour cycles

10 Hours

## Module –III

**Combustion Thermodynamics**: Theoretical (Stoichiometric) air for combustion of fuels. Excess air, mass balance, Exhaust gas analysis, A/F ratio. Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion. Combustion efficiency. Dissociation and equilibrium, emissions.

**I.C.Engines:** Classification of IC engines, Combustion of SI engine and CI engine, Detonation and factors affecting detonation, Performance analysis of I.C Engines, heat balance, Morse test, IC Engine fuels, Ratings and Alternate Fuels. Automotive Pollutions and its effects on environment.

10 Hours

**Module –IV**

**Refrigeration Cycles:**Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required, units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Any one case study on cold storage or industrial refrigerator. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system. Steam jet refrigeration.

**Pscychrometrics and Air-conditioning Systems:**Properties ofAtmospheric air, and Psychometric properties of Air, Psychometric Chart, Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification, Evaporative Cooling. Adiabatic mixing of twomoist air streams. Cooling towers.

10 Hours

**Module –V**

**Reciprocating Compressors: Operation** of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis. Effect of Clearance and Volumetric efficiency. Adiabatic, Isothermal and Mechanical efficiencies. Multi-stage compressor, saving in work, Optimum intermediate pressure, Inter-cooling, Minimum work for compression.

**Steam nozzles**: Flow of steam through nozzles, Shape of nozzles, effect of friction, Critical pressure ratio, Supersaturated flow.

10 Hours

**Course outcomes**

Students will be able to

- Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems.
- Evaluate the performance of steam turbine components.
- Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment.
- Apply thermodynamic concepts to analyze turbo machines.
- Determine performance parameters of refrigeration and air-conditioning systems.
- Understand the principles and applications of refrigeration systems.
- Analyze air-conditioning processes using the principles of psychrometry and Evaluate cooling and heating loads in an air-conditioning system.
- Understand the working, applications, relevance of air and identify methods for performance improvement.

Text Books:

1. Thermodynamics an engineering approach, by Yunus A. Cenegal and Michael A. Boles. Tata McGraw hill Pub. Sixth edition, 2008.

2. Basic and Applied Thermodynamics" by P .K. Nag, Tata McGraw Hill, 2nd Edi. 2009
3. Fundamentals of Thermodynamics by G.J. Van Wylen and R.E. Sonntag, Wiley Eastern. Fourth edition 19993.

Reference Books:

1. Thermodynamics for engineers, Kenneth A. Kroos and Merle C. Potter, Cengage Learning, 2016
2. Principles of Engineering Thermodynamics, Michael J,Moran, Howard N. Shapiro, Wiley, 8th Edition
3. An Introduction to Thermo Dynamics by Y.V.C.Rao, Wiley Eastern Ltd, 2003.
4. Thermodynamics by Radhakrishnan. PHI, 2nd revised edition.
5. I.C Engines by Ganeshan.V. Tata McGraw Hill, 4rth Edi. 2012.
6. I.C.Engines by M.L.Mathur & Sharma. Dhanpat Rai& sons- India

**E- Learning**

- Nptel.ac.in
- VTU, E- learning
- MOOCS
- Open courseware

**Scheme of Examination:**

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

**Heat Transfer**

| Course | Code | Credits | L-T-P | Assessment | | Exam Duration |
|---|---|---|---|---|---|---|
| | | | | SEE | CIA | |
| Heat Transfer | 15ME63 | 04 | 3-2-0 | 80 | 20 | 3Hrs |

**Pre-requisites:** Basic and Applied Thermodynamics

**Course learning objectives:**

- Study the modes of heat transfer.
- Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- Study the basic principles of heat exchanger analysis and thermal design.
- Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

**Module – I**

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer combined heat transfer mechanism, Types of boundary conditions. General Heat Conduction Equation: Derivation of the equation in (i) Cartesian, (ii) Polar and (iii) Spherical Co-ordinate Systems.

Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) with and without heat generation and (ii) with and without varying thermal conductivity - in Cartesian system with various possible boundary conditions, Thermal Resistances in Series and in Parallel. **8 Hours**

**Module – II**

Critical Thickness of Insulation: Concept, Derivation, Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications

Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems, Heisler and Grober charts.

**9 Hours**

**Module – III**

Numerical Analysis of Heat Conduction: Introduction, one-dimensional steady conduction, one dimensional unsteady conduction, two-dimensional steady and unsteady conduction, the difference equation, boundary conditions, solution methods, cylindrical coordinates and irregular boundaries.

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's, Rayleigh-Jeans' and Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchhoff's Laws, View factor, Net radiation exchange in a two-body enclosure, Typical examples for these enclosures, Radiation Shield.

**9 Hours**

**Module – IV**

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Governing Equations – Continuity, Navier-Stokes and Energy equations, Boundary layer assumptions, Integral and Analytical solutions to above equations, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions, Forced Convection Cooling of Electronic Devices.

Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

**8 Hours**

**Module – V**

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts, compact heat exchangers.

Heat Transfer with Phase Change: Introduction to boiling, pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation, heat pipes, entrainment, wicking and boiling limitations. **9 Hours**

**Course Outcomes**

At the end of the course, the student will be able to:

- Understand the basic modes of heat transfer.
- Compute temperature distribution in steady-state and unsteady-state heat conduction
- Understand and interpret heat transfer through extended surfaces.
- Interpret and compute forced and free convective heat transfer.
- Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.
- Design heat exchangers using LMTD and NTU methods.

**TEXT BOOKS:**


1. Principals of heat transfer, Frank Kreith, Raj M. Manglik, Mark S. Bohn, Seventh Edition, Cengage learning, 2011.
2. Yunus A. Cengel - Heat transfer, a practical approach, Fifth edition,Tata Mc Graw Hill.


**REFERENCE BOOKS:**


1. Heat nd mass transfer, Kurt C, Rolle, second edition, Cengage learning.
2. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.
3. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and De Witt, D. P., 5th Edition, John Wiley and Sons, New York, 2006.
4. Heat Transfer, Holman, J. P., 9th Edition, Tata McGraw Hill, New York, 2008.


**E-Books/Web references:**

1. A Text book of Heat Transfer, John H Lienhard, 4th Edition,
2. NPTEL Heat Transfer course for Mechanical Engineering, http://nptel.ac.in/courses/112101097/
3. Heat Transfer, Chris Long & Naser Sayma, Bookboon.com

**MOOCs:**

1. Fluid flow, Heat and Mass Transfer- http://ocw.tudelft.nl/courses/applied-earth-sciences/fluid-flow-heat-mass-transfer/course
2. Heat transfer course- https://legacy.saylor.org/me204/Intro/

**Scheme of Examination:**

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

**Heat Transfer Lab**

| Course | Code | Credits | L-T-P | Assessment | | Exam Duration |
|---|---|---|---|---|---|---|
| | | | | SEE | CIA | |
| Heat Transfer Lab | 15MEL67 | 02 | 1-0-2 | 80 | 20 | 3Hrs |

**Co□requisite Courses:** Heat Transfer

**Course Objectives:**

- The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
- This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

**PART – A**

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a
5. Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.
6. Determination of Emissivity of a Surface.
7. Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).

**PART – B**

1. Determination of Steffan Boltzmann Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
3. Experiments on Boiling of Liquid and Condensation of Vapour.
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner.
6. Experiment on Transient Conduction Heat Transfer.
7. Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package)

**Course Outcomes:** At the end of this course students are able to,

- Perform experiments to determine the thermal conductivity of a metal rod

- Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
- Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
- Determine surface emissivity of a test plate
- Estimate performance of a refrigerator and effectiveness of fin
- Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.

**Reading:**

1. M. Necati Ozisik, Heat Transfer – A Basic Approach, McGraw Hill, New York, 2005.
2. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, John Wiley and Sons, New York, 2006.
3. Holman, J. P., Heat Transfer, 9th Edition, Tata McGraw Hill, New York, 2008.

**Scheme of Examination:**

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

| MARKETING MANAGEMENT | | | |
|---|---|---|---|
| Course Code | 20MBA15 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives**

1. Make students have an understanding of the fundamental concepts of marketing & the environment in which marketing system operates.
2. To analyze the motives influencing buying behaviour & Describe major bases for segment marketing, target marketing, and market positioning.
3. Identify a Conceptual framework, covering basic elements of the marketing mix.
4. To understand fundamental premise underlying market driven strategies.
5. Giving them hands on practical approach to subject study.

**Module-1 Introduction to Marketing** **9 hours**

Marketing V/s Selling, Customer value, Components of customer value and components of customer cost. Marketing Ethics- green marketing and green economy. Marketing Myopia.Marketing Environment - Components of Environment to be analysed- Micro/ Macro Environment, Technological environment, Socio-cultural environment, Economic Environment, Legal Environment, Consumer/demographic environment, Government policies, Political environment. Techniques used in Environment Analysis. Contemporary Indian Marketing Environment. Cause and Social Marketing alternate concepts like 3V concepts of Nirmalaya Kumar Social Responsibility of marketing- new marketing realities, new responsibilities, new-age marketing, societal marketing concept, Corporate Social Responsibility. Emerging areas- Neuro Marketing , Sensory Marketing- concepts only. **Assignment:** Contemporary Indian Marketing Environment

**Module -2 Analysing Consumer Behaviour** **9 hours**

Connecting with consumers and consumer in sighting, Factors influencing Consumer Behaviour, Consumer characteristics influencing buying behaviour- personal factors and cultural factors. Consumer Buying Decision Process, Buying Roles, Buying Motives. The black box model of consumer behaviour. Psychological Processes underlying consumer behaviour. **Market Segmentation:** Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies. Segmentation method – Geographic segmentation and Demographic segmentation, psychographic segmentation, behavioural segmentation, volume segmentation, deep segmentation. Indian Consumer- Features about consumer India, Classifying Indian consumer by Income B2B marketing Vs Consumer Marketing. **Assignment- Live projects on Consumer Behaviour.**

**Module -3 Product, Brand Equity, Services Marketing** **9 hours**

Product Management- fundamentals, primary objective of product management, product hierarchy, product line, product mix, product mix strategies, Appraisal of product lines, products and brands. Managing PLC of product/brand, New Product Development, packing as a marketing tool, Role of labelling in packing. Main tasks in product management. Components of Product personality. Brand- selecting brand name, selecting logo, brand extension- effects. Introducing new product, innovations, new product development, stages in new product development, pricing strategy for new product. Branding - Concept of Branding, Types, Brand Equity, Branding strategies.Services Marketing & its Characteristics- tasks involved in service marketing, differentiating, positioning and brand building in services, premiumisation in service marketing.Market Segmentation, Targeting & Positioning (STP): Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Product Differentiation Strategies, Tasks involved in Positioning. Monitoring brands performance and positioning.

**Module -4 Pricing , Marketing Channels** **7 hours**

**Pricing decisions:** Significance of pricing, factor influencing pricing (Internal factor and External factor), objectives, Pricing Strategies-Value based, Cost based, Market based, Competitor based, Pricing Procedure.
**Marketing Channels:** Roles and purpose of Marketing Channels, Factors Affecting Channel Choice, Channel Design, Channel Management Decision, Channel Conflict, Designing a physical Distribution System, Network Marketing. Contemporary Channels and Retailing in India.**Product Distribution Logistics:** Product distribution Concept. Distinction between distribution logistics and Supply Chain Management..

**Module -5 Direct Marketing & Digital Marketing:** **9 hours**

Concept and scope of direct marketing, concept and components of digital marketing. Digital marketing communications, digital marketing in India. **Promotions**- Marketing communications- Integrated Marketing

Communications (IMC)-communication objectives, steps in developing effective communication, Stages in designing message. Advertising: Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model, Traditional Vs Modern Media- Online and Mobile Advertising, Social Media for Advertising. Customer Relationship Management- components. Significance of Marketing Research- importance of data.

**Module - 6 Sales Promotion, Marketing Planning and Rural Marketing 7 hours**

**Sales Promotion:** Tools and Techniques of sales promotion, Push-pull strategies of promotion. Personal selling: Steps/process involved in Personal Selling. Publicity/Public Relation-word of mouth, sponsorships. Database marketing: Basic concepts of e-commerce, e-marketing, m-Commerce, m-marketing, e-networking, CRM, MkIS.
**Marketing Planning:** Meaning, Steps involved in Marketing planning. Marketing Audit- Meaning, components of Marketing Audit. Market Share analysis, Marketing cost analysis, Marketing Strategic Planning Process.
**Concept of Rural Marketing:** Flumist (HBR) and Saffola Journey- Case Studies
Classroom Exercise: Brand Communication (create and enact a commercial)

**Course outcomes:**

At the end of the course the student will be able to:

1. Develop an ability to assess the impact of the environment on marketing function.
2. To formulate marketing strategies that incorporate psychological and sociological factors which influence buying .
3. Understand concept of Branding, development of product and significance of market segmentation , targeting and positioning.
4. Identifying marketing channels and the concept of product distribution.
5. Identifying techniques of sales promotion , significance of marketing research.
6. Synthesize ideas into a viable marketing plan for various modes of marketing

**Practical Components:**

- Understanding Contemporary Indian Marketing Environment.
- Understanding and demonstrating their exposure on consumer behaviour
- Effectively using their skill in creating and enacting a commercial on brand communication.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | X | | |
| CO2 | X | X | X | | X |
| CO3 | X | X | X | | |
| CO4 | X | X | | | X |
| CO5 | X | | | X | |
| CO6 | X | | | X | X |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Textbooks**

| Sl No | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Marketing Management- Indian Context, Global Perspective. | Ramaswamy & Namakumari | SAGE | 6th Edition |

| | | | | |
|---|---|---|---|---|
| 2 | Marketing Management: A South Asian Perspective. | Kotler, Keller, Koshy & Jha | Pearson Education | Latest edition |
| 3 | New Product Management | Merle Crawford and Anthony Di Benedetto | McGraw-Hill | Latest Editon |
| 4 | Advertisement Brands & Consumer Behaviour | Ramesh Kumar | Sage Publications | 2020 |
| **Reference Books** | | | | |
| 1 | Marketing in India: Text and Cases | Neelamegham S | Vikas | Latest edition |
| 2 | Marketing | Lamb, Hair, Mc Danniel | Cengage Learning | Latest edition |
| 3 | Fundamentals of Marketing Management, | Etzel M J BJ Walker & William J Stanton | Tata Macgraw Hill | Latest edition |
| | | | | |

## II SEMESTER

| HUMAN RESOURCE MANAGEMENT | | | |
|---|---|---|---|
| Course Code | 20MBA21 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives**

1. The student will be able to recite the theories and various functions of Human Resources Management
2. The student will be able to describe and explain in her/his own words, the relevance and importance of Human Resources Management at workplace
3. The student will be able to apply and solve the workplace problems through Human Resources Management intervention
4. The student will be able to classify and categorise in differentiating between the best method to solve the problem
5. The student will be able to compare and contrast different approaches of HRM for solving the complex issues and problems at the workplace
6. The student will be able to design and develop an original framework and model in dealing with the problems in the organization.

**Module-1 Introduction** **7 hours**

Human Resource Management and Personnel Management, The Importance of Human Resource Management, Models of Human Resource Management, Evolution of Human Resource Management, HRM in India, The Factors Influencing Human Resource Management , Human Resource Management and Line Managers, The HR Competencies, Human Resource Management and Firm Performance.

**Module -2 Human Resource Planning** **9 hours**

Importance of HR Planning, Manpower Planning to HR Planning, Factors Affecting HR Planning, Benefits of HR Planning, HRP Process, Tools for Demand Forecasting, Attributes of an Effective HR Planning, Barriers to HR Planning, The Challenges for HR, Process of Job Analysis and Job Evaluation.

**Recruitment and Selection:** Importance of Recruitment, Recruitment Policies, Factors Influencing Recruitment, Recruitment Process, Sources, Evaluation of Recruitment Process, Recruitment Strategy ; Selection, Future Trends in Recruitment; Selection Process; Selection Tests; Factors Influencing Selections, Challenges in Selection, Application Tracking System using MS-Excel

**Learning, Training, and Development:** Training, Learning and Development, Learning Theories, The Future of Training, Learning, and Development: Crystal Gazing into the Future, World of Learning. Process of training and Techniques of Training

**Module -3 Performance Management and Appraisal** **9 hours**

Objectives of Performance Management, Performance Management and Performance Appraisal, Common Problems with Performance Appraisals, Performance Management Process, Types of Performance Rating Systems, Future of Performance Management.

**Compensation and Benefits**

Introduction, Definitions, Total Compensation, Total Rewards System, Forms of Pay, Theories of Compensation, External Factors, Internal Factors, Establishing Pay Rates, Employee Benefits.

**Industrial Relations**

Decent Workplace: International Labor Organisation, Industrial Relations, The Objectives of Industrial Relations, Approaches of Industrial Relations Systems, The Actors in Industrial Relations, Indian Context, Industrial Relations and Human Resource Management.

**Employment Relations** - The Definition, Traditional Employment Relations, Actors in the Fray: Role-taking, The New Frameworks for Employment Relations, The Future of Employee Relations.

**Module -4 Human Resource Management in Small and Medium Enterprises** **9 hours**

Definition of SMEs, Human Resource Management and Performance in SMEs, The Difference in Adoption of Human Resource Management: SMEs and Large Firms, Indian Experience, Impact of Weak Adoption of Human Resource Management in SMEs, Factors Influencing the Adoption of Human Resource Management Practices in SMEs, Future of Human Resource. Management in SMEs.

**Human Resource Management in the Service Sector**

Introduction, The Emergence of the Services Sector, Implications for Human Resource, Management Function, Differences Between Services Sector and the Manufacturing Sector, Difference in Human Resource Management

Practices in Services and Manufacturing Sectors, Human Resource Management and Service Quality Correlation, Some Specific Industries in Services Sector, Trade Unions in Services Sector, Models of Union Strategies.
Case Study on "Training Program at ABC Cement". .

**Module -5 Human Resource Management Innovations** **9 hours**

Introduction, Human Resource Management and Innovations, Factors Affecting the Innovation Process in Organisations, Characteristics of Human Resource Management Innovations, Conditions Necessary for Successful HRMI Implementation, Current Trends in Human Resource Management Innovations, Innovative Human Resource Management Practices in India, How Human Resource Management Practices Contribute to Organisational Innovation, How to Make Human Resource Management Innovations Sustainable.

**Module - 6 HR Leadership and Organisation Transformation** **7 hours**

Future of Human Resource Management: The next generation HR professionalism, Critical HR Issues of Today and Tomorrow, Changing Mental Models: HR's Most Important Task, HR roles critical for business survival, HR profession in today's changeful workplace, HR and Technology.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Gain practical experience in the field of Human Resource Concepts, functions and theories.
2. Acquire the conceptual insight of Human Resource and various functions of HR.
3. Apply personnel, managerial and welfare aspects of HR.
4. Develop a greater understanding about HR practices, analyse the trends in the field of HR.

**Practical Component:**

- An visit to Organisation and interact with HR Manager and list out the roles played by HR manager.
- Meet Recruitment Manager and ask- 10 questions one asks during Interview.
- Meet Training and Development Manager and list out various training given to employees; basis of training program; Need analysis.
- Visit any Service Organisation and observe HR functions; List them.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | X | X | | X |
| CO2 | X | X | | X | |
| CO3 | X | X | X | | |
| CO4 | X | | | X | |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE

**Textbooks**

| Sl No | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Human Resource Management: Theory and Practices, | R. C. Sharma, Nipun Sharma | Sage Publication India Pvt. Ltd., | 2019 |
| 2 | Human Resource Management: Concepts | Amitabha Sengupta | Sage Publication India Pvt. Ltd. | 2019 |

| | | | | |
|---|---|---|---|---|
| 3 | Leadership: Theory and Practices | Peter G. Northouse | Sage Publication | 2016 |
| 4 | Human Resources Management | T.P RenukaMurthy | HPH. | 2015 |
| **Reference Books** | | | | |
| 1 | The HR Scorecard: Linking People, Strategy, and Performance | Brian Becker, Dave Ulrich, and Mark A. Huselid | Harvard Business School Press | 2001 |
| 2 | The HR Answer Book: An Indispensable Guide for Managers and Human Resources Professionals | Shawn Smith and Rebecca Mazin | AMACOM | 2011 |
| 3 | Performance Management and Appraisal Systems HR Tools for Global Competitiveness | T. V. Rao | | First Edition, 2004 |
| 4 | Human Resource Management | Appasaba L.V and Kadakol A M | College Book House | 2016 |
| 5 | Human Resource Management | V.S.P Rao | | 2014 |

| FINANCIAL MANAGEMENT | | | |
|---|---|---|---|
| Course Code | 20MBA22 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives:**

1. To familiarize the students with basic concepts of financial management and financial system.
2. To understand concept of time value of money and its implication.
3. To evaluate the investment proposals.
4. To understand the management of working capital in an organization.
5. To analyze capital structure and dividend decision.

**Module-1 Introduction** **9 hours**

Meaning and objectives of Financial Management, changing role of finance managers. Interface of Financial Management with other functional areas. Indian Financial System: Financial markets, Financial Instruments, Financial institutions and financial services. Emerging issues in Financial Management: Risk Management, Behavioural Finance, Financial Engineering, Derivatives (Theory).

**Module-2 Time value of money** **9 hours**

Meaning of Time value of money –Future value of single cash flow & annuity, present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest, Capital recovery & loan amortization. (Theory & Problem). Case Study on Loan amortization. Computer lab for calculation of future value, present value and loan amortisation in MS excel.

**Module-3** **9 hours**

**Sources of Financing:** Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture Capital, Angel investing and private equity, Warrants and convertibles (Theory Only). **Cost of Capital:** Basic concepts. Cost of debenture capital, cost of preferential capital, cost of term loans, cost of equity capital (Dividend discounting and CAPM model) - Cost of retained earnings - Determination of Weighted average cost of capital (WACC) and Marginal cost of capital. (Theory & Problem). Case Study on WACC.

**Module-4 Investment Decisions** **9 hours**

Capital budgeting process, Investment evaluation techniques – [Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rate of return Problem). Risk analysis in capital budgeting-Case Study on replacement of capital project. (Numerical problems). Computer lab for calculation of NPV, IRR, PI, Payback period, ARR in MS excel.

**Module-5 Working Capital Management** **7 hours**

Factors influencing working capital requirements - Current asset policy and current asset finance policy- **Determination of operating cycle and cash cycle on Excel**- Estimation of working capital requirements of a firm. (Does not include Cash, Inventory & Receivables Management). Case study on Working Capital Determination and the impact of negative working capital Amazon-negative working capital and profitability. Computer lab for calculation of working capital cycle and operating cycle in MS excel.

**Module-6 Capital structure and dividend decisions** **7 hours**

Capital structure and dividend decisions – Planning the capital structure-Governance of Equity and Debt, Fall in interest rates and perils of Debt funding. Leverages, EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy. Dividend policy – Factors affecting the dividend policy - Dividend Policies- Stable Dividend, Stable Payout (No dividend theories to be covered). Case Study on EBIT-EPS analysis & Leverages.

**Course outcomes:**

At the end of the course the student will be able to:

1. Understand the basic financial concepts
2. Apply time value of money
3. Evaluate the investment decisions
4. Estimate working capital requirements
5. Analyze the capital structure and dividend decisions

**Practical Components:**

- Identifying the small or medium sized companies and understanding the Investment evaluation techniques used by them.
- Using the annual reports of selected companies, students can study the working capital management employed by them. Students can also compare the working capital management of companies in the same sector.
- Students can choose the companies that have gone for stock split and Bonus issue in the last few years and study the impact of the same on the stock price.
- Students can study any five companies capital structure
- Students can do Company analysis for select companies using profitability and liquidity ratios.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | | | |
| CO2 | X | X | | | |
| CO3 | X | | X | | |
| CO4 | X | | X | X | |
| CO5 | X | | X | | |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

**Textbooks**

| Sl. No. | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Financial Management | Khan M. Y.& Jain P. K, | TMH | 7/e, |
| 2 | Financial Management | Prasanna Chandra | TMH | 9/e, |
| 3 | Financial Management | Prahlad Rathod ,Babitha Thimmaiah and Harish Babu | HPH | 1/e, 2015 |
| 4 | Financial Management: A Strategic Perspective | Nikhil Chandra Shil & Bhagaban Das | Sage Publications | 1/e, 2016 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Financial Management | I M Pandey | Vikas Publishing | 11/e, 2012 |
| 2 | Principles of Corporate Finance | Brealey, Myers, Allen & Mohanty | McGraw Hill Education | 11/e, 2014 |
| 3 | Cases in Financial Management | I.M.Pandey & Ramesh Bhat | McGraw Hill Education | 3/e, 2015 |
| 4 | Corporate Finance | Vishwanath S. R. | Sage Publications | 3/e, 2019 |

**MARKETING SPECIALISATION COURSES**

| SERVICES MARKETING | | | |
|---|---|---|---|
| Course Code | 20MBAMM303 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives**

1. To acquaint the students with the characteristics of services and their marketing implications.
2. To discuss and conceptualize the service quality, productivity in services, role of personnel in service marketing and to manage changes in the environment.
3. To familiarize the students with the GAPS model and strategizing towards closing the GAPS for effective services marketing.

**Module-1 Introduction to services** **9 hours**

Reasons for the growth of services sector and its contribution; difference in goods and service marketing; characteristics of services; concept of service marketing triangle; service marketing mix; GAP models of service quality.

**Consumer behaviour in services:** Search, Experience and Credence property, consumer expectation of services, two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services.

Customer perception of services-Factors influencing customer perception of service, Service encounters, Customer satisfaction, Strategies for influencing customer perception.

**Module -2 Market Research for Customer Expectation** **9 hours**

Key reasons for gap using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies –Relationship marketing, Evaluation Of customer relationships, Benefits of customer relationship, levels of retention strategies, Market segmentation-Basis & targeting in services.

**Module -3 Customer defined service standards** **9 hours**

"Hard" & "Soft" standards, challenges of matching supply & demand in capacity, four common types of constraints facing services, optimum v/s maximum use of capacity, strategies for matching capacity & demand.

Yield management-balancing capacity utilization, pricing. Waiting line strategies- four basic Waiting line strategies.

Leadership &Measurement system for market driven service performance-key reasons for GAP-2 service leadership- Creation of service vision and implementation, Service quality as profit strategy, Role of service quality In offensive and defensive marketing.

**Module -4 Employee role in service designing and Delivery** **7 hours**

Boundary spanning roles, Emotional labour, Source of conflict, Quality- productivity trade off, Strategies for closing GAP 3.

Customer's role in service delivery-Importance of customer & customer's role in service delivery, Strategies for enhancing-Customer participation, Delivery through intermediaries-Key intermediaries for service delivery, Intermediary control strategies.

**Module -5 Role of services marketing communication** **9 hours**

Role of services marketing communication- Key reasons for GAP 4 involving communication, four categories of strategies to match service promises with delivery.

Pricing of services- Role of price and value in provider GAP 4, Role of non-monitory cost, Price as an indicator of service quality –Approaches to pricing services, pricing strategies, SERVQUAL Model.

**Mini Project – On measuring SERVQUAL**

**Module - 6 Physical Evidence in Services** **7 hours**

**Physical evidence in services:** Importance of Physical Evidence, Elements of Physical Evidence, Physical Evidence Strategies, Guidelines for Physical Evidence.

**Service scapes:** Types of service scapes-Objective and Goals of services capes Role of services capes, Approaches for understanding service scapes effects, Frame work for understanding services capes & its effect on behaviour-Guidance for physical evidence strategies.

**Course outcomes:**

At the end of the course the student will be able to:

1. Develop an understanding about the various concepts and importance of Services Marketing.
2. Enhance knowledge about emerging issues and trends in the service sector.
3. Learn to implement service strategies to meet new challenges.

**Practical Component:**

- Ask students to choose a service industry of their choice at the beginning of the semester
- Ask them to do an in-depth study of the industry and give a presentation at the end of the every Module relating the concepts to the particular industry(GAPS).
- Students can prepare service blueprints for any service of their choice.
- Identify any existing services, locate loopholes in the design and suggest modifications.
- Visit a service industry and analyze the role of customers in service delivery.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | | | |
| CO2 | X | | | X | |
| CO3 | X | | X | | X |

**Question paper pattern**:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Textbooks**

| Sl No | Title of the book | Name of the Author/s | Publisher Name | Edition and |
|---|---|---|---|---|
| 1 | Services Marketing | Valarie A Zeithmal & Mary Jo | McGraw Hill | 6/e 2018 |
| 2 | Services Marketing | Christopher Lovelock | Pearson Education | 2014 |
| 3 | Services Marketing | Rajendra Nargundkar | McGraw Hill | 2015 |
| 4 | Marketing Research | Kumar | Sage Publications | 4/e, 2018 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Services Marketing | Parasuraman | Sage Publications | 2018 |
| 2 | Services Marketing | Hoffman & Bateson | Cengage Learning | 2017 |
| 3 | Services Marketing: Operation, Management and Strategy | Strategy-Kenneth E Clow& David L. Kurtz | Biztantra | 2016 |

| MARKETING RESEARCH & ANALYTICS | | | |
|---|---|---|---|
| Course Code | 20MBAMM304 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives**

1. To provide an understanding of the basics of marketing research process.
2. To orient on the theoretical and practical aspects of marketing research.
3. Encourage the students to take up analytical thinking through research.
4. To highlight importance marketing research for enhancing marketing strategies.

**Module-1 Marketing Research Dynamics** **9 hours**

Meaning of Marketing research; when marketing research is unnecessary; Nature and Scope of Marketing Research; Marketing Research in the 21st Century (Indian Scenario); limitations of Marketing Research; threats to marketing research; Introduction to marketing intelligence: concept of marketing intelligence (MI), components, need for MI, Domains of MI. Ethics in marketing research. Design of consumer experiments using Conjoint Analysis. Case Study on Marketing Research Dynamics.

**Module -2 Marketing Research Projects** **7 hours**

Design and implementation of Marketing Research Projects, defining research questions, identifying respondents, sampling accuracy and sufficiency. Issues around studying human subjects.

***Lab on socially acceptable responses- managing***

**Module -3 Decision Support System** **9 hours**

Marketing Decision Support System-meaning, Use of Decision Support Systems in Marketing Research, Data base & Data warehousing. The three Vs: Volume, Velocity & Varity, The Fourth V: Value. Elements of data base, types of data base, using marketing data base for marketing intelligence, ways to gather consumer data.

**Module -4 Applications of Marketing Research** **9 hours**

**Applications of Marketing Research:** Introduction, Consumer Market Research, Business-to-Business Market Research, Product Research, Pricing Research, Motivational Research, Distribution Research, Advertising Research, Media research, Sales Analysis and Forecasting.

***Live project & Assignment: Agriculture Marketing or B2B marketing***

**Module -5 Predictive analysis** **9 hours**

Meaning of predictive analysis, how good are models at predictive behavior, benefits of predictive models and applications of predictive analysis, reaping the benefits, avoiding the pitfalls, importance of predictive model, process of predictive analytics. Predictive Analytics, Data Mining and Big Data_ Myths, Misconceptions and Methods by Steven Finlay.

**Module - 6 Product Research** **7 hours**

Product Research- Analysis of Diffusion of products, Adoption decisions, Product – services tradeoffs, evaluating prototypes, Luxury and Lifestyle products.

**Live project: New Product adoption**

**Course outcomes:**

The student should be able to:

1. Comprehend the objectives of Market research & its application in solving marketing problems.
2. Appreciate the use of different data collection methods, sampling design techniques, measurement methods to analyze the data.
3. Generalize and interpret the data with the help of various measurement techniques.
4. To understand the emergence of new trends in research.

**Practical Component:**

- Choose 5 successful products or services and identify the insight behind them through a field survey.
- Do a comprehensive essay on the difference between consumers vs. trade vs. Competition insights & how best to exploit them.
- Take 5 recent digital innovations like twitter or face book and identify the insights.
- Running case with real data Dell, Comprehensive critical thinking case Baskin-Robbins.
- Data Analysis case with real data IBM.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | X | | |
| CO2 | X | X | | X | |
| CO3 | X | | X | | X |
| CO4 | X | | | X | X |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Textbooks**

| Sl No | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Marketing Research- An Applied Orientation | Naresh K Malhotra & SatyaBhushan Dash | Pearson | 7th Edition |
| 2 | Marketing Analytics Using Excel | .Ajithab Dash | Sage publications | 2019 |
| 3 | Essentials of Marketing Research | William G Zikmund et. al | Cengage Learning | 7/e |
| 4 | Marketing Research | V Kumar | Sage Publications | 1/e, 2015 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Market Research: Text and cases | Rajendra Nargundkar | Mc Graw Hill | 3rd Edition |
| 2 | The Effective Use of Market Research: How to drive and focus better business decisions | Robin J Birn | Viva | 4th Edition |
| 3 | Marketing Research: Methodological Foundations | Gilbert A Churchill & Dawan Lacobucci | | 8th Edition |

| CONSUMER BEHAVIOUR | | | |
|---|---|---|---|
| Course Code | 20MBAMM305 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives**

1. To understand the concept of consumer behaviour, decision making by consumers, behavioural variables and its influences on consumer behaviour.
2. To comprehend the social and cultural dimensions of consumer behaviour.
3. To provide an insight of the psychological and behavioural concepts of consumers.

**Module-1 Introduction** **7 hours**

Meaning of Consumer Behaviour; Difference between Consumer & Customer; Nature & characteristics of Indian Consumers; Consumerism: meaning; Consumer Movement in India; Rights & Responsibilities of consumers in India; Benefits of consumerism. Research on Consumer Behaviour; Consumer Behaviour and Society.

**Module -2 Models of Consumer Behaviour** **9 hours**

Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Internal Influences, External Influences.

**Consumer Decision Making:** Consumer Buying Decision Process, Levels of Consumer Decision Making – Four views of consumer decision making. On-line Decision Making: Meaning & Process/Stages.

Situational Influences- Nature of Situational Influence, Situational Characteristics and consumption behaviour.

Class Exercise: Conducting consumer experiments.

**Module -3 Individual Influences on Consumer Behaviour and CRM Part –I** **9 hours**

**a) Motivation:** Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals. Motivation Theories and Marketing Strategy - Maslow's Hierarchy of Needs, McGuire's Psychological Motives.

**b) Personality:** Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, Neo-Freudian Theory, Trait Theory), Applications of Personality concepts in Marketing, Personality and understanding consumer diversity, Brand Personality, Self and Self-Image.

**c) Perception:** Basics of Perception & Marketing implications, Elements of Perception, Dynamics of Perception, Influence of perception on CB, Consumer Imagery, Perceived price, Perceived quality, price/quality relationship, Perceived Risk, Types of risk, How to consumers' handle risk.

**Module -4 Individual Influences on Consumer Behaviour and CRM Part –II** **9 hours**

**d)Learning:** Elements of Consumer Learning, Marketing Applications of Behavioural Learning Theories, Classical Conditioning – Pavlovian Model, Neo-Pavlovian Model, Instrumental Conditioning.

**e) Attitude:** Basics of attitude, the nature of attitude, Models of Attitude and Marketing Implication, (Tri-component Model of attitude, Multi attribute attitude models. Elaboration Likelihood Model).

**Persuasive Communication:** Communications strategy, Target Audience, Media Strategy, Message strategies, Message structure and presentation

**Module -5 External Influences on Consumer Behaviour** **9 hours**

**Social Class:** Social Class Basics, What is Social Class? (Social class & Social status, the dynamics of status consumption, Features of Social Class, Five Social-Class Categories in India.

**Culture:** Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour. Subculture: Meaning, Subculture division and consumption pattern in India, Types of subcultures. Cross Culture - Cross-cultural consumer analysis - Cross-cultural marketing strategy: Cross-cultural marketing problems in India, Strategies to overcome cross-cultural problems.

**Groups:** Meaning and Nature of Groups, Types Family: The changing structure of family, Family decision making and consumption related roles, Dynamics of husband-wife decision making, The family life cycle & marketing strategy, Traditional family life cycle & marketing implications, Reference Groups: Understanding the power & benefits of reference groups, Factors that affect reference group influence, Types of reference group, Reference Group Appeals.

**Module - 6 Consumer Influence and Diffusion of Innovations** **7 hours**

**Opinion Leadership:** Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders.

**Diffusion of Innovations:** Diffusion Process, Adoption Process: Stages, categories of adopters, Post Purchase Processes.

Customer Relationship Management- Meaning & Significance of CRM, Types of CRM Strategies for building relationship marketing, e-CRM, Meaning, Importance of e-CRM, Difference Between CRM & e-CRM
***Case Study: Pillsbury Cookie Challenge***.

**Course outcomes:**

At the end of the course the student will be able to:

1. Explain the background and concepts vital for understanding Consumer Behaviour.
2. Identify the role of variables that determines Consumer Behaviour in Social & cultural domain.
3. Identifying the psychological and behavioural practices adopted by organizations to enhance the Consumer Behaviour.

**Practical Components:**

- Students can go to malls and unorganized retail outlets and observe the behaviour of consumers of different demographic segments while buying different category of goods. The students need to present the findings / observations followed with a group discussion.
- Students have to prepare a questionnaire and conduct the survey on consumer buying behaviour and present the findings in the class.
- Find three advertisements that appeal to the need for power, affiliation and achievement. Discuss their effectiveness. Rewrite these for persons in different levels of Maslow's Hierarchy?
- Meet your friends and conduct a survey to find what are the important factors in their purchase of mobiles, shoes, bags etc.
- Conduct a study on advertisements regarding a specific product and find out how consumer deal with the information overload.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | | | |
| CO2 | X | | X | X | |
| CO3 | X | | | | X |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Texbooks**

| Sl No | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Consumer Behaviour | Leon Schiffman, Leslie | Pearson | Latest Edition |
| 2 | Consumer Behaviour: A Managerial Perspective | Dr.Dheeraj Sharma, Jagdish N Sheth, Banwari Mittal | Cengage Learning | Latest Edition |
| 3 | Consumer Behaviour | Sethna | Sage Publications | 4/e, 2018 |
| 4 | Advertisement Brands & Consumer Behaviour-Case Book | Ramesh Kumar | Sage Publications | 2017 |

| Reference Books | | | | |
|---|---|---|---|---|
| 1 | Consumer Behaviour in Indian Perspective | Suja Nair | Himalaya Publications | 2015 |
| 2 | Consumer Behaviour: Building Marketing Strategy | Dell, Hawking & others | Tata McGraw Hill | Latest Edition |
| 3 | Consumer Behaviour | Satish K Batra & S H H Kazmi | Excel Books | Latest Edition |

**FINANCE SPECIALISATION COURSES**

| INVESTMENT MANAGEMENT | | | |
|---|---|---|---|
| Course Code | 20MBAFM303 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives**

1. To understand the capital market and various instruments for investment.
2. Learn valuation of equity, debt and mutual funds.
3. To learn theories of portfolio management.
4. To learn diversification of securities for risk return trade off in capital market.
5. To lean portfolio construction for retail investors, high net worth individuals, mutual funds.

**Module -1 Introduction to Investment** **7 hours**

Investment Avenues, Attributes, Investor V/s speculator, Features of a good Investment, Investment Process. Financial Instruments: Money Market Instruments, Capital Market Instruments, Derivatives.

**Securities Market:** Primary Market, Secondary Market. Stock Market Indicators- Indices of Indian Stock Exchanges (only Theory).

**Module -2** **7 hours**

**Return and Risk Concepts:** Concept of return, individual security returns, rate of return, Concept of Risk, Causes of Risk, Types of Risk- Systematic risk- Market Price Risk, Interest Rate Risk, Purchasing Power Risk, Unsystematic Risk- Business risk, Financial Risk, Insolvency Risk, Risk-Return Relationship, Concept of diversifiable risk and non-diversifiable risk. Calculation of Return and Risk of Individual Security (Theory & Problems).

**Module -3 Valuation of Securities** **9 hours**

Bond features, Types of Bonds, Determinants of interest rates, Bond Valuation, Bond Duration, Bond Management Strategies. Preference Shares- Concept, Features, Valuation. Equity Shares- Concept, Valuation, Dividend Valuation Models, P/E Ratio valuation model. (Theory & Problems).

**Module -4** **7 hours**

**Macro-Economic and Industry Analysis:** Fundamental analysis-EIC Frame Work, Economy Analysis, Industry Analysis, Company Analysis- Financial Statement Analysis.

**Market Efficiency:** Efficient Market Hypothesis, Forms of Market Efficiency, Empirical test for different forms of market efficiency.

**Technical Analysis** – Concept, Theories- Dow Theory, Eliot Wave theory. Charts-Types, Trends and Trend Reversal Patterns. Mathematical Indicators –Moving Average Convergence-Divergence, Relative Strength Index (Theory only).

**Module -5 Modern Portfolio Theory** **11 hours**

Markowitz Model- Diversification, Portfolio Return, Portfolio Risk, Efficient Frontier. Sharpe's Single Index Model, Capital Asset Pricing Model: Assumptions, CAPM Equation, Capital Market Line, Security Market Line, CML V/s SML. Sharpe's Optimum Portfolio Construction. Arbitrage Pricing Theory: Equation, Assumption, CAPM V/s APT (Theory & Problems).

**Module-6 Portfolio Management Strategies and Performance Evaluation** **9 hours**

**Portfolio Management Strategies:** Active and Passive Portfolio Management strategy. Portfolio Revision: Portfolio Revision Strategies – Objectives, Performance plans. **Mutual Funds**: Concept of Mutual Funds, Participants in Mutual Funds, Advantages of Investment in Mutual Fund, Measure of Mutual Fund Performance. **Portfolio performance Evaluation:** Measures of portfolio performance (Theory & Problems).

**Course outcomes:**

At the end of the course the student will be able to:

1. The student will understand the capital market and various Instruments for Investment.
2. The learner will be able to assess the risk and return associated with investments and methods to value securities.
3. The student will be able to analyse the Economy, Industry and Company framework for Investment Management.
4. The student will learn the theories of Portfolio management and also the tools and techniques for efficient portfolio management.

**CO-PO MAPPING**

**Practical Components:**

• Each student will be given a virtual cash of Rs.10 Lakhs and they will be asked to invest in equity shares based on fundamental analysis throughout the semester. At the end the best investment will be awarded based on the final net worth. Virtual on line trading account can be opened for the student and every week 2 hours can be allotted to invest, monitor and evaluate.

• Students should study the stock market pages from business press and calculate the risk and return of selected companies.

• Students can do a macro economy using GDP growth.

• Students' are expected to do Industry analysis for specific sectors.

• Students can do Company analysis for select companies using profitability and liquidity ratios.

• Practice technical analysis using Japanese candle sticks.

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | | | |
| CO2 | X | | | X | X |
| CO3 | X | | | | X |
| CO4 | X | | | X | |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

40 percent theory and 60 percent problems in the SEE.

**Textbook/ Textbooks**

| Sl. No. | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Investment Analysis and Portfolio management | Prasanna Chandra | Tata McGraw Hill Education | 3/e, 2010 |
| 2 | Investments | ZviBodie, Kane, Marcus & Mohanty | Tata McGraw Hill Education | 8/e, 2010 |
| 3 | Security Analysis & Portfolio Management | J Kevin | Tata McGraw Hill Education | 2014 |
| **Reference Books** | | | | |
| 1 | Analysis of Investments & Management | Reilly & Brown | Cengage Publications, | 10e/2017 |
| 2 | Security Analysis & Portfolio Management | Punithavathy Ehavathy Pandian | Vikas Publications | 2/e, 201/8 |
| 3 | Investment management (Security Analysis and & Portfolio Management) | Bhalla V.K. | Vikas Publications | 19/e, 2018 |

| BANKING & FINANCIAL SERVICES | | | |
|---|---|---|---|
| Course Code | 20MBAFM305 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives:**

1. To understand the structure and functions of central and Commercial banking in India.
2. To learn the functions of various financial services in India.

**Module-1 Structure of Banking in India** **7 hours**

**Structure of Banking in India:** Functions of RBI, Monetary system, Sources of funds, Quantitative and qualitative measures of credit control. Banking sector reforms, Bank performance analysis and Future of Banking.(Theory)

**Module -2 Commercial Banking** **9 hours**

Commercial Banking: Structure, Functions - Primary & secondary function, Role of commercial banks in socio-economic development, Services rendered. Banking Technology- Concept of Universal Banking-Home banking– ATMs-Internet Banking– Mobile Banking-Core Banking Solutions–Debit, Credit and Smart Cards– Electronic Payment systems-MICR- Cheque Truncation-ECS- EFT – NEFT-RTGS. (Theory)

**Module -3 Merchant Banking** **9 hours**

Merchant Banking: Categories, Services offered, Issue management – Pre and Post issue management, Issue pricing, preparation of prospectus, Issue Management, Underwriting, Private Placement, Book Building Vs. Fixed price issues.(Theory)

**Module -4 NBFCs; Micro-finance; Leasing & Hire Purchase Banking** **9 hours**

**A. NBFCs:** An Overview -Types of NBFCs in India-Regulatory framework.
**B. Micro-finance:** Models, Services, Challenges.
**C. Leasing & Hire Purchase:** Concept, Types, Evaluation. Problems in Evaluation of Leasing & Hire Purchase. (Theory& Problems)

**Module -5 Credit Rating; Venture Capital; Depository System & Securitisation of Debt** **9 hours**

**A. Credit Rating:** Meaning, Process, Methodology, Agencies And Symbols.
**B. Venture Capital:** Concept, Features, Process. Stages, Performance of Venture Capital Funded Companies In India.(Theory)
**C. Depository System:** Objectives, Activities, NSDL& CDSL. Process of Clearing and Settlement.
**D. Securitization of Debt:** Meaning, process, Types, Benefits. (Theory)

**Module-6 Mutual Funds** **7 hours**

Meaning, Structure, Functions, Participants, Types of Funds, Types of Schemes, Performance of Mutual Funds, Regulations for Mutual Funds.

**Course outcomes:**

At the end of the course the student will be able to:

1. The Student will be acquainted to various Banking and Non-Banking financial services in India.
2. The Student will understand the activities of Merchant Banking and credit rating.
3. The Student will be equipped to understand micro financing and other financial services in India.
4. The Student will understand how to evaluate and compare leasing & hire purchase.

**Practical Components:**

- Study and compare the performance of Public and private sector banks.
- Issue management: Study the recent public issues.
- Factoring and forfeiting business in India.
- Venture capital funding and start up challenges.
- Status of securitization in India

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | **X** | | | | |
| **CO2** | **X** | | | **X** | |
| **CO3** | **X** | | | | **X** |
| **CO4** | **X** | | | **X** | |
| | | | | | |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 80 percent theory and 20 percent problems in the SEE.

**Textbook/ Textbooks**

| Sl. No. | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Financial services | Khan M Y | McGraw Hill | 6/e |
| 2 | Banking and Financial Services | Mukund Sharma | Himalaya Publishing House | 2015 |
| 3 | Financial Services in India: Concept and Application | Rajesh Kothari | Sage Publications | 1/e, 2010 |
| **Reference Books** | | | | |
| 1 | Financial Markets and Services | Gordon & Natarajan | Himalaya Publishing House | 7/, 2011 |
| 2 | Merchant Banking & Financial | Vij & Dhavan | McGraw Hill | 1/e, 2011 |
| 3 | Investment Banking | Pratap G Subramanyam | Tata McGraw Hill | 2012 |
| 4 | Behavioural Finance | Sujata Kapoor & Jaya Mamta Prosad | Sage Publications | 1/ e, 2019 |

| ADVANCED FINANCIAL MANAGEMENT | | | |
|---|---|---|---|
| Course Code | 20MBAFM306 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Objectives**

1. To understand the concept capital structure and capital structure theories.
2. To assess the dividend policy of the firm.
3. To be aware of the management of working capital and its financing.
4. To understand the techniques of managing different components of working capital.

**Module -1 Capital Structure Decisions** **9 hours**

Capital structure & market value of a firm. Theories of capital structure – NI approach, NOI approach, Modigliani Miller approach, Traditional approach. Planning the capital structure: EBIT and EPS analysis. ROI & ROE analysis. (Theory and Problems).

**Module -2 Dividend Policy** **9 hours**

**Dividend policy – Theories of dividend policy:** relevance and irrelevance dividend decision. Walter's & Gordon's model, Modigliani & Miller approach. Dividend policies – stable dividend, stable payout and growth. Bonus shares and stock split corporate dividend behavior. (Theory and Problems).

**Module -3 Working Capital Management Policy** **9 hours**

Working capital management – Determination of level of current assets. Sources for financing working capital. Bank finance for working capital. (No problems on estimation of working capital). Working capital financing: Short term financing of working capital, long term financing of working capital. Working capital leverage. (Theory).

**Module -4 Inventory Management** **7 hours**

Inventory Management: Determinations of inventory control levels: ordering, reordering, danger level. EOQ model. Pricing of raw material. Monitoring and control of inventories, ABC Analysis. (Theory and problems)

**Module -5 Receivables Management** **7 hours**

Receivables Management – Credit management through credit policy variables, marginal analysis, Credit evaluation: Numerical credit scoring and Discriminate analysis. Control of accounts receivables, Problems on credit granting decision. (Theory and Problems)

**Module-6 Cash Management** **9 hours**

Cash Management – Forecasting cash flows – Cash budgets, long-term cash forecasting, monitoring collections and receivables, optimal cash balances – Baumol model, Miller-Orr model, Strategies for managing surplus fund. (Theory and Problems)

**Course outcomes:**

At the end of the course the student will be able to:

1. Get an overview of capital structure theories.
2. Understand and assess the dividend policy of the firm.
3. Realize the importance of management of working capital in an organization.
4. Be aware of the techniques of cash, inventory and receivables management

**Practical Component:**

- Study the working capital financing provided by a Bank and submit the report on the same.
- Study the annual report of any two companies and prepare a cash budget for next year.
- Study dividend policy of companies and its impact on shareholders' wealth.
- Study implications of bonus issues/stock splits of companies.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| CO1 | X | | | | |
| CO2 | X | | | X | |
| CO3 | X | | | | |
| CO4 | X | | | | X |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

**Textbooks**

| Sl. No. | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Financial Management | M.Y.Khan & P.K.Jain | TMH | 6/e, 2011 |
| 2 | Financial Management | Prasanna Chandra | TMH | 8/e, 2011 |
| 3 | Corporate Finance-Text and Cases | Vishwanath S.R. | Sage Publishing | 3/e, 2019 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Financial Management & Policy | Vanhorne | Pearson | 12/e, |
| 2 | Financial Planning: Theory and Practice | Sid Mittra, Shailendra Kumar Rai, Anandi P Sahu & Harry Starn, Jr. | Sage Publishing | 1/e, 2015 |
| 3 | Financial Management-A | Rajesh Kothari | Sage Publishing | 2/e, 2017 |

| LOGISTICS AND SUPPLY CHAIN MANAGEMENT | | | |
|---|---|---|---|
| Course Code | 20MBAMM402 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Objectives**

1. To understand the basic concepts, processes and key elements of a supply chain.
2. To understand the elements and scope of logistics in supply chain management
3. To provide insights for establishing efficient, effective, and sustainable supply chains.
4. To comprehend the role of warehouse management
5. To gain knowledge about Inventory Management
6. To provide insights into International Logistics
7. To explain the role of technology in supply chain planning, visibility, and execution.

**Module-1 Supply Chain** **7 hours**

Concept, significance and key challenges. Scope of SCM- historical perspective, essential features, decision phases – process view, supply chain framework, key issues in SCM and benefits.

**Definition and scope of Logistics**. Elements of Logistics, types, incremental value delivery through Logistics management. Innovations in Supply Chain. Estimating customer demand, forecasting in Supply Chain.

**Case Study**.

**Module -2 Warehouse Management System** **7 hours**

Warehousing – scope, primary functions. Efficient Warehouse Management. Types of Warehouse. Warehouse Layout Design, criteria. Warehouse Management System,

Distribution Management, Designing the distribution network, role of distribution, factors influencing distribution, design options, distribution networks in practice, network design in the supply chain, factors affecting the network design decisions. HUB & SPOKE vs Distributed Warehouses. **Case Study**

**Module -3 Inventory Management** **7 hours**

Concept, various costs associated with inventory, EOQ, buffer stock, lead time reduction, reorder point / re-order level fixation, ABC analysis, SDE/VED Analysis. Goals, need, impact of inventory management on business performance. Types of Inventory, Alternative approach for classification of inventories, components of inventory decisions, inventory cost management, business response to stock out, replenishment of inventory, material requirements planning.

Dealing with demand uncertainty in Supply Chain- managing uncertainty in Supply Chain, (Bullwhip Effect) ,Impact of uncertainties. **Case Study**

**Module -4 Transportation** **5 hours**

Role, functions, mode of transportation and criteria of decision. Transportation Infrastructure. Factors impacting road transport cost, hazards in transportation, State of Ocean Transport, global alliances.

Packaging Issues in Transportation, role of containerisation. **Case Study**

**Module -5 Logistics Management** **7 hours**

Logistics of part of SCM, logistics costs, logistics, sub-systems, inbound and out bound logistics bullwhip effects in logistics, distribution and warehousing management. Demand Management and Customer Service: Demand Management, CPFRP, customer service, expected cost of stock outs.

**Recent Issues in SCM:** Role of computer/ IT in supply chain management, CRM Vs SCM, Benchmarking concept, features and implementation, outsourcing – basic concepts, value addition in SCM.

**Case Study**

**Module - 6 International Logistics** **7 hours**

Logistics and Environment, Methods and tools facilitating International Logistics, challenges, Integrated Supply Chain and Logistics Value Chain, Supply Chain Security Initiatives in the USA, Logistics Industry in India.

Sourcing Decisions in Global SCM- Logistics, trends, Key issues in Global sourcing, Factors influencing Outsourcing. Performance Management in Supply Chain introduction. **Case Study**

**Course outcomes:**

The student should be able to:

1. Demonstrate knowledge of the functions of logistics and supply chain management.
2. To relate concepts and activities of the supply chain to actual organizations.
3. Highlight the role of technology in logistics and supply chain management.
4. Evaluate cases for effective supply chain management and its implementation.

**Practical Components:**

- Students are expected to choose any four Indian Organizations and study their supply chain in terms of drivers of the Supply chain and submit a report.
- Students should visit different logistics companies and understand the services provided by them and submit a report.
- Students should identify any product/service and study the type of distribution system used and understand the reason for using that particular type and present it in the class.
- Students should identify the various types of IT applications employed by Indian Organizations in their Supply chain

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | | | |
| CO2 | X | | X | X | |
| CO3 | X | | | | X |
| CO4 | X | | | X | |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in SEE

**Textbooks**

| Sl No | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | A Logistic approach to Supply Chain Management | Coyle, Bardi, Longley | Cengage Learning | Latest edition |
| 2 | Integrated Supply Chain and Logistics Management | Rajat K. Baisya | Sage | 2020 |
| 3 | Supply Chain Management- Text and Cases | Janat Shah | Pearson | Latest edition |
| 4 | Supply Chain Management- Strategy, Planning and Operation | Sunil Chopra, Peter Meindl, D.V.Kalra | Pearson | Latest edition |
| 5 | Marketing Channels | Anne Coughlan, Anderson, Stern and El-Ansary | | |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | The Box | Marc Levinson | | |
| 2 | Essentials of Supply Chain Management | Michaael H Hugos | | |
| 3 | Logistics and Supply Chain | Martin Christopher | FT Publishing | 5th Editon |
| 4 | Supply chain Logistics Management | Donald J Bowersox, | Mc Graw Hill | 4th Edition |
| | | | | |

| DIGITAL MARKETING MANAGEMENT | | | |
|---|---|---|---|
| Course Code | 20MBAMM403 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Objectives**

1. To understand the important concepts related to e-marketing
2. To learn the use of different electronic media for designing marketing activities.
3. To acquaint the students with the latest techniques of e-marketing.

**Module-1 Introduction to Digital Marketing** **7 hours**

Concept of Digital Marketing, Origin, traditional versus Digital Marketing. Digital Marketing Strategy- The P-O-E-M Framework, Segmenting and customising Messages, Digital Landscape. Digital advertising Market in India. Skills required in Digital Marketing, Digital Marketing Plan

**Module -2 Display Advertising** **7 hours**

Concept of Display Advertising, types of display ads, buying models, display plan
Targeting- contextual targeting placement targeting, remarketing, interest categories, geographc and language tagging, demographics, mobile, other targeting methods. Programmatic digital advertising, You Tube Advertising.

**Module -3 Search Engine Advertising** **7 hours**

Understanding Ad Placement, Understanding Ad Ranks, Creating First Ad Campaign, Performance Reports.
Social Media Marketing: Building a successful Strategy
**Live Project: Create a digital marketing plan**

**Module -4 Social Media Marketing** **7 hours**

**Face Book Marketing:** Facebook for business & facebook insights
**LinkedIn Marketing:** LinkedIn Strategy, LinkedIn Analytics
**Twitter Marketing:** Building Content Strategy, twitter usage , Twitter Analytics
**Instagram & Snanpchat:** Objectives of Instagram, Hashtags. What is Snanpchat. Digital Public Relations

**Module -5 Mobile Marketing** **7 hours**

Mobile Usage, Mobile Advertising- Mobile Advertising Models, advantages of Mobile advertising, Mobile Marketing Toolkit, Mobile Marketing features- Location based services, Social marketing on mobile, QR Codes, Augmented Reality, Gamification.**Tracking mobile campaigns-** Mobile Analytics.
**Live Project: Create a mobile advertising project.**.

**Module – 6 Search Engine Optimization** **5 hours**

Search Engine Optimization: How search engines work, concept of search engine optimisation (SEO), On Page Optimisation, Off Page Optimisation, Social media Reach, Maintenance- SEO tactics, Google Search Engine, Web Analytics- Key Metrics- concepts only

**Course outcomes:**

At the end of the course the student will be able to:

1. Recognize appropriate e-marketing objectives.
2. Appreciate the e-commerce framework and technology.
3. Illustrate the use of search engine marketing, online advertising and marketing strategies.
4. Develop social media strategy's to solve business problems.

**Practical Components:**

- Students will learn to create a digital marketing plan.
- Students will learn to create a mobile advertising project.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | | | |
| CO2 | X | X | | | |
| CO3 | X | | X | X | |
| CO4 | X | | X | | X |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Textbooks**

| Sl No | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Digital Marketing | Seema Gupta | McGraw Hill Education | 2017 |
| 2 | Markeing 4.0: Moving from Traditinal to Digital | Philip Kotler, Hermawan Kartajaya, Iwan Setiawan | Wiley | 2017 |
| 3 | Fundamentals of Digital Marketing | Puneet Bhatia | Pearson | 2/e, 2014 |
| 4 | Social Media Marketing | Tracy L Tuten, Michael R Solomon | Sage Publications | 3/e, 2020 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Digital Marketing | Swaminathan T N, Karthik Kumar | Cengage Learning India Pvt. Ltd | 2019 |
| 2 | Digital Marketing | Hanlon | Sage Publications | 2/e, 2017 |
| 3 | Digital Marketing | Ian Dodson | Wiley | 2016 |

**FINANCE SPECIALISATION COURSES**

| RISK MANAGEMENT AND INSURANCE | | | |
|---|---|---|---|
| Course Code | 20MBAFM401 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Objectives**

1. To provide an understanding of different types of risk.
2. To provide an understanding of the risk identification and measurement.
3. To give an overview of role of Life Insurance in risk management.
4. To provide an understanding of general insurance contract.

**Module -1 Introduction to Risk Management** **5 hours**

and Risk Identification: Risk-Risk and Uncertainty-Types of Risk-Burden of Risk-Sources of Risk-Methods of handling Risk-Degree of Risk-Management of Risk. Risk Identification-Business Risk Exposures-Individual Exposures-Exposures of Physical Assets -Exposures of Financial Assets -Exposures of Human Assets - Exposures to Legal Liability - Exposure to Work-Related Injury. (Theory).

**Module -2 Risk Measurement** **7 hours**

Evaluating the Frequency and Severity of Losses-Risk Control-Risk Financing Techniques-Risk Management Decision Methods-Pooling Arrangements and Diversification of Risk. Advanced Issues in Risk Management: The Changing Scope of Risk Management-Insurance Market Dynamics-Loss Forecasting-Financial Analysis in Risk Management -- Decision Making Other Risk Management Tools. (Theory).

**Module -3 Introduction to Insurance** **7 hours**

Risk and Insurance- Definition and Basic Characteristics of Insurance-Requirements of an Insurable Risk-Adverse Selection and Insurance-Insurance vs. Gambling Insurance vs. Hedging Types of Insurance-Essentials of Insurance Contracts. Indian Insurance Industry -Historical Framework of Insurance, Insurance sector Reforms in India. IRDA-Duties and powers of IRDA-IRDA Act 1999. (Theory).

**Module -4 Life Insurance** **7 hours**

Basics of Life Insurance-Growth of Actuarial Science-Features of Life Insurance-Life Insurance Contract-Life Insurance Documents-Insurance Premium Calculations. Life Insurance Classification-Classification on the Basis –Duration-Premium Payment Participation in Profit-Number of Persons Assured-Payment of Policy Amount-Money Back Policies-Module Linked Plans. Annuities-Need of Annuity Contracts, Annuity V/s Life Insurance, Classification of Annuities. (Theory).

**Module -5 General Insurance** **7 hours**

Laws Related to General Insurance-General Insurance Contract-General Insurance Corporation (GIC). Health Insurance-Individual Medical Expense Insurance – Long Term Care Coverage – Disability Income Insurance – Medi-claim Policy – Group Medi-claim Policy – Personal Accident Policy – Child Welfare Policy-Employee Group Insurance – Features of Group Health Insurance – Group Availability Plan. Fire Insurance-Essentials of Fire Insurance Contracts, Types of Fire Insurance Policies, Fire Insurance Coverage. Marine Insurance-Types of Marine Insurance – Marine Insurance principles Important Clauses in Marine Insurance– Marine Insurance Policies –Marine Risks-Clauses in Marine Policy. Motor Vehicles Insurance-Need for Motor Insurance, Types of Motor Insurance, Factors to be considered for Premium Fixing. (Theory).

**Module-6 Management of Insurance Companies** **7 hours**

Functions and Organization of Insurers- Types of Insurance Organization, Organizational Structure of Insurance Companies-Functions of Insurers. Underwriting-Principles of Underwriting, Underwriting in Life Insurance, Underwriting in nonlife Insurance. Claims Management-Claim Settlement in General Insurance-Claim Settlement in Life Insurance. (Theory).

**Course outcomes:**

At the end of the course the student will be able to:

1. Understand various types of risks.
2. Assess the process of identifying and measuring the risk.
3. Acquaint with the functioning of life Insurance in risk management.
4. Understand general insurance contract.

**Practical Component:**

- Should visit insurance companies and undertand the types of policies
- Undesatnd how insurance premium are fixed
- Interact with insurance agents and understand the ground reality of insurance investors.
- Undesatnd how different insurance companies settles the accident claims/death claims
- Undesatnd the functioning and organisation structure of insurances companies.
- Compile and analyse General and Life insurance policies offered by Indian insurance companies (one public sector and one private sector)
- Visit policy bazaar portal and study the different types of insurance policies offered by the Indian insurance companies.
- Analyse the Systematic and unsystematic risk of any two companies
- Analyse the types of Risk in different sectors of India due to Covid- 19 Pandemic

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | | | |
| CO2 | X | | X | X | |
| CO3 | X | X | | | |
| CO4 | X | | | | |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Textbooks**

| Sl. No. | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Principles of Risk Management and Insurance | George E Rejda | Pearson | 12/e, 2009 |
| 2 | Insurance and Risk Management | P.K. Gupta | Himalaya | 1/e, 2010 |
| **Reference Books** | | | | |
| 1 | Principles and Practice of Insurance | P. Periasamy | Himalaya Publishing House | 2/e, 2009 |
| 2 | Introduction to Risk Management and Insurance | Dorfman, Mark S. | Prentice Hall India | 10/e, 2008 |
| 3 | Risk Management and Insurance | Scott E. Harrington, Gregory R Niehaus | TMH | 2/e, 2007 |

| INDIRECT TAXATION | | | |
|---|---|---|---|
| Course Code | 20MBAFM403 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Objectives:**

1. To provide an overview of GST in India
2. To provide an understanding of levy and collection of GST
3. To give an overview of customs duty in India
4. To provide an understanding of valuation for customs duty

**Module-1 Introduction to Goods and Services Tax (GST)** **7 hours**

Goods and Services Tax Act & Rules, Need for GST in India, Dual GST Model - Central Goods and Services Tax Act, 2017 (CGST) State Goods and Services Tax Act, 2017 (SGST) Union Territory Goods and Services Tax Act, 2017 (UTGST) Integrated Goods and Services Tax Act, 2017 (IGST) Goods and Services Tax Network (GSTN), GST Council Guiding principle and Functions of the GST Council. (Theory).

**Module -2 Levy and Collection of Tax** **7 hours**

Scope of Supply, Composite and Mixed Supplies, Levy and Collection, Composition Levy, Exemptions Person Liable to pay GST, Exemption from tax. (Simple problems on calculation of value of taxable supply and GST Levy). (Theory and Problems).

**Module -3 Time and Value of Supply** **7 hours**

Time of Supply, Change in Rate of Tax in respect of Supply of Goods or Services, Place of Supply and Value of Supply. (Simple problems on Time of supply, place of supply and value of supply) (Theory and Problems).

**Module -4 Input Tax Credit** **7 hours**

Introduction and Eligibility to avail Input Tax Credit (ITC). Registration under GST: Persons not liable for Registration, Compulsory Registration in Certain Cases, Procedure for Registration, Deemed Registration. Returns under GST: Furnishing of Returns, First Return, Revision of Returns and Penalty/Late Fee. (Theory).

**Module -5 Customs Duty** **7 hours**

Concept, Meaning of Customs Duty, Circumstances of Levy of Customs Duties and Types of Duties and Exemption from Customs Duty. Valuation under customs: Valuation of Imported Goods and Valuation of Export Goods.. (Problems on Valuation of Imported Goods). (Theory and Problems).

**Module -6 Import and Export Procedure for Customs** **5 hours**

Introduction to Baggage and General Free Allowance. Provisional Assessment of Duty, Due Dates for Payment of Duty, Penalties under Customs, Seizure of Goods, Confiscation of Goods. (Theory).

**Course outcomes:**

At the end of the course the student will be able to:

1. Have clarity about GST system in India
2. Understanding of levy and collection of GST in India
3. Have an overview of customs duty in India
4. Understanding of valuation for customs duty.

**Practical Component:**

- Compile and analyze documents pertaining to Registration under GST and Returns under GST
- How to file Online GST Returns
- How to Generate GSTR 1 & GSTR 3B, E way Bill and How to calculate and avail Input Tax Credit(ITC)
- Conduct a survey among local business community about compliance with GST regime.
- Encourage students to register for online GST Certification Course – Suggested.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | X | | | | |
| CO2 | X | | | | |
| CO3 | X | | | | |
| CO4 | X | | | | X |

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE

**Textbooks**

| Sl. No. | Title of the book | Name of the Author/s | Publisher Name | Edition and year |
|---|---|---|---|---|
| 1 | Indirect Taxes Law and practices | V S Datey | Taxmann's | *Latest Edition* |
| 2 | GST & Customs Law (University Edition) | K.M Bansal | Taxmann's | *Latest Edition* |
| **Reference Books** | | | | |
| 1 | Principles of GST & Customs Law | V.S. Datey and Dr. Krishnan Sachdeva | Taxmann's | *Latest Edition* |
| 2 | Goods & Services Tax (GST) in India | B. Viswanathan | UBS Publishers | *Latest Edition* |
| 3 | Indirect Taxation | Raj K Agrawal & Shivangi Agrawal | Bharat Law House Pvt. Ltd | *Latest Edition* |