

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. Assess the improvement in mechanical behaviour by densification of soil deposits 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 and 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 consolidation theory-assumptions and limitations. Governing differential Equation 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			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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			
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			
<ol style="list-style-type: none"> 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 Design 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:			
<ol style="list-style-type: none"> 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:			
<ul style="list-style-type: none"> • 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. 			
<ul style="list-style-type: none"> • The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper. 			
Textbooks:			
<ol style="list-style-type: none"> 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

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 4th twenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDC) 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.Subramaniam, "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			
Course Code	18CV34	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<p>Course Learning Objectives: This course will develop a student;</p> <ol style="list-style-type: none"> 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, painting. 			
Module-1			
<p>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, specific 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.</p>			
Module-2			
<p>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.</p>			
Module-3			
<p>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.</p>			
Module-4			
<p>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.</p>			
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, Standard Publishers
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			
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			
<ol style="list-style-type: none"> 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 Geotechnology 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- ϕ (Method of slices) soils, Felineous 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;			
<ol style="list-style-type: none"> 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
<p>Course Learning Objectives: This course will enable students to</p> <ol style="list-style-type: none"> 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			
<p>Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans.</p> <p>Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles.</p> <p>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.</p>			
Module -2			
<p>Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.</p> <p>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</p> <p>Materials: material management functions, inventory management.</p>			
Module -3			
<p>Construction Quality , safety and Human Values:</p> <p>Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management</p> <p>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.</p> <p>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.</p>			
Module -4			
<p>Introduction to engineering economy: Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.</p> <p>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.</p> <p>Comparison of alternatives: Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.</p>			
Module -5			

<p>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.</p> <p>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.</p> <p>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.</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 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.
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • 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.
<p>Textbooks:</p> <ol style="list-style-type: none"> 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 Pearson Education 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:
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Robert L Peurifoy, Clifford J. Schexnayder, AviadShapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education 2. Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, New Delhi 3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell 4. Mike Martin, Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill Education 5. Chris Hendrickson and Tung Au, “Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pittsburgh 6. James L.Riggs, David D. Bedworth , Sabah U. Randhawa “ Engineering 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			
<ol style="list-style-type: none"> 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			
<p>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</p> <p>Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.</p>			
Module -2			
<p>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.</p> <p>Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above.</p>			
Module -3			
<p>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.</p>			
Module -4			
<p>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.</p> <p>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.</p>			
Module -5			
<p>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.</p>			
Course outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 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:			
<ul style="list-style-type: none"> • 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:			
<ol style="list-style-type: none"> 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			
<p>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.</p>			
Module-2			
<p>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.</p>			
Module-3			
<p>Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –factors 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.</p>			
Module-4			
Concrete Mix Proportioning			
<p>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.</p>			
Module-5			
Special Concretes			
<p>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.</p>			
Course outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 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 University 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.		02 Class	L1,L2,L3
4. Determination of BOD.			
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: I) Total Solids, II) Suspended Solids, III) Dissolved Solids, IV) Volatile Solids, Fixed Solids, V) Settle able Solids.		02 Class	L1,L2,L3
8. Determination of Turbidity by Nephelometer		01 Class	L1,L2,L3
9. Determination of Optimum Dosage of Alum using Jar test apparatus.			
10. Determination of sodium and potassium using flame photometer.		01 Class	L1,L2,L3
11. Determination Nitrates by spectrophotometer.		01 Class	L1,L2,L3
12. Determination of Iron & Manganese.			
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 – Pozzolan 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 –factors 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
<p>Concrete Mix Proportioning</p> <p>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</p> <p style="text-align: right;">L1, L2, L3, L4</p>
Module-5
<p>Special Concretes</p> <p>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</p> <p style="text-align: right;">L1, L2, L3 L4</p>
<p>Course outcomes:</p> <p>After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 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.
<p>Text Books:</p> <ol style="list-style-type: none"> 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-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014 4. A.R. Santha Kumar, "Concrete Technology", Oxford University Press, New Delhi (New Edition) <ol style="list-style-type: none"> 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

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 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 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 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) 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 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 <ul style="list-style-type: none"> • 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) Hetenyi M. “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 simple tension, 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
<p>Course outcomes:</p> <p>On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • 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 		
<p>Question paper pattern:</p> <p>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.</p>		
<p>Reference Books:</p> <ol style="list-style-type: none"> 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 devices, 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
<p>Course Outcome: On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • 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. 		
<p>Question paper pattern:</p> <p>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.</p>		
<p>Reference Books:</p> <ol style="list-style-type: none"> 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
<p>Course Outcome:</p> <p>After successful completion of this the course, students shall be able to:</p> <ul style="list-style-type: none"> • 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 		
<p>Question paper pattern:</p> <p>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.</p>		
<p>Reference Books:</p> <ul style="list-style-type: none"> • 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		
<ul style="list-style-type: none">• Design of R C slabs by yield line method• Design of flat slabs	8 Hours	L1, L2, L3, L4, L5
Module-2		
<ul style="list-style-type: none">• Design of grid or coffered floors• Design of continuous beams with redistribution of moments	8 Hours	L1, L2, L3, L4, L5
Module -3		
<ul style="list-style-type: none">• Design of R C Chimneys	8 Hours	L1, L2, L3, L4,
Module -4		
<ul style="list-style-type: none">• Design of R C silos• Design of R C bunkers	8 Hours	L1, L2, L4, L5
Module -5		
Formwork: 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			
<ul style="list-style-type: none"> • 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 of Structural 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 the structures

Modules	Teaching Hours	RBT Level
Module-1		
<p>Introduction: Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles .</p> <p>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.</p>	8 Hours	L₁, L₂, L₅
Module-2		
<p>Response of Single-degree-of-freedom systems to harmonic loading including support motion, vibration isolation, transmissibility.</p> <p>Numerical methods applied to Single-degree-of-freedom systems – Duhamel integral.</p> <p>Principle of vibration measuring instruments– seismometer and accelerometer.</p>	8 Hours	L₃, L₄, L₅
Module -3		
<p>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.</p>	8 Hours	L₁, L₂, L₄, L₅

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	L₃, L₄, L₅
Module -5		
Approximate methods: Rayleigh's method, Dunkarley's method, Stodola's method. Dynamics of Continuous systems: Flexural vibration of beams with different end conditions. Stiffness matrix, mass matrix (lumped and consistent).	8 Hours	L₂, L₄
<p>Course outcomes:</p> <p>On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Achieve Knowledge of design and development of problems solving skills. • Understand the principles of Structural Dynamics • Design and develop analytical skills. • Summarize the Solution techniques for dynamics of Multi-degree freedom systems • Understand the concepts of damping in structures. 		
<p>Question paper pattern:</p> <p>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.</p>		
<p>Reference Books:</p> <ol style="list-style-type: none"> 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. 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. 		

<p align="center">Matrix methods of Structural Analysis [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I</p>			
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			
<p>Prerequisites:</p> <ul style="list-style-type: none"> • Engineering Mechanics • Strength of Materials • Structural Analysis • Matrix Algebra 			
<p>Course objectives:</p> <ul style="list-style-type: none"> • 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			
<p>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.</p>		8 Hours	L1,L2, L3,L4
Module-2			
<p>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 rigid plane frames, Displacement-transformation matrix, Development of global stiffness matrix for continuous</p>		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
<p>Course outcomes:</p> <p>Upon completing this course, the students will be able to:</p> <ul style="list-style-type: none"> • 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 		
<p>Question paper pattern:</p> <p>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.</p>		
<p>Reference Books:</p> <ol style="list-style-type: none"> 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		
<p>Laterally Unrestrained Beams:</p> <p>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.</p>	8 Hours	
Module-2		
<p>Beam- Columns in Frames:</p> <p>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</p>	8 Hours	

Module -3		
Steel Beams with Web Openings: 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: 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: 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. Numerical Examples.	8 Hours	
Course outcomes: After studying this course, students will be able to: <ul style="list-style-type: none"> • 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: <ol style="list-style-type: none"> 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			
<ul style="list-style-type: none"> • 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. 			