SECOND YEAR CIVIL ENGINEERING

THIRD SEMESTER

3CE02 – Strength of Materials

Learning Objectives of Subject:

1. To determine the Mechanical behavior of the body and construction materials by determining the stresses, strains produced by the application of loads.
2. To apply the fundamentals of simple stresses and strains.
3. To make one understand the concept of bending and its theoretical analysis.
4. To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, principal stresses and strains, slopes and deflection.

Course outcomes:

At the end of the subject the students will be able -

1. To understand the basics of material properties, stress and strain.
2. To apply knowledge of mathematics, science, for engineering applications
3. To identify, formulate, and solve engineering & real life problems
4. To design and conduct experiments, as well as to analyze and interpret action and reaction data.
5. To understand specific requirement from the component to meet desired needs within realistic constraints of safety

SECTION – A

Unit I: Mechanical properties: Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit II: Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.

Unit III: Stresses in beams (Bending, Shear), i) Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, impact loads and instantaneous stresses.

SECTION – B

Unit IV: Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load. Thin cylinders subjected to internal pressures.

Unit V: Principal stresses: Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, principal strains. Combined direct & bending stresses.

Unit VI: Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macauley's method. Theory of long columns, Euler, Rankin's formula.

Books Recommended:

1. E. P. Popov, Mechanics of Materials, Prentice Hall of India, New Delhi.

2. S.Timoshenko and O. H. Young, Elements of Strength of Materials, East West Press Private Ltd., New Delhi.

3. Ferdinard L. Singer, Strength of Materials, Harper and Row, New York

4. Shames, I. H., Introduction to solid mechanics, Prentice Hall of India, New Delhi

5. R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.

6. Junnarkar, S. B., Mechanics of materials

7. Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pvt. Ltd.

8. Beer and Johston, Mechanics of materials, Mc-Graw Hill

9. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co Pvt Ltd

3CE03 – Building Construction & Engineering Geology

Learning Objectives of Subject:

1. To understand various types and components of civil structure.
2. To learn about the type of infilling material, its features and construction methodology.
3. To understand various levels in building – floor, sill, lintel, roof levels and their need.
4. To understand the need and type of vertical and horizontal circulation.
5. To make aware of knowledge and importance of rock, soil and its impact for site selection.
6. To help one to understand the reason for Earthquake and its impact on soil / rock properties.

Course outcomes:

At the end of the subject the students will be able -

1. To understand Load bearing and Frame structure.
2. To recognize various types of construction material and its suitability
3. To recognize the various levels in building and its need.
4. To know types of staircase, doors, windows and other related fixtures.
5. To recognize types of rock and minerals and its construction properties.
6. To know reason for earthquake and seismic waves.

SECTION - A

Unit I: Introduction: Definition, types of buildings as per national building code, components of buildings and their functions, Types of structure – load bearing & framed structures. Foundation: Definition and necessity, loads of foundation, Bearing Capacity soil, field methods of improving bearing capacity. Types of foundation – shallow foundation and Types of Shallow foundation.Causes of failure of foundations and precautions to be taken.

Unit II: Masonry: Classification of bricks, manufacturing of bricks, tests on bricks, properties of burnt bricks, fly ash bricks, ALC Blocks. Brick masonry construction – Technical terms, general principles, commonly used types of bonds such as stretcher, header, English bond and Flemish bond, their suitability. Formwork: Different types, their relative merits, demerits, period for removal of formwork for different members. Earthquake resistant bands in masonry-Types, location and application.

Unit III: Floors: Types of Floors – Basement floor, ground floor and upper floors, Floorfinishes – Types of flooring material, different types of floor finishes, suitability, method of construction, criteria for selection. Roofs – Flat, pitched roof, steel roof trusses – types and suitability, types of roof covering. Arches, lintels – Types and their suitability, details of R.C.C. lintels.; chajja, precast lintels arches.

SECTION - B

Unit IV: Doors: Purpose, criteria for location, size of door, door frames.; its types, methods of fixing, Types of door shutters and their suitability, Windows – Purpose, criteria for location, no., sizes; shapes of Windows, types of windows; their suitability. Ventilators – Types and their suitability. Fixtures & fastening for doors and windows. Stairs – Function, technical terms, criteria for location, types of staircases, their suitability, principle of stair layout design.

Unit V: Plastering - Necessity, types, processes of different types of plastering, defects inplastered work. Scaffolding – Purpose, types and suitability. Special Aspects of Construction – Damp proofing – causes of dampness, its effects, various methods of damp proofing.Fire proof construction –Fire protection requirements for a multistoried building. Sound proof Construction – Sound absorbents and their characteristic. Expansion & construction joints in building.

Unit VI: Introduction - Different branches of Geology and importance of Geology in CivilEngineering.Folds, faults, joints in Geology. Geological studies related to site selection for dams and reservoirs. Petrology - rock cycle, rock weathering and soil formation, study of common rock types. Earthquake Engineering - earthquake waves, causes and effects, magnitudeand intensity, earthquake zones of India.

Books Recommended:

1. Mackay W.B.: Building Construction, Vol. I, II, III, Longmans.

2. Sushil Kumar: Building Construction, Standard Publishers Distributors.

3. Singh Parbin: General & Engineering Geology.

4. Mukherjee: A Text Book of Geology.

5. TuyrellG.W.: The Principle of Petrology.

6. WadiaD.N. : Geology of India.

7. Sane L.S.: Construction Engg. ManakTalas, Mumbai.

8. National Building Code of India, 2016.

9. Punmia B.C.: Building Construction.

10. A Manual of Earthquake Resistant, Non-Engineered Construction Indian Society of Earthquake Tech.

3CE04 – Transportation Engineering

Learning Objectives of Subject:

1. To learn about basics of Road construction like surveys, alignment principles, types of roads.
2. To study and understand various road studies for safe road design principles and essential geometry.
3. To learn about various road pavements its construction and maintenance procedure.
4. To learn about railway transportation and terms related to it.
5. To learn about construction concepts of Airport runway, Apron layout , various survey and terms related to Airport Transportation.
6. To learn about Tunnels and Bridges components types and related transportation study.

Course outcomes:

At the end of the subject the students will be able –

1. To identify type of roads and its utility.
2. To understand the application of various road studies at time of survey and actual construction.
3. To design the various types of road pavements.
4. To understand rules regulations, signals , type of gauges and railway sleepers density.
5. To recognize the Airport features and design concept of components for Aero plains movement.
6. To identify types and components of Tunnels and bridges and its design components.

SECTION-A

Unit-I Highway: Road Transport characteristics, classification of Roads, Road Patterns, Alignment principles, Survey for highway.

Unit-II Geometric Design: Cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, overtaking sight distance, Horizontal alignment, curves, superelevation.

Unit-III Pavement Design and Traffic Engineering: Components of Flexible and Rigid pavement, Design factor, Traffic Characteristics, Traffic Studies, Construction and Maintenance – WBM Surface dressing, bituminous roads and construction procedure. Road parking system, traffic control devicesand 3 E's of traffic

SECTION-B

Unit-IV:Railway: Railway transportation, track sections, embankment & cutting. Points and crossing Left &right hand turnouts. Objects, Permanent way, gauges, coning of wheels, components of permanent way, Sleeper density, Rail fixtures & fastening. Rail types and functions.

Unit-V: Airport: Agencies controlling national & international aviation, various surveys to be conducted, airport site selection, Aero plane component parts, Aircraft characteristics. Airport

obstructions: Zoning laws, wind rose diagram. Basic runway length and corrections, Apron layout, Aircraft parking & parking system.

Unit-VI: Tunnel and Bridges: Tunnels- necessity, types, tunnel alignment, Size and shape of tunnels, and Tunnel lining. Tunnel drainage, ventilation & lighting of tunnels. Bridge Engineering-Components, classification and identification, data collection, site selection, economic span, Estimation of flood discharge, water way, scour depth, depth of foundation, Afflux, clearance and free board, different structural form – culverts, types of foundation, abutments, piers and wing wall.

Books Recommended:

1) Khanna S.K. & Justo C.E. : Highway Engineering

2) Rao G.V. : Principles of Transportation& Highway Engg.

3) Dr.KadiyaliL.R. : Traffic Engg. & Transport Planning.

4) BindraS.P. : Principles & Practice of Bridge Engg.

5) Saxena &Arora : Railway Engineering.

6) Agrawal M.M. : Railway Engineering.

7) Khanna S.K., Arora M.G., Jain S.S. : Airport Planning & Design,

8) Srinivasan: Tunnel Engineering.

9) Shrarma S.K. : Principles, Practice & Design of Highway Engg.

10) Duggal A.K. &Puri V.P. : Laboratory Mannual in Highway Engg.

3CE05 – Concrete Technology & RCC

Learning Objectives of Subject:

1. To understand basic construction material - Cement, its property and suitability tests.
2. To learn about meaning of concrete, strength of concrete, mixing proportion and suitability test.
3. To understand meaning of RCC and its need.
4. To learn various properties of concrete and use of different admixtures.
5. To learn about special concrete materials and methods.
6. To be able to perform mix design of concrete

Course outcomes:
At the end of the subject the students will be able -

1. To know need and composition of binding material, cement.
2. To recognize concrete and RCC and will be able to perform desired test for suitability,
3. To analyze RCC Components like slab and lintels.
4. To decide and utilize the admixtures as per the need of Concrete.
5. To understand importance of mix design.

SECTION-A

Unit I: Cement: Physical properties of Portland cement, laboratory tests on cement, types of cements. Aggregate: Classification of aggregate, physical properties, bulking and moisture content, specific gravity, bulk density.

Unit II: Properties of fresh concrete: Workability of concrete, methods of measuring workability, nominal mix, mixing, centering & formwork, placing, compaction and curing of concrete. Properties of hardened concrete: Grades of concrete, properties of concrete, compressive, tensile, and shear strength, modulus of elasticity, creep, shrinkage.Durability of concrete,laboratory tests on concrete.

Unit III: Basic elastic theory and concept of reinforced concrete, types of reinforcement, Analysis of rectangular sections by working stress method, modes of failure, design of singly reinforced beams, one-way slabs (simply supported), lintels, and chajjas.

SECTION-B

Unit IV: Pozzolana and Admixtures: Plasticizer, retarders, accelerators, water proofing agents, mineral admixtures, IS code provisions. Construction chemicals: concrete curing compounds, polymer bonding agent, surface retarders, bond aid for plastering, protective and decorative coating.

Unit V: Special concrete: Ready Mix Concrete Light weight concrete, fiber reinforced concrete, Roller compacted concrete, self-compacted concrete, high strength concrete, high performance concrete, high volume fly ash concrete. Special concreting techniques: Guniting, grouting and shotcrete concrete, introduction & application of Ferrocement.

Unit VI: Introduction of mix design, factors governing mix design, IS Code method of mix design (IS: 10262 – 2019) and Ambuja method

Books Recommended:

1. Lea, F. M. The Chemistry of Cement and Concrete, Edward Arnold (Publishers) ltd.

2. Neville, A. M.: Properties of Concrete, Pitman Publishing Company.

3. Neville, Brooks: Concrete Technology, ELBS

4. Gambhir, M. L. : Concrete Technology, Dhanpat Rai and Sons

5. Orchard D. F.: Concrete Technology, Applied Science Pub Ltd.

6. Shetty, M. S.: Concrete Technology, S. Chand

7. Varshney, R. S.: Concrete Technology, Oxford Pub. house.

8. IS: 456 – 2000,

9. IS: 10262 – 2019,,

10. Krishna Raju: Design of Concrete Mixes, Mc – Graw Hill.

11. Ambuja Cement Concrete Mix Design- Ambuja Technical Literature series 79.

3CE06 – Strength of Materials – Lab

List of Practical's in Strength of Material Lab (Minimum any eight practical from the list should be perform)

1. Tension test on metals.
2. Compression test on metals.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Buckling of columns.
10. Deflection of springs.

3CE07 – Building Construction & Engineering Geology – Lab

List of Practical's in Building Construction & Engineering GeologyLab (Minimum any eight practical from the list should be perform)

1. Drawing of following building elements on A-2 size sheet.

a) Paneled door, flush door, and glazed window.

b) Steel truss with details of joints, details & support, details of fixing of roof covering.

2. Planning & drawing of a staircase for the given data. [On A-2 size sheet, Design calculations, plan & section.]

3. Preparation of foundation plan from the given line plan of a two room building [On a A-2 size sheet.]

4. Layout of the above, in field.

5. Fields visits to building under construction and its report writing including material of construction, construction processes, Human recourses required, and construction details.

6. Sketch book containing Free hand sketches of following:

Different types of foundations, Bonds in brick masonry, Types of floors. [Sections] Types of stairs. [Plans and side view], Line sketches of different types of steel roof trusses, Details of expansion joints, Details of damp proofing for basement, Fixtures & fastenings of doors & windows.

7. To determine shape and size of supplied bricks.

8. Field visit for different types of roof structures.

9. Field visit for studying building component in Load bearing and framed structure.

10. Megascopic study of silicate and non-silicate mineral, with special reference to physical properties of minerals and uses.

11. Megascopic study of the common igneous, sedimentary and metamorphic rocks, with special reference to engineering properties of rock and uses.

3CE08 – Transportation Engineering – Lab

List of Practical's in Transportation Engineering-Lab (Minimum eight experiments from the list should be perform)

1. Determination of Los Angeles value
2. Determination of Abrasion value of Aggregates by the use of devil machine
3. Determination of Aggregate Impact value
4. Determination of Aggregate Crushing value
5. Determination of Flakiness and Elongation Index of Aggregate.
6. Determination of Viscosity of Bituminous material
7. Determination of softening point of bituminous material.
8. Determination of ductility of bitumen.
9. Determination of marshal stability value

3CE09 – Concrete Technology & RCC – Lab

List of Practical's in Concrete Technology & RCC Lab (Minimum eight practical from the list should be perform)

1. Mix Design (Compulsory) by IS method.

2. Compulsory site visit and submission of site visit report.

3. Fineness of cement

4. Soundness of cement

5. Consistency and setting time of the cement

6. Compressive strength of cement

7. Sieve analysis of aggregate.

8. Bulking of sand (fine aggregate).

9. Silting of sand.

10. Workability by slump cone test compaction factor test

11. Admixture: Density, Compatibility Test

12. Workability by flow table method.

13. Compressive & Tensile strength of concrete.

FORTH SEMESTER

4CE01- Building Planning Designing & CAD

Learning Objectives of Subject:

1. To understand need of engineering drawings and methods to draw it.
2. To learn about various planning principles and able to apply on residential buildings.
3. To understand seasonal and climatic condition and corresponding provisions in structure.
4. To know regional rules regulation related to building construction.
5. To learn various types of plan – Block , Site , Line , Detail , Section etc.
6. To learn about smart buildings.

Course outcomes:

At the end of the subject the students will be able -

1. To make engineering drawings by First angle and Third angle method.
2. To apple building planning principles practically while developing projects.
3. To study the climatic conditions and decide the corresponding provision in structure.
4. To know about Bylaws, Town development authority rules and terms.
5. To draw various plans manually and computationally.

SECTION-A

Unit I: Importance of building drawing for Civil Engineering in construction & industry, estimation, Selection of scales for various drawings. Types of line and theirapplication. Methods of dimensioning in architectural drawing. Abbreviations and graphical symbols used in Civil Engineering Drawing as per IS: 962. Compare first angle and third angle method of projection. Layout of sheet for civil engineering drawing. Requirements of drawing and documents as per plan sanctioning authorities. Define FSI and TDR.

Unit II: Planning of residential building. Introduction, general principles of planning viz. aspect, prospect, roominess, privacy, grouping, circulation, ventilation, furniture requirement.

Climate of Indian and its influence on Building planning: Solar radiation, air temperature, wind, humidity, precipitation, earth & its motion, directions to their characteristics. Orientation of buildings: factors affecting orientation, sun, wind, rain. Requirement of the owner. Alternatives of building types viz. individual bungalows, semidetached houses, row houses, apartments. Provision of mezzanine floor, balconies and porches in the building. Common utilities such as parking, security, water supply, sanitation, etc. for apartments. Criteria for earthquake resistant planning of building.

Concepts of Digitized/Smart Buildings, Internet of Things (IOT) in buildings and Green Buildings, Industrialized Buildings

SECTION-B

Unit-III: Building Bye-laws and Development Control Rules for D Class Municipal Corporations in the Maharashtra State under the provisions of the Maharashtra Regional & Town Planning Act, 1966. Conversion of land to non-agricultural lands, layout for a housing project.Types of public building and their requirements, planning of public building.

Preparing line plans of different public buildings such as schools, commercial market, primary health center, workshop, college building, post-office. Free hand sketching of components of buildings and elevation features of building such as balconies, chajjas, etc., Staircase planning & drawing.

Unit IV: Concept of line plan, working and submission drawings of the building. Details to be incorporated in the working drawing. Necessity and use of working and submission drawing. Concept of site plan, block plan and layout plan. Importance and details to be incorporated. Concept of foundation plan, importance and use. Developing working and submission drawings for load bearing and framed structures building from the given line plan(Develop plan, elevation, LHSV, RHSV, back side view, section, foundation plan, site plan and their detail). Plumbing ramp, Electric plan.

Books Recommended :

1. Shah, Kale &Patki, Building Planning & Drawing, Tata McGraw-Hill plubication

2. Dr. Kumar Swamy& Rao Swamy, Charotar publications

3. CheryR , Auto cad Pocket reference, BPB Publication.

4CE02 - Hydrology & Water Resource Engineering

Learning Objectives of Subject:

1. To study the different hydrological parameters.
2. To understand hydrological statistics and design.
3. To characterize and mitigate natural and man-made hazard.
4. To understand the various irrigation systems and its design.

Course outcomes:
At the end of the subject the students will be able -

1. Explain the hydrology and hydrological data.
2. To analyse the hydrological methods for runoff.
3. Evaluate the ground water hydrological problems.
4. Explain the need of irrigation systems and its alternatives.

SECTION – A

Unit I: Introduction - Hydrologic cycle, applications in engineering, sources of data. Precipitation- Forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area- duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP).

Unit II: Abstractions from precipitation - evaporation process, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modeling infiltration capacity, classification of infiltration capacities, infiltration indices.

Unit III: Runoff - runoff volume, methods of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph. Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

SECTION – B

Unit IV: Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler, pipeline distribution network(PDN) and trickle / drip irrigation.

Unit V: Distribution systems - canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels, Kennedy's and Lacey's theory of regime channels. Canal

outlets: non-modular, semi-modular and modular outlets. Lining of canals, types of lining. Water logging problems, causes, effects and remedies.

Unit VI: Dams and spillways – Earthen dams: Classification, design considerations, selection of suitable site. Estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Economic height of dam, Spillways: components of spillways, types of gates for spillway.

Books Recommended:

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.

2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.

3. G L Asawa, Irrigation Engineering, Wiley Eastern

4CE03 Surveying

Learning Objectives of Subject:

1. To learn about the term surveying, various instruments and possible error.
2. To learn Linear Measurement methods and way of conduction.
3. To learn about the measurement at elevation and of Directions , contour development process.
4. To understand and learn performing Plane table surveying.

Course Outcomes:

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

1. Define principles of Surveying, Remote Sensing and Geomatics.
2. Describe different instruments, tools, applications and techniques to determine the positions on the surface of the earth, change detection.
3. To perform Liner measurement methods of surveying.
4. Differentiate the techniques for setting out alignments, curves, other layouts, modern survey systems etc.
5. To perform survey at elevation and conduct Plane Table survey.

SECTION-A

Unit I: INTRODUCTION:Geoinformatics- definition, disciplines covered, importance. Field Surveying- definition & objectives; concept of Geoids and reference spheroids, coordinate systems, plane and geodetic surveys. Methods of location of a point- classification of surveys; principles of surveying Errors in measurements- sources, types of errors and their treatment. Random error distribution, accuracy, precision and uncertainty. Surveying instruments- temporary and permanent adjustment concept, principle of reversal. Maps- types, importance, scales/CI, conventional symbols, and generalization; topographic maps projection systems, sheet numbering systems, map layout.

Unit II:LINEAR MEASUREMENTS:Direct and indirect methods; Chain and tape measurements- corrections to tape measurements; Optical methods- tacheometers, sub tense bar; Electronic methods- EDMs, total stations.

Unit III: MEASUREMENT OF ELEVATIONS:Various terms; Methods of height determination; Spirit leveling- different types of levels and staves; booking and reduction of data, classification and permissible closing error; profile leveling and cross sectioning; curvature & refraction and collimation errors; reciprocal leveling. Contours- characteristics, uses and methods of contouring.

SECTION – B

Unit IV:MEASUREMENT OF DIRECTIONS:Bearings and angles; Compass surveying-magnetic bearings, declination, local attraction errors and adjustments.

Unit V: TRAVERSING: Purpose and classification of each; Compass and theodolite traverses, theodolites- different types, uses, methods of observation and booking of data, balancing of traverses, computation of coordinates, omitted measurements Gale's traverse table.

Unit VI: PLANE TABLING: Merits and demerits, accessories; orientation and resection; methods of plane tabling; three point problem and solutions; errors in plane tabling, least square principle, Engineering project surveys- requirements and specifications, various stages of survey.

Books Recommended:

1. D. Clarke: Plane and Geodatic Surveying, Volume I&II
2. T.P. Kanetkar& Kulkarni: Surveying & Levelling, Part I & II.
3. B.C. Punmia : Surveying I&II
4. N.N. Basak : Surveying & Levelling

4CE04 - Geotechnical Engineering –I

Learning Objectives of Subject:

1. To understand the various types of soil and its classification.
2. To learn about the Index and Engineering properties of soil.
3. To make one understand the mechanics of compaction and factors affecting the compaction.
4. To understand the concept of permeability and factors affecting to it.
5. To learn about the concept of seepeage discharge and effective, neutral and total stress in soil mass.
6. To make one understand the stress distribution in soil mass& its engineering applications.

Course Outcomes:

At the end of the subject the students will be able –

1. To determine the Index properties and Atterberg limits for soil classification.
2. To understand the mechanics of compaction and quality control in field.
3. To explain permeability of soil and methods of dewatering.
4. To calculate the seepage discharge and design the graded filter.
5. To understand the concept of consolidation and stress distribution in soil mass.
   To calculate the shear strength of different soil.

SECTION - A

Unit- I History of development of soil mechanics, formation of soil, its significance to the field problems. Soilproperties and its classification, system: Definition of soil, soil as a three phase system, weight – volume relationship Index properties of coarse and fine grained soil BIS classification of fine grained & coarse grained soil.

Unit-II Concept of clay mineral, major soil minerals, their structural formation and properties. Mechanics of compaction, factors affecting compaction, Standard and modified Proctor test, their field Determination, zero air void line, concept of wet of optimum, and dry of optimum, different structures of soil, field compaction & their control. CBR test and CBR value for soak and unsoaked conditions.

Unit-III Absorbed water, surface tension, capillarity and its effect on Soil properties permeability of soil, Darcy's law and validity, Discharge and seepage velocity, factors affection Permeability, determination of coefficient of permeability laboratory and field methods. Permeability for stratified deposits. Drainage and dewatering of soil and it's various methods.

SECTION – B

Unit-IV Laplace equation, its derivation in Cartesian co-ordinate system, its application for the computation of discharge seepage, seepage pressure, quick sand condition, concepts flow net, method to draw flow nets, characteristics and use of flow net, preliminary problem of discharge, estimation of discharge through homogenous earthen embankment, concept of effective neutral and total stress in soil mass, method of arresting seepage, design Terzaghi's criteria for graded filter, concept of piping and criteria of stability against piping.

Unit-V A physical concept of shear strength, Introduction of Mohr's stress diagram, Mohr's failure criteria, Mohr- Coulomb's theory and development of failure envelopes, Unconfined compression test, Laboratory measurement of shear strength for different drainage, conditions by direct shear test, Triaxial test for various drainage conditions, Merits and demerits of various shear strength tests. Concept of pore pressure coefficient shear characteristics of sand, NC and OC clays and partially saturated soil, Influence of soil structure and strain rate on shear strength.

Unit-VI State of stress at a point, stress distribution in soil mass, Boussinesq's theory and its applications, point load, uniformly loaded rectangular and circular area New-mark's chart, its preparation and use, equivalent point load Compression of laterally confined soil, concept of consolidation spring analogy, Terzaghi's theory of one-dimensional consolidation. e-p curve, compression index, swelling index, coefficient of compressibility, Consoledometer-test, determination of CvCassagrande's method for determination of pre-consolidation pressure.

BOOKS RECOMMENDED:

1) Craig R.F.: Soil Mechanics,

2) Lambe T.W. & Whiteman R.V.: Soil Mechanics, John Wiley and Sons, 1969.

3) Terzaghi K. & Peck R.B.: Soil Mechanics in Engg. Practice, John Wiley & Sons, 1967.

4) Gulhati S.K.: Engg. Properties of Soils, Tata McGraw Hill, New Delhi, 1978.

5) Singh A.: Soil Engg. in Theory and Practice, Asia Publishing House, Mumbai.

6) Venkataramiah C.: Soil Mechanics and Foundation Engineering.

7) B. M. Das Advanced Soil Mechanics.

8) S. K. Garg: Soil Mechanics and Foundation Engineering.

4CE05 - Structural Analysis- I

Learning Objectives of Subject:

1. To understand the action and corresponding displacement in various type of structural elements.
2. To learn about statically determinate and indeterminate structures.
3. To analyze continuous, cantilever and propped cantilever beams.
4. To learn different analysis methods for analysis of beam, frames and trusses.
5. To learn analysis of 2 Hinge and 3 Hinge arches.

Course outcomes:

At the end of the subject the students will be able -

1. To decide what is required to be analyzed depending upon type of structural element.
2. To know about degree of freedom, Condition of equilibrium and determinacy of element.
3. To understand reason for failure and permissible limits for safety.
4. To apply the knowledge of beam analysis for practical analysis and design purpose.
5. To make application of various analysis methods for actual structural member analysis and design.
6. To know merits for utilization of suspension, 2 hinged and 3 hinged arches.

SECTION – A

Unit-I

1. Classification of Structures, Concept of statically indeterminate Structures, Analysis of fixed beam and propped cantilever, Rotation and sinking of support.
2. Analysis of Continuous beam by theorem of three moments, sinking of support.

Unit-II

1. Castigliano's theorem I, Unit load method, slope and deflection in determinate beams and portals.
2. Deflection in determinate trusses.

Unit-III

Influence line diagrams for reactions, bending moment and shear force for determinate beams. Rolling loads on simply supported beams concentrated and uniformly distributed loads, maximum shear force and bending moment, focal length.

SECTION - B

Unit-IV

1. Analysis of Cables Suspension Bridge under Concentrated Load and UDL for Cables over pulleys and Cable provided with saddles.
2. Two & Three hinged arches subjected to static loads, Bending moment, radial shear and axial thrust.

Unit-V

Slope deflection method: 1. Analysis of continuous beams with and without sinking of support.
2. Analysis of portal frames without side sway.

Unit-VI

Moment Distribution method: 1. Analysis of continuous beams with and without sinking of support. 2. Analysis of portal frames without side sway.

BOOKS RECOMMENDED:

1. Junnarkar, S. B., Mechanics of Structure, Volume I and II
2. Jain and Arya, Theory and Analysis of Structures
3. Reddy. C. S., Basic Structural Analysis, Tata – McGraw hill
4. Wang, C. K., Elementary Analysis of Structures
5. Norris and Wilbur, Elementary Structural analysis

4CE07- Building Planning Designing & CAD – Lab

A. SKETCH BOOK

1. Draw various types of lines, Graphical symbols for materials, doors, windows, sanitary and water supply installations, electrical installations, Abbreviations as per IS 962:1989, Location for bed, sofa, dining table with chairs, wardrobe, kitchen furniture, etc. Free hand sketches of Verandah, lobby, passage, corridor and balconies. Building layout plan with setback lines, sanitary and water supply lines. Loft and Mezzanine floor.

2. Collect one readymade drawing for residential building (1 BHKD or 2BHKD) Read various details shown on drawing. write summary of observations on the drawing itself such as orientation of rooms, placement of doors and windows, wall thicknesses, flooring in rooms and sanitary block, skirting, dado, kitchen platform-size, height etc; room height, chajja projections, staircase-rise, tread, landing etc. Attach these drawings with the sketch book.

3. Draw line plans for five Residential Buildings with minimum three rooms and staircase in each with WC and Bath.

4. Draw line plans for five Public Building- School Building, Primary Health Centre, Hospital Building, Bank, Post Office, Hostel, Canteen and Shopping Complex. Bar & Restaurant and Hotels, Saloon, Bus Station.

B. FULL IMPERIAL SIZE SHEET (A1)

AUTOCAD: Understanding basic concepts such as Absolute, relative & world Co-ordinates, Drawing units, drawing limits, extend, layers, line types, object snapping, and filter.

Drawing entities in AutoCAD/Felix CAD, various drawing commands, use of object snaps & filters, Editing the drawing different editing commands, Dimensioning commands, Text commands, Hatching commands viewing the drawing different views, view ports, zooming in & out, panning, saving & printing in different scales.

Draw sheet no. 1, 2 and 3 drawing in Auto-CAD or similar software.Prepare sheet no. 3 in Pre-DCR software.

1. SHEET NO. 1 : Submission drawing, **to the scale 1:100,** of single storied Load Bearing Residential Building (4 Room) with Flat Roof and staircase showing developed plan, elevation, section passing through Stair or W.C. and Bath, site plan (1:200), **foundation plan and section (1:50),** area statement, schedule of openings , construction notes.

2. SHEET NO. 2 : Submission drawing, to the scale 1:100, of (G+1) Residential Building Framed Structure (2 BHKD) with attached toilet to 1 bedroom showing the position of European type WC pan) showing developed plan, elevation, section passing through staircase, site plan (1:200), foundation plan **and section** (1:50), area statement, schedule of openings. (Also Show the place for Washing machine, WHB, Pooja, store, bed, dining table with chairs, sofa, wardrobe etc.)

3. SHEET NO. 3: Submission drawing of Apartment / Multi storeyed building to the scale 1:100, showing developed plan, elevation, section passing through staircase or W.C. and Bath and Component Drawing of RCC Lintel and Chajjas. Shows detailed enlarge section.

Note: No identical plans and every student must have his/her own plans and drawings.

4CE08 - Hydrology & Water Resource Engineering - Lab

TERM WORK: Five problems from the following to be worked out by the students, whenever necessary scale drawing on half empirical size must be drawn:

Practical examination shall consist of viva – voce.

1. Fixing control levels of Reservoir from given data.

2. Cross section, plan, L-section of Earth dam showing all components.

3. Drawing of elementary and practical profile of gravity dam.

4. Drawing of diversion weir on permeable foundation.

5. Drawing of ogee spillway with energy dissipaters.

6. Computer Aided design of unlined and lined canal.

7. Drawing of any four canal structure (No design)

8. Technical Field visit.

4CE09 : Surveying– Lab

List of Practical's in Surveying Lab (Minimum eight practical from the list should be perform)

1. Distance measurement by chain tape and EDM.
2. Finding RL of given point.
3. Profile and cross section leveling for road.
4. Measurement of bearings with prismatic compass.
5. Chain and compass traversing.
6. Local attraction detection- correction of bearings.
7. Measurement of Horizontal and Vertical angles using Theodolite.
8. Theodolite Traversing.
9. Plane table surveying- Radiation, Intersection and Resection method.
10. Engineering Project Surveys.

4CE10 - Geotechnical Engineering –I– Lab

List of Practical's in Geotechnical Engineering- I Lab (Minimum eight practical from the list should be perform)

Experiments:

1. Determination of specific gravity of soil solids by Pyconometer, density bottle.

2. Determination of moisture content by ovendrying method.

3. Determination of field density of the soil by sand replacement / core cutter method.

4. Determination of grain size distribution by mechanical sieve analysis.

5. Determination of Atterbergs limits (LL, PL and SL)

6. Determination of Compaction properties (Standard Proctor Test)

7. Determination of permeability of soil by using falling head test

8. Determination of shear strength parameters by direct shear test

9. Determination of unconfined compressive strength of soil.

10. Determination of shear strength parameters by Triaxial list of UU type

11. C.B.R. test. Determination of C.B.R. value by conducting CBR test on soaked sample.

12. Determination of Coefficient of consolidation by conducting consolidation.

Sant Gadge Baba Amravati University, Amravati
B.E Civil Engineering Syllabus

V Semester

5CE01 : Design Of Reinforced & Prestressed Concrete Structures

Learning Objectives of Subject:

- To understand basic concept of limit state method.
- To understand behavior of slab under external loading.
- To understand behavior of staircase and retaining wall.
- To understand behavior of column and footing.
- To learn concept of grid slab and earthquake resistant construction.
- To introduce basic concept of prestressed concrete.

Course outcomes:

At the end of the subject the students will be able -

- To analyze and design of rectangular section.
- To analyze and design of slab.
- To analyze and design of staircase and retaining wall.
- To analyze and design of column and footing.
- To understand grid slab and ductile detailing.
- Explain the general behavior of PC sections under external load.

SECTION-A

Unit I:

1) Introduction to limit state method, basic concept and design of singly and doubly reinforced rectangular sections.

2) Analysis and design of flanged sections.

Unit II:

1) Analysis and design of one way continuous slabs

2) Analysis and design of two way slab.

Unit III:

1) Design of Dog legged staircase.

2) Design of cantilever retaining walls (Horizontal backfill only).

SECTION-B

Unit IV:

1) Analysis and design of columns for axial load, uniaxial and biaxial bending.

2) Design of isolated footings: square and rectangular subjected to axial load and uniaxial bending moment only (with uniform depth only).

Unit V:

1) Design of Grid Slab by I.S. code method.

2) Detailing for earthquake resistant construction. Introduction, Cyclic behavior of concrete and reinforcement, significance of Ductility, Ductile detailing for beams, columns, beam-column joint and footing.

Unit VI:

1. Introduction to Prestressed concrete: Materials and their characteristics, types of prestressing, Methods and various prestressing systems, Losses of prestress.

2. Analysis of Rectangular and flanged beams.

Notes:

1) Students should use IS 456:2000, IS 1343:2012, IS 1893:2016, IS 13920:2016.

2) Field visit on any RCC framed structure & report of the same.

3) Students must be shown video CD, slides, transparencies, and photograph of actual structures.

Books Recommended:

1. Ashok K Jain : Reinforced Concrete Limit state Design (Nem Chand & Bros Roorkee)
2. S.K.Sinha: Reinforced Concrete Design (M C Graw Hill Education India Pvt Ltd)
3. Devdas Menon, S. UnnikrishnaPillai :Reinforced concrete Design
4. Dr.Shah V.L. &Karve S.R. : Limit State Theory & designof Reinforced concrete IS 456:2000(Structurs Publication)
5. Neelam Sharma :Reinforced Cement Concrete design (S.K.Kataria& Sons)
6. S.S.Bhavikatti :Design of R.C.C. Structural Element (R.C.C. Vol. I)(New Age International Publishers)
7. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
8. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi

5CE02: Surveying & Geomatics

Course Objectives:

- To prepare the student to understand applications of curves.
- To enable the students to establish accurate control for photogrammetric survey and to determine accurate locations of points in engineering works
- To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources.
- To develop the skills in surveying and thematic mapping.

Course Outcomes:

Students will be able to

- Understand the use of different types of curves and their field implications.

- Understand the triangulation adjustment.
- Understand the hydrographic survey.
- Acquire skills in handling spatial data base warehousing and mining.
- Understand the surveying with advance instrument like remote sensing, GPS and GIS.

SECTION- A

Unit-I: Curves: Classification, degree of curve, elements of circular and compound curves, theory and methods of setting out simple curves, Instrumental method of setting out compound curves.

Unit-II: Triangulation: principles, classification of triangulation system, triangulation figures, their choice of station, phase of signals, towers, satellite station, reduction to center, field work, reconnaissance, Inter-visibility, angular measurements. Basenet, extension of Basenet.

Unit-III: Hydrographic surveying: necessity, controls, shore line surveys, gauges, sounding equipment's and procedure of taking soundings, methods of location of sounding, three-point problem in hydrographic surveying, analytical and graphical methods. Underground Surveying: surface alignment, correlation of surface and underground surveys; Weisbach triangle, transferring levels and alignment underground.

SECTION – B

Unit-IV: Elements of photogrammetry: Basic definitions, terrestrial and aerial photography, scale of vertical photograph, Relief and relief displacements, heights from parallel measurements, flight planning, photographs required.

Unit-V: 1.Remote sensing: Introduction, definitions, remote sensing systems, advantages over conventional system, energy interaction in the atmosphere, Indian remote sensing satellite series and their characteristics 2. GPS: Global positioning system (GPS) introduction, definitions, GPS receivers, antenna, advantages of GPS.

Unit-VI: 1. Geographical Information System: Definition and history, Components of GIS, Data structure and formats, Spatial data models – Raster and vector, Data base design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Introduction to QGIS software. 2. GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning.

Books Recommended:

1. D. Clark.: Plane and Geodetic Surveying Vol II
2. T.P. Kanetkar&S.V.Kulkarni : Surveying and Levelling Part II
3. B.C.Punmia: Surveying Vol. II and III
4. Kang-tsung Chang: Introduction to Geographic Information Systems, McGraw-Hill Book Company, 2006.
5. B.C. Punmia, Ashok Jain, Arun k. Jain: Higher surveying, Laxmi publications (P), Ltd,
6. Dr. S. Kumar: Basics of remote sensing and GIS, Laxmi publications (P), Ltd.

5CE03: Numerical Methods And Computer Programming

Learning Objectives of Subject:

- To learn computer programming concepts.
- To apply these concepts to programming civil engineering related problems and numerical methods.
- To develop software for solving variety of practical civil engineering problems.

Course outcomes:

Upon completion of this course, students will be able to

- Define computer programming related terms
- Explain computer programming related concepts
- Write demonstration programs to show working of I/O statements, control structures, arrays, library functions and subprograms
- Analyze programs related to numerical methods, civil and structural engineering problems
- Write programs to demonstrate the application of programming to numerical methods, civil and structural engineering problems
- Develop own program for automating/ solving Civil Engineering problems

Note: Use Spreadsheet Software like Microsoft Excel, Google Sheets for Unit I and FORTRAN 77 Programming Language for Unit II to Unit VI

SECTION – A

Unit-I : Spreadsheet software basics, Expressions, Mathematical Functions, Conditional Execution Functions like IF, COUNT,COUNTIF, SUM, SUMIF, AVERAGE, AVERAGEIF, VLOOKUP, HLOOKUP. Application to Civil Engineering Problems

Unit-II :1. Basic grammar of FORTRAN, use of library functions, FORTRAN coding sheet, input output statements, format for input output statement, flowchart.

2. Control statements: GO TO, computed GO TO, Assigned GO TO, arithmetic IF, logical IF, block IF, DO statement, implied DO loop

Unit-III: 1. Type declaration statement, DIMENSION statement, subscripted variables, DATA statement.

2. Sub – programs: Statement function, function sub – program, subroutine sub program. Dummy and actual arguments.

SECTION-B

Unit-IV:1. Matrix operations such as:a. Addition and substraction, b. Multiplication, c. Transpose, d. Testing summary etc.

2. Fourth order, Runge - Kutta method for solution of first order, second order differential equations and two simultaneous equations.

Unit-V:1. Solution of quadratic equation

2. Numerical integral using Trapezoidal and Simpson rule

3. Finding root of equation f (x) = 0 by Newton -Raphson,Regula -Falsi and Bisection method.

Unit VI:1. Centre of gravity, moment of inertia & radius of gyration of Tee section.

2. Bending moment and shear force ordinates for simply supported beam subjected to point and uniformlydistributed load only.

3. Design of singly reinforced beam by limit state method.

4. Determination of coefficient of permeability in parallel andperpendicular direction of bedding plane

5. Reduce level by height of instrument method.

6. Determination of Chezy's constant.

RECOMMENDED BOOKS & WEBSITES:

1. Rajaraman V, COMPUTER PROGRAMMING IN FORTRAN 77, 4th edition, Prentice Hall of India, Delhi.
2. Willam Mayo& Martin Cwiakala, Schaum's Outline of Programming With Fortran 77.
3. Chapra, Cannale, "Numerical Methods for Engineers", 8th edition, McGraw-Hill Int.,
4. Sastry S. S., "Introductory Methods of Numerical Analysis", 5th edition, Prentice Hall of India Delhi.
5. S Rajasekaran, Numerical Methods in Science and Engineering A Practical Approach, S Chand &Company Ltd, New Delhi
6. N Krishna Raju, K U Muthu, Numerical Methods for Engineering Problems, 2nd edition, Macmillan India Ltd.
7. Amos Gilat, "Numerical Methods for Engineers and Scientists", 3rd Edition, Wiley International,2014.
8. Sanjay G Adhau, Computer Programming, Numerical Methods & Civil Engineering Applications using FORTRAN, Adisan Learning Tools, Amravati
9. MS Excel Online Excel help & learning site: https://support.microsoft.com/en-us/excel
10. Google Sheets Online Help:
https://support.google.com/docs/topic/9054603?hl=en&ref_topic=1382883

(Professional Elective I)

5CE04 : Highway Construction and Management

Learning Objectives of Subject:

- To know the development of transport, various road development plans and
- policies in India and test procedures for highway materials.
- To understand the principles of highway geometric design as per IRC standards.
- To study the different types of pavement its construction, maintenance & design
- by different methods.
- To understand the Traffic engineering & different types of traffic control
- devices.
- To study the causes, preventions, better planning & design of highway to
- prevent accidents.
- To study various types of equipments, their working principles & limitations for
- flexible and rigid pavement.

Course outcomes:

At the end of the subject the students will be able –

- Explain the basic concepts about highway engineering
- To design geometric elements of the highway.
- To design the various types of road pavements with construction and
- Maintenance of highway.
- To carry out traffic studies and implement traffic regulation and control
- measures and intersection design.
- To apply the knowledge to prevent the road accidents.
- To use appropriate equipments for road construction.

SECTION A

Unit I: Highway: Development and Planning, Road Transport characteristics, classification of Roads, Road development plans & Salient features, Road pattern, Alignment principles, Egg. Survey for highway. Material and Testing. Various properties of aggregates and bituminous materials and Test, IRC, IS Specifications, bituminous mix design.

Unit II: Geometric Design : cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, Overtaking sight distance, Horizontal alignment - curves, superelevation, Extra widening, transition curves, vertical alignment, Design of summit and valley curves, IRC Standards for Geometric design.

Unit III: Pavement Design: Components of Flexible and Rigid pavement, Design factors, ESWL, Flexible pavement design by C.B.R. Method. Westergards analysis for wheel load & Temperature

stresses in rigid pavement, Rigid pavement by IRC method (As per IRC-37), Combination of stresses, Joints in Rigid Pavement, Construction And Maintenance – WBM Surface dressing, Bituminous roads, cement concrete Pavement, construction procedure, construction of roads in expansive soil.

SECTION B

Unit IV: Traffic Control Devices: Traffic signs, markings, islands and signals. Different methods of signal design; redesign of existing signal including case studies. Signal system and co-ordination. Evaluation and design of road lighting.

Unit V: Road Safety:Road accidents, Causes, scientific investigations and data collection. Safety in Road Design – Accident prevention through better planning and design of roads –planning road networks by land use planning. Traffic calming techniques and innovative ideas in road safety.

Unit VI: Equipment in Highway Construction: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

Books Recommended:

1. Kadiyali L.R., " Principles & Practice of Highway Engineering" Khanna Publisher
2. "Highway Engineering", Khanna & Justo, (Nem Chand & Poros, Roorkee.1997)
3. E.J. Yoder, "Principles of Pavement Design," John Wiley & Sons lnc., New York
4. Chakroborty P Das "Principles & Practice of Highway Engineering" (Khanna Publisher 2000)

REFERENCE BOOKS:

1. Highway Material Testing – S K Khanna- C.E.G. Justo, NemchandBros- Rookee, 2000
2. S.K.Khanna & Justo C.E.G., Highway Material Testing Manual
3. A.K. Duggal , Highway Engineering.

5CE04 : Repairs & Rehabilitation Of Structures

Learning Objectives of Subject:

- To learn various distress and damages to concrete and masonry structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To assess the damage to structures using various tests
- To learn the importance and methods of substrate preparation
- To learn various repair techniques of damaged structures, corroded structures

Course outcomes

By the end of this course students will have the capability/knowledge of

- Various distress and damages to concrete and masonry structures
- The importance of maintenance of structures, types and properties of repair materials etc

- Assessing damage to structures and various repair techniques

SECTION A

Unit I : Introduction: General Consideration, Distresses monitoring, Causes of distresses, Quality assurance, Defects due to climate, chemicals, wear and erosion, inspection, Structural appraisal, Economic appraisal Structural Health, factors affecting health of structures, effect of leakage, age, creep, corrosion, fatigue on life of structure.

Unit II: Structural health monitoring, various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete, Factors affecting durability of concrete, Corrosion in structures, Testing and prevention of corrosion, fire safety.

Unit III : Structural Audit, Assessment of health of structure, study of structural drawings, nature of distress, visual observations, Collapse and investigation, limitations of investigator, tools for investigation, Various NDT Methods for assessing strength of distressed materials, investigation management, review of assimilated information, interviews and statements, evaluation and reporting, presentation of report, communication gap among client, architect, consulting engineer & contractor.

SECTION B

Unit IV: Retrofitting of Structures, parameters for assessment of restoration strategies, selection of construction chemicals during restoration, Specification for important items of work in restoration, Structural detailing for restoration, and various techniques of retrofitting. Waterproofing of RCC water retaining structures.

Unit V: Safety during construction, formwork and staging, material handling, Existing methods of formwork, Modular formwork, Structural aspects for formwork in buildings & bridges.

Unit VI: Demolition of Structure, study of structural system and structural drawings, need and importance for demolition, outline of various demolition methods and their evaluation, partial and controlled demolition, role of safety measures, temporary support structures in demolition. Recycling of demolished materials

Books Recommended:

1. Deananmmer: ‘Handbook of Material Management’; McGraw Hills.
2. Gopalkrishnan: ‘Fundamentals of Material Management’; Tata McGraw Hills.
3. M Y Khan and Jain: ‘Financial Management’; Tata McGraw Hills
4. A M Neville: ‘Properties of Concrete’; Longman
5. R N. Raikar: ‘Durable Structures’, R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
6. R.N. Raikar: ‘Learning from Failures’, R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
7. R.N. Raikar: ‘Diagnosis and treatment of structures in Distress’, R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.

8. Hanbook on Seismic Retrofit of building , Central public works Department & Indian Building Congress In Association with IIT - Madras

5CE04 : Sustainable Construction Methods

SECTION A

Learning Objectives of Subject:

- Student should learn about the present demand supply gap of various construction resources and resource forecasting .
- Student should be able to understand various pollutions and its impact, rules and regulation related to pollution control.
- Student should be able to understand the concept of Sustainability , strategy to achieve it .
- Student should turn aware about various organizations working for implementing sustainability , Green rating agency and process to achieve it.
- Student should be able to determine use of waste material by proper process and percentage.
- Student should learn about sustainable construction like – Green roofs, Green walls etc.
- Student should be able to understand thermo resistive property of construction material and its effect on utilization.
- Student should learn about sustainable Illumination , ventilation techniques .
- Student should know to manage domestic water resources.

Course outcomes:

At the end of the subject the students will be able -

- To understand present condition and need for replacement of non renewable resources.
- To understand concept of sustainability and strategy to achieve it.
- To understand various criteria's and considerations to achieve sustainable construction according to Green Rating Agencies.
- To decide application of sustainable methods in construction for Roof, Wall, thermo resistivity etc.
- To reduce water need and reuse of house hold waste water.

Unit I: Role of Construction sector in Global Resource Consumption, Resource like sand , water , aggregates , cement etc. demand supply gap analysis. Construction & Demolition waste. Environmental pollution related terms like Global warming, Carbon credit, Resource exploitation, Land pollution, Urban Heat Island, Air and water Pollution. Rules and Act related to waste management and pollution mitigation.

Unit II: Concept of Sustainability, Its origin, Legislation related to Sustainable construction , Reduce –Reuse – Recycle (3 R) Strategy , Various Green Rating Agency worldwide, Detail study of criteria's and process under GRIHA (Green Rating for Integrated Habitat Assessment), IGBC (Indian Green Building Council), LEED, India (Leadership in Energy and Environmental Design).

Unit III: Concept of Manufacturing cost, operational cost and life time cost, Payback Period. Thermo resistive property of construction materials and its importance. Implementation of Waste and recycled materials in construction – Case study of some projects like Use of Plastic in Road construction, recycled aggregate utilization and similar to this. Various types of Renewable Energy and its application.

SECTION B

Unit IV: Concept of Green/ Sustainable Roofs, Its types, geometry, material, methodology and Limitations. Concept, material & methodology and limitation of Green walls, various methods like implementation of Cavity wall, Rattrap bond wall, thermo resistive material wall, Green vegetative wall etc.

Unit V: Sick Room, Need and types of windows & ventilations, active and passive ventilation concept, Role of opening location and dimension in Ventilation and air circulation. Sustainable ventilation techniques.

Unit VI: Illumination terms :- Glare , Glare Index ,dark room, comfortable illumination , Lux value for various rooms as per utilization as in latest Building Code of India , Role of Solar direction, season and location for direction and provision of openings. Sustainable Illumination Techniques (Natural & Artificial methods) ,

Water Management **–** Re Use of domestic water, Grey water – Concept and some Grey water treatment units example, Ground water recharging techniques , Rain water harvesting.

Books Recommended:

1. Moore F: Environmental Control System McGraw Hill, Inc., 1994.
2. K S Jagadish, B V Venkataramana Reddy, K. S. NanjundaRao : Alternative Buildings Materials and Technologies, New Age International Publishers, New Delhi, 2007
3. "Construction Materials, Methods & techniques" (3e) by William P Spence, Yesdee Publication 2012, pvt.ltd, Chennai, India
4. "Concrete Structure Properties & Materials" by mehataP.K&MantreioP.J.M, Prentice hall.
5. "Building Materials" ny M. L. Gambhir, NeaJamwal, Tata McGraw Hill Publication.

Book Recommended:-

1.Building Reuse ,Sustainability preservation and value of life by Kathrin Rogers Mrilino.
2. Sustainable Construction Engineering & Management by Dr. S.K.Deshmukh & Dr. Abhinandan R.Gupta
3.Sustainable Construction by Charles Kibert.
4. Handbook of GRIHA for Green Rating

5. Handbook of LEED , India for Green Rating.

5CE04 : Watershed Engineering And Management

Course Objective:

1. To study the different hydrological parameters.

2. To understand hydrological statistics and design.

3. To characterize and mitigate natural and man-made hazards

Course Outcome: Student shall be able to

1. Explain the hydrology and hydrological data.

2. Analyze the hydrological methods for runoff.

3. Evaluate the ground water hydrological problems.

SECTION - A

UNIT I: Introduction: Watershed, Definitions, Concept of watershed development, objectives of watershed development, and need for watershed development, Integrated and multidisciplinary approach for watershed management.

UNIT-II: Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

UNIT-III: Hydrology in water resources development, statistical analysis of rainfall and runoff, different distributions methods, Estimation of Unit Hydrograph-flood flow formulae, Storm hydrograph, Storage and regulation of runoff-safe yield of streams

SECTION - B

UNIT-IV: Hydrology of ground water : Common aquifers-Exploration for ground water, hydraulics of ground water flow- Measurement of permeability of formations, flow nets and their constructions, Boundary conditions – Unconfined and Confined, steady and unsteady flow into wells, Method of images – Types, design, construction and maintenance of wells and infiltration galleries, Development of wells – well strainer – functions and selections, Ground water recharge

UNIT-V: Practice of watershed management: rehabilitation, protection and enhancement, non-point sources of pollution: the legal basis, the process of non point source pollution control, best

management practices principles, Applications of Geographical Information System and Remote Sensing in Watershed Management

UNIT-VI: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation. Drought assessment and classification, drought analysis techniques, drought mitigation planning. Water conservation by recycle and reuse

Books Recommended:
1. Watershed Hydrology by Peter E. Black.
2. Water Resources Systems, Planning and Management by R. N. Chaturvedi.

(Open Elective)

5CE05 : Basics To Building Construction

Learning Objectives of Subject:

- To understand the basic concepts of structures and types of foundation of civil structure.
- To learn about the different type of masonry, types of bonds and construction methodology.
- To understand various levels in building – Types of floorings and floors,
- To understand the type and need of openings for access and circulation.
- To make aware of knowledge and importance of stairs, plastering and painting of structures.
- To understand the aspects of construction.

Course outcomes:
At the end of the subject the students will be able -

- To understand Load bearing and Frame structure with their foundations.
- To recognize various types of construction material and its suitability
- To recognize the various levels in building and its need.
- To know types of openings, doors, windows and other related fixtures.
- To recognize types of rock and minerals and its construction properties.
- To understand the basic concepts of DPC, fireproof, soundproof and expansion joints in structure.

SECTION –A

Unit I: Introduction: Definition of building as per national building code, components of buildings and their function , Types of structure-load bearing structure and frame structures, their relative advantages and disadvantages, load bearing walls and partition walls. Types of foundation-

Definition and necessity and types of foundations, precautions to be taken against failure of foundations

Unit II: Stone Masonry- Technical term, general principles to be observed during construction, selection of stone masonry. Brick Masonry Construction- Technical term, general principles to be observed during construction, commonly used types of bonds such as Stretcher, Header, English bond Flemish bond and their suitability.

Unit III: Floors- Types of floors-Basement floor, ground floor and upper floor. Types of upper floors-R.C.C. slab floor, R.C.C. slab and beam floor, R.C.C. grid floor, R.C.C. flat slab floor. Floor Finishes Types of flooring material, Shahabad , Kota, Granite, Ceramic tiles, Plain tiles, mosaic tiles,glazed tiles ,different types of floor finishes , their suitability. Method of construction, criteria of selection. Roofs-Flat and pitched roof, steel roof trusses-types and suitability ,fixing details at supports ,types of roof covering, AC and GI sheets, acrylic sheets, fixing details of roof covering.

SECTION –B

Unit IV: Door –Purpose, criteria for location, size of door, door frames and its types, method of fixing Windows- Purpose, criteria for location, size and shapes of windows, types of windows and their suitability. Ventilators – Types and their suitability. Fixtures and Fastening for doors and windows. Glass- Types of glass and their suitability. Arches and Lintels - Types and their suitability. Details of R.C.C. lintels and chajja, precast lintels and arches

Unit V: Stairs- Function, technical terms, criteria for location, types of staircases and their suitability. Painting and Coloring – Necessity, types, processes of painting and coloring to the wall surface, wooden surfaces, iron and steel surfaces, types of paints and their uses Scaffolding-Purposes, types, suitability.

Unit VI: Special Aspects of Construction, Damp proofing-causes of dampness, its effects, various methods of damp proofing, material used for damp proofing. Fire proof construction- Points to be observed during planning and construction. Fire protection requirement for a multistoried building, Sound proof construction –Sound absorbents and their characteristic. Joints Expansion and construction joints necessity, details of expansion joint at foundation level and roof level of load bearing structure and framed structure, Provision of construction joints in slabs, beams and columns.

Books Recommended:

1. DeshpandeR.S... And Vartak C.V.: A Treatise on Building Construction.
2. Sharma S.K. Kaul and B.K.:A.T.B. Building Construction, S Chand and co.
3. Sane L.S.: Construction Engineering, ManakTalas, Mumbai
4. Chudley R.: Construction Technology, Volume I.II.III. And IV, Longmans Group Ltd.
5. Gurucharan Sing: Building Construction Engineering, Standard Book House, Delhi-06
6. Sushilkumar :Building construction ,Standard publisher distributors.
7. B.C.Punmia ,A.K. Jain,: Buildingconstruction.

ISE National Building code of India, 1970

5CE05 : Disaster Management

Learning Objectives of Subject:

- Student should learn about the term Disaster and definitions associated with it.
- Student should know various types , reasons for happening and preventive measures for Natural Disasters .
- Student should know various types , reasons for happening and preventive measures for Artificial Disasters .
- Student should know about Impact and mitigation measures against disasters.
- Student should know about Disaster Risk Reduction and its utility practices.
- Learner should know about various Government and NG organization working for Disaster Management.
- Student should know role and responsibility of individual and group for managing Disaster.

Course outcomes:

At the end of the subject the students will be able -

- To understand concept and terms related to Disaster.
- To understand various types of Natural and Artificial Disaster .
- To decide and take actions to mitigate impact of disaster.
- To know roles and responsibility of organizations – public and private , individual and group to manage disaster.

SECTION A

Unit I: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation. Study about natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.);

Unit II: Study about manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit III: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

SECTION B

Unit IV: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures, vulnerability and capacity assessment; early warning systems, Post disaster environmental response

Unit V: Institutional mechanism for Disaster Management**,** Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, Disaster Management Policy Environment and local Action, Funding for Disaster Management, Capacity Building, Disaster Management Act 2005.

Unit VI:. Disaster Management practices at working and residential places. Key responsibility of engineers in disaster reduction techniques, medical preparedness aspect of disaster, plan to counter, threats to water supply.

Books Recommended:

1. Cuny, Fred C; Disasters and management, oxford Uni. Press.
2. Alexander, David; Principles of emergency planning and management, Terra publishing, ISBN 1-903544-10-
3. National Disaster Management Authority, Govt. of India, Report.
4. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994

5CE05 : Soft Skills and Interpersonal Communication
(Open Elective I)

Learning Objectives of Subject:

- Student should learn about the methods and measures to develop the interaction skills.
- Student should be able to have strong decision making and lateral thinking skills.
- Should know the do's and don'ts for being good leader.
- Should be able to understand about conflict and be able to manage it.
- Should understand need of Negotiation and strategy to handle it wisely.
- Should be able to recognize the type, ways and barriers in Communication so as to develop it.
- Should be able to conduct effective correspondence process and shall have knowledge of documentation and formal writing skills.

Course outcomes:

At the end of the subject the students will be able -

- Interact in developed way so as to handle the situations .
- To take analyzed decisions over the problem and will effectively carry out wok in time.

- To handle task with developed leadership skills.
- To determine the reasons and solutions over conflict and will be able to manage it.
- To understand need for negotiation and strategy negotiate things.
- To have strong communication.
- To carry out formal documentation process and will have proper guideline for writing formal basic documents.

Unit I : Individual's Basic Interaction Skills –Within family, Society Personal and interpersonal intrapersonal skills . Types of skills; conceptual, supervisory, technical, managerial and decision making skills. Problem Solving, Lateral Thinking. Self Awareness and Self Esteem Group Influence on Interaction Skills Human relations examples through role – play and cases.

Unit II : Leadership Skills Working individually and in a team Leadership skills Leadership Lessons through Literature Team work & Team building . Interpersonal skills – Conversation, Feedback, Feed forward Interpersonal skills – Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team – work. Conflict Management – Types of conflicts, how to cope with them Small cases including role – plays will be used as teaching methodology.

Unit III : Negotiation Skills (To be Taught through Role Plays and Cases) Types of Negotiation Negotiation Strategies Selling skills – Selling to customers Selling to Superiors Selling to peer groups, team mates & subordinates Conceptual selling, Strategic selling Selling skills – Body language

Section B

Unit IV : Introduction, Need for Communication, Process of Communication - Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication - Inter-cultural, Intra-cultural, Cross-cultural and International communication - Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

Unit V : Barriers to Communication Improving Communication Skills -Preparation of Promotional Material -Non-verbal communication -Body language -Postures and gestures -Value of time -Organizational body language - Importance of Listening -Emotional Intelligence.

Unit VI : -Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos - Business Presentations to Customers and other stakeholders,

Presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids .

Book Recommended

1. Personality Development & Soft Skills by Barun K. Mitra.
2. Soft Skills and Interpersonal Communication by S. Blasubhramanium.

5CE06 : Design Of Reinforced & Prestressed Concrete Structures - Lab

Practicals:

1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any RCC framed structure & report of the same.

5CE07: Surveying & Geomatics - Lab

Practical's –

Ant 8 Practical's from the list mentioned below shall be performed by each student and observations, calculation and relevant work shall be submitted as a term work.

Practical examination shall consist of field exercise and viva voce examination based on the above syllabus & practical's.

LIST OF EXPERIMENTS:

1. Ranging circular curve by offset from long chord
2. Ranging circular curve by offset from tangent
3. Ranging circular curve by offset from chord produced
4. Ranging circular curve by Rankine's method
5. Triangulation by satellite station
6. Base line measurement in triangulation system
7. To Find horizontal distance and difference in elevation between two points by using Total station
8. To plot a layout using Total station
9. Study on Stereoscope
10. Study on GPS

5CE08 : Numerical Methods And Computer Programming -Lab

PRACTICALS: Preparation and execution of at least eight computer programs using FORTRAN. Solution of at least two civil engineering problems using spreadsheet software.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course

5CE09 Highway Construction and Management (LAB)

1. Plate Bearing Test.
2. Field CBR Test.
3. Pavement Evaluation by Benkelman Beam Method.
4. Road Unevenness Measurement by Bump-Integrator.
5. Valuation of Pavement Roughness by Roughometer / Profilometer.
6. Design of Flexible Pavements for Highway and Runway.
7. Design of Rigid Pavements for Highway and Runway.
8. Design of Overlays
9. Marshal Stability Test

Field Visit:

1. Hot – mix plant visit,
2. Road construction site visit: Earth work construction procedure and bituminous mix laying, spreading and rolling procedure.

5CE09 : Repairs & Rehabilitation Of Structures - Lab

List of Experiments: (Any Three)

1. To perform a non-destructive and semi-destructive testing on the cast specimens of the beams using set up of Rebound hammer, UPSV, Core drilling etc. and there by prepare a report on the interpretation of the strength i.e quality of concrete based on NDT test results.
2. Take up Conditional Assessment of 5 different structures including Residential, Commercial, Industrial, and Government buildings, Private structures (old & new construction both). Prepare Rapid visual inspection data sheets of the same.
3. Prepare a report of the buildings surveyed, to highlight all the defects/deterioration seen through proper resolution photographs. The report must clearly indicate the distress – its source and symptoms.
4. Perform experiment to evaluate the Compatibility between the substrate material concrete and any repair material. (For instance comparing the Bond strength of Polymer modified mortar and Conventional Mortar with Concrete).
5. Experimental investigation to carry out the efficacy of repair material/ technique of enhancing the strength of concrete beam post cracking. (For instance, Cast a RCC beam, simulate cracking and then filling the crack with repair material and check the post-repair strength results).

Major Equipment: Compression Testing Machine, Concrete Mixture, NDT equipment like USPV, Rebound Hammer, Corrosion Meter, Rebar Locator, Engineer's inspection Kit.

5CE09 : Sustainable Construction Methods – Lab

1. Experimentation to check the corresponding strength of material by mixing waste material for –
   a) Concrete work : Casting of 2 sets of specimen only with each set of 3 cubes , for percentage replacement of concrete elements with any suitable waste material like – Recycled aggregate, waste vehicle tire etc.
   b) Brick work : Study of cavity wall and rattrap wall for thermo resistive property.

2. Student can work out and prepare report on installation plan , process ,budget, payback period and maintenance required for renewable energy source like solar / wind for small residential house of around 5 rooms.

3. Case Study : Students should visit to nearby sustainable construction like old existing monumental structure like Palace, religious place, well , fort **or** any Green rated structure by valid Rating agency like GRIHA , LEED India etc. **or** any undergoing sustainable project in vicinity for better understanding and needs to prepare the short report over learning's.

5CE09 : Watershed Engineering And Management – Lab

Minimum 8 practical's out of the given should be performed. The Site visit is compulsory. The Graphs and sheets are to be drawn whenever are necessary. The practical examination shall consist of viva-voce based on theory and Practical.

List of Experiment

1. Study of watershed management technologies.
2. Watershed planning and development.
3. Surveying and preparation of watershed map.
4. Analysis of hydrologic data for planning of watershed development.
5. Water budgeting of watersheds.
6. Grid survey of watershed area.
7. Study of Aquifer (Working, Types, Flow net)
8. Study of infiltration galleries. (Types, Design, Construction, Maintenance)
9. Study of unit hydrograph, Storm hydrograph
10. Design of storm water drainage system.
11. Visit to watershed development project

Sixth Semester

6CE01: Design Of Steel Structure

Learning Objectives of Subject:

- To introduce steel structures and its basic components
- To understand methods of design of steel structure.
- To introduce structural steel fasteners like welding and bolting
- To introduce design method of tension & compression members.
- To introduce design method of beams, Column, Base Plate.
- To introduce design load on a typical steel roof trusses.

Course outcomes:

At the end of the subject the students will be able -

- To explain the methods of design of steel structure.
- To design bolted and welded connection.
- To identify the different failure modes of bolted and welded connections, and determine their design strengths.
- To design the Tension and compression member.
- To identify and compute the design loads on a typical steel roof trusses.
- To design basic elements of steel structure like beams, column and bases.

(By Limit State Method IS 800:2007)

SECTION – A

Unit I:

- Introduction to WSM, LSM & Plastic analysis of steel structure, plastic hinge, plastic moment capacity, shape factor, plastic section modulus.
- Design of bolted & welded connections subjected to axial and eccentric loading (In the plane of group of Bolts & Weld).

Unit II:

- Design of Compression & Tension member.
- Design of Industrial shed.

SECTION – B

Unit III:

- Design of simple & compound columns for axial loading.
- Design of column bases (Slab base & Gusseted base) subjected to axial load.

Unit IV:

- Design of simple Beams (laterally supported).
- Design of compound Beams (laterally supported).

Books Recommended:

1. Duggal, S. K., Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
2. N. Subrramanyam, Design of Steel Structures, Oxford University Press, 2008.
3. V L Shah & Veena Gore: Limit State Design of steel structures IS 800-2007
4. Sheyakar, Design of steel structure.
5. Bhavikatti, Design of steel structure
6. M. L. Gambhir, Fundamentals of Structural Steel Design.

6CE02: Environmental Engineering – I

Course Objectives: -

- To make the students conversant with sources and its demand of water
- To understand the basic characteristics of water and its determination
- To expose the students to understand the design of water supply lines
- To provide adequate knowledge about the water treatment processes and its design
- To have adequate knowledge on operation and maintenance of water supply

Course Outcomes: -

- Define and explain the significance of terms and parameters frequently used in water supply engineering.
- Evaluate the influence of the different parameter in design and treatment of water treatment plant (water quality parameters).
- Basic methodology for water treatment (viz., sedimentation, coagulation, flocculation, filtration, disinfection and water softening.)
- An understanding of water quality criteria and standards, and their relation to public health.

SECTION – A

Unit-I : Quantity Estimation of water: Demand of water. Consumption for various purposes. Fire Demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population.

Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection.

Unit-II :Water quality: Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis- physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment works. Intakes-type, location, requirement & features.

Unit-III: Aeration: Purpose, types of gravity aerators & spray aerators.

Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, Flocculation, clarrifloculator. Design criteria for sedimentation tanks, surface loading, simple problems on design of sedimentation tanks.

SECTION – B

Unit-IV: Filtration: - Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process. Control system, Negative head, operating difficulties, pressure filter; Simple design problems on rapid sand filters.
Unit V:Disinfection: - Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination, forms of chlorine. Use of bleaching powder - Simple problems. Introduction to tertiary treatments-Softening and Defloridation.
Unit-VI: Distribution system: - Types of supply: Continuous, and intermittent. Types of system: Gravity, Pumping andcombined gravity and pumping, Layouts of distributions system. Maintenance of distribution system. Equalising storage, Type of storage reservoirs, capacity.Types of conduits, joints, appurtenances. Pipe laying and testing.

Books Recommended:
1. Steel E. W., "Water Supply and Sewerage", Mc-Graw Hill.
2. Kshirsagar S. R., "Water Supply Engineering", Roorkee Pub house, Roorkee.
3. Birde G. S. , "Water Supply and Sanitary Engineering", Dhanpat Rai and Sons, Delhi.
4. Punmia B. C. "water Supply Engineering".
5. Garg S.K. Water Supply Engineering, Khanna Publishers.

6CE03: Fluid Mechanics

Course Objective :
1. To study the basic behavior of fluids and fluid system and the laws governing this behavior
2. To understand and apply the basic concepts Mechanics to carry out professional engineeringactivities in the field of fluids.
3. To apply scientific strategies to analyze qualitatively and quantitatively the problems and givesolutions.

Course Outcome : Student shall be able to
1. Describe basic properties of fluid flow.
2. Apply the knowledge to fluid flow problems.
3. Analyze the type of flow by using basic of mathematical principle.
4. Solve and modeling the pipe flow problems.

SECTION - A

Unit I: Properties of fluids: Introduction, properties of fluids, viscosity, surface tension, & capillarity, related problems.
Pressure and its measurement: Fluid pressure at a point, Pascal's Law, pressure variation in a fluid at rest, absolute gauge, atmospheric & vacuum pressures, measurement of pressure, simple manometers, differential manometers, related problems.

Unit II: Hydrostatic forces on surfaces: Introduction, total pressure & centre of pressure, vertical, horizontal& inclined plane surface submerged in liquid, related problems.
Buoyancy & floatation**:** Introduction, buoyancy, centre of buoyancy, metacentre, metacentric height, analytical method of metacentric height, conditions of equilibrium of a floating & submerged bodies, related problems.

Unit III: Kinematics of flow :Introduction, methods of describing fluid motion, types of fluid flows, rate of flow or discharge, continuity equation in three dimensions, velocity & acceleration, velocity potential function & stream function, related problems.
Dynamics of fluid flow:Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, its assumptions, related problems.

SECTION - B

Unit IV: Uniform flow, Open channel flow, Types of flow, geometric elements of rectangular & trapezoidal sections, Chezy's&Mannings equations, most efficient rectangular & trapezoidal section, Energy & momentum principles, Normal & critical depth, specific energy diagram, discharge diagram.
Unit V: Dimensional Analysis; Buckingham's Pie theorem, it's application, similitude, Dimensionless numbers, Re, Fr, We, Predominant forces & their ratio, Model Analysis - Geometrically similar models, Reynolds law, Froudes law, Model study of spillways.

Unit VI: Impact of jet on stationary & moving plates, symmetrical, asymmetrical curved vanes; Moment of momentum equation (statement only), velocity diagrams.
Introduction to Hydraulic turbines (Pelton wheel & Francis turbine) No numericals
Introduction to Centrifugal pumps, Reciprocating pump, Submersible pump, Hydraulic Ram (no numerical)

Books Recommended:

1) Modi P.N. & Seth S.M.: Hydraulics & Fluid Mechanics, SI Edition.
2) Dr. Jain A.K.: Fluid Mechanics.
3) Subramanya K.: Fluid Mechanics.
4) Streeter: Fluid Mechanics.
5) Garde&Mirajgaonkar: Fluid Mechanics.

Professional Elective - II

6CE04: Advanced Construction Materials

Learning Objectives of Subject:

- To understand thespecial type of concrete and supplementary cementitious materials.
- To learn about the different type of metals and new alloy steels.
- To learn different composite materials and Thermal and Sound insulating materials.
- To understand different types of construction chemicals and wastes.
- To learn different types of shoring and formwork materials.
- To understand the concept of smart materials.

Course outcomes:

At the end of the subject the students will be able -

- To understand special type of concrete and supplementary cementitious materials.
- To recognize various types of metals and new alloy steels.
- To understandThermal and Sound insulating materials.
- To know types of construction chemicals and wastes.
- To recognize types of shoring and formwork materials.
- To understand the elementary concept of smart materials.

UNIT I: Cement, Mortar And Concrete Ceramic Materials

Study of Special Purpose Cement, Mortar, Concrete - High Strength And High Performance Concrete, Self Compacting Concrete, supplementary cementitious material - Fly Ash, Red Mud, Gypsum, Various Types of Finishes & Treatments, Engineering Grouts, Mortar plaster, Gypsum, Glass. GGBS, micro silica etc. Replacement of aggregates; stone dust, light weight aggregates, recycled aggregate.

UNIT II: Metals

Steels - HYSD, TMT, Tendons, Light Gauge Steel, Steel Fastenings, New Alloy Steels – Aluminum and Its Products, Protective Coatings to Reinforcement.

UNIT III: Composites

Polymer and its composites , Ceramic and its composite, FRC, Ferro cement etc.,Timber, bamboo, veneer, Laminates, Particle boards,Thermal and Sound insulating materials.

UNIT IV: Construction Chemicals And Waste

Chemical Admixtures and Adhesives, Water Proofing Compounds – Non Weathering Materials, GeoSynthetics, Geo-Membranes,, Asphalt, Tar & Bituminous Materials, Agro Waste Materials, Industrial Waste Materials, Disposable Materials.

UNIT V: Shoring & Formwork Materials

Materials, Accessories and Proprietary Products - Lumber - Types - Finish - Plywood -Types and grades, Reconstituted wood -Steel -Aluminum Form lining materials, Design Considerations, Building and Erecting the formwork, Causes of Failure of Formwork.

UNIT VI: Elementary Concept Of Smart Material

Smart and Intelligent Materials-Piezoelectric Materials, Shape Memory Alloys & Polymers, Magnetostrictive Materials, Temperature Responsive Polymer, Halo chromic Materials, Smart Hydrogels, Chromomeric Systems, Photomechanical Materials, Self Healing Materials, Dielectric Elastomers. Bio cement, Phase change material.

Text Book:

1. Building Materials, P.C. Varghese, Prentice-Hall India, 2555.

Reference Books:

1. Materials Science and Engineering: An introduction, W.D. Callister, John Wiley, 1994.
2. Materials Science and Engineering, V. Raghavan, Prentice Hall, 1990.
3. Properties of Engineering Materials, R.A. Higgins, Industrial Press, 1994.
4. Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., Spon Press, 2551.
5. The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess, R.J. Gray & A. Bentur, Prentice Hall, 1998.
6. Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann, 2553.
7. The Science and Design of Engineering Materials, J.P. Schaffer, A. Saxena, S.D. Antolovich, T.H. Sanders and S.B. Warner, Irwin, 1995.
8. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill, 2556.
9. Properties of concrete, A.M. Neville, Pearson, 2554.
10.Materials for Civil and Construction engineers by Michael S. Mamlouk, John P. Zaniewski, Pearson Publication

6CE04 : Geographic Information System & Science

Course Objectives:

- To prepare the student to understand remote sensing, it's techniques and interpretations.
- To introduce the concepts of image processing and basic analytical methods to be used in image processing
- To familiarize students with image enhancement, restoration techniques, and to understand different image compression techniques.
- To gain a basic, practical understanding of GIS concepts, techniques and real-world applications

Course Outcomes:

Students will be able to

- Explain and communicate quantitative remote-sensing principles and integrate different tools for remote sensing data analysis
- Perform image corrections, enhancements and generate high-level remote sensing products.
- Apply basic graphic and data visualization concepts such as colour theory, symbolization, and use of white space.
- Demonstrate proficiency in the use of gis tools to create maps that are fit-for-purpose and effectively convey the information they are intended to.
- Apply mathematical concepts, including statistical methods, to data to be used in geospatial analysis.
- Review the fundamental concepts of a digital image processing system.

SECTION - A

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

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

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

SECTION - B

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

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

Unit VI: Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and

analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

Books Recommended:

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

6CE04 : Masonry Structure

Course objectives:

This course will enable students to

- Understand properties of masonry units, strength and factor affecting strength
- Understand design criteria of various types of wall subjected to different loads system
- Impart the culture of following the codes, for strength, serviceability and durability as an ethics.
- Provide knowledge in analysis and design of masonry elements for the success in competitive examination

Course Outcomes:

After studying this course student will be able to

- Explain engineering properties and use of masonry units defect and cracks in masonry and its remedial measures
- Summaries various formulas for finding compressive strength of masonry units.
- Explain permissible stress and design criteria as per IS: 1905 and SP-20.
- Design different types of masonry walls for different load considerations.

Unit -1 :- Masonry unit materials, types and masonry construction : brick, stone and block masonry unit- strain, modulus of elasticity and water absorption of masonry materials, classification and properties of Mortar. Defect and errors in masonry construction- cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and stability: strength and stability of axially loaded masonry walls, effects of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of aging, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

Unit -2:- **Permissible stresses:** Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and Lateral load, permissible tensile stress and shear stresses.

Design consideration: Effective height of wall and columns, openings in walls, effective length, effective thickness, slenderness ratio,eccentricity, load dispersion, arching action in lintels. problems on design considerations for solid walls, cavity walls, walls with piller.

Unit – 3Load consideration and design of Masonry walls subjected to axial loads: - Design criteria, Design of wall subjected to concentrated axial loads: - Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers,

Unit – 4Design examples of walls under UDL ,Solid walls ,cavity walls ,solid walls supported at the end by cross walls, walls with piers .

Unit – 5Design of wall subjected to eccentric loads: - Design criteria - stress distribution under eccentric loads -problems on eccentrically loaded solid walls, cavity walls, walls with piers.

Unit -6Design of laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall- design of compound walls.

Text Books:

1. Dayaratnam P, Brick and Reinforced Brick Structures, Scientific International Pvt. Ltd.
2. M. L. Gambhir, Building and Construction Materials, McGraw Hill education Pvt. Ltd.

Reference Book:

1.Materials for Civil and Construction engineers by Michael S. Mamlouk, John P. Zaniewski, Pearson Publication
2. Design of Masonry StructuresBy A.W. Hendry, B.P. Sinha, S.R. Davies
3. Design of Reinforced Masonry Structures, Second Edition, Narendra Taly, McGraw Hill education Pvt. Ltd

6CE04 : Solid And Hazardous Waste Management

Course Objectives: -

- To provide an overview of waste generation, waste characterization and waste management processes.
- To impart knowledge on solid waste management with particular emphasis on municipal solid waste management which includes different waste processing options such as pyrolysis, composting, and incineration; designing and operating sanitary landfill.
- To enrich knowledge about characteristics of hazardous wastes and their management.
- To impart knowledge on industry specific solid waste management practices.
- To provide an overview about the concept of land degradation and land reclamation

Course Outcomes: -

- An ability to identify and interpret the criteria for the classification of a substance as a solid/hazardous wastes.
- An ability to recognize waste minimization and source reduction, assess and describe the procedure for solid and hazardous waste identification and characterization and various waste processing options.

- Define and elucidate the management, treatment and disposal of hazardous wastes.
- Skill to assess and develop physical/chemical/biological treatment techniques for the control of hazardous wastes.
- Skill to address and describe solid waste management including landfill operation.
- Ability to design and execute land reclamation projects.

SECTION A

Unit I: Municipal solid waste: Definition, Sources and types of solid waste, composition and its determinants of Solid waste-factors influencing generation, quantity assessment of solid wastes, methods of sampling and characterization.

Unit II: Collection and Transfer Collection: Collection of Solid waste, collection services , collection system, equipments, time and frequency of collection. Transfer and Transport: Need for transfer operation, transport means and methods, Optimization of Transport Cost.

Unit III: Disposal of Solid Wastes Refuse disposal : various methods, incinerations, principle features of an incinerator, site selection and plant layout of an incinerator, sanitary landfill-methods of operation, advantages and disadvantages of sanitary land fill, site selection, reactions accruing in completed landfills, gas and leachate movement and control, equipments necessary, Energy Recovery.

SECTION B

Unit IV: Introduction: Definition, Need for hazardous waste management, Sources of hazardous wastes, Effects on community, terminology and classification. Storage and collection of hazardous wastes, Problems in developing countries, Protection of public health and the environment.

Unit V: Management of hazardous wastes: Identifying a hazardous waste, methods, Quantities of hazardous waste generated, Components of a hazardous waste management plan, Hazardous waste minimization, Disposal practices in Indian Industries, Future challenges.

Unit VI: Nuclear wastes and E-waste: Characteristics, Types, Health and environmental effects, Audit of E-Waste. Biomedical and chemical wastes: Biomedical wastes, Types, Management and handling, control of biomedical wastes & Chemical wastes.

Books Recommended:

1) George Techobanoglous et al,"Integrated Solid Waste Management" McGraw - Hill, 1993.
2) TechobanoglousThiesenEllasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.
3) R.E.Landrefh and P.A.Rebers," Municipal Solid Wastes-Problems & Solutions" Lewis, 1997.
4) J. Glynn Henry and Gary. W. Heinke, "Environmental Science and] Engineering", Pretice Hall of India, 2004.

5) A. D.Bhide and B.B.Sundaresan, "Solid Waste Management – Collection, Processing and disposal" Mudrashilpa Offset Printers, Nagpur, 2001.
6) Biomedical waste (Management and Handling) Rules, 1998.

6CE04 : Traffic Engineering & Management

Learning Objectives of Subject:

1. To understand traffic planning & characteristics for urban roads.
2. To understand different surveys and methods of traffic volume study.
3. To understand the design of different intersections and use visual aids
4. To understand the Traffic safety & control devices to prevent road accidents.
5. To understand the traffic system management.
6. To know advanced technology used in traffic engineering.

Course outcomes:

At the end of the subject the students will be able –

1. To explain the road characteristics & traffic planning.
2. To analyze traffic capacity of roads & intersection by different methods.
3. To design different types of road intersections & use of visual aids for roads.
4. To use knowledge of traffics safety & environmental hazards.
5. To recommend suitable traffic management system and traffic regularity measures
6. To apply the knowledge of Intelligent Transportation System to traffic management system.

Section A

Unit 1: Traffic Planning & Characteristics

Road Characteristics – Road User Characteristics – PIEV theory – vehicle – Performance Characteristics – Fundamental of traffic flow – Urban Traffic problems in India – Integrated planning of town, country, regional and all urban infrastructure – towards sustainable approach – Land use & transport and model integration

Unit 2 : Traffic surveys

Traffic surveys – Speed, Journey time and delay surveys – vehicles volume survey including non-motarized transport – methods and interpretation – origin destination survey – accident analyses methods , interpretation and presentation – statistical applications in traffic studies and traffic forecasting – level of service – concept, application and significance.

Unit 3 : Traffic design and visual aids

Intersection Design – channelization, Rotary intersection design – signal design – coordination of signals – grade separation – traffic signs including VMS and road markings – significant roles of traffic control personnel – networking pedestrian facilities & cycle tracks.

Section B

Unit 4: Traffic Safety and Environment

Road Accident – Causes, effects, prevention, and cost – street lighting – traffic and environment hazards – air and noise pollution, causes, abatement measures – promotion and integration of public transportation – Promotion of non-motorized transport.

Unit 5: Traffic Management

Area Traffic management system – traffic system management (TSM) with IRC standards _ Traffic Regulatory Measures – Travel Demand Management (TDM) – Direct and Indirect Methods - congeation and parking pricing – all segregation methods – coordination among different agencies

Unit 6 : ITS

Intelligent transport system for traffic management, enforcement and education, Application of ITS to Traffic Management System- Public Transportation Management System

(Open Elective II)

6CE05 : Environmental Management

Course Objectives:

The objective of the course is to provide skills and an improved understanding of how firms and organisations work with sustainability issues such as environmental and natural resource management in order to protect our eco system.

Course Outcomes:

At the end of the course the student will:

- Be aware of different environmental problems, their causes and effects.
- Have knowledge regarding different environmental policies & management plans.
- Have thorough knowledge about Environmental Legislation and Acts.
- Acquire information about various agencies for Environmental Managements in India.
- Have knowledge regarding different systems working for Environmental Management.

SECTION – A

Unit I: Different environmental problems - Energy and the environment, Agriculture and the environment, the atmosphere and human activities, etc. Need for environmental management, the nature, scope and components of environmental management.

Unit II: Environmental policy analysis- micro level and macro level, methods of policy analysis, steps involved. : Operational methods, quantitative methods, statical analysis public policy analysis resource allocation, environmental economics etc.

Unit III: Environmental management plan (EMP): components of Environmental Management Plan, Preparation of Environmental Management Plan.

SECTION – B

Unit IV: Environmental Legislation and Acts: Water (prevention and control of pollution) Act1974,Air (prevention and control of pollution) Act 1981, environmental protection Act (EPA) 986, Hazardous waste rules1989, Factory Act 1984 amendments in 1987, Environmental Management System: ISO 14000(EMS) Environmental Audits: methods, components and preparation.

Unit V: Various agencies for Environmental Managements in India: Ministry of environment and forest, central pollution control boards, state pollution control boards, local bodies, - their scopes, organizational and functional issues, their working etc.

Unit VI: Basics of Data Base Management System (DBMS), Geographic Information System (GIS) and remote sensing in Environmental Management.

Books Recommended:

1. Environmental Impact Analysis- a decision Making Tool: By R KJain
2. Theory and Practice of Environmental Impact Assessment: By Abbasi and Ramesh

6CE05 : Human Resource Development & Organizational Behavior

Learning Objectives of Subject:

- Student should learn about concept of Management and its utility.
- Student should learn about various types of Organization and its structure.
- Learner should be able to understand the concept of Human Resource Management .
- Learner should understand self development process and its fixity for Organizational need .
- Student should be able to understand and develop skills of Leadership , Team Work , Professional behavior , Job analysis and ethics .
- Student should be able to analyze job , opportunities and growth criteria's.

Course outcomes:

At the end of the subject the students will be able -

- To understand the concept of Management and Organization.
- To understand types of Organsiation and Its structure.

- To develop himself/ herself as per the need and requirement of work and self updation.
- To develop better skills related to leadership, team behavior, ethics at working place .
- To analyze job opportunity and future in it .
- To understand expectations for job evaluation , assessment of work and growth in the field.

UNIT – 1:- Understanding the Term Management and Organization. Learning about various types of Organizations and Organizational chart. Concept and need for Human Resource Management (HRM) and Human Resource Development (HRD) . Concept, Origin and Need, for HRD as a Total System; Approaches to HRD; Human Development and HRD; Introduction to Organizational Behavior (OB) .

Unit II :- Knowing and Managing Yourself Individual Behaviour: MARS model of individual behaviour Values: Values across cultures (Hofstede's framework); Personality: Big five model; MBTI; Use of personality tests; Personality attributes influencing OB Emotions: Understanding emotions; Emotional labour; Emotional Intelligence Attitudes: Attitudes v/s values; Job Satisfaction; Organizational Commitment Perception: Factors influencing perception; Perceptual errors; Self-fulfilling prophecy; Know yourself: Johari window

Unit III :- Motivation in the workplace , What is motivation; Types of Motives; Theories of Maslow; Herzberg, McGregor, Alderfers, Porter and Lawler's Model; Job Enlargement, Job Enrichment, Behaviour Modification.
Unit IV :- Communication What is communication; Organizational communication: Formal networks and Grapevine; Electronic communications; Barriers to effective communication; non-verbal communication; Improving Interpersonal communication: Empathy and Active listening

Unit V :- Leadership Difference between managers and leaders; Perspectives of leadership: Trait, Behavioural, Contingency; Inspirational leadership: Transactional, Transformational, Charismatic; NGO leadership

Unit VI :- Job Analysis, Job description; Job Specification; Job Evaluation, Recruitment, Selection, Orientation Sources of recruitment: Internal and external; Steps in selection process; Performance Management , What is performance appraisal; Purposes, Process and Uses.
Compensation Management – Need, Objectives and factors determining compensation; Developing pay structures, Executive remuneration; components of compensation; Incentives

Prescribed Books :
1. Nadler, Leonard : Corporat Human Resource Development, Van Nostrand Reinhold, ASTD, New York .
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005.

3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi , 2004.
4. Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi .
5. Rao, T.V.(et.al): HRD in the New Economic Environment, Tata McGraw-Hill Pub.Pvt, Ltd., New Delhi , 2003.
6. Rao, T.V: HRD Audit, Sage Publications, New Delhi .
7. ILO, Teaching and Training Methods for Management Development Hand Book, McGraw-Hill , New York .
8. Rao, T.V: Human Resource Development, Sage Publications, New Delhi .
9. Kapur, Sashi: Human Resource Development and Training in Practice, Beacon Books, New Delhi .
10. Lynton, Rolf. P and Pareek, Udai: Training for Develfopment, Vastaar Publishers, New Delhi .
11. Viramani, B.R and Rao, Kala: Economic Restructuring, Technology Transfer and Human Resource Development, Response Books, New Delhi .
12. Jaya Gopakl, R: Human Resource Development : Coneputal analysis and Strategies, Sterling Publishing Pvt. Ltd., New Delhi .
13. Truelove, Steve.A: hand book of Training and Development, Beacon Books, New Delhi . 14. Goldstein, Irwin : Training in Organisations, Cole Publishing Co., California .
15. Malcom W. Warrant : Training for Results, Addision Wesley Pub. Co., London .
16. Graig, Robert L. and Bittel, Lester r. (Ed): Training and Development Hand Book, McGraw-Hill, New Delhi .
17. Padmalita Routry Kalyani Mohanthy, Human Resource Development and Organisational Effectiveness, Excel Books New Delhi 2009

6CE05 : Introduction To Earthquake Engineering

Course Learning Objective:

This course will cover the basics of seismology and Earthquake engineering. Students will learn
1. Basic seismology, earthquake phenomenon and its characteristic.
2. Earthquake resistantconcept
3. Use of earthquake bands in masonry structure
4. Behavior of buildings during earthquakes

Course outcomes:

At the end of the subject the students will be able to -
1. Identify type of earthquake, its properties
2. Earthquake resistance planning
3. Apply knowledge of seismic bands in masonry structure construction

4. Solve engineering problems in the context of Earthquake Engineering.

SECTION A

Unit I: Interior of earth, engineering geology of earthquakes, plate tectonics, Seismicity of the world, tectonics features of India, Faults, and Propagation of earthquake waves.

Unit II: Quantification of earthquake (magnitude, energy, intensity of earthquake), Measurements of earthquake (accelerograph, accelerogram recording), Determination of magnitude, Epicenter distance, Ground motion and their characteristics, Factors affecting ground motions.

Unit III: Guidelines for achieving efficient seismic resistant planning, selection of sites, importance of architectural features in earthquake resistant buildings.

SECTION B

Unit IV: Projections & suspended parts, special construction features like separation of adjoining structure, crumble section, stair case etc., twisting of building, seismic effects on structures, inertia forces, horizontal & vertical shaking.

Unit V: Behavior of masonry structure during earthquake, bands & reinforcement in masonry building opening in walls, importance of flexible structures.

Unit VI: Behavior of R.C. building in past earthquakes. Concept ofearthquake Resistant design, Introduction to IS: 1893

Books Recommended:

1. Duggal S. K., Earthquake Resistant Design of Structures, OxfordUniversity Press 2007
2. AmitaSinvhal; Understanding Earthquake Disasters, Tata McGrawHill
3. P. N. Agraval; Engineering Seismology Oxford & IBH Publishing
4. C.V.R.Murty; Earthquake Tips National Information Centre of Earthquake Engineering IIT Kanpur
5. Pankaj Agrawal & Manish Shrikhande ; Earthquake Resistant Designof Structures Prentice- Hall of India

6CE06 : Design Of Steel Structure– Lab

List of Experiments:

1. Candidates are required to prepare at least two designs of steel structures based on theoretical course detailed working drawings are necessary.

2. A compulsory site visit for studying the various aspect and prepare a report. A Journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

6CE07: Environmental Engineering Lab – I

Course Objectives:-

The subject offers the readers a fundamental understanding of the water quality parameters and its role in environmental engineering.

Course Outcomes:-

1. Understand the water quality parameters and the significance.
2. Understanding the operational condition during research work.

Minimum 8 practical out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Graphs are to be drawn wherever necessary

List of Experiments

1. Determination of Turbidity of water sample
2.Determination of Electrical Conductivity water sample
3.Determination of pH of water sample
4. Analysis of Dissolved, Suspended and Total solids
5. Analysis of Volatile and Fixed solids
7. Optimum coagulant dose
8.Determination of Temporary and Permanent Hardness of water sample
9.Determination of Acidity & Alkalinity of water sample
10. Determination of Iron and Manganese
11.Determination of residual chlorine in the given water sample
12. Total Count of Bacteria Test

6CE08 : Fluid Mechanics – Lab

Minimum 8 practical out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Graphs are to be drawn wherever necessary.

1. Verification of Bernoulli's theorem.
2. Determination of coefficient of discharge for Venturimeter
3. Determination of metacentric height.
4. Determination of friction factor for GI pipe
5. Determination of coefficient of discharge for triangular notch.
6. Determination of Chezy's coefficient.
7. Determination of coefficient of discharge of Venturiflume.
8. Verification of momentum equation.

6CE09 : Mini Project

Semester Seventh

7CE01: Structural Analysis – II

Learning Objectives of Subject:

- To understand the action and corresponding displacement in various type of structural elements.
- To learn about statically determinate and indeterminate structures.
- To analyze frames subjected to sway.
- To learn different analysis methods for analysis of beam and frames.
- To learn analysis of Plane truss, Space truss.

Course outcomes:

At the end of the subject the students will be able -

- To decide what is required to be analyzed depending upon type of structural element.
- To know about degree of freedom, Condition of equilibrium and determinacy of element.
- To understand reason for failure and permissible limits for safety.
- To apply the knowledge of beam analysis for practical analysis and design purpose.
- To make application of various analysis methods for actual structural member analysis and design.

SECTION - A

Unit-I: 1. Moment distribution method, application to portal frames with sway. Multibay, multistoried, symmetrical frames subjected to symmetric loads only.

2. Slope deflection method: Application to portal frames with side sway.

Unit-II: 1. Kani's method: Continuous beams and single bay single storey portal frames with side sway.

2. Multi- bay, multi storeyed frames subjected to symmetric loads.

Unit-III:1. Castigliano's second theorem, principle of least work, Analysis of redundant frames. (up to two degree redundancy).

2. Analysis of redundant trusses (up to second degree of redundancy).

SECTION - B

Unit-IV:1. Muller - Breslau's principle, Influence linediagrams for continuous beams, upto two spanwith simple end supports.

2. Tension coefficient method & its applications to simple space trusses.

Unit-V:1. Flexibility method, static redundancy, flexibility coefficients, compatibility condition application to beams.

Unit-VI: Stiffness method, kinematic redundancy, stiffness coefficients, direct stiffness approach, application tocontinuous beams and single - bay, single - storey portal frame.

BOOKS RECOMMENDED:

1. Junnarkar, S. B., Mechanics of Structure, Volume I and II, Charotar Publishing House Pvt. Ltd., 2017
2. Jain and Arya, Theory and Analysis of Structures, Nem Chand & Bros.
3. Reddy. C. S., Basic Structural Analysis, Tata McGraw Hill
4. Norris and Wilbur, Elementary Structural Analysis
5. Bhavikatti, S. S, Structural Analysis Vol I and II, Vikas Publishing
6. Ramamrutham., S and Narayan R., Theory of Structures 9th Edition, Dhanpat Rai Books

7CE02: Geotechnical Engineering – II

Learning Objectives of Subject:

- To learn the methods of exploration, objectives and its field application along with data interpretation.
- To understand the bearing capacity of shallow foundation.
- To study the earth pressure on retaining wall.
- To learn the pile foundation and well foundation.
- To understand the settlement evaluation of different types of foundation.
- To know the various ground improvement techniques.

Course Outcomes:

At the end of the subject the students will be able –

- To select the appropriate soil investigation method and get true sub soil parameters used for selection of type of foundation.
- To determine the bearing capacity of shallow foundation.
- To calculate the lateral earth pressure on retaining wall
- To find bearing capacity of well foundation and design of pile foundation.
- To evaluate the settlement of different types of foundation.
- To suggest the suitable method o ground improvement.

SECTION – A

Unit I: Exploratory Programme : Field exploration, objectives and methods of exploration planning of exploration programme soil boring , hand augers, percussion boring, rotary wash boring, collection of sample, split spoon sampler, disturbed and undisturbed samples and their

criteria SPT test, field vane shear test, geophysical methods, electrical resistivity and soil refraction methods. Soil log bore presentation and interpretation exploration data.

Unit II : Bearing Capacity of Shallow foundation :- Concept of local and general shear failure, Different theories: Terzaghi's Skempton's, Meyerhof's, BIS method for bearing capacity , determination bearing capacity of granular soils based on SPT value. Concept of raft foundation and floating foundation. In situ methods of evaluation of bearing capacity, plate load test, static cone penetrometer, pressure meter test, contact pressure distribution diagram below the base of footing.

Unit III : Earth pressure: Earth pressure at rest, & plastic equilibrium of soil, Rankine's and Coulomb's theory of active and passive earth pressure on retaining wall. Influence of surcharge, water table, Rebhann's and Culmann's simple graphical methods. Introduction to sheet pile and bulkhead and their classifications,(No design criteria) Cofferdam purpose, various types and their suitability.

SECTION – B

Unit IV : Pile foundation : Classification of piles and their uses, static analysis, formula for determination of pile capacity for driven and bored pile in sandy and in clayey soil , dynamic pile formula Negative skin friction, factors affecting it, piles ingroup and their capacity, group efficiency, factors affecting group efficiency, behavior of group of pile in sandy and inclayey soil, pile load test, effect of pile cap. Criteria for spacing and depth of piles. BISdesign criterion for undereamed Pile in clays and sands.

Unit V Settlement Evaluation: Immediate, primary and secondary settlement for footing resting on homogenous isotropic, cohesive and cohesion less soils related to single footing, combined footing, & raft foundation etc., concept of differential settlement factors and causes for differential settlement, BIS requirement for total as well as differential settlement, service loads, proportioning of footing for uniform settlement, Computation of total and differential settlement of a single pile and group of piles in sandy and clayey soil.

Unit VI Well foundation: Component & their function, sinking of well, types of force system, and their computation, design criteria for various components of wells, tilting and shifting Bearing capacity of well as per BIS.

Ground Improvement: Methods of soil stabilization use of admixture (lime, cement, fly ash) in stabilization) Mechanism of reinforced soil, use of Geo synthetics material and it's function, vibroflotation, sand drain and preloading techniques.

BOOKS RECOMMENDED:

1) Craig : Soil Mechanics.
2) Bowles J.E. : Foundation Design Analysis.
3) Hanson : Theoretical Soil Mechanics.
4) Peck and Hanson : Foundation Engineering.
5) Tomlinson : Foundation Engineering.
6) Leoner : Foundation Engineering.

7) Bramha : Foundation Engineering.
8) Prakash S. : Analysis and Design of Foundation and Retaining Structure.
9) Kasmalkar : Foundation Engineering.
10) Arora K.R. : Foundation Engineering.
11) Venkataramiah : Soil Mechanics and Foundation Engineering.
12) Rao G.V. : Engineering with Geosynthetics.
13) S. K. Garg : Soil Mechanics and Foundation Engineering.
14) P. P. Raj : Geotechnical Engineering.

7 CE03 : Hydraulics Engineering

Course Objectives:

1. To understand the flow pattern in the open channels.
2. To understand the criteria for formation hydraulics jump.
3. Study different types of GVF profiles and apply various methods to determine the length of GVFprofiles.

Course Outcomes: Student shall be able to

1. Illustrate the flow pattern in the open channels, criteria for formation hydraulics jump.
2. Identify different types of GVF profiles and methods.
3. Compute of water hammer pressures in pipe.
4. Design penstocks and surge tanks, understand causes of water hammer.

Unit I

Computation of uniform flow, Computation of critical Flow.Theory of gradually varied flow, Analysis of surface profile of gradually varied flow.

Unit II

Computation of gradually varied flow, Bresse's method, Chow's method, Direct stepmethod, standard step method. . Numerical Modeling of open channel flow using finitedifferential method and finite element method

Unit III

Theory of Hydraulic jump, Location of hydraulic jump, application & design of hydraulicjump, type stilling basin with horizontal apron.

Unit IV

Equation of unsteady flow in a pipe line for incompressible fluid. Time of flowestablishment. Rigid water column theory of water hammer and computation of waterhammer pressures

Unit V

Equation describing water hammer phenomena when compressibility of fluid andelasticity of pipe is considered, computation of water hammer pressure of frictionlessflow in horizontal pipe for sudden and slow closer of valve, Application of Allievi'smethod and charts approximate pressure. Water hammer pressures in pumpingsystems. Method characteristics.Computation of water

hammer pressures in pipe system and surge tank system. Variousdevices used for protection from water hammer pressures.

Unit VI

Function of surge tank and different type of surge tanks. Equation governing the flow inthe simple surge tank system. Analysis of flow in a simple surge tank system.Computation of maximum surges in surge tank system.

Text Books:

1 K. G. RangaRaju, "Flow through open Channel", Wiley Eastern Limited (New Delhi), 2nd Edition, 1992

2. VenTe Chow, "Open Channel hydraulics", Wiley Eastern Limited (New Delhi),13th Edition, 2009

3 K. Subramanya, "Flow in open Channels", Wiley Eastern Limited (New Delhi),3rd

7CE04: Environmental Engineering – II

Course Objectives: -

- To learn the basics of sewage composition and its characteristics.
- To depict the information about various sewage treatment processes.
- To provide the adequate information on various disposal standards for industrial effluents.
- To study the information about air pollution and its effects.
- To understand the knowledge about solid waste generation and disposal methods.

Course Outcomes: -

- Define and explain the significance of terms and parameters frequentlyused in wastewater Treatment.
- Evaluate the influence of the different parameter in design and treatment of wastewater treatment plant (wastewater characteristics).
- Basic methodology for wastewater treatment (screening, grit chambers,sedimentation, biological treatment and chemical treatment)
- Appreciate the advantages, disadvantages and limitations of the technologies and new developments.
- An ability to identify and interpret the criteria for the classification of a substance as a solid/hazardous wastes.
- Ability to identify air pollution problems and interpret criteria air quality data.
- Evaluate the engineering solutions for industrial and vehicular air pollution problems.

- The candidate at the end of the experimental exercise would be able to perform field-oriented testing of wastewater

SECTION –A

Unit-I Quantity of storm water, DWF, variation of sewage, flow systems of sewerage - separate combined and partially combined, layouts of sewerage system, capacity of sewers design of sewers Laying out of circular sewers-Boning rod and sight rail method, Testing & maintenance of sewers.

Unit-II Waste water characteristic, sampling of sewage, physical chemical and biological examinations, B.O.D. and C.O.D., B.O.D. equation, problems on B.O.D Pollution due to domestic and industrial waste. Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Flow diagram for conventional sewage treatment plant. Preliminary Treatment:- Screening, Grit chamber, Detritus tank. Primary Treatment:- Sedimentation of sewage.

Unit-III Biological treatment: Trickling filters, low rate & high rate tricking filters, construction details, Re- circulation Modification of trickling filters Activated sludge process - Process description, Methods of aeration, loading rates, Different modified forms of A.S.P.,MLSS& SVI, F/M.

SECTION –B

Unit-IV Low cost waste treatments - Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal Septic tank, working and design, Disposal of septic tank effluent Disposal of sewage on land and in stream. Effluent standards for disposal on land, into stream and into sewers. MINAS. Self purification capacity of stream

Unit-V Characteristics of solid waste:- Physical, chemical, biological analysis. Collection of solid waste:- Types of collection system and services, frequency of collection, methodology involved in setting up collection bins. Disposal of solid wastes:- Different methods, sanitary land fill, composting, incineration.

Unit-VI Air pollution: Introduction to air pollution, various pollutants their sources and their effects on man and material, prevention or air pollution at sources, introduction to control devices electrostatic precipitator & cyclones only human tolerance level Introduction to EIA and Environmental Audit.

Books Recommended:

1) KshirsagarS.R. : Sewerage and Sewage Treatment, Roorkee Pub House, Roorkee.

2) Steel E.W. : Water Supply & Sewerage, McGraw Hill Book Co.

3) Birdie G.S. : Water Supply and Sanitary Engineering, Dhanpat Rai & Son's.

4) Garg S.K. : Waste Water Engineering, Khanna Publishers.

5) Dr. Bhide A.D., SundersonB.B. : Solid Waste Management in Developing Countries.

6) Rao M.N., Rao H.V.N. : Air Pollution, Tata McGraw Hill.

7) Stern, Wohlers, Boobel, Lowry : Fundamentals of Air Pollution, Academic Press, 1973.

(Professional Elective III)

7CE05 : Analysis And Design Of Structures For Earthquake And Wind

SECTION-A

Course Learning Objective:

This course will cover the basics of seismology and Earthquake engineering. Students will learn

- Basic seismology, earthquake phenomenon and its characteristic.
- Earthquake resistant concept
- Use of earthquake bands in masonry structure
- Behavior of buildings during earthquakes
- Earthquake resistant design concept
- IS code procedure to find earthquake forces on structure
- Wind load Calculation for Multy-story Building

Course outcomes:

At the end of the subject the students will be able to -

- Identify type of earthquake, its properties
- Do earthquake resistance planning
- Apply knowledge of seismic bands in masonry structure construction
- To analyse and design buildings to resist seismic and wind forces
- Solve engineering problems in the context of Earthquake Engineering.

Unit I: Interior of earth, Engineering geology of earthquakes, plate tectonics, Seismicity of the world, tectonics features of India, Faults, Propagation of earthquake waves, Quantification of earthquake (magnitude, energy, intensity of earthquake), Measurements of earthquake (accelerograph, accelerogram recording), Determination of magnitude, Epicentre distance, focal depth, etc. Ground motion and their characteristics, Factors affecting ground motions, Inertia forces, horizontal & vertical shaking.

Unit-II: Guidelines for achieving efficient seismic resistant planning, selection of sites, importance of architectural features in earthquake resistant buildings, continuity of construction, projection & suspended parts, special construction features like separation of adjoining structure, stair case etc, twisting of building, seismic design philosophy for building.

Unit-III: Importance of flexible and ductile structures, Effect of earthquake on RCC Building, How Beam, Column & Beam Column joint resist earthquake, Effect of open ground story, Effect of short column, Use of shear wall, latest technique used to reduce earthquake effect on building (Base Isolation). Behaviour of R.C. building in past earthquakes.

SECTION-B

Unit-IV: Introduction to IS:1893 (2016),Concept of earthquake Resistant design, design philosophy. Design Horizontal Acceleration, Zone factor, Importance factor, Response Reduction Factor, Natural Time Period, Base Shear, Earthquake eccentricity, Earthquake load combination, Diaphragm, Centre of mass & rigidity, Seismic mass & weight, P-Δ Effect, Calculation of nodal loads due to earthquake using Equivalent lateral force method.

Unit-V: Ductility and its important in earthquake resistant design, Factors affecting ductility, Ductile detailing considerations as per IS:13920 (2016) for flexural member, axial member and joints of frame. Earthquake resistant design of RCC Columns, beams.

Unit-VI: Wind load Calculation for Multy-story Building as per IS 875-Part-3 : 2015

Note:

1) Students should use IS 1893:2016, IS 13920:2016, IS 875-Part-3: 2015.

Books Recommended:

1. Duggal S.K. Earthquake Resistant Design of Structures , Oxford University Press
2. Pankaj Agrawal, Manish Shrikhande Earthquake resistant design of Structures,Prentice Hall India

7CE05 : Environmental Impact Assessment And Life Cycle

Course Objectives:

The course aims to introduce the concepts, procedures and methodology of Environmental Impact Assessment (EIA) in order to develop a critical awareness of factors that will be helpful in the use of EIA as part of project management in the legislative and regulatory context of recently-industrialized or less -industrialized countries that would eventually expose the students to the need for environmental impact assessments and would be help them in the preparation of various documents required for legal procedures.

Course Objectives:

At the end of the course the student will:

1.Understand the concept and basic process of environmental impact assessment.
2.Have knowledge regarding Impact assessment methodologies and Components of EIA.
3.Be able to perform environmental auditing.
4.Have knowledge regarding Sustainable development & environmental management.

SECTION A

Unit I: Environmental impact assessment (EIA): Definition of EIA and EIS, Concepts, scope and objectives of EIA; National Environmental Policy Act (NEPA, 1969); EIA guidelines1994 (Notification of Government of India).Screening and Scoping in EIA.

Unit II: Impact assessment methodologies: Definition and concept of impact; Types of impacts (Negative & Positive: Primary & Secondary; Reversible and Irreversible); Impact identification; Methods for impact identification: Matrices, networks and checklists, Advantage & disadvantages of EIA methodologies.

Unit III: Components of EIA: Baseline data; Prediction and evaluation of impacts; Environmental management plan and monitoring, Baseline information, Prediction, evaluation and mitigation of impacts on socioeconomic, air water, soil and noise environment.

Public participation in EIA: Decision making, public participation in environmental decision making, Objectives and techniques for public participation, Advantages and disadvantages of public participation.

SECTION B

Unit IV: Preparation and writing of EIA: For water resources, Dams and irrigation projects; Mining and Infrastructural projects etc., eco – labelling eco-marks, ecotourism, eco-feminism, Eco-regulation, eco-accountability, green management, green products, green claims, and eco wars.

Unit V: Environmental auditing: Notification and guidelines for Environmental audit; Scope, applicability and objective of environmental audit; procedure of environmental auditing ;Cost Benefit analysis, Designing and implementation of audit tools

Pre audit activities – on site activities – post audit activities – Environmental statement – benefits of environmental audit – EA scenario in India – submission of Environmental Audit report in MoEF format .Life cycle Assessment, Resource Balance, Energy Balance and Management Review.

Unit VI: Sustainable development & environmental management, Natural Resource Conservation, Conservation of Energy, Pollution Prevention, disposal of treated effluents and solid waste, Environmental Management in India.

Books Recommended:

1. Environment Impact Assessment: Larry W. Canter, Mc-Graw Hill Inc., New York (1996).
2. Introduction of Environmental Impact Assessment: John Glassion, Rikay Therival and A. Chadwick, UGC Press Ltd., London (1994).
3. Methods of Environmental Impact Assessment: Peter Morris, Ricky Therivel, UGC Press Limited, London (1994).

7CE05 –Pavement Design

Learning Objectives of Subject:

- To understand types of pavement for highway & airport.
- Perform analysis of flexible pavement by various methods.
- Perform design of flexible pavement by various methods.
- Perform analysis of rigid pavement by various methods.
- Perform design of rigid pavement by various methods.
- To understand design, maintenance, repair & rehabilitation of pavement as per
- IRC standards.

Course outcomes:

At the end of the subject the students will be able –

- To explain basics of highway & airport pavement.
- To carry out analysis of flexible pavement by various methods.
- To carry out design of flexible pavement by various methods.
- To carry out analysis of rigid pavement by various methods.
- To carry out design of rigid pavement by various methods.
- To apply IRC design parameters in design, maintenance, repair & rehabilitation
- for different types of pavement.

Unit I: Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements.Stresses and deflection in flexible pavements.

Unit II: Stresses and deflections in homogeneous masses. Burmister's two layer theory, three layer and multi-layer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels. Repeated loads and EWL factors; sustained loads. Pavement behaviour under transient traffic loads.

Unit III: Flexible Pavement Design Methods For Highways and Airports: Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages; design of flexible pavements as per IRC;

Unit IV: Stresses in Rigid Pavements: Types of stresses and causes, factors influencing the stresses;general considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

Unit V: Rigid Pavement Design: Types of joints in cement concrete pavements and their functions, joint spacings; design of CC pavement for roads and runways as per IRC, design of joint details for longitudinal joints, contraction joints and expansion joints.

Unit VI: IRC method of design by stress ratio method. Design of continuously reinforced concrete pavements; Maintenance, repair and rehabilitation of pavements including design of bituminous and concrete overlays as per IRC.

7CE05 : Water Power Engineering

Course Objective

1. To understand necessity and importance of sources of energy
2. To learn about different types of hydropower plants
3. To study various power canals and design of power canal structures

Course Outcome: Student shall be able to

1. Describe the various sources of energy systems.
2. Classify the different power plants.
3. Identify the problems related to hydraulic pressure.

SECTION A

UnitI: Water Power: Introduction, sources of energy, importance of water power, estimation of water power potential, primary and secondary power, load factor, pondage and pondagefactor, load curve, numericals. Type of hydropower plants:- low and high head, run of river, valley dam, diversion canal, high head diversion, pumped storage underground, general description, layout, topographical requirements of each of above.

Unit-II: Penstocks: general classification, design criteria, economical dia, anchorages and accessories. Water hammer: - meaning, rigid and elastic water column theory, Allievi's charts, numericals.

Unit-III: Surge tanks: Necessity, types, function, location, effect of sudden load change, Hydraulic design of simple surge tanks, stability of surge tanks, numericals.

SECTION – B

Unit-IV: Intakes: types, locations, requirements, trashrack and other components, control gates, emergency gates, Air Entrainment.

Unit-V: Hydel Channel:- power canal and forebay, general principles of alignment and capacity, balancing tank. Turbines:-types, hydraulic features, size, general description of components and layout, specific speed, choice and selection of turbines, approximate costs, numericals on specific speed only.

Unit-VI : Power house:- types, general layout and approximate dimensions, advantages and disadvantages of underground power stations. Non-conventional sources of energy: - tidal power, wind power, geothermal power, solar power, elementary principles and description, application of water power in drilling and blasting of rocks. Note : Technical visit to nearby hydro power station is compulsory.

BOOKS RECOMMENDED :

1) Dandekar M.M. &Sharma : Water Power Engineering, Vikas Pub. House, Delhi.

2) Brown J.G., Blackie and Practice : Hydro Electric Engg., Vol. I, II & III, W. Sons, London.

3) Mosonyi E. : Water Power Development, Hungarian Academic Sciences, Budapest.

4) Deshmukh M.M. : Water Power Engineering.

5) Davin C. and Sorenson K.C. : Hand Book of Applied Hydraulics, McGraw Hill.

6) Barrows H.K., Water Power Engineering, McGraw Hill.

7CE07: Geotechnical Engineering- II– Lab.

Learning Objectives of Subject:

- To carry out the field vane shear test for determining the shear strength of soil in situ.
- To perform standard penetration test for determining the soil characteristics and bearing capacity of soil.
- To conduct soil resistivity / seismic refraction test for identifying the subsoil strata.
- To perform static cone penetration test for determining the soil properties.
- To understand the analytical approach of bearing capacity determination.
- To know the soil bore log for determining the soil characteristics.

Course Outcomes:

At the end of the subject the students will be able –

1. To calculate the shear strength of soil by conducting Field Vane shear test.
2. To determine the soil characteristics and the bearing capacity of soil by conducting standard penetration test
3. To recognize the subsoil strata by conducting soil resistivity / seismic refractivity method
4. To determine the soil properties by conducting the static cone penetration test.
5. To evaluate the bearing capacity of soil by analytical approach to verify with field test
6. To decide the soil characteristic with respect to soil log bore

List Of Experiments: (Any six)

1. To determine the shear strength by conducting Field Vane shear test.
2. To identify the subsoil strata by conducting soil resistivity / seismic refractivity method
3. To determine the soil characteristics by conducting standard penetration test
4. To determine the bearing capacity of soil by conducting standard penetration test
5. To determine the soil properties by conducting the static cone penetration test.
6. Computation of bearing capacity by analytical approach to verify with field test
7. To determine the soil characteristic with respect to soil log bore

Compulsory: Introduction to Geotechnical Software, determination of bearing capacity , earth pressure etc. professional this software.

7CE08 : Environmental Engineering Lab II

Course Objectives:-

1. To quantify the wastewater pollutant.
2. To apply the theory of air and noise pollution in relevance to practical situations.

Course Outcomes:-

1. Student should able to recommend the degree of treatment required for the wastewater.
3. Understand and use the wastewater sampling procedures and sample preservations.
2. Use engineering equipment through laboratory investigations for air and noise pollution as a representative of industrial practices.
3. Statistically analyze and interpret laboratorial results.

Minimum 8 practical out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Field visit & report is compulsory.

List of Experiments

1. Chemical Oxygen Demand (COD)

2. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)

3. Determination of Chloride concentration

4. Determination of Sulphate concentration

5. Colour measurement

6. Odour Measurement

7. Sludge volume index (SVI) determination

8. Physical characteristic of solid waste

9. Analysis of SPM by using sampler

10. Ambient noise measurement

11. Sketches on sewer appurtenances

12. Report of Field visit to Municipal wastewater treatment plant/Industrial effluent treatment plant

Semester Eight

8CE01 : Construction Project Management

Learning Objectives of Subject:

- Students should be able to understand meaning of project and Project Management .
- Students should be able to understand Project Life Cycle and Project Development Steps.
- Learner should know the process and various planning tools and their Limitation.
- Student should be able to carry out project planning using tools like BAR chart, Networking methods like CPM, PERT etc.
- Student should know the method of controlling using Baseline Plans and process of updating it.
- Student should know optimizing process of Project and way to carry out it by method of Network Crashing.
- Student should know process and need of Resource Smoothening / Leveling.
- Student should be able to develop planning's using Project Planner software.
- Students should know the various management skills related to Quality, Safety and Inventory and Risk Handling.

Course outcomes:

At the end of the subject the students will be able –

- To understand meaning of Project and Project Management.
- To understand the phases of Project Life Cycle and process of developing it.
- To use and apply various planning tools like BAR chart, Milestone Chart, Networking Methods like CPM , PERT .
- To compare and control the project at the time of execution.
- To update projects and review the status of work.
- To optimize project using Network crashing method
- To understand the concept of Project Smoothening/ leveling.
- To plan and develop the project using Project Planner software's.
- To understand importance and application of various management like Quality , Safety , Risk handling and Inventory .
- To turn good manager at individual and organizational level.

SECTION – A

Unit I – Basic Element of Construction Management–

Stakeholders of Construction Project, Meaning of terms Project, Management and need of Construction Management. Life cycle of Project.

Learning of project elements like – Activity & its types, Events, Work Breakdown Structure, Resources, Scheduling, and Resource Allocation.

Unit II – Planning Tools –
Detail steps of planning, Concept , Limitation &**Numerical** over Planning Tool BAR CHART, MILESTONE CHART .
Introduction to Networking Development using Critical Path Method, Programme Evaluation & Review Technique, Concept of Line of Balance Method.

Unit III – Total Project Duration, Float/ Slack calculation –
Geometrical and Numbering Rules for Network Development.
Numerical to find out Total duration, critical path and Float/ Slack of a project by CPM & PERT method.

SECTION – B

Unit IV – Project Controlling: -
Concept and **numerical** over both Network Updatingof Project and Project optimization by Network crashing method.
Concept of Resource Smoothening / Leveling.

Unit V :- Project Review & Planning using Management software –
Importance of Documentation, Daily, Weekly, Monthly Progress report. Project Review process and documentation. Concept of Project associated Risk & Risk handling strategies.
Introduction to Illustration for project development using software like of MS Project and Primavera. Developing one small construction project using project planning software.

Unit V- Organization & Management – Concept & Types of Organization, Feyol's Principals of Management, Need and Concept of Quality Management, Safety Management, Inventory Management. Learning EOQ Analysis.

Text Book:
1. Kumar NeerajJha, "Construction Project Management- Theory and Practice", Pearson Education, New Delhi ,17
Reference Books:
1. K. K. Chitkara, "Construction Project Management- Planning, schedule and controlling", second edition", Tata McGraw Hill Education pvt. Ltd, New Delhi.
2. John M. Nicholas and Herman steven, "Project management for engineers, business and technology", fourth edition, Routledge Publication, New York.

3. Prasanna Chandra, “Projects Planning, analysis, selection, financing, implementation and review”, 7th edition, McGraw Hill Education India Pvt. Ltd., New Delhi.
4. Harold Kerzner, “Project Management system approach to planning, scheduling and controlling, second

8 CE02: Construction Economics & Estimating – Costing

Learning Objectives of Subject:

- Student should be able to understand the concept of Estimation and construction Economics.
- Student should be able to understand and apply various estimation methods.
- Student should be able to understand need , concept and types of Specification.
- Student should be able to understand various cost estimation related terms and Rate Analysis.
- Student should be able to carry out Rate analysis of basic construction materials.
- Student should know the application of Current Schedule of Rate .
- Student should be able to carry out estimation of Residential and Commercial structures.
- Student should be able to carry out estimation of various road types like Rigid , Flexible and Hilly roads.
- Student should be able to understand concept , need and process of valuation of construction projects.
- Students should be able to understand and practice the Bidding and Tendering process.

Course outcomes:

At the end of the subject the students will be able -

- Determine need and basics of Estimation and Construction Economics.
- Carry of estimation by various methods.
- Write and understand specification of materials and items of construction.
- Carry out rate analysis of basic construction material and apply calculation logic for other construction materials.
- Use of CSR for Estimation work and carry out estimation of residential , Commercial building, Flexible and Rigid Roads, Water Tank , Septic tank etc.
- Understand need, purpose and process of valuation .
- Understand and carry out Bidding and tendering process .

Section A

Unit I:- Basics of Construction Economics & Estimations – Concept of Construction Economics, Stakeholders of Construction Project, Need of Estimation , Units of Measurement as per IS1200 , various approximate and details method of Estimation. Specification – Purpose and Principles of Specification Writing, Types of Specification Writing.

Unit II: - Introduction to Schedule of rates in Cost estimates, Factors affecting analysis of rates, Fixed, Variable, Prime, Supplementary cost , Overhead cost and its allocation. Rate analysis concept and explainatory calculations of Some materials like Cement, Steel, Bricks, aggregates & Timber. Bar Bending Schedule – Process of development.

Unit III: - Current Schedule Rates (CSR) understanding & Utilization, Developing Cost & Quantity Estimates for – the Residential block, Commercial building, House hold water tank, Septic tank, Staircase and Lift duct.

Unit IV: - Developing Cost & Quantity Estimates for – Road works example for Rigid & Flexible Pavement. Earthwork Estimation in Hill roads and for earthen dams.

Unit V: - Valuation Purpose and types of Valuation, Market value, Potential value, Sentimental values , scrap Value etc. Tenure of Land, free hold and lease hold property, sinking fund, deprecation and capitalized value and annualized value of old building. Consideration of Building Life and Structural Stability Report at the time of valuation. Valuation validity period.

Unit VI: - Public organizations and various stake holders in construction Industry, Contract and its types, Detail process of Tendering & Bidding – Concept of E Tendering, Tender Notice, Process of Filling the Tender, Process of Submission of Tender, Acceptance of tender, Tender Awarding. Land acquisition Act, Leal aspects of contract provision.

BOOKS RECOMMENDED:

1. R.H. Namavati. : Estimating and Valuation
2. D.N.Datta : Estimating & Costing – Datta Lucknow.
3. Vazirani: C.E.Estimating & Costing, Chandola Khanna Publisher Delhi.
4. B.S.Patil: Estimating Costing – Orient Longmans.
5. P.W. & H.Deptt. Govt. of Maharashtra: Standard Specification
6. Namavati: Valuation
7. Rangawala: Valuation Charotar Book Stall
8. Dhanpat Rai: Text book of Estimates Costing – Anand & Sons, Delhi.
9. B.C.Chakraborty: Principles of Estimation & Costing.
10. Indian Contract Act.

Professional Elective IV

8CE03: Advanced Design Of Steel Structures

Learning Objectives of Subject:

1. To introduce the concept of foot bridge.
2. To understand the behavior of transmission tower.
3. To understand the behavior of steel chimney
4. To introduce the concept of truss bridge.
5. To understand the behavior of plate girder.
6. To understand the behavior of lattice girder and steel tanks.

Course outcomes:

At the end of the subject the students will be able –

1. To explain the methods of design of foot bridge.
2. To design transmission tower line.
3. To design steel chimney and its foundation.
4. To design the truss bridge.
5. To design the plate girder.
6. To design lattice girder and steel tanks.

SECTION - A
(By Limit State Method IS 800:2007)

Unit-I : (a) Design of foot bridge (N-Truss or Pratt)

(b) Analysis and design for transmission tower lines

Unit-II :(a) Design of self-supporting steel chimney and its foundation.

(b) Design of through type truss bridge member for dead loadand equivalent live load including top, bottom bracings and open web girder bridges of Pratt trusses and portal bracing for railway broad gauge single main line.

SECTION – B

Unit-III : Design of Plate girder.

Unit-IV : a) Design of north light trusses and lattice girder.

b) Design of elevated, square pressed steel tanksand staging

Books Recommended:

1.Ramchandra, Design of Steel Structure, Volume - I and II.

2.Arya, Ajmani, Design of Steel Structures.

3.Duggal, Design of Steel Structures by Limit state method.
4.N. Subrramanyam, Design of Steel Structures, Oxford University Press 2008

8CE03: Advanced Prestress Concrete Structures

Learning Objectives of Subject:

1. To introduce the need for Prestressing as well as the methods
2. To introduce the general behavior of PC sections under external load.
3. To introduce the design of PC flexural members.
4. To introduce the design of shear in PC members.
5. To introduce the design for deflection and crack control of Prestress concrete members.

Course outcomes:

At the end of the subject the students will be able –

1. Explain the general behavior of PC sections under external load.
2. Explain behavior of Prestress concrete members and Losses in Prestress steel.
3. Analyze & Design of Prestress concrete flexural members.
4. Analyze & Design of Prestress concrete for shear
5. Analyze & Design of Prestress concrete Water Tank.

SECTION-A

Unit I: Introduction to Pre-stressed concrete: Pre-stress concrete concept, Materials and their characteristics as per IS code, Advantaged & Disadvantaged, Application, Differences of Pre-stressed concrete over Reinforced Concrete. Principle of Pre-stressing, Methods of Pre-stressing (Pre-Tension & Post-Tension), Tensioning Devices, Nature of concrete-Steel Interface (Bonded & Unbonded) various Pre-stressing systems. Losses of Pre-stress.

Unit-II: Analysis of Pre-stressed concrete beams for flexure, at different stages, under working load for Rectangular and flanged sections. Permissible stress at different stages as per IS 1343:2012 code.

SECTION-B

Unit-III: Introduction to Limit state Design (Serviceability & Collapse). Basic Design of rectangular sections for flexure by limit state method, Design of one way single span slabs.
Analysis and design of end block, anchorage zone reinforcement, Check for transfer bond length in pre-tensioned beams.

Unit-IV: Design of Pre-stressed concrete circular water tanks by IS code method.Analysis and design of Poles

Note:

1) Students should use IS 456:2000, IS 1343:2012, IS 875 (Part III) :2015.

Books Recommended:

1. Edward G. Nawy "Prestressed Concrete- A fundamental Approach", Prentice Hall**.**
2. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
3. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi)**.**
4. P. Dayaratnam, Prestressed Concrete Structures, Oxford & IBH 5.

8CE03 : Advanced Water Treatment

SECTION-A

Unit - I: water treatment facilities flow diagram, different unit operations and unit processes. Coordination of unit operations. Common attributes of water affected by conventional unit operations and processes. Aeration: rate of gas absorption and desorption, objectives of aeration, gravity aerators and spray aerators, design of aerators.

Unit-II: Coagulation& Flocculation: Coagulation Process ,concept of surface charge, coagulating effects of electrolytes, zeta potential, coagulants and coagulant aids, factors affecting coagulation. flocculation - Objectives of flocculation, mixing and stirring devices, flash mixing flocculators, construction and operation of flocculators, problems on design of flocculators.

Unit-III: Sedimentation: objectives, theory of sedimentation discrete settling and hindered settling, settling of floucculant suspension. Ideal settling basin and its efficiency.Design, construction andoperation of sedimentation tanks.Inlet and outlet hydraulics, sludge, removal and disposal, tube and plate settlers.Problems on design of sedimentation tanks.

SECTION-B

Unit-IV: Filtration: Filtration Process, Principal Mechanisms of Filtration, Design of rapid and slow sand filters, filtering sand & their performance. Fluidization & bed expansion in backwashing, Under drainage systems with design, operation problem .Scour intensification, high rate, declined rate, upflow biflow, dual media, diatomaceous earth filters.

Unit-V: Disinfection : objectives, different disinfectants, chemical disinfection, theory, factors governing, and kinetics. Non Chemical Methods for Disinfection: Ozonation, UV radiation. Chemical Disinfection by chlorine, Types of Chlorinationand other uses of chlorine, manageable variables.

Unit-VI: Miscellaneous methods of treatment : Water softening: lime soda and zeolite process, split treatment problems on calculation of dose of lime and soda ash. Iron and Manganese Removal : Fluoridation and Defluoridation. Theory & Methods of Desalination.

Books Recommended:

1) Fiar, Geyer &Okun : Water and Waste Water Engg., John Wiley & Sons.
2) Mark J. Hammer : Water and Waste Water Technology, John Wiley & Sons.
3) Steel E.W. & Ghee M.C. : Water Supply & Sewerage, McGraw Hill Co.

8CE03: Industrial Waste Water Treatment

SECTION A

Unit I:Problem of Industrial Waste Water: Variation in quality and quantity of industrial wastewater. Effects of discharge of industrial waste water on streams; land and municipal sewers. Benefits of water pollution control by doing treatment of industrial waste.

Unit 2: Indian Standards for discharge of treated wastewater on land, into municipal sewer and natural water courses. Sampling Procedure.Industrial waste survey; Stream sanitation, Stream sampling, Types of sampling, Stream survey, Sampling analysis.

Unit 3: Approaches to Minimization of problem of industrial waste water, Good housekeeping, equalization, neutralization, precipitation, mixing of different effluent streams, recycle of effluent streams, process modifications in terms of raw materials or chemicals used general approach to planning of industrial waste water treatment and disposal.

SECTION B

Unit 4: General Approach for handling and treatment of industrial wastewater with following special characteristics. Shock Loads, presence of colours, toxic metal/ions, refractory substances, e.g. A B S and other detergents, growth inhibiting substances such as insecticides, waste rich in nutrients (N.P.K. etc.), waste rich in oil & grease, high suspended solids, high BOD, high temperature, acidity, alkalinity etc.

Unit 5:Process Line Diagrams, characteristics and treatment of industrial waste of: - Pulp and paper, textile, tannery, food, Cannings, sugar mill, distillery, dairy, pharmaceutical, electroplating etc. industries. Design of Effluent Treatment Plant

Unit 6: Advanced industrial wastewater treatment: Principles of tertiary treatment, Reuse and resource recovery. Recent trends in industrial waste management, Cleaner technologies

Recommended Books:

1. Waste Water Treatment, Disposal and Reuse, Mctcalf and Eddy, Tata McGraw HillPublishing Co.Ltd, 1995
2. Pollution Control in Process Industries, S. P. Mahajan, Tata McGraw-Hill, 1985.
3. Liquid Waste of Industry – Theory, Practices and Treatment, Nemcrow, Addison- Wesley,1971.
4. Industrial Water Pollution Control, W.W. Eckenfelder, McGraw-Hill, 1989.M.Tech Environmental Engineering Curriculum w.e.f. Aug 2019 Page 28
5. Natural Systems for Waste Management and Treatment, S.C. Reed, E.J.
6. Middlebrooks and R.W. Crites, McGraw-Hill, 1988.

7. Biological Treatment of Waste Waters: W.W. Eckenfelder, Pergamon Press,1961.

8CE03: Structural Analysis By Matrix Method

SECTION – A

Learning Objectives of Subject:

1. To introduce students, matrix-based approach for linear elastic analysis of skeletal structure by using stiffness method/ flexibility method.
2. To form the bridge form basic subject like structural analysis to more advanced analysis subjects such as finite element method/analysis
3. To enable the student to have a goodgrasp of all the fundamental issues in structural analysis, besides enjoying the learning process,and developing analytical and intuitive skills.

Course outcomes:

At the end of this course students will be able to,

1. Analyze simple structure using flexibility method,
2. Analyze simple structure using stiffness method (structure approach)
3. Analyze structure (truss, continuous beam, plane frame etc.) using stiffness method (member approach)
4. Understand basic programming/ flowchart aspects of structural analysis programs.

SECTION A

Unit I: Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility coefficients, stiffness coefficient,flexibility and stiffness matrices of beam and plane truss elements.

Unit II: Flexibility method, Advantages, Disadvantages, basic determinate structure, redundant, alternate choices of redundant and corresponding primary structures, matrix formulation, Analysis using flexibility method of simple problem on truss, beams, frames, up to two unknown.

Unit III: Stiffness method(structural approach), unknown joint displacements for various structures, joint equilibrium equations, Analysis of simple problems of beams, frames, trusses up to three unknowns using Stiffness method (structural approach).

SECTION B

Unit IV: Stiffness method (member approach), Formation of member stiffness matrix, Transformation of load vector and displacement vector, Formation of global stiffness matrix, Solution of equations, member end forces, Analysis of plane trusses.

Unit V: Stiffness method (member approach), Formation of member stiffness matrix, Transformation of load vector and displacement vector, Formation of global stiffness matrix, Solution of equations, member end forces, Analysis of beams and plane frames.

Unit VI:Special analysis procedures – static condensation, Analysis of beams and plane frames.Programming aspects, flow charts. Introduction to FEM

Reference Books:

1. Pandit G.S. and Gupta S.P., Structural Analysis A matrix approach, Tata Mc Graw Hill, New Delhi 1986
2. Gere J.M. and W.Weaver, Analysis of framed Structures, D.Van Nostrand com. Inc.,Affiliated East West Press, 1965
3. Meghre A.S. and Deshmukh S.K., Matrix Methods of Structural Analysis, Charotar Publishing, Anand, India 2003.

Professional Elective V

8CE05 : Advanced Geotechnical Engineering

Learning Objectives of Subject:

- To study the clay mineralogy in detail.
- To learn about the concept of seepage discharge in anisotropic medium.
- To know the concept of three dimensional consolidation of soil.
- To understand the behavior of expansive soil.
- To study the stability of infinite and finite slope.
- To understand the concept of soil stabilization and to know the use of geosynthetics material.

Course Outcomes:

At the end of the subject the students will be able –

- To explain the structure of different clay mineral groups and their physical properties.
- To calculate the seepage discharge in anisotropic medium.
- To compute the degree of consolidation of soil.
- To recommend suitable type of foundation for expansive soils.
- To analyze the stability of infinite and finite slope.
    - To suggest the suitable method of soil stabilization and to recognize the major geosynthetics applications and their significance.

8CE05 : Advanced Geotechnical Engineering

SECTION-A

Unit I : Clay mineralogy: Introduction, atomic bonds, classification and nomenclature, structure of clay mineral, Kaolinite. Illite and Montmorillonite groups, physical properties, clay-water relations, diffused double layer, thixotropy, base exchange capacity formation of different structure in soil deposites, electrical effects, electro osmosis, electrophoresis, stemming potential, zeta potential, clay mineral identification, DTA analysis, X ray diffraction method.

Unit II : Seepage : Flow net for anisotropic soil media, construction of flow net for hydraulic structure on non- homogenous soil, directional variation of permeability in aniosotropic medium. Numerical analysis of seepage in layered soil computation of seepage force, seepage through earthen dam resting on confined and unconfined medium entrance discharge and Transfer condition of line of seepage through earth dam.

Unit-III : Three dimensional consolidation. Equation, solution of 3dimensional consolidation equation, consolidation by vertical sand drain and its design aspect, free strain consolidation with no smear, effect of smear zone on radial consolidation. Calculation of the degree of consolidation with radial drains and solutions of problems based on this.

SECTION – B

Unit IV : Expansive soils: orgin of soil, intensification of expansive soil, swelling potential, factors affecting the swelling, different systems of classification, concept of swelling pressure and its measurements in the laboratory, special constructional measures adopted for the construction on expansive soils, special foundations adopted for the construction in expansive soils, concept of cohesive non-swelling techniques and its effect on expansive soil.

Unit V : Stability analysis : Stability analysis of infinite and finite slope, causes of failure of slopes, Stability analysis of infinite and finite slope in cohesive and non cohesive soils, Taylor's stability number, Friction circle method and Swedish circle method.

Soil stabilization concept of mechanical stabilization, physical and chemical stabilization with organic and inorganic material like line, cement, lime, fly ash and mechanisms, various factors affecting stabilization.

Unit VI : Geosynthetics: types, specifications, functions and various applications in the field of Geotechnical engineering. Reinforced earth, mechanism of reinforced earth, various constructional methods and its effect towards altering, the properties of soil, field situations for application of this techniques.

BOOKS RECOMMENDED :

1) ScothR.F. : Principles of Soil Mechanics.
2) Das B.M. : Advanced Soil Mechanics.
3) Terzaghi : Theoretical Soil Mechanics.
4) Proceedings of Indian Geotechnical Conference, Dec. 22-24, 2013, Roorkee

5) Proceedings of first Indian Geotextile Conference, Dec. 08-09, 1988, IIT, Bombay.

8CE04: Advanced Structural Analysis

Course Learning Objective:

This course will cover the theory of structural response to dynamic loads. Students will learn

1. To mathematically describe the response of SDOF systems with and without damping
2. To mathematically describe the response of SDOF systems subjected to free vibration, harmonic, and arbitrary excitations.
3. To prepare lumped mass systems including modal analysis of MDOF systems.
4. To understand fundamental of elastic foundation and have an insight on soil-structure interaction problems.
5. To aware students regarding nomenclature of stress-strain coordinate system and its associated relationship.

Course outcomes:

At the end of the subject the students will be able to -

1. Formulate the equation of motion for dynamics analysis of structures
2. Demonstrate an understanding the assumptions and limitations of the structural dynamics theories.
3. Find the response of SDOF systems with and without damping
4. Find the response of SDOF systems subjected to free vibration, harmonic, and arbitrary excitations.
5. Solve engineering problems in the context of structural dynamics.
6. Students will be able to differentiate, analyze structures on firm base and elastic base foundations.
7. By virtue of stress-strain relationship, advance aspects of stress-strain resultants allied with plates and shell can be understood.

SECTION - A

Unit 1: Equation of Motion, Mass, Stiffness, and Damping. Ground Excitation and Rotational Motion. Free Vibration Single Degree of Freedom Systems (with and without damping). Definition of natural frequency/period. Simple harmonic motion. Effect of damping

Unit 2: Harmonic and Periodic Excitation of SDOF systems (with and without damping). Dynamic Response Factors. Resonance. Transmissibility

Unit 3: Response to Arbitrary, Step, and Pulse Excitations of SDOF systems (with and without damping) for Unit impulse, Arbitrary Force and Pulse Excitations. Duhamal Method.Numerical Evaluation of Dynamic Response of SDOF system using Newmark's Method.

SECTION - B

Unit 4: Earthquake Response of Structures. Concept of Response Spectrum. Free vibration, Modal analysis, Response of Linear systems and Earthquake analysis of linear systems for Multiple Degree of Freedom Systems.

Unit 5: 1) Response spectrum Analysis as per IS 1893:2016

2) Introduction to plastic analysis of steel structure, shape factor, plastic section modulus, Redistribution of moment, upper and lower bound theorems, collapse loads for beams, single bay, single storey portals. Application of the concept in steel structures.

Unit 6: 1)Infinite & Semi-infinite beams resting on elastic foundation subjected to general loading condition.

2)Introduction to theory of elasticity - (treatment in Cartesian co-ordinates), state of stress at a point, stress –equilibrium equations, strain-components, stress -strain relations, generalized Hooke's law, strain planestress and plane conditions, stress and compatibility for 2D.

BooksRecommended:

1. Chopra A. K. , Dynamic of Structures, Theory and Applications to Earthquake Engineering , 3rd edition (2007), Prentice Hill (on reserve)
2. Duggal S.K. Earthquake Resistant Design of Structures , Oxford University Press 2007
3. PankajAgrawal , Manish Shrikhande Earthquake resistant design of Structures, Prentice Hall India
4.Timoshenko & Goodier, Theory of Elasticity
5. Vazirani&Ratwani : Advanced Theory of Structures.

8CE05 : Advanced Design Of R. C. C. Structures

SECTION - A

Learning Objectives of Subject:

- To understand behavior of Flat slab under external loading.
- To understand behavior of retaining wall.
- To understand behavior of combined footingunder external loading.
- To understand behavior of simple structure under external loading.
- To learn behavior of portal frame under external loading.
- To introduce basic concept of water tank.

Course outcomes:

At the end of the subject the students will be able -

- To analyze and design of Flat slab.
- To analyze and design retaining wall.
- To analyze and design of combined footing.
- To analyze and design of simple structure.
- To analyze and design of portal frame.
- To analyze and design of water tank.

Unit I:

1. Design of flat slab.
2. Design of Counterfort retaining wall.

Unit II:

1. Design of combined footing.
2. Complete design of simple, small structures like Canopies & Parking shed.

SECTION – B

Unit III:

1) Design of Portal frame up to two bay two storied symmetrical frame for symmetrical loading.
2) Design of circular slab for uniformly distributed load only.

Unit IV:

1. Design of circular tanks with rigid and flexible base resting on firm ground by working stress method. (By IS code Method, IS 3370-2021)
2. Design of circular tanks with rigid base resting on firm ground by Limit State method. (By IS code Method, IS 3370-2021)

Note :1) Students should use IS 456:2000, IS 3370-2021
2) Field visit on any RCC framed structure & foundation, report of the same.
3) Students must be shown video CD, slides, transparencies, and photograph of actual structures.

Books Recommended:

1. Sushil Kumar, Treasure of R. C. C. Design
2Ashok K Jain : Reinforced Concrete (Limit state Design) (Nem Chand & Bros Roorkee)
3.Dr.Shah V.L. &Karve S.R. : Limit State Theory & design of Reinforced concrete IS 456:2000(Structurs Publication)
4. N. Krishna Raju, Advanced R. C. C. Design
5. Rajgopalan, K., Storage Structures
6 P.C.Varghese : Advanced reinforced concrete Design (PHI Publication)

8CE05 ADVANCED WASTEWATER ENGINEERING

Course Objectives:

The objective of advanced wastewater engineering is to extract pollutants, remove toxicants, neutralise coarse particles, kill pathogens so that quality of discharged water is improved to reach the permissible level of water to be discharged into water bodies or for agricultural land.

Course Outcome:

At the end of the course students will :

1. Have knowledge regarding different types and sources of wastewater.
2. Apply advanced technologies in Wastewater treatment.
3. Select the most appropriates types of membrane processes for tertiary treatment of wastewater.
4. Apply advanced oxidation processes to treat concentrated non biodegradable wastewater.
5. Learn sludge handling and disposal processes.

SECTION A

Unit I: Water Pollution and Treatment: Types and Sources, quality of water, various stages of treatment of Water treatment process: aeration, Sedimentation, Filtration: slow and rapid sand filters.

Unit II: Biological nutrient removal: Nitrogen removal: nitrification, denitrification, processes for biological nitrogen removal, phosphorous removal mechanism; application of phostrip, bardenpho and phoredox process.

Unit III: Membrane Separation: Membrane process terminology & classification, Materials, membrane configuration, membrane operation, ultra filtration, reverse osmosis, microfiltration, Nanofiltration: Applicability, limitations, advantages and disadvantages, membrane fouling, electro dialysis, membrane bioreactors.

SECTION B

Unit IV: Adsorption: Types of adsorbents, fundamentals of adsorption, adsorption isotherm, activated carbon adsorption kinetics, activated carbon treatment.

Ion Exchange: Fundamentals of ion exchange, types of ion exchange resins, general characterization of ion exchange resins, theory and application of ion exchange.

Unit V: Advanced Oxidation Process: Theory of advanced oxidation, technologies used to produce hydroxyl radicals, applications.

Unit VI: Sludge handling and disposal: Sludge processing steps- Preliminary operations, thickening, stabilization, conditioning, dewatering and heat drying and thermal reduction. Aerobic and anaerobic sludge digestion microbiology and design, land application of sludge and design consideration. Sludge storage, land application of domestic sewage and ground water recharge.

Books Recommended:

1. Wastewater Engineering: Treatment, disposal, Reuse (4th ed.) - Metcalf & Eddy Inc. Tata McGraw-Hill, New Delhi, 2003.

2. Wastewater Treatment for Pollution Control (2nd ed.) - SJArceivala, Tata McGraw-Hill, 1998.
3. Wastewater Treatment Plants: Planning, Design and Operation Holt - SR Qasim, Rinehart & Winston, NY, 1985
4. Wastewater Treatment - DWSunderstorm and HE Klei, Prentice-Hall, Englewood Cliffs, NJ, 1979.
5. Biological Wastewater Treatment: Theory and Application - CLP Grady, and HC Lim, Marcel Dikker, NY, 1980.

8 CE04 : Construction Equipment and Machinery

Learning Objectives of Subject:

- Student should learn about the basic terms related to construction machinery and equipments.
- Student should understand use of various equipments and tools in sequence of Project Life cycle.
- Student should be able to know the application of Survey tool and basic construction minor tools.
- Student should know about various equipment and machinery related to excavation and dumping work like excavator, Machine Shovel , Hoe etc.
- Learner should know about various material mixing machinery like Rotating drum concrete mixer, transit mixer etc.
- Learner should study about compacting machine and tools like various vibrators and rollers.
- Student should know about various material movement equipment like crane , hoist and lifts etc.

Course outcomes:

At the end of the subject the students will be able -

- To recognize the various terms related to the tools that are required for any construction work.
- To decide which machine or tool can be implemented as per the project life cycle stage.
- To understand the survey process with help of Total station and will be able to analyze the performance of basic minor tools and machinery
- To understand various equipments like excavators, shovels, mixers, compactors , crane , hoist , lift etc.

Section A

Unit I: Basics of Construction Equipment and Machinery – History of Construction Equipments and Tools, Need of utilizing equipments and Machinery in Construction work. Understanding Terms like operating time, Idle time, Capacity, Efficiency of Machine, depreciation and obsolesce cost of machines and equipments. Purchase, Rent and Lease considerations while using Machine or Equipments. Factors affecting selection of Machinery, General Safety rules and measures while using equipments, tools and machinery at time of construction.

Unit II : Land Survey Equipments and essential Tools- Need for survey equipments , Application of Total Station for land survey and layout work. Introduction to Drone surveying and mapping method. Tools like Hoe , Head pan , Masonry Trowel , Wheel barrow , Wooden Float , Plumb Bob , Line Level etc.

Unit III : Excavating & Dumping Machines :- Components , Capacity , Working method of Excavator , Front Shovel , Loaders and Back Hoe.

Section B

Unit IV : Mixers - Components , Capacity , Working method of Batch mixers, Drum Types Mixer, Tilting drum mixers, Non-tilting drum mixer, Reversing drum mixer, Pan Type Mixer , Concept & Types of Continuous Concrete Mixer – Transit Mix trucks/ Ready mixed Concrete Mixers.

Unit V: Compacting Equipments, Tools & Machinery:
Vibrator – Its need and types – Internal/ needle, surface, vibrating table & surface vibrating machine. Details of Rollers and its types – Sheep Foot, Tamping , Smooth drum vibratory soil compactors , Pneumatic- tired rollers.

Unit VI: Material handling Equipments, Tools & Machinery: Components , Capacity , Working method of various Cranes – Tower , Mobile, Truck mounted Rough Terrain, Overhead .
Components, Capacity, Working method of Loader , Conveyors , Lifts , Hoist & Forklift.

8CE05 FINITE ELEMENT METHOD

Course Learning Objective:
The aim of the course is to provide the students an overview on Finite Element Method, Material models, and Applications in Civil Engineering.

Course outcomes:
At the end of the subject the students will be able to -
1. Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer.
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems.
4. Implement and solve the finite element formulations using software.

SECTION – A

Unit I: Introduction to Finite Element Method,its application, Steps in Finite Element Analysis, Advantage/ Disadvantages, Virtual Work and Variational Principle, :Galerkin Method, DisplacementApproach, Stiffness Matrix and Boundary Conditions.

Unit II: Finite Element and Interpolation Functions/shape function, One dimensional Element (Line, Quadratic, cubic, Lagrangian form, higher order), Two dimensional Element (Triangular element- linear / quadratic, Rectangular element, Isoparametric, Serendipity element), Three dimensional Element (Tetrahedral element, Prismatic element)

Unit III: One dimensional Finite Element Analysis; Linear spring, Truss element, one dimensional fluid flow thro porous media, steady state heat conduction, solutions of simple engineering 1D problems.

SECTION – B

Unit IV: One dimensional Finite Element Analysis; 1) Beam Element, review of beam theory, FE formulation of beam element, solutions of engineering problems. 2) Analysis of plane frame, Transformation Matrix, solutions of engineering problems

Unit V: Two dimensional Finite Element Analysis; 2D Continuum Structures: Plane stress and plane strain analysis by constant strain triangle (CST), rectangular element,Isoparametric Elements, development of element stiffness matrices, load vectors and solution.

Unit VI: Three dimensional Finite Element Analysis; Development of element stiffness matrices and load vectors using Axi-symmetric solids, tetrahedron, eight node brick element, Isoparametric Elements. Introduction to FEMsoftware's STAAD, RAM Product, NISA, MSC Nastron, ANSYS, ABAQUS, MIDAS, CRISP, PLAXIS etc.

BooksRecommended:

1. Introduction to Finite Elements in Engineering, Chandragupta T. R. andBelegundu A. D., 3rd Edition, Prentice Hall, 2002
2. Finite Element Method in Structural Analysis, A.S.Meghre and Ms. K.N.Kadam, First Edition, Khanna Publishers, 2014.
3. Finite Element Analysis: Theory and Programming: C. S. KrishnamurthiSecond Edition, Tata McGraw Hill Publishing Company Limited, 1994
4. O. C. Zienkiewicz., R. L. Taylor & J. Z. Zhu., "The Finite Element Method Its Basis & Fundamentals", Elsivier Publications, 2007

8 CE05: Construction Economics & Estimating – Costing Lab

1. Writing specification for 5 items that includes Building Work, Road work, Irrigation work etc.

2. Rate Analysis of 6 items like Cement, Sand, Steel, Brick, Paver and Timber etc.
3. Preparation of BAR bending Schedule.
4. Manual & Software Application for detail estimate of Residential Block with 4 rooms only.
5. Quantity & Rate Estimate of small Commercial building.
6. Quantity & Rate Estimate of Rigid/ Flexible Pavement Road for stretch of 1 km only.
7. Valuation of small building/ flat for any existing structure.

Note: - Faculty should carry out Mock exercise for Tendering & Bidding Process among the concern class students.

8 CE06 : Advance Design of Steel Structure- Lab

Practical:

1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any Steel framed structure & report of the same.

8CE06: Advanced Prestress Concrete Structures-Lab

Practical:

1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any Prestressed structure & report of the same.

8CE06:Advanced Water Treatment- Lab

LIST OF EXPRIMENTS

Minimum 8 practicals out of the given should be performed. The site visit is compulsory.

1. Determination of Turbidity of water sample.
2. Determination of pH of water sample.
3. Determination of Electrical Conductivity of water sample.
4. Determination of Chlorides.
5. Determination of suspended, settleable, volatile & fixed solids.
6. Determination of hardness of water sample.
7. Determination of Optimum Coagulant dosage.
8. Determination Dissolved oxygen and BOD for the given sample.
9. Determination of COD for given sample.
10. Report of Field visit to Municipal Water Treatment Plant.

8CE06: Industrial Waste Water Treatment- LAB

LIST OF EXPRIMENTS

Minimum 8 practicals out of the given should be performed. The site visit is compulsory.

1. Determination of Alkalinity and Acidity
2. Determination of Dissolved oxygen
3. Determination of Biochemical Oxygen Demand
4. Determination of Chemical Oxygen Demand
5. Determination of suspended, settleable, volatile & fixed solids.
6. Determination of Oil & Grease.
7. Determination of Phosphates and Sulphates.
8. Determination of SVI of Biological sludge
9. Metal analysis from Industrial Wastewater a) Arsenic b) Nickel c) Chromium
10. Report of Field visit to Industrial Waste Water Treatment Plant.

8CE06 : Structural Analysis By MATRIX METHODS - LAB

Any five

1. Analysis of axially loaded member/ problem using stiffness method/ flexibility method and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
2. Analysis of Continuous beam problem using structural approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
3. Analysis of Continuous beam problem using member approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
4. Analysis of Truss problem using member approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
5. Analysis of Plane frame problem using member approach hand Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
6. Prepare computer program for Matrix addition, subtraction, multiplication, inverse using C/FORTRAN language

Prepare computer program to form Stiffness matrix for 1) Truss element, 2) Beam Element, 3) Plane frame Element using C/FORTRAN language

8 CE07 : Project & Seminar

As per the details in the scheme of B.E Civil Engineering .