VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: STRENGTH OF MATERIALS B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

<table>
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<tr>
<th>Course Code</th>
<th>17 CV32</th>
<th>CIE Marks</th>
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<td>60</td>
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<tr>
<td>Total Number of Lecture Hours</td>
<td>50 (10 Hours per Module)</td>
<td>Exam Hours</td>
<td>03</td>
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Credits – 04

Course Objectives: This course will enable students:

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To analyse and understand principal stresses due to the combination of two dimensional stresses on an element and failure mechanisms in materials.
5. To evaluate the behavior of torsional members, columns and struts.

Module-1

Simple Stresses and Strain:
Introduction, Definition and concept and of stress and strain. Hooke’s law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self weight. Saint Venant’s principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

Module-2

Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr’s circle of stresses

Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame’s equation, radial and hoop stress distribution.
### Module-3

**Shear Force and Bending Moment in Beams:** Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.

### Module-4

**Torsion in Circular Shaft:** Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus. Power transmitted by a shaft, combined bending and torsion.

**Theories of Failure:** Introduction, maximum principal stress theory (Rankine’s theory), Maximum shearing stress theory (Tresca’s theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant’s theory).

### Module-5

**Bending and Shear Stresses in Beams:** Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, ‘I’, and ‘T’ sections. Shear centre (only concept)

**Columns and Struts:** Introduction, short and long columns. Euler’s theory; Assumptions, Derivation for Euler’s Buckling load for different end conditions, Limitations of Euler’s theory. Rankine-Gordon’s formula for columns.

### Course outcomes:

After studying this course, students will be able;

1. To evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion.
2. To suggest suitable material from among the available in the field of construction and manufacturing.
3. To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts
4. To understand the basic concept of analysis and design of members subjected to torsion.
5. To understand the basic concept of analysis and design of structural elements such as columns and struts.

### Text Books:


**Reference Books:**

# TITLE OF THE COURSE: FLUIDS MECHANICS

**B.E., III Semester, Civil Engineering**

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

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<td>50 (10 Hours per Module)</td>
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**Credits – 04**

**Course Objectives:** The objectives of this course is to make students to learn:

1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to practical problem solving
3. Principles of Kinematics and Hydro-Dynamics for practical applications
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements

## Module-1

**Fluids & Their Properties:** Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension & Capillarity. Fluid as a continuum, Newton’s law of viscosity (theory & problems). Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, capillarity, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems

**Fluid Pressure and Its Measurements:** Definition of pressure, Pressure at a point, Pascal’s law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices.

## Module-2

**Hydrostatic forces on Surfaces:** Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.

### Module-3

**Fluid Dynamics:** Introduction. Forces acting on fluid in motion. Euler’s equation of motion along a streamline and Bernoulli’s equation. Assumptions and limitations of Bernoulli’s equation. Modified Bernoulli’s equation. Problems on applications of Bernoulli’s equation (with and without losses).

Vortex motion; forced vortex, free vortex, problems Momentum equation problems on pipe bends.

**Applications:** Introduction. Venturimeter, Orificemeter, Pitot tube. Numerical Problems

L2,L4

### Module-4

**Orifice and Mouthpiece:** Introduction, classification, flow through orifice, hydraulic coefficients, Numerical problems. Mouthpiece, classification, Borda’s Mouthpiece (No problems).

**Notches and Weirs:** Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.

L1,L2,L4

### Module-5


**Surge Analysis in Pipes:** Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems

L2 ,L4

### Course outcomes:

After successful completion of the course, the student will be able to:

1. Possess a sound knowledge of fundamental properties of fluids and fluid Continuum
2. Compute and solve problems on hydrostatics, including practical applications
3. Apply principles of mathematics to represent kinematic concepts related to fluid flow
4. Apply fundamental laws of fluid mechanics and the Bernoulli’s principle for practical applications
5. Compute the discharge through pipes and over notches and weirs

### Text Books:


### Reference Books:


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5
TITLE OF THE COURSE: BASIC SURVEYING  
B.E., III Semester, Civil Engineering  
[As per Choice Based Credit System (CBCS) scheme]

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Credits – 04

Course Objectives: This course will enable students to;
1. Understand the basic principles of Surveying
2. Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
3. Employ conventional surveying data capturing techniques and process the data for computations.
4. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

Module-1

Introduction: Definition of surveying, Objectives and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision and accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout, Survey of India Map numbering systems.


Module-2

Measurement of Directions and Angles: Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor’s compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

Theodolite Survey and Instrument Adjustment: Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite

Module-3

Traversing: Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems
**Tacheometry:** basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems

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<tr>
<th>Module-4</th>
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<tr>
<td><strong>Leveling:</strong> Basic terms and definitions, Methods of leveling, Dumpy level, auto level, digital and laser levels. Curvature and refraction corrections. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling, trigonometric leveling (heights and distances-single plane and double plane methods.)</td>
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<td><strong>Areas and Volumes:</strong> Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson’s one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- rapezoidal and prismoidal formula.</td>
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<tr>
<td><strong>Contouring:</strong> Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.</td>
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<tr>
<th>Course outcomes:</th>
<th>After a successful completion of the course, the student will be able to:</th>
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<tbody>
<tr>
<td>1.</td>
<td>Posses a sound knowledge of fundamental principles Geodetics</td>
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<tr>
<td>2.</td>
<td>Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.</td>
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<tr>
<td>3.</td>
<td>Capture geodetic data to process and perform analysis for survey problems</td>
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<tr>
<td>4.</td>
<td>Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours</td>
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TITLE OF THE COURSE: ENGINEERING GEOLOGY B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

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Credits – 04

Course Objectives: This course will enable students:

1. To understand the internal structure and composition of the earth.
2. To comprehend the properties, occurrence and uses of minerals in various industries.
3. To learn about geo-morphological agents such as river, wind, sea waves, and their implications in implementing civil engineering projects.
4. To gain knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways.
5. To learn the application of Topographic maps, remote sensing and GIS in Civil engineering practices and natural resource management.

Module-1

Introduction: Application of Earth Science in Civil Engineering Practices, Understanding the earth, internal structure and composition.

Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group (Cement) ; Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chromite (Alloy); Bauxite (aluminum); Chalcopyrite (copper)

L1,L2

Module-2

Petrology: Formation, Classification and Engineering Properties. Rock as construction material, concrete aggregate, railway ballast, roofing, flooring, cladding and foundation. Deformation of rocks, Development of Joints, Folds, Faults and Unconformities. Their impact in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges, Rock Quality Determination (RQD), Rock Structure Rating (RSR): Igneous Rocks - Granite, Gabbro, Dolerite, Basalt; Sedimentary rocks - Sandstone, Shale, Limestone, Laterite; Metamorphic rocks - Gneiss, Quartzite,Slate, Charnockite: Decorative stones - Porphyries, Marble and Quartzite

L2,L3.

Module-3

Geomorphology and Seismology: Landforms – Classification, Rock weathering, types and its effects on Civil Engineering Projects. Study of Geo-morphological
aspects in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges. Watershed management, Floods and their control, River valley, Drainage pattern – parameters and development; Coastlines and their engineering considerations.

Earthquake - Causes and Effects, Seismic waves, Engineering problems related to Earthquakes, Earthquake intensity, Richter Scale, Seismograph, Seismic zones-World and India, Tsunami – causes and effects. Early warning system. Reservoir Induced Seismicity; Landslides – causes and their control

Module-4


Module-5

Geodesy: Study of Topographic maps and Contour maps; Remote Sensing – Concept, Application and its Limitations; Geographic Information System (GIS) and Global Positioning System (GPS) – Concept and their use resource mapping, LANDSAT Imagery-Definition and its use. Impact of Mining, Quarrying and Reservoirs on Environment. Natural Disasters and their mitigation.

Course outcomes: After a successful completion of the course, the student will be able to:
1. Students will able to apply the knowledge of geology and its role in Civil Engineering
2. Students will effectively utilize earth’s materials such as mineral, rocks and water in civil engineering practices.
3. Analyze the natural disasters and their mitigation.
4. Assess various structural features and geological tools in ground water exploration, Natural resource estimation and solving civil engineering problems.
5. Apply and asses use of building materials in construction and asses their properties

Text Books:
2. Parbin Singh, “Text Book of Engineering and General Geology”, Published by S.K.Kataria and Sons, New Dehli

Reference Books:
2. Dimitri P Krynine and William R Judd, “Principles of Engineering Geology and
5. Ground water Assessment, development and Management by K.R. Karanth, Tata Mc Graw Hills
Course Code: 17 CV36
Number of Lecture Hours/Week: 04
Total Number of Lecture Hours: 50 (10 Hours per Module)
CIE Marks: 40
SEE Marks: 60
Exam Hours: 03
Credits: 04

Course Objectives: This course will develop a student:
1. In recognizing the good materials to be used for the construction work
2. In investigation of soil condition, Deciding and design of suitable foundation for different structures
3. In supervision of different types of masonry
4. In selection of materials, design and supervision of suitable type of floor and roof.
5. To gain knowledge about doors, windows, plastering, painting, damp proofing, scaffolding, shoring, underpinning and to take suitable engineering measures.

Module-1

Building Materials: Stone as building material: Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.
Cement Concrete blocks, Stabilized Mud Blocks, Sizes, requirement of good blocks.
Mortar: types and requirements. Timber as construction material
Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.
Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

Module-2

Foundation: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation
Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls
Module-3

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

Floors and roofs: Floors; Requirement of good floor, Components of ground floor, Selection of flooring material, Laying of Concrete, Mosaic, Marble, Granite, Tile flooring, Cladding of tiles. Roof;-Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

Module-4

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

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

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

Module-5

Plastering and Pointing: purpose, materials and methods of plastering and pointing, defects in plastering-Stucco plastering, lathe plastering Damp proofing-causes, effects and methods.

Paints: Purpose, types, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

Course outcomes: After a successful completion of the course, the student will be able to:
1. Select suitable materials for buildings and adopt suitable construction techniques.
2. Adopt suitable repair and maintenance work to enhance durability of buildings.

Text Books:

Reference Books:
3. Building Materials and Components, CBRI, 1990, India
Course Objectives: The objectives of this course is to make students to learn:
1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

Experiments:
1. Tension test on mild steel and HYSD bars.
2. Compression test on mild steel, cast iron and wood.
3. Torsion test on mild steel circular sections
4. Bending Test on Wood Under two point loading
5. Shear Test on Mild steel- single and double shear
6. Impact test on Mild Steel (Charpy & Izod)
7. Hardness tests on ferrous and non-ferrous metals- Brinell’s, Rockwell and Vicker’s
8. Tests on Bricks and Tiles
9. Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking
10. Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis
11. Demonstration of Strain gauges and Strain indicators

NOTE: All tests to be carried out as per relevant latest BIS Codes

Course outcomes: After successful completion of the course, the students will be able to:
1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.

Question paper pattern:
- Group experiments - Tension test, compression test, torsion test and...
bending test.

- Individual Experiments - Remaining tests.
- Two questions are to be set - One from group experiments and the other as individual experiment.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

**Reference Books:**

7. Relevant **latest IS Codes**
TITLE OF THE COURSE: BASIC SURVEYING PRACTICE B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code | 17CVL38  | CIE Marks  | 40  
--- | --- | --- | ---  
Number of Lecture Hours/Week | 03=(1 Hour Instruction + 2 Hours Laboratory) | SEE Marks | 60  
Total Number of Hours | 40  | Exam Hours | 03  
RBT Levels | L1, L2, L3, L4  |

Credits – 02

Course Objectives: The objectives of this course is to make students to:

1. Apply the basic principles of engineering surveying and measurements
2. Follow effectively field procedures required for a professional surveyor
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

Experiments:

1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.
   b) Setting out perpendiculars. Use of cross staff, optical square
2. Obstacles in chaining and ranging – Chaining but not ranging, ranging but not chaining, both ranging and chaining.
5. Determination of distance between two inaccessible points using compass and accessories
6. Determination of reduced levels of points using dumpy level/auto level (simple leveling)
7. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling)
8. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error
9. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale
11. Determination of horizontal distance and vertical height to a base inaccessible object using theodolite by single plane and double plane method.
12. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.
13. Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule.
14. Demonstration of Minor instruments Clinometer, Ceylon Ghat tracer, Box sextant, Hand level, Planimeter, nautical sextant and Pentagraph
**Course outcomes:** After a successful completion of the course, the student will be able to:

1. Apply the basic principles of engineering surveying for linear and angular measurements.
2. Comprehend effectively field procedures required for a professional surveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

**Question paper pattern:**

- All are individual experiments.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

**Reference Books:**

TITLE OF THE COURSE: Analysis of Determinate Structures B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

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Credits – 04

Course Objectives: This course will enable students to

1. Apply knowledge of mathematics and engineering in calculating slope and deflections
2. Identify, formulate and solve engineering problems
3. Analyse structural systems and interpret data
4. Engage in lifelong learning with the advances in Structural Engineering

Module-1

**Introduction and Analysis of Plane Trusses:** Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non-linear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.

Module-2

**Deflection of Beams:** Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay’s method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple. Moment area method: Derivation, Mohr’s theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections.

Module-3

**Energy Principles and Energy Theorems:** Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castigliano’s theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit
load method.

L2, L4, L5

Module-4

**Arches and Cable Structures**: Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.

L2, L4, L5

Module-5

**Influence Lines and Moving Loads**: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses-Reactions, BM and SF in determinate beams using rolling loads concepts.

L2, L4, L6

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

1. Evaluate the forces in determinate trusses by method of joints and sections.
2. Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods
3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames.
4. Determine the stress resultants in arches and cables.
5. Understand the concept of influence lines and construct the ILD diagram for the moving loads.

**Text Books**:

**Reference Books**:
## Course Objectives:

The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

### Module-1

**Dimensional analysis:** Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham ð theorem, dimensional analysis, choice of variables, examples on various applications.

**Model analysis:** Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynold's model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model

**Buoyancy and Flotation:** Buoyancy, Force and Centre of Buoyancy, Metacentre and Metacentric height, Stability of submerged and floating bodies, Determination of Metacentric height, Experimental and theoretical method, Numerical problems

L1, L2, L3, L4

### Module-2

**Open Channel Flow Hydraulics:**

Uniform Flow: Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes, Numerical Problems

L3, L4

### Module-3

**Non-Uniform Flow:** Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems, Control sections

L2, L3, L4

### Module-4

**Hydraulic Machines:**

Introduction, Impulse-Momentum equation. Direct impact of a jet on a stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems
**Turbines – Impulse Turbines:** Introduction to turbines, General lay out of a hydro-electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel-components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems

**Module-5**

**Reaction Turbines and Pumps:** Radial flow reaction turbines: (i) Francis turbine- Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)

Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.

**Course outcomes:**

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

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

**Text Books:**

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17 CV44</th>
<th>CIE Marks</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>04</td>
<td>SEE Marks</td>
<td>60</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>50 (10 Hours per Module)</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
</tbody>
</table>

Credits – 04

Course objectives: This course will enable students to:

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

Module-1

Concrete Ingredients

Module-2

Fresh Concrete

Module-3

Module-4

**Concrete Mix Proportioning**

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

Module-5

**Special Concretes**

RMC- manufacture and requirement as per QC1-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and aiplications

**Course outcomes:**

After studying this course, students will be able to:

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

**Text Books:**

2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.

5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House
TITLE OF THE COURSE: Basic Geotechnical Engineering B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17 CV45</th>
<th>CIE Marks</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>04</td>
<td>SEE Marks</td>
<td>60</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>50 (10 Hours per Module)</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
</tbody>
</table>

Credits – 04

Course Objectives: This course will enable students

1. To appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering. Also to become familiar broadly with geotechnical engineering problems such as, foundation engineering, flow of water through soil medium and terminologies associated with geotechnical engineering.

2. To know the basic engineering properties and the mechanical behaviour of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also consolidation properties of clayey soils.

3. To determine the improvement in mechanical behaviour by densification of soil deposits using compaction.

4. To know how the properties of soils that can be measured in the lab

Module-1

Introduction:

Introduction, origin and formation of soil, Phase Diagram, phase relationships, definitions and their inter-relationships. Determination of Index properties-Specific gravity, water content, in-situ density and particle size analysis (sieve and sedimentation analysis) Atterberg’s Limits, consistency indices, relative density, activity of clay, Plasticity chart, unified and BIS soil classification.

Module-2

Soil Structure and Clay Mineralogy

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

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

Module-3

Flow through Soils:

Darcy’s law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena

Seepage Analysis: Laplace equation, assumptions, limitations and its derivation. Flow nets- characteristics and applications. Flow nets for sheet piles and below the dam section.
Unconfined flow, phreatic line (Casagrande’s method—with and without toe filter), flow through dams, design of dam filters.

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

**Module-4**

**Consolidation of Soil:**
Definition, Mass-spring analogy, Terzaghi’s one dimensional consolidation theory - assumption and limitations. Derivation of Governing differential Equation Pre-consolidation pressure and its determination by Casagrande’s method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils. Consolidation characteristics of soil (Cc, av, mv and Cv. Laboratory one dimensional consolidation test, characteristics of e-log(o) curve, Determination of consolidation characteristics of soils compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

**Module-5**

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

**Course outcomes:**
On the completion of this course students are expected to attain the following outcomes;
1. Will acquire an understanding of the procedures to determine index properties of any type of soil, classify the soil based on its index properties
2. Will be able to determine compaction characteristics of soil and apply that knowledge to assess field compaction procedures
3. Will be able to determine permeability property of soils and acquires conceptual knowledge about stresses due to seepage and effective stress; Also acquire ability to estimate seepage losses across hydraulic structure
4. Will be able to estimate shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory.
5. Ability to solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same.

**Text Books:**
<table>
<thead>
<tr>
<th>Reference Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi</td>
</tr>
</tbody>
</table>
TITLE OF THE COURSE: Advanced Surveying B.E., IV Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17 CV46</th>
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<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>04</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>50 (10 Hours per Module)</td>
</tr>
</tbody>
</table>

| Credits – 04 |

Course Objectives: This course will enable students to:
1. Apply geometric principles to arrive at solutions to surveying problems.
2. Analyze spatial data using appropriate computational and analytical techniques.
3. Design proper types of curves for deviating type of alignments.
4. Use the concepts of advanced data capturing methods necessary for engineering practice

Module-1

Curve Surveying

Module-2

Geodetic Surveying and Theory of Errors
Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations Theory of Errors: Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.

Module-3

Introduction to Field Astronomy: Earth, celestial sphere, earth and celestial coordinate systems, spherical triangle, astronomical triangle, Napier’s rule
### Module-4

**Aerial Photogrammetry**

Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax

L2,L3, L5

### Module-5

**Modern Surveying Instruments**


L2,L3, L5

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

1. Apply the knowledge of geometric principles to arrive at surveying problems
2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.
3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;
4. Design and implement the different types of curves for deviating type of alignments.

### Text Books:

2. Kanetkar T P and S V Kulkarni , Surveying and Levelling Part 2, Pune Vidyarthi Griha Prakashan,

### Reference Books:

3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers
TITLE OF THE COURSE: Fluid Mechanics and Hydraulic Machines Laboratory
B.E., IV Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17CVL47</th>
<th>CIE Marks</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03=(1 Hour Instruction + 2 Hours Laboratory)</td>
<td>SEE Marks</td>
<td>60</td>
</tr>
<tr>
<td>Total Number of Hours</td>
<td>40</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
<tr>
<td>RBT Levels</td>
<td>L1, L2, L3, L4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Credits – 02

Course Objectives: This course will enable students to;
1. calibrate flow measuring devices
2. determine the force exerted by jet of water on vanes
3. measure discharge and head losses in pipes
4. understand the fluid flow pattern

Experiments:
1. Verification of Bernoulli’s equation
2. Determination of C_d for Venturimeter and Orifice meter
3. Determination of hydraulic coefficients of small vertical orifice
4. Calibration of Rectangular and Triangular notch
5. Calibration of Ogee and Broad crested weir
6. Determination of C_d for Venturiflume
7. Experimental determination of force exerted by a jet on flat and curved plates (Hemispherical Vane).
8. Experimental determination of operating characteristics of Pelton turbine
9. Determination of efficiency of Francis turbine
10. Determination of efficiency of Kaplan turbine
11. Determination of efficiency of centrifugal pump
12. Determination of Major and Minor Losses in Pipes
13. Demonstration Experiments:
   a. Reynold’s experiment to understand laminar and turbulent flow
   b. Flow Visualization
   c. Calibration of Sutro-weir

Course outcomes: During the course of study students will develop understanding of:
1. Properties of fluids and the use of various instruments for fluid flow measurement.
2. Working of hydraulic machines under various conditions of working and their characteristics.

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:
## Title of the Course: Engineering Geology Laboratory

**BE–IV SEMESTER Civil Engineering [ApeirChoiceBasedCreditSystem (CBCS) scheme]**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>CIE Marks</th>
<th>SEE Marks</th>
<th>No. of Hours/Week</th>
<th>Lecture</th>
<th>Total Number of Hours</th>
<th>Exam Hours</th>
<th>RBT Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>17CVL48</td>
<td></td>
<td>40</td>
<td>60</td>
<td></td>
<td>03(1hrtutorial+2hr laboratory)</td>
<td>40 hr</td>
<td>03</td>
<td>L1, L2, L3, L4</td>
</tr>
</tbody>
</table>

**CREDITS–02**

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

1. To identify the minerals and rocks based on their inherent properties and uses in civil engineering
2. To interpret the geological maps related to civil engineering projects.
3. To learn the dip and strike, borehole problems, thickness of geological formation related to foundation, tunnels, reservoirs, and mining.
4. To understand subsurface geological conditions through geophysical techniques and watershed management.
5. To visit the civil engineering projects like dams, reservoirs, tunnels, quarries, etc.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT Level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identification of minerals as mentioned in theory, their properties, uses and manufacturing of construction materials.</td>
<td>6 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>2. Identification of rocks as mentioned in theory, their engineering properties and uses in construction and decorative purposes</td>
<td>6 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>3. Dip and Strike problems: Determination of dip and strike direction in Civil Engineering projects (Railway lines, tunnels, dams, reservoirs) – graphical or any other method.</td>
<td>6 Hours</td>
<td>L3, L4</td>
</tr>
<tr>
<td>4. Borehole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs, and mining. Triangular and Square</td>
<td>6 Hours</td>
<td>L3, L4</td>
</tr>
<tr>
<td>5. Calculation of Vertical, True thickness and width of the outcrops.</td>
<td>3 Hours</td>
<td>L3, L4</td>
</tr>
<tr>
<td>6. Interpretation of Electrical resistivity curves to find out subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone</td>
<td>4 Hours</td>
<td>L3, L4</td>
</tr>
<tr>
<td>7. Interpretation of Toposheets and geological maps related to Civil Engineering Projects</td>
<td>9 Hours</td>
<td>L2, L3, L4</td>
</tr>
</tbody>
</table>
Course outcomes:
During this course, students will develop expertise in;
1. Identifying the minerals and rocks and utilize them effectively in civil engineering practices
2. Understanding and interpreting the geological conditions of the area for the implementation of civil engineering projects.
3. Interpreting subsurface information such as thickness of soil, weathered zone, depth of hardrock and saturated zone by using geophysical methods.
4. The techniques of drawing the curves of electrical resistivity data and its interpretation for geotechnical and aquifer boundaries

Program Objectives (as per NBA):
○ Engineering Knowledge.
○ Problem Analysis.
○ Design/development of solutions (partly).
○ Interpretation of data.

Question paper pattern: **Question paper should be set for 100 marks**
All are individual experiments
Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
All exercises are to be included for practical examination.

<table>
<thead>
<tr>
<th>Qn.No.</th>
<th>EXPERIMENT</th>
<th>MARKS (100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identification of Minerals by giving their physical properties and civil engineering applications (5 minerals)</td>
<td>25 (5 x 5)</td>
</tr>
<tr>
<td>2</td>
<td>Identification of Rocks by giving their physical properties, classification and their civil engineering applications (5 rocks)</td>
<td>25 (5 x 5)</td>
</tr>
<tr>
<td>3</td>
<td>Dip and strike problems</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Borehole problems (3 point method)</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>Thickness of strataproblems including calculation of vertical, true thickness and its width of outcrop.</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Electrical resistivity curves drawing and its interpretation for Geotechnical and Aquifer investigations.</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>Interpretation of Toposheets</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Geological maps, their cross sections and description</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>Vivavoce</td>
<td>5</td>
</tr>
</tbody>
</table>

Note:
1) Question nos. 1, 2, 4, 5, 7, 8, & 9 are compulsory.
2) Among question no. 3 & 6 any one shall be given.
3) Internal Assessment Marks = 40: By conducting at least one test for 20 marks remaining
   a) 10 marks for record
   b) 10 marks for field visit report submission (Engineering projects)
<table>
<thead>
<tr>
<th>Reference Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. MP Billings, <em>Structural Geology</em>, CBS Publishers and Distributors, New Delhi</td>
</tr>
</tbody>
</table>
5th Semester
TITLE OF THE COURSE: DESIGN OF RC STRUCTURAL ELEMENTS  
B.E., V Semester, Civil Engineering  
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17CV51</th>
<th>CIE Marks</th>
<th>40</th>
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</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>04</td>
<td>SEE Marks</td>
<td>60</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>50 (10 Hours per Module)</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
</tbody>
</table>

Credits – 04

Course objectives: This course will enable students to

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

Module-1


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


L1, L2

Module-2

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

L2, L4

Module-3

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

L2, L4

Module-4

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

L2, L4

Module-5

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

<table>
<thead>
<tr>
<th>Course outcomes:</th>
<th>After studying this course, students will be able to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>understand the design philosophy and principles</td>
</tr>
<tr>
<td>2.</td>
<td>solve engineering problems of RC elements subjected to flexure, shear and torsion</td>
</tr>
<tr>
<td>3.</td>
<td>demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings</td>
</tr>
<tr>
<td>4.</td>
<td>owns professional and ethical responsibility</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Text Books:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
### TITLE OF THE COURSE: ANALYSIS OF INDETERMINATE STRUCTURES

B.E., V Semester, Civil Engineering  
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIE Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>17CV52</td>
<td>40</td>
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</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>SEE Marks</th>
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</thead>
<tbody>
<tr>
<td>04</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 (10 Hours per Module)</td>
<td>03</td>
</tr>
</tbody>
</table>

**Credits – 04**

**Course Objectives:** This course will enable students to
1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani’s method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. Use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. Communicate effectively in design of structural elements

**Module-1**

**Slope Deflection Method:** Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3

**Module-2**

**Moment Distribution Method:** Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of 08 Hours orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3

**Module-3**

**Kani’s Method:** Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway

**Module-4**

**Matrix Method of Analysis (Flexibility Method):** Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3

**Module-5**

**Matrix Method of Analysis (Stiffness Method):** Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤3

**Course outcomes:** After studying this course, students will be able to:
1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope deflection method
2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani’s method.
4. Construct the bending moment diagram for beams and frames using flexibility
method

5. Analyze the beams and indeterminate frames by system stiffness method.

<table>
<thead>
<tr>
<th>Text Books:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
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</table>
Title of the Course: Applied Geotechnical Engineering
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code 17CV53  CIE Marks 40

Number of Lecture Hours/Week 04  SEE Marks 60

Total Number of Lecture Hours 50 (10 Hours per Module)  Exam Hours 03

Credits – 04

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

Module-1

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

L1,L2,L3

Module-2

Stress in Soils: Introduction, Boussinesq’s and Westergaard’s theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark’s chart Foundation Settlement - Approximate method for stress distribution on a horizontal plane, Types of settlements and importance, Computation of immediate and consolidation settlement

L2,L3,L4

Module-3

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine’s theory for cohesionless and cohesive soils, Coulomb’s theory, Rebhann’s and Culmann’s graphical construction.

Stability of Slopes: Assumptions, infinite and finite slopes, factor of safety, use of Taylor’s stability charts, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle

L2,L4,L5

Module-4

Bearing Capacity of Shallow Foundation: Types of foundations, 10 Hours determination of bearing capacity by Terzaghi’s and BIS method (IS: 6403), Effect of water table and eccentricity, field methods - plate load test and SPT Proportioning of shallow foundations- isolated and combined footings (only two columns)

L2,L4,L5,L6

Module-5

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

<table>
<thead>
<tr>
<th>L1, L2, L3 L4</th>
</tr>
</thead>
</table>

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

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

**Text Books:**

4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India

**Reference Books:**

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
### Course Objectives:

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

### Module-1

**Drawing Basics:** Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962


12 Hours  L1, L2

### Module-2

**Drawings Related to Different Building Elements:**

Following drawings are to be prepared for the data given using CAD Software:

a. Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.

b. Different types of bonds in brick masonry

c. Different types of staircases – Dog legged, Open well

d. Lintel and chajja

e. RCC slabs and beams

f. Cross section of a pavement

g. Septic Tank and sedimentation Tank

h. Layout plan of Rainwater recharging and harvesting system

i. Cross sectional details of a road for a Residential area with provision for all services

j. Steel truss (connections Bolted)

*Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing*

12 Hours  L2, L3, L4, L5, L6

### Module-3

**Building Drawings:** Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services *using CAD software for:*
1. Single and Double story residential building
2. Hostel building
3. Hospital building
4. School building
5. Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

Note:
- *Students should sketch to dimension the above in a sketch book before doing the computer drawing*
- *One compulsory field visit/exercise to be carried out.*
- *Single line diagrams to be given in the examination*

Course outcomes: After studying this course, students will be able to
1. Gain a broad understanding of planning and designing of buildings
2. Prepare, read and interpret the drawings in a professional set up.
3. Know the procedures of submission of drawings and Develop working and submission drawings for building
4. Plan and design a residential or public building as per the given requirements

Question paper pattern:
- There will be two full questions with sub divisions if necessary from Module 2 with each full question carrying **thirty** marks. Students have to answer one question.
- There will be two full questions from Module 3 with each full question carrying **fifty** marks. Students have to answer one question.
- The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It’s a drawing paper but the exam will be conducted by batches in the computer labs. question papers should be given in batches

Text Books:

Reference Books:
1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
2. IS: 962-1989 (Code of practice for architectural and building drawing)
TITLE OF THE COURSE: AIR POLLUTION AND CONTROL  
B.E., V Semester, Civil Engineering  
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIE Marks</th>
<th>SEE Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>17CV551</td>
<td>40</td>
<td>60</td>
<td>03</td>
</tr>
</tbody>
</table>

Number of Lecture Hours/Week: 03
Total Number of Lecture Hours: 40 (8 Hours per Module)

Credits – 03

Course Objectives: This course will enable students to
1. Study the sources and effects of air pollution
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models
4. Illustrate particular and gaseous pollution control methods.

Module-1

Module-2
Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models-Gaussian dispersion model

Module-3
Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3)

Module-4
Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP.

Module-5
Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards. Environmental issues, global episodes, laws, acts, protocols

Course outcomes: After studying this course, students will be able to:
1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertained and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Text Books:
**Reference Books:**

1. Noel De Nevers, “Air Pollution Control Engineering”, Waveland Pr Inc.
TITLE OF THE COURSE: RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17 CV552</th>
<th>CIE Marks</th>
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<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>SEE Marks</td>
<td>60</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40 (8 Hours per Module)</td>
<td>Exam Hours</td>
<td>03</td>
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</tbody>
</table>

Credits – 03

Course Objectives: This course will enable students to
1. Understand the history and development, role of railways, railway planning and development based on essential criteria’s.
2. Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction
3. Understand various aspects of geometric elements, points and crossings, significance of maintenance of tracks.
4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
5. Apply design features of tunnels, harbours, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

Module-1

Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.

L1,L2

Module-2


L1,L2,L3

Module-3

Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

L2,L3,L4

Module-4

Airport Planning: Air transport characteristics, airport classification, airport planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.
### Module-5

**Airport Design:** Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

**Course outcomes:** After studying this course, students will be able to:
1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.

**Text Books:**
3. Khanna S K, Arora M G and Jain S S, “Airport Planning and Design”, Nemchand and Brothers, Roorkee,

**Reference Books:**
Course Code: 17 CV553
CIE Marks: 40
Number of Lecture Hours/Week: 03
SEE Marks: 60
Total Number of Lecture Hours: 40 (8 Hours per Module)
Exam Hours: 03
Credits – 03

Course Objectives:
1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load systems.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

Module-1


Module-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 Considerations: Effective height of walls 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, wall with pillars.

Module-3

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

Module-4

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

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

**Design of Laterally and transversely loaded walls:** Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs. In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

**L2, L3, L4, L5**

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

1. Explain engineering properties and uses of masonry units, defects and crack in masonry and its remedial measures.
2. Summarize various formulae’s for finding compressive strength of masonry units.
3. Explain permissible stresses and design criteria as per IS: 1905 and SP-20.
4. Design different types of masonry walls for different load considerations.

### Text Books:


### Reference Books:

TITLE OF THE COURSE: THEORY OF ELASTICITY
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17CV554</th>
<th>CIE Marks</th>
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</thead>
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<tr>
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<td>SEE Marks</td>
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<tr>
<td>Total Number of Lecture Hours</td>
<td>40 (8 Hours per Module)</td>
<td>Exam Hours</td>
<td>03</td>
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<tr>
<td>Credits-03</td>
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</table>

Course Objectives: This course will enable students to

1. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials into more general, two and three-dimensional problems.

2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.

3. Introduction to the stress – strain relationship, basic principles and mathematical expressions involved in continuum mechanics. also solution of problems in 2-dimensional linear elasticity

Module-1

Concepts of continuum, Stress at a point, Components of stress, Differential equations of equilibrium, Stress transformation, Principal stresses, Maximum shear stress, Stress invariants.

Strain at a point, Infinitesimal strain, Strain-displacement relations, Components of strain, Compatibility Equations, Strain transformation, Principal strains, Strain invariants, Measurement of surface strains, strain rosettes

L1,L2,L3

Module-2

Generalized Hooke’s Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant’s principle, Principle of superposition, Uniqueness theorem, Airy’s stress function, Stress polynomials (Two Dimensional cases only).

L1,L2,L3

Module-3

Two-dimensional problems in rectangular coordinates, bending of a cantilever beam subjected to concentrated load at free end, effect of shear deformation in beams, Simply supported beam subjected to Uniformly distributed load.
Two-dimensional problems in polar coordinates, strain-displacement relations, equations of equilibrium, compatibility equation, stress function.

**Module-4**

Axisymmetric stress distribution - Rotating discs, Lame’s equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

**Module-5**

Torsion: Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections

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

1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum  
2. Ability to formulate boundary value problems; and calculate stresses and strains  
3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints;  
4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

**Text Books:**


**Reference Books:**

TITLE OF THE COURSE: TRAFFIC ENGINEERING
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17 CV561</th>
<th>CIE Marks</th>
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<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>SEE Marks</td>
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<tr>
<td>Total Number of Lecture Hours</td>
<td>40 (8 Hours per Module)</td>
<td>Exam Hours</td>
<td>03</td>
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</table>

Credits – 03

Course Objectives: This course will enable students to
1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analysing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
4. Understand and analyse traffic issues including safety, planning, design, operation and control.
5. Apply intelligent transport system and its applications in the present traffic scenario.

Module-1


Module-2

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and significance.

Module-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

Module-4

Traffic Safety and Environment: Road accidents, Causes, effect, 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.

Module-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, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

**Course outcomes:** After studying this course, students will be able to:
1. Understand the human factors and vehicular factors in traffic engineering design.
2. Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
3. Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
4. Understand the basic knowledge of Intelligent Transportation System.

**Text Books:**
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management

**Reference Books:**
2. Garber and Hoel, “Principles of Traffic and Highway Engineering”, CENGAGE Learning, New Delhi, 2010
TITLE OF THE COURSE: SUSTAINABILITY CONCEPTS IN ENGINEERING
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code 17 CV562 CIE Marks 40
Number of Lecture Hours/Week 03 SEE Marks 60
Total Number of Lecture Hours 40 (8 Hours per Module) Exam Hours 03
Credits – 03

Course Objectives: This course will enable students to
1. Learn about the principles, indicators and general concept of sustainability.
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
3. Student shall be able to apply the sustainability concepts in engineering
4. Know built environment frameworks and their use
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

Module-1

Introduction: Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act

Module-2

Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon footprint Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking

Module-3

Sustainable Design: Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

Module-4


Module-5

Green Engineering: Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis
**Course outcomes:** After studying this course, students will be able to:

1. Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.
2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.
4. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.

**Text Books:**

2. Bradley, A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning

**Reference Books:**

1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers
TITLE OF THE COURSE: REMOTE SENSING AND GIS
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code 17CV563 CIE Marks 40
Number of Lecture Hours/Week 03 SEE Marks 60
Total Number of Lecture Hours 40 (8 Hours per Module) Exam Hours 03
Credits – 03

Course Objectives: This course will enable students to
1. Understand the basic concepts of remote sensing.
2. Analyze satellite imagery and extract the required units.
3. Extract the GIS data and prepare the thematic maps.
4. Use the thematic maps for various applications.

Module-1

Module-2

Module-3

Module-4
Data Models: Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion.

Module-5
Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based
<table>
<thead>
<tr>
<th><strong>Services And Its Applications.</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Course outcomes:</strong> After studying this course, students will be able to:</td>
</tr>
<tr>
<td>1. Collect data and delineate various elements from the satellite imagery using their spectral signature.</td>
</tr>
<tr>
<td>2. Analyze different features of ground information to create raster or vector data.</td>
</tr>
<tr>
<td>3. Perform digital classification and create different thematic maps for solving specific problems</td>
</tr>
<tr>
<td>4. Make decision based on the GIS analysis on thematic maps.</td>
</tr>
<tr>
<td><strong>Text Books:</strong></td>
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<tr>
<td><strong>Reference Books:</strong></td>
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</table>
TITLE OF THE COURSE: OCCUPATIONAL HEALTH AND SAFETY  
B.E., V Semester, Civil Engineering  
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>17CV564</th>
<th>CIE Marks</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>SEE Marks</td>
<td>60</td>
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<tr>
<td>Total Number of Lecture Hours</td>
<td>40 (8 Hours per Module)</td>
<td>Exam Hours</td>
<td>03</td>
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</tbody>
</table>

Credits – 03

Course Objectives: This course will enable students to
1. Gain an historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Module-1

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation

L1,L2,L3

Module-2


L2,L3,L4,L5

Module-3


L2,L3,L4,L5

Module-4

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability

L2,L3,L4,L5

Module-5

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors

L3,L4,L5,L6
**Course outcomes:** After studying this course, students will be able to:

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

**Text Books:**

3. “Industrial Safety and Pollution Control Handbook

**Reference Books:**

TITLE OF THE COURSE: GEOTECHNICAL ENGINEERING LAB

B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code 17CVL57  CIE Marks 40
Number of Lecture Hours/Week 03=(1 Hour Instruction + 2 Hours Laboratory)  SEE Marks 60
Total Number of Hours 40  Exam Hours 03

RBT LEVEL L1,L2
Credits – 02

Course Objectives: This course will enable students to;
1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

Modules


2. Grain size analysis
   i. Sieve analysis
   ii. Hydrometer analysis

3. In-situ density tests
   i. Core-cutter method
   ii. Sand replacement method

4. Consistency limits
   i. Liquid limit test (by Casagrande’s and cone penetration method)
   ii. Plastic limit test
   iii. Shrinkage limit test

5. Standard compaction test (light and heavy compaction)

6. Co-efficient of permeability test
   i. Constant head test
   ii. Variable head test

7. Shear strength tests
   i. Unconfined compression test
   ii. Direct shear test
   iii. Triaxial test (undrained unconsolidated)

8. Consolidation test : Determination of compression index and co-efficient of consolidation

9. Laboratory vane shear test

10. Demonstration of Swell pressure test, Standard penetration test and boring equipment

Course outcomes: Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine
1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shear strength and consolidation parameters to assess strength and deformation characteristics
5. In-situ shear strength characteristics (SPT- Demonstration)

Question paper pattern:
All experiments are to be included in the examination except demonstration exercises.

Candidate to perform experiment assigned to him

Marks are to be allotted as per the split up of marks shown on the cover page of answer script

**Reference Books:**

TITLE OF THE COURSE: CONCRETE AND HIGHWAY MATERIALS LABORATORY
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
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<th>Course Code</th>
<th>17CVL58</th>
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<tr>
<td>Number of Lecture Hours/Week</td>
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<td>Total Number of Hours</td>
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<td>Exam Hours</td>
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<td>RBT Levels</td>
<td>L1, L2, L3,</td>
<td>Credits – 02</td>
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</tbody>
</table>

Course objectives: This course will enable students
1. To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

Modules

Part A: Concrete Lab

1. Tests on Cement:
   a. Normal Consistency
   b. setting time
   c. compressive strength
   d. fineness by air permeability test
   e. specific gravity

2. Tests on Concrete:
   a. Design of concrete mix as per IS-10262
   b. Tests on fresh concrete:
      i. slump,
      ii. compaction factor and
      iii. Vee Bee test
   c. Tests on hardened concrete:
      i. compressive strength test,
      ii. split tensile strength test,
      iii. flexural strength test
   d. NDT tests by rebound hammer and pulse velocity test.

3. Tests on Self Compacting Concrete:
   a. Design of self compacting concrete,
   b. slump flow test,
   c. V-funnel test,
   d. J-Ring test,
   e. U Box test and
   f. L Box test

Part B: Highway materials Lab

1. Tests on Aggregates
   a. Aggregate Crushing value
   b. Los Angeles abrasion test
   c. Aggregate impact test
   d. Aggregate shape tests (combined index and angularity number)

2. Tests on Bituminous Materials
   a. Penetration test
   b. Ductility test
   c. Softening point test
   d. Specific gravity test
   e. Viscosity test by tar viscometer
   f. Bituminous Mix Design by Marshall Method (Demonstration only)
### Course outcomes:
During this course, students will develop expertise in:
1. Conduct appropriate laboratory experiments and interpret the results
2. Determine the quality and suitability of cement
3. Design appropriate concrete mix
4. Determine strength and quality of concrete
5. Test the road aggregates and bitumen for their suitability as road material.
6. Test the soil for its suitability as sub grade soil for pavements.

### Question paper pattern:
- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

### Reference Books:
5. Relevant BIS codes.
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

6th Semester
**Course Title:** CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP  
*As per Choice Based Credit System (CBCS) scheme*

**SEMESTER: VI**

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

**Module - 1**

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

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

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

**Module - 2**

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

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

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

**Module - 3**

**Construction Quality, safety and Human Values:**
Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management

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

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

**Module - 4**

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

**Interest and time value of money:** concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.
**Comparison of alternatives**: Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis  

**Module -5**

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

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

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

**Course Outcomes**: After studying this course, students will be able to:
1. Understand the construction management process.
2. Understand and solve variety of issues that are encountered by every professional in discharging professional duties.
3. Fulfill the professional obligations effectively with global outlook

**Program Objectives**:
- Engineering knowledge
- Problem analysis
- Interpretation of data

**Text Books**:
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:

**Reference Books**:
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “Modern Construction Management”, Wiley-Blackwell
7. S.C Sharma –“Construction Equipments and its management” – Khanna publishers
Course Title: DESIGN OF STEEL STRUCTURAL ELEMENTS  
As per Choice Based Credit System (CBCS) scheme  
SEMESTER: VI

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Course Objectives: This course will enable students to
1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Module - 1

Module - 2
Bolted Connections: Introduction, Types of Bolts, Behaviour of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)
Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member, Advantages and Disadvantages of Bolted and Welded Connections.

Module - 3
Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

Module - 4
Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.
Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

Module - 5
Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems]

Course Outcomes: After studying this course, students will be able to:
1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

**Program Objectives:**
- Engineering knowledge
- Problem analysis
- Interpretation of data

**Question Paper Pattern:**
- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

**Text Books:**

**Reference Books:**
**Course Title: HIGHWAY ENGINEERING**

As per Choice Based Credit System (CBCS) scheme

**SEMESTER: VI**

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**Total Number of Lecture Hours**: 50

**Credits**: 04

**Total Marks**: 100

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

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

**Module -1**

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

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

**Module -2**

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

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

**Module -3**

**Pavement Materials**: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates-Desirable properties and tests, Bituminous materials-Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material

**Pavement Design**: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples

**Module -4**

**Pavement Construction**: Design of soil aggregate mixes by Rothfuch’s method. Uses and properties of bituminous mixes and cement concrete in pavement construction.

Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads
## Module -5

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

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

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

## Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

## Text Books:

## Reference Books:
1. Relevant IRC Codes
Course Title: WATER SUPPLY AND TREATMENT ENGINEERING
As per Choice Based Credit System (CBCS) scheme

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**Course objectives:** This course will enable students to
1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

**Module -1**
Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting per capita demand, Variations in demand of water, Peak factor, Design period and factors governing design period.
Different methods of population forecasting -with merits and demerits. Numerical Problems. L1,L2,L3

**Module -2**
Water Treatment: Objectives, Treatment flow chart – significance of each unit
Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling - Objectives, methods, Preservation techniques.
Water quality characteristics: Physical, Chemical and Microbiological. L1,L2,L3

**Module -3**

**Module -4**
Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration: Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nano filtration membranes and elements, Conventional pre treatment techniques for RO and nano filtration.
Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation. L1,L2,L3

**Module -5**
Collection and Conveyance of water: Intake structures - types of intakes -Factors to be considered in selection of intake structures.
Pipes: Design of the economical diameter for the rising main; Numerical Problems.
Pipe appurtenances, Valves, Fire hydrants
Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material.
Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination.
Visit to Intake structure, Water treatment plant and report working of each unit
Design of water treatment plant units and distribution system with population forecasting for the given city

<table>
<thead>
<tr>
<th>Course Outcomes: After studying this course, students will be able to:</th>
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<tbody>
<tr>
<td>1. Estimate average and peak water demand for a community.</td>
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<td>2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.</td>
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<td>3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.</td>
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<td>4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.</td>
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<th>Program Objectives:</th>
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<td>• Engineering knowledge</td>
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<td>• Problem analysis</td>
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<td>• Interpretation of data</td>
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Course Title: SOLID WASTE MANAGEMENT
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VI

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CREDITS –03
Total Marks- 100

Course objectives: This course will enable students to
1. Study the present methods of solid waste management system and to analyze their drawbacks comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Module -1
Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.
Collection: Collection of solid waste- services and systems, equipments,

Module -2
Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

Module -3
Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems.
Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems

Module -4
Sources, collection, treatment and disposal of : Biomedical waste, E-waste, Hazardous waste and construction waste

Module -5
Incineration -3Ts factor affecting incineration, types of incinerations, Pyrolysis, design criteria for incineration
Energy recovery technique from solid waste management

Course outcomes: After studying this course, students will be able to:
1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
4. Design suitable processing system and evaluate disposal sites.

Program Objectives:
• Engineering knowledge
• Problem analysis
• Interpretation of data

Text Books:
1. George Tchobanoglous, Hilary Theisen, Samuel A Vigil, “Integrated Solid Waste
Management: Engineering principles and management issues, M/c Graw hill Education. Indian edition


**Reference Books:**


### Course Title: MATRIX METHOD OF STRUCTURAL ANALYSIS

As per Choice Based Credit System (CBCS) scheme

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**CREDITS –03**

### Course objectives:

This course will enable students to
1. Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.
2. Understand flexibility and stiffness matrices to solve problems in beams, frames and trusses.
3. Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses.
4. Gain knowledge of solving problems involving temperature changes and lack of fit.

#### Module -1

**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 and stiffness matrices of beam and truss elements

L2, L4, L5

#### Module -2

**Element Flexibility Method:** Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.

L2, L4, L5

#### Module -3

**Element Stiffness Method:** Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

L2, L4, L5

#### Module -4

**Effects of Temperature Changes and Lack of Fit:** Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.

L2, L4, L5

#### Module -5

**Direct Stiffness Method:** Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses

L2, L4, L5

### Course Outcomes:

After studying this course, students will be able to:
1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.

### Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

### Text Books:

**Reference Books:**

Course Title: ALTERNATIVE BUILDING MATERIALS  
As per Choice Based Credit System (CBCS) scheme]  

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CREDITS –03  
Total Marks- 100

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

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

**Module -1**

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

**Module -2**

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

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

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

**Module -3**


**Module -4**

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

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

**Module -5**
**Course Outcomes:** After studying this course, students will be able to:

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

**Program Objectives:**

- Engineering knowledge
- Problem analysis
- Interpretation of data

**Text Books:**


**Reference Books:**

1. RJS Spence and DJ Cook, “Building Materials in Developing Countries”, Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.
**Course Title:** GROUND IMPROVEMENT TECHNIQUES  
**As per Choice Based Credit System (CBCS) scheme**  
**SEMESTER: VI**

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**CREDITS –03**

**Total Marks- 100**

**Course objectives:** This course will enable students to
1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosynthetics, vibration, grouting and Injection.

**Module -1**

**Formation and Development of Ground:** Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits; Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes.

**Compaction:** Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.

**Module -2**

**Drainage Methods:** Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.

**Pre-compression and Vertical Drains:** Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading

**Module -3**


**Chemical Modification-II:** Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

**Module -4**

**Vibration Methods:** Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibroflotation, sand compaction piles, stone columns, heavy tamping

**GROUTING AND INJECTION:** Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting

**Module -5**

Course Outcomes: After studying this course, students will be able to:
1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. Utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

Reference Books:
**Course Title:** WATER RESOURCES MANAGEMENT  
* [As per Choice Based Credit System (CBCS) scheme]  
**SEMESTER:** VI

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**Course objectives:** This course will enable students to:  
1. Judge surface and ground water resources.  
2. Address the issues of water resources management.  
3. Learn the principles of integrated water resources management.  
4. Understand the legal framework of water policy.  
5. Know the different methods of water harvesting.

**Module -1**  
**Surface and Ground water Resources:** Hydrologic Cycle, Global water resources and Indian Water resources, Surface Water Resources, Water Balance, Available Renewable Water Resources, Water Scarcity, The Water Balance as a Result of Human Interference, Groundwater Resources, Types of Aquifers, Groundwater as a Storage Medium  
L2, L3

**Module -2**  
**Water Resources Planning and Management:** Necessity, System components, planning scales, Approaches, planning and management aspects, Analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues.  
L2, L3

**Module -3**  
**Integrated Water Resources Management:** Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types and Forms of Private Sector Involvement.  
L3, L4

**Module -4**  
L2, L3

**Module -5**  
L2, L3

**Course outcomes:** After studying this course, students will be able to:  
1. Assess the potential of groundwater and surface water resources.  
2. Address the issues related to planning and management of water resources.  
3. Know how to implement IWRM in different regions.
4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

### Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

### Text Books:

### Reference Books:
Course Title: ENVIRONMENTAL PROTECTION AND MANAGEMENT
As per Choice Based Credit System (CBCS) scheme

Semester: VI

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Credits - 03

Total Marks - 100

Course objectives: This course will enable students to gain knowledge in Environmental protection and Management systems

Module - 1 Environmental Management Standards

Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management
Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption - Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship
Environmental Management Principles
National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.

L1, L2, L3

Module - 2 Environmental Management Objectives

Environmental quality objectives - Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking, Pollution control Vs Pollution Prevention - Opportunities and Barriers - Cleaner production and Clean technology, closing the loops, zero discharge technologies

L1, L2, L3

Module - 3 Environmental Management System

EMAS, ISO 14000 - EMS as per ISO 14001 - benefits and barriers of EMS - Concept of continual improvement and pollution prevention - environmental policy - initial environmental review - environmental aspect and impact analysis - legal and other requirements - objectives and targets - environmental management programs - structure and responsibility - training awareness and competence - communication - documentation and document control - operational control - monitoring and measurement - management review.

L1, L2, L3

Module - 4 Environmental Audit

Environmental management system audits as per ISO 19011 - Roles and qualifications of auditors - Environmental performance indicators and their evaluation - Non conformance - Corrective and preventive actions - compliance audits - waste audits and waste minimization planning - Environmental statement (form V) - Due diligence audit

L1, L2, L3

Module - 5 Applications

Applications of EMS, Waste Audits and Pollution Prevention opportunities in Textile, Sugar, Pulp & Paper, Electroplating, Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes.

L1, L2, L3

Course outcomes: After studying this course, students will be able to:
1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards
2. Lead pollution prevention assessment team and implement waste minimization options
3. Develop, Implement, maintain and Audit Environmental Management systems for Organisations

L1, L2, L3
<table>
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<th>Program Objectives:</th>
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<tbody>
<tr>
<td>• Engineering knowledge</td>
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<td>• Problem analysis</td>
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<td>• Interpretation of data</td>
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<table>
<thead>
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Course Title: NUMERICAL METHODS AND APPLICATIONS  
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VI

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CREDITS – 03  
Total Marks - 100

Course objectives: This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

Module - 1


Module - 2

Interpolation and Approximation: Interpolation with unequal intervals - Lagrange’s interpolation – Newton’s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton’s forward and backward difference formulae.

Module - 3


Module - 4


Module - 5

Boundary Value Problems in Ordinary and Partial Differential Equations: Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

Course Outcomes: After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from Industry, management and other engineering fields.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

Reference Books:
### Course Title: FINITE ELEMENT METHOD

**As per Choice Based Credit System (CBCS) scheme**

**SEMESTER: VI**

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**Total Number of Lecture Hours**: 40

**Total Marks**: 100

### Course objectives:
This course will enable students to:
1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

### Module -1
Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions

### Module -2
Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity, one dimensional formulations; beam and truss with numerical examples

### Module -3
2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisymmetric Element

### Module -4
Isoparametric concepts; isoparametric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoparametric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems

### Module -5
Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques. Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

### Course outcomes:
The student will have the knowledge on advanced methods of analysis of structures

### Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

### Text Books:

### Reference Books:
2. Bathe K J - “Finite Element Procedures in Engineering analysis” - Prentice Hall
Course Title: SOFTWARE APPLICATION LAB  
As per Choice Based Credit System (CBCS) scheme

<table>
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CREDITS –02  
Total Marks- 100

Course objectives: This course will enable students to
1. Use industry standard software in a professional set up.
2. understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design
3. Develop customized automation tools

Module -1

Use of civil engineering softwares:
Use of softwares for:
- Analysis of plane trusses, continuous beams, portal frames
- 3D analysis of multistoried frame structures

Module -2

1. Project Management- Exercise on Project planning and scheduling of a building project using any project management software:
   a. Understanding basic features of Project management software
   b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.
   c. Identification of Predecessor and Successor activities with constrain
   d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non Critical paths, Project duration, Floats.
   e. Study on various View options available
   f. Basic understanding about Resource Creation and allocation
   g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project
   (9hrs)

1. GIS applications using open source software:
   a. To create shape files for point, line and polygon features with a map as reference.
   b. To create decision maps for specific purpose. (3hrs)

Module -3

Use of EXCEL spread sheets:
Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation

Course Outcomes: After studying this course, students will be able to:
use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:
- The question paper will have 3 modules comprising of 6 questions.
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- Module-1: 40 Marks, Module-2: 20 Marks, Module-3: 20 Marks
The students shall answer three full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Reference Books: Training manuals and User manuals and Relevant course reference books
Course Title: EXTENSIVE SURVEY PROJECT /CAMP
As per Choice Based Credit System (CBCS) scheme]

SEMESTER: VI

Subject Code 17CVL68  IA Marks 40
Number of Practice Hours/Week 04  Exam Marks 60
Total Number of Practice Hours 50  Exam Hours 03

CREDITS –02  Total Marks- 100

Course objectives: This course will enable students to
1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. Use of Total Station is compulsory for minimum of TWO projects.
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

1. NEW TANK PROJECTS: The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design and preparation of drawing with report.

2. WATER SUPPLY AND SANITARY PROJECT: The work shall consist of;
   a. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   b. Preparation of village map by using total station.
   c. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   d. Design of all elements and preparation of drawing with report.

3. HIGHWAY PROJECT: The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
   c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
   d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.
### 4. **RESTORATION OF AN EXISTING TANK:**
The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.

c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement

d. Design of all elements and preparation of drawing with report.

### 5. **TOWN/HOUSING / LAYOUT PLANNING:**
The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Detailed survey required for project execution like contour surveys

c. Preparation of layout plans as per regulations

e. Centerline marking-transfer of centre lines from plan to ground

f. Design of all elements and preparation of drawing with report as per regulations

---

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

1. Apply Surveying knowledge and tools effectively for the projects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
4. Professional etiquettes at workplace, meeting and general
5. Establishing trust based relationships in teams & organizational environment
6. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques

**Program Objectives:**
- Engineering knowledge
- Problem analysis
- Interpretation of data

**Reference Books:**
Training manuals and User manuals
Relevant course reference books
7th Semester
Course Title: MUNICIPAL AND INDUSTRIAL WASTE WATER ENGINEERING

As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

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<td>CREDITS –04</td>
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Course objectives: This course will enable students to;

4. Understand sewerage network and influencing parameters.
5. Understand and design different unit operations involved in conventional and biological treatment process.
6. Apply the principles of Industrial effluent treatment process for different industrial wastes.
7. Evaluate self purification of streams depending on hydraulic and organic loading of sewage into receiving waters.

Module - 1

Introduction, need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm flow, time of concentration flow, material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers. low-cost waste treatment; oxidation pond, septic tank, Sewer appurtenances, manholes, catch basins, basic principles of house drainage, typical layout plan showing house drainage connections,

Module -2

Design of sewers, hydraulic formula for velocity, effects of variation on velocity, regime velocity, design of hydraulic elements for circular sewers for full flow and partial flow conditions, disposal of effluents by dilution, self purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents, Streeter-Phelps equation

Module -3

Waste water characteristics, sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water treatment, unit operations; screens, grit chambers, skimming tanks, equalization tanks

Suspended growth and fixed film bio process, design of trickling filters, activated sludge process, sequential batch reactors, moving bed bio reactors, sludge digesters,

Module -4
Difference between domestic and industrial waste water, effect of effluent discharge on streams, methods of industrial waste water treatment; volume reduction, strength reduction, neutralization, equalisation and proportioning. Removal of organic, inorganic and colloidal solids, combined treatment methods; merits, demerits and feasibility, principles of discharge of raw, partially treated and completely treated wastes into streams

Module -5

Process flow chart, sources and characteristics of industrial waste water, treatment methods, reuse and recovery and disposal; cotton and textile industry, tanning industry, cane sugar and distilleries, dairy industry, steel and cement industry, paper and pulp industry, pharmaceutical and food processing industry.

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

4. Acquires capability to design sewer and Sewerage treatment plant.
5. Evaluate degree of treatment and type of treatment for disposal, reuse and recycle.
6. Identify waste streams and design the industrial waste water treatment plant.
7. Manage sewage and industrial effluent issues.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:


Reference Books:

Course Title: DESIGN OF RCC AND STEEL STRUCTURES

As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

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Course objectives: This course will enable students to

6. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
7. Identify, formulate and solve engineering problems in RC and Steel Structures
8. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
9. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
10. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module - 1

Footings: Design of rectangular slab type combined footing.

Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.

Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. As per IS: 3370 (Part IV)

Design of portal frames with fixed and hinged based supports.

L1,L2,L3

Module -2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given.

Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks

Gantry Girder: Design of gantry girder with all necessary checks

L1,L2,L3

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

6. Students will acquire the basic knowledge in design of RCC and Steel Structures.
7. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.
### Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

### Question Paper Pattern:

- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
- One full question should be answered from each module.
- Each question carries 40 marks.

3. Code books – IS 456, IS 800, IS 3370 (Part IV), SP (6) – Steel Tables, shall be referred for designing

4. The above charts shall be provided during examinations

### Text Books:


### Reference Books:

Course Title: HYDROLOGY AND IRRIGATION ENGINEERING
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: VII

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

Module -1

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

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

L2, L3

Module -2

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

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

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

L2, L3

Module -3

**Runoff:** Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.
**Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations

Module -4

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

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

Module -5

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

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

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

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.
4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:


Reference Books:

5. Garg S.K, “Irrigation Engineering and Hydraulic Structures” Khanna publications,
New Delhi.
Course Title: DESIGN OF BRIDGES
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

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Number of Lecture Hours/Week: 03
Total Number of Lecture Hours: 40

CREDITS -03
Total Marks- 100

Course objectives: This course will enable students to understand the analysis and design of concrete Bridges.

Module -1
Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth
Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

L1, L2

Module -2
Design of Slab Bridges: Straight and skew slab bridges

L2, L3

Module -3
Design of T beam bridges (up to three girder only)
Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load BM & SF using IRC Class AA Tracked vehicle. Structural design of main girder.

L2, L3, L4

Module -4
Other Bridges:
Design of Box culvert (Single vent only)
Design of Pipe culverts

L2, L3, L4
## Module -5

**Substructures - Design of Piers and abutments,**

Introduction to Bridge bearings, Hinges and Expansion joints.(No design)

**L2,L3,L4**

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

- Understand the load distribution and IRC standards.
- Design the slab and T beam bridges.
- Design Box culvert, pipe culvert
- Use bearings, hinges and expansion joints and
- Design Piers and abutments.

### Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

### Text Books:

3. T R Jagadeesh and M A Jayaram, “Design of bridge structures”, Prentice Hall of India

### Reference Books:

2. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
3. “Concrete Bridges”, The Concrete Association of India
Course Title: GROUND WATER & HYDRAULICS
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: VII

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Number of Lecture Hours/Week 03
Total Number of Lecture Hours 40

CREDITS – 03
Total Marks- 100

Course objectives: This course will enable students

- To characterize the properties of ground water and aquifers.
- To quantify the ground water flow.
- To locate occurrence of ground water and augment ground water resources.
- To synthesize ground water development methods.

Module -1

Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.

Module -2

Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy’s law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotopic, unisotropic layered soils, steady one dimensional flow: cases with recharge.

Module -3

Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test, Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow’s method, solution of unsteady flow equations, leaky aquifers (only introduction), interference of well, image well theory.

Module -4

Ground Water Exploration: Seismic method, electrical resistively method, Geophysical techniques, electrical logging, radioactive logging, induction logging, sonic and
Module -5

**Ground Water Development:** Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.

**Ground Water Recharge:** Artificial recharge, groundwater runoff

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

- Find the characteristics of aquifers.
- Estimate the quantity of ground water by various methods.
- Locate the zones of ground water resources.
- Select particular type of well and augment the ground water storage.

### Program Objectives:
3. Engineering knowledge
4. Problem analysis
5. Interpretation of data

### Text Books:

### Reference Books:
Course Title: DESIGN CONCEPT OF BUILDING SERVICES

As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>17CV743</th>
<th>IA Marks</th>
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<td>Exam Hours</td>
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</tr>
<tr>
<td>CREDITS –03</td>
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<td>Total Marks- 100</td>
<td></td>
</tr>
</tbody>
</table>

Course Objectives: This course will enable students to

1. learn the importance of sanitation, domestic water supply, plumbing and fire services
2. Understand the concepts of heat, ventilation and air conditioning
3. Develop technical and practical knowledge in Building Services.

Module -1

Water Supply, Drainage and Solid Waste Disposal:

Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps – quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit

Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers

Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods

Module -2

Heat Ventilation and Air Conditioning (HVAC):


Module -3

Electrical and Fire Fighting Services:

Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires,

Wiring systems and their choice, planning electrical wiring for building, Main and
distribution boards, Principles of illumination,

Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc.

Provisions of NBC.

**Module -4**

**Plumbing and Fire Fighting Layout of Simple Buildings:**

Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

**Module -5**

**Engineering Services:** engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems. Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,

**Building Maintenance:** Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

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

1. Describe the basics of house plumbing and waste water collection and disposal.
2. Discuss the safety and guidelines with respect to fire safety.
3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
4. Understand and implement the requirements of thermal comfort in buildings

**Reference Books:**
<table>
<thead>
<tr>
<th>Book Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Building Code</td>
<td></td>
</tr>
<tr>
<td>Charangith shah, Water supply and sanitary engineering, Galgotia publishers.</td>
<td></td>
</tr>
<tr>
<td>O.H. Koenigsberger, “Manual of Tropical Housing and Building”, Longman Group United Kingdom</td>
<td></td>
</tr>
<tr>
<td>V.K. Jain, Fire Safety In Building 2 edition, New Age International Publishers</td>
<td></td>
</tr>
<tr>
<td>E.G. Butcher, Smoke control in Fire-safety Design.</td>
<td></td>
</tr>
<tr>
<td>Handbook for Building Engineers in Metric systems, NBC, New Delhi</td>
<td></td>
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</table>
**Course Title:** STRUCTURAL DYNAMICS  
**As per Choice Based Credit System (CBCS) scheme**

**SEMESTER: VII**

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<td><strong>Total Marks- 100</strong></td>
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</tbody>
</table>

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

1. Understand the behaviour of structure especially building to various dynamic loads: such as wind, earthquake, machine vibration and ambient vibration
2. Basic understanding of structural analysis and knowledge of engineering mathematics.

**Module -1**

Introduction: Introduction to structural dynamics, brief history of vibration, Basic definitions, vibration of SDOF (Single Degree of Freedom) systems, undamped, Damped, Free vibrations, equivalent viscous damping, Logarithmic decrement  

**Module -2**

Forced vibrations of SDOF system, Response of undamped and damped system subjected to harmonic loading, response to SDOF subject to harmonic base excitation, Duhamel's integral, response to general system of loading, dynamic load factor, response spectrum.

**Module -3**

Free vibration of MDOF (Multi Degree Freedom System), Natural frequencies, Normal modes, Orthogonality of normal modes, Eigen Values Shear buildings modeled as MDOF systems. Free vibrations, Natural frequencies,

**Module -4**

Forced vibrations, Motion of shear buildings, Model Superposition Method, Response to shear buildings, Base motion, Harmonic fixed excitation.

Damped motion of shear buildings, Equations for damped shear buildings, uncoupled damped equations, Conditions for damping uncoupled.
### Module -5

Dynamic analysis of base stiffness matrices, Lumped mass and consistent mass formulation, Equations of motion.

<table>
<thead>
<tr>
<th>Course outcomes:</th>
<th>After studying this course, students will be able to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.</td>
</tr>
<tr>
<td>2.</td>
<td>Basic understanding of fundamental analysis methods for dynamic systems. Interpret dynamic analysis results for design, analysis and research purposes.</td>
</tr>
<tr>
<td>3.</td>
<td>Apply structural dynamics theory to earthquake analysis, response, and design of structures.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Engineering knowledge</td>
</tr>
<tr>
<td>2. Problem analysis</td>
</tr>
<tr>
<td>3. Interpretation of data</td>
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<table>
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<tr>
<th>Text Books:</th>
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<tbody>
<tr>
<td>Anil K Chopra, <em>Structural Dynamics</em>, PHI Publications</td>
</tr>
<tr>
<td>Vinod Husur, <em>Earth Quake resistant design of building structures</em>, WILE EASTERN India Publications</td>
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<table>
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<th>Reference Books:</th>
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<tbody>
<tr>
<td>Manik A Selvam, “Structural Dynamics”, Danpatra publications</td>
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</table>
Course Title: URBAN TRANSPORTATION AND PLANNING

As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
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<td>40</td>
<td>60</td>
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**Course Objectives:** This course will enable students to:

1. Understand and apply basic concepts and methods of urban transportation planning.
2. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
3. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
4. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

**Module -1**

*Urban transport planning:* Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

L1,L2,L3

**Module -2**


L1,L2,L3

**Module -3**


L3,L4

**Module -4**
**Trip Distribution:** Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above**

**Module -5**

**Traffic Assignment:** Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Introduction to land use planning models, land use and transportation interaction.

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

1. Design, conduct and administer surveys to provide the data required for transportation planning.
2. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
3. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
4. Adopt the steps that are necessary to complete a long-term transportation plan.

**Program Objectives:**

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

**Text Books:**


**Reference Books:**

Course Title: PREFABRICATED STRUCTURES

As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
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Course objectives: This course will enable students to

1. Understand modular construction, industrialised construction
2. Design prefabricated elements
3. Understand construction methods.

Module -1


L1,L2

Module -2

**Prefabricated Components:** Behaviour of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels

–Columns–Shear walls

L1,L2

Module -3

**Design Principles:** Disuniting of structures–Design of cross section based on efficiency of material used–Problems in design because of joint flexibility

–Allowance for joint deformation.

L2,L3

Module -4

**Joint In Structural Members:** Joints for different structural connections–Dimensions and detailing–Design of expansion joints

L1,L2,L3

Module -5

**Design For Abnormal Loads:** Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,–Importance of avoidance of progressive collapse.
**Course Outcomes:** After studying this course, students will be able to:

1. Use modular construction, industrialised construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

**Program Objectives:**

- Engineering knowledge
- Problem analysis
- Interpretation of data

**Text Books:**

- CBRI, Building materials and components, India, 1990

**Reference Books:**

- "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009
Course Title: REHABILITATION AND RETROFITTING OF STRUCTURES

As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
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<tr>
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</table>

Course Objectives: This course will enable students to;

- Investigate the cause of deterioration of concrete structures.
- Strategise different repair and rehabilitation of structures.
- Evaluate the performance of the materials for repair

Module -1

**General**: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

L1,L2

Module -2

**Damage Assessment**: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems

L1,L2

Module -3

**Influence on Serviceability and Durability**: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

L1,L2,L3

Module -4

**Maintenance and Retrofitting Techniques**: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building

L1,L2,L3

Module -5
**Materials for Repair and Retrofitting:** Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning

L1,L2,L3

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

1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different type of structures
3. Summarize the principles of repair and rehabilitation of structures
4. Recognize ideal material for different repair and retrofitting technique

**Program Objectives:**

- Engineering knowledge
- Problem analysis
- Interpretation of data

**Text Books:**


**Reference Books:**

1. R.T.Allen and S.C. Edwards, “Repair of Concrete Structures”-Blakie and Sons
Course Title: REINFORCED EARTH STRUCTURES
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
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CREDITS –03

Course Objectives: This course will enable students to;

1. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Module -1

Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven & non-woven, Raw materials – Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics

Properties and Tests on Materials Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties

L1,L2,L3

Module -2

Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems

Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken

L1,L2,L3,L4

Module -3

Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.
Module -4

Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes

L2,L3,L4

Module -5

GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS: Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability (No Numerical Problems)

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems)

L2,L3,L4

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

1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;
2. understand the laboratory testing concepts of Geosynthetics
3. design RE retaining structures and Soil Nailing concepts
4. Determine the load carrying capacity of Foundations resting on RE soil bed.
5. asses the use of Geosynthetics in drainage requirements and landfill designs

Program Objectives:

• Engineering knowledge
• Problem analysis
• Interpretation of data

Text Books:


Reference Books:

Course Title: ENVIRONMENTAL ENGINEERING LABORATORY

As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

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Course objectives: This course will enable students,

1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

Revised Bloom’s Taxonomy (RBT) Level L1,L2,L3

<table>
<thead>
<tr>
<th>1. Determination of pH, Acidity and Alkalinity</th>
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<tr>
<td>2. Determination of Calcium, Magnesium and Total Hardness.</td>
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<tr>
<td>4. Determination of BOD.</td>
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<tr>
<td>5. Determination of Chlorides</td>
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<tr>
<td>6. Determination of percentage of available chlorine in bleaching powder,</td>
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<td>7. Determination of Residual Chlorine</td>
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<tr>
<td>8. Determination of Solids in Sewage:</td>
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<tr>
<td>I) Total Solids,</td>
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<td>II) Suspended Solids,</td>
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<td>III) Dissolved Solids,</td>
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<td>IV) Volatile Solids, Fixed Solids,</td>
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<td>V) Settle able Solids.</td>
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<tr>
<td>9. Determination of Turbidity by Nephelometer</td>
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<tr>
<td>11. Determination of sodium and potassium using flame photometer.</td>
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<tr>
<td>12. Determination Nitrates by spectrophotometer.</td>
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<tr>
<td>14. Determination of COD. (Demonstration)</td>
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<tr>
<td>15. Air Quality Monitoring (Ambient, stack monitoring , Indoor air pollution) (Demonstration)</td>
</tr>
<tr>
<td>16. Determination of Sound by Sound level meter at different location(Demonstration)</td>
</tr>
</tbody>
</table>

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

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

**Program Objectives:**

1. Evaluation of the test results and assesses the impact on water and waste water treatment.
2. Train student to undertake student project work in 8\textsuperscript{th} semester in the field of environmental engineering.

**Question paper pattern:**

1. Two experiments shall be asked from the above set
2. One experiment to be conducted and for the other student should write detailed procedure.

**Reference Books:**

Course Title: COMPUTER AIDED DETAILING OF STRUCTURES

As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
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<td>CREDITS –02</td>
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</table>

Course objectives: This course will enable students to
- Be aware of the Scale Factors, Sections of drawings,
- Draft the detailing of RC and Steel Structural member.

RBT LEVEL  

L1, L2, L3

Module -1 Detailing of RCC Structures

- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

Module -2 Detailing of Steel Structures

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Beams with Bolted and Welded
6. Gantry Girder

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

4. Prepare detailed working drawings

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 40 marks.

Text Books:

1. N Krishna Raju, “Structural Design and Drawing of Reinforced Concrete and Steel”, University Press

Reference Books:
1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards
2. IS 13920:2016, Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard
8th Semester
Course Title: QUANTITY SURVEYING AND CONTRACTS MANAGEMENT
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VIII

<table>
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Number of Lecture Hours/Week | 04 | Exam Hours | 03 |
Total Number of Lecture Hours | 50 |

CREDITS -04

Course objectives: This course will enable students to;
1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project
2. Understand and apply the concept of Valuation for Properties
3. Understand, Apply and Create the Tender and Contract document.

Module -1
Quantity Estimation for Building; study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised, Estimation of building - Short wall and long wall method - centre line method.
Estimate of R.C.C structures including Slab, beam, column, footings, with bar bending schedule.

Module -2
Estimate of Steel truss, manhole and septic tanks.
Quantity Estimation for Roads: Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling, Detailed estimate and cost analysis for roads.

Module -3
Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings,
Analysis of Rates: Factors Affecting Cost of Civil Works, Concept of Direct Cost, Indirect Cost and Project Cost
Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

Module -4
Law of Contract as per Indian Contract act 1872, Types of Contract, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub Contracting.
Contract Forms: FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC

Module -5
Contract Management-Post award: Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay’s and Compensation, Disputes & its resolution mechanism, Contract management and administration
Valuation: Definitions of terms used in valuation process, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land, building, facilities), freehold and lease hold, Sinking fund, depreciation—methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation,
valuation for mortgage, valuation of land.

**Course outcomes:** After studying this course, students will be able to:
1. Prepare detailed and abstract estimates for roads and building.
2. Prepare valuation reports of buildings.
3. Interpret Contract document’s of domestic and international construction works

**Program Objectives:**
- Engineering knowledge
- Problem analysis
- Interpretation of data

**Text Books:**
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi

**Reference Books:**
8. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka
9. FIDIC Contract forms
10. B.S. Ramaswamy “Contracts and their Management” 3ed, Lexis Nexis (a division of Reed Elsevier India Pvt Ltd)
# Course Title: DESIGN OF PRE STRESSED CONCRETE ELEMENTS

As per Choice Based Credit System (CBCS) scheme

<table>
<thead>
<tr>
<th>SEMESTER: VIII</th>
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<td>17CV82</td>
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<td>CREDITS –04</td>
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<td>Total Marks- 100</td>
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## Course objectives:
This course will enable students to learn Design of Pre Stressed Concrete Elements

## Module -1

**Introduction and Analysis of Members:** Concept of Prestressing - Types of Prestressing - Advantages - Limitations - Prestressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.
Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete - prestressed concrete - Force concept - Load balancing concept - Kern point - Pressure line.

## Module -2

**Losses in Prestress:** Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss. Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force - Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

## Module -3

**Design of Sections for Flexure:** Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1 members

## Module -4

**Design for Shear:** Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

## Module -5

**Composite Sections:** Types of composite construction - Analysis of composite sections - Deflection - Flexural and shear strength of composite sections.

## Course outcomes:
After studying this course, students will be able to:
- Understand the requirement of PSC members for present scenario.
- Analyse the stresses encountered in PSC element during transfer and at working.
- Understand the effectiveness of the design of PSC after studying losses.
- Capable of analyzing the PSC element and finding its efficiency.
- Design PSC beam for different requirements.
Course Title: EARTHQUAKE ENGINEERING
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

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<tr>
<th>Subject Code</th>
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CREDITS –03 Total Marks- 100

Course Objectives: This course will enable students to learn about
1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

Module -1

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake)

Module -2

Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

Module -3

Seismic Performance of Buildings and Over View of IS-1893 (Part-1): Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

Module -4


Module -5

Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings


Course outcomes: After studying this course, students will be able to:
1. Acquire basic knowledge of engineering seismology
2. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
3. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios
4. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
5. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry structures thorough exposure to different IS-codes of practices.

**Program Objectives:**
1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

**Text Books:**
- Pankaj Agarwal and Manish Shrikande, “Earthquake resistant design of structures”, PHI India.

**Reference Books:**
1. David Dowrick, “Earthquake resistant design and risk reduction”, John Wiley and Sons Ltd.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi
Course Title: HYDRAULIC STRUCTURES
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER: VIII

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CREDITS – 03

### Course objectives
This course will enable students to:
- Analyze and design gravity dams.
- Find the cross-section of earth dam and estimate the seepage loss.
- Design spillways and aprons for diversion works.
- Design CD works and choose appropriate canal regulation works.

#### Module -1
**Gravity Dams:** Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries.

L2, L3

#### Module -2
**Earth Dams:** Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande’s method. Estimation of seepage.

L2, L3

#### Module -3
**Spillways:** Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices.

**Diversion Head works:** Design of aprons- Bligh’s and Koshla’s theory, Simple Problems

L2, L3, L4

#### Module -4
**Cross Drainage Works:** Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.

L2, L3

#### Module -5
**Canal Regulation Works:** Introduction, Function of a regulator.

**Canal falls:** Necessity and types.

**Canal outlets:** Necessity and types.

L2, L3

### Course outcomes
After studying this course, students will be able to:
- Check the stability of gravity dams and design the dam.
- Estimate the quantity of seepage through earth dams.
- Design spillways and aprons for various diversion works.
- Select particular type of canal regulation work for canal network.

### Program Objectives:
1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

### Text Books:
**Reference Books:**

Course Title: PAVEMENT DESIGN
As per Choice Based Credit System (CBCS) scheme
SEMESTER: VIII

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

Module -1

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

Module -2

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

Module -3


Module -4

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

Module -5
**Rigid Pavement Failures, Maintenance and Evaluation:** Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of subgrade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints

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<tr>
<th>Course outcomes: After studying this course, students will be able to:</th>
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<tbody>
<tr>
<td>1. Systematically generate and compile required data’s for design of pavement (Highway &amp; Airfield).</td>
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<td>2. Analyze stress, strain and deflection by boussinesq’s, burmister’s and westergaard’s theory.</td>
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<td>4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.</td>
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<tr>
<th>Text Books:</th>
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<tbody>
<tr>
<td>2. L.R.Kadiyali and Dr.N.B.Lal, “Principles and Practices of Highway Engineering”, Khanna publishers</td>
</tr>
<tr>
<td>3. Yang H. Huang, “Pavement Analysis and Design”, University of Kentucky</td>
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<tbody>
<tr>
<td>2. Subha Rao, “Principles of Pavement Design”.</td>
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<td>4. Relevant recent IRC codes</td>
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</table>
**Course Title:** ADVANCED FOUNDATION DESIGN  
**As per Choice Based Credit System (CBCS) scheme**  
**SEMESTER:** VIII

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

1. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course (15CV53)
2. Develop profound understanding of shallow and deep foundation analyses
3. Develop understanding of choice of foundation design parameters
4. Learn about cause and effect of dynamic loads on foundation

**Module -1**

General bearing capacity equation – Terzaghi’s, Brinch Hansen’s and Mayerhof’s analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

**Module -2**

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure

**Module -3**

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

**Module -4**


**Module -5**


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

4. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
5. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles
6. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons
7. Understand basics of analysis and design principles of machine foundations
<table>
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<th><strong>Program Objectives:</strong></th>
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<td>- Engineering knowledge</td>
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Course Title: INTERNSHIP /PROFESSIONAL PRACTICE
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

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<tr>
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<tr>
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| Number of Lecture Hours/Week | Industry Oriented | Exam Marks | 50 |
|-----------------------------|-------------------|------------|
| Total Number of Lecture Hours | Industry Oriented | Exam Hours | 03 |

CREDITS –02

Course objectives: This course will enable students to get the field exposure and experience

Note: Internship /Professional Practice:

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organisations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.

2. The professional certification programs like ACCE[I]- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI’s RMCPCS Certification Programs, RMCMA-NRMCA’S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions.

3. The industry/organisation should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor’s name and duration of internship.

4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.

5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute.

6. The College shall facilitate and monitor the student internship program.

7. The internship should be completed during vacation after VI and VII semesters.