General Notes:

1. The teaching learning process should be as per the Choice Based Credit System

2. All Civil Engineering Departments should have a “CIVIL ENGINEERING MUSEUM” with collections related to civil engineering like models, charts, material samples, fixtures and fittings etc. which assist effective teaching learning process.

3. The teaching learning process may be planned to develop capabilities, competencies and skills required for career development based on course beginning and course end surveys.

4. Course objectives, course outcomes and program objectives given under each course are broad and indicative.

5. The course coordinator/teacher/instructors are informed to deliberate in the faculty meeting with module coordinator, program coordinator along with the stake holders to develop the respective course plans.

6. The department advisory board may make suitable changes to the course objectives, course outcomes and program objectives according to their finalized course plans.

7. The faculty should complement the teaching with case studies and field visits wherever required.

8. One faculty development program to be conducted to compliment teaching learning process by the department in a year
### Course Title: STRENGTH OF MATERIALS

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

**SEMESTER – III**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>I.A. Marks</th>
<th>Exam. Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam. Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV32</td>
<td>20</td>
<td>80</td>
<td>50</td>
<td>3</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1: Simple Stresses and Strain:</td>
<td>10 Hours</td>
<td>L2, L3</td>
</tr>
</tbody>
</table>

| Module -2: Compound Stresses: | 5 Hours | L2, L4 |
| 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. | 5 Hours | L2, L4 |

| Module-3: | | |

---
<table>
<thead>
<tr>
<th>Module 4: Bending and Shear Stresses in Beams</th>
<th>6 Hours</th>
<th>L2,L4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shear centre (only concept)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Column and Struts:</th>
<th>4 Hours</th>
<th>L2,L4</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module 5: Torsion in Circular Shaft:</th>
<th>7 Hours</th>
<th>L2,L4</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theories of Failure:</th>
<th>3 Hours</th>
<th>L1,L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>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).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**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.

**Program Objectives (as per NBA)**

- Engineering Knowledge.
- Problem Analysis.
- Interpretation of data.

**Question paper pattern:**

- The question paper will have Ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under 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: FLUIDS MECHANICS
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV33</td>
<td>20</td>
<td>04</td>
<td>80</td>
<td>50</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluids &amp; Their Properties:</td>
<td>5 Hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Fluid Pressure and Its Measurements:</td>
<td>5 Hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Module -2</td>
<td></td>
<td>Hours</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Hydrostatic forces on Surfaces:</td>
<td>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.</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module -3</th>
<th></th>
<th>Hours</th>
<th>Reference</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module -4</th>
<th></th>
<th>Hours</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>L2,L4</td>
</tr>
<tr>
<td>Module -5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td><strong>Flow through Pipes:</strong></td>
<td></td>
<td>7 Hours</td>
<td></td>
</tr>
<tr>
<td><strong>Surge Analysis in Pipes:</strong></td>
<td></td>
<td>3 Hours</td>
<td></td>
</tr>
<tr>
<td>Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems</td>
<td></td>
<td>L2,L4</td>
<td></td>
</tr>
</tbody>
</table>

**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

**Program Objectives (as per NBA)**

- Engineering Knowledge.
- Problem Analysis.
- Interpretation of data.

**Question paper pattern:**

- The question paper will have Ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum Three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under 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.
<table>
<thead>
<tr>
<th>Text Books:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
Course Title: BASIC SURVEYING

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

SEMESTER – III

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>15CV34</th>
<th>IA Marks</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>04</td>
<td>Exam Marks</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>50</td>
<td>Exam Hours</td>
<td>03</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>6 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>Introduction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition of surveying, Objectives and importance of surveying.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification of surveys. Principles of surveying.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement of Horizontal Distances:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring tape and types. Measurement using tapes, Taping on level ground and sloping ground. Errors and corrections in tape measurements, ranging of lines, direct and indirect methods of ranging, Electronic distance measurement, basic principle. Booking of tape survey work, Field book, entries, Conventional symbols, Obstacles in tape survey, Numerical problems.</td>
<td>4 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>Module -2</td>
<td>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</td>
<td>5 Hours</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Module -2</td>
<td>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</td>
<td>5 Hours</td>
</tr>
<tr>
<td>Module -3</td>
<td>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</td>
<td>5 Hours</td>
</tr>
<tr>
<td>Module -4</td>
<td>Leveling: 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>
<td>10 Hours</td>
</tr>
<tr>
<td>Module -5:</td>
<td>Areas and Volumes: 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-trapezoidal and prismoidal formula. Contouring Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.</td>
<td>8 Hours</td>
</tr>
<tr>
<td>Module -5:</td>
<td></td>
<td>2 Hours</td>
</tr>
</tbody>
</table>
### Course outcomes:
After a successful completion of the course, the student will be able to:

1. Posses a sound knowledge of fundamental principles Geodetics\[L1][PO1]
2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.\[L2][L3][PO3]
3. Capture geodetic data to process and perform analysis for survey problems \[L4][PO2]
4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours \[L4][PO2]

### Program Objectives (as per NBA)
- Engineering Knowledge.
  - Problem Analysis.
  - Interpretation of data.

### Question paper pattern:
- The question paper will have Ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum Three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under 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: ENGINEERING GEOLOGY

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

SEMESTER – III

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV35</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Lecture Hours</td>
<td>50</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>10 Hours</td>
<td>L1,L2</td>
</tr>
</tbody>
</table>

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); Chalcopryite (copper)
<table>
<thead>
<tr>
<th>Module -2</th>
<th>10 Hours</th>
<th>L2,L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrology:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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).:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Igneous Rocks - Granite, Gabbro, Dolerite, Basalt; Sedimentary rocks - Sandstone, Shale, Limestone, Laterite; Metamorphic rocks - Gneiss, Quartzite, Slate, Charnockite: Decorative stones - Porphyries, Marble and Quartzite.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module -3</th>
<th>12 Hours</th>
<th>L2, L3, L5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geomorphology and Seismology:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module -4</th>
<th>8 Hours</th>
<th>L4,L5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogeology:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Module -5:

<table>
<thead>
<tr>
<th>Geodesy:</th>
<th>10 Hours</th>
<th>L2, L3, L5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study of Topographic maps and Contour maps;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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

### Program Objectives (as per NBA)

- Engineering Knowledge.
- Problem Analysis.
- Interpretation of data.

### Question paper pattern:

- The question paper will have Ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum Three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under 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:

2. Parbin Singh, “Text Book of Engineering and General Geology”, Published by S.K. Kataria and Sons, New Dehli
<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy</td>
</tr>
<tr>
<td>Published by National Information Centre of Earthquake Engineering, Indian</td>
</tr>
<tr>
<td>Institute of Technology, Kanpur.</td>
</tr>
<tr>
<td>and Geotechnics”, CBS Publishers and Distributors, New Delhi.</td>
</tr>
<tr>
<td>Hyderabad.</td>
</tr>
<tr>
<td>System”, BS Publications, Hyderabad.</td>
</tr>
<tr>
<td>5. Ground water Assessment, development and Management by K.R. Karanth, Tata</td>
</tr>
<tr>
<td>Mc Graw Hills</td>
</tr>
<tr>
<td>New Delhi.</td>
</tr>
<tr>
<td>Education (India) Pvt, Ltd. New Delhi.</td>
</tr>
<tr>
<td>Delhi.</td>
</tr>
<tr>
<td>Geologists”, Prasaranga, University of Mysore, Myso</td>
</tr>
</tbody>
</table>
Course Title: Building Materials and Construction  
[As per Choice Based Credit System (CBCS) scheme]  
SEMESTER – III

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV36</td>
<td>20</td>
<td>80</td>
<td>50</td>
<td>03</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>10 Hours</td>
<td>L1 L2</td>
</tr>
</tbody>
</table>

**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 | |
|-----------||


<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
<th>Duration</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td><strong>Foundation:</strong> 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. <strong>Masonry:</strong> 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.</td>
<td>10 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>4</td>
<td><strong>Lintels and Arches:</strong> Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch. <strong>Floors and roofs:</strong> Floors; Requirement of good floor, Components of ground floor, Selection of flooring material, Laying of Concrete, Mosaic, Marble, Granite, Tile flooring, Cladding of tiles. Roofs:-Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.</td>
<td>10 hours</td>
<td>L3</td>
</tr>
<tr>
<td>5</td>
<td><strong>Doors, Windows and Ventilators:</strong> 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 <strong>Stairs:</strong> Definitions, technical terms and types of stairs, Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs. <strong>Formwork:</strong> Introduction to form work, scaffolding, shoring, under pinning.</td>
<td>10 Hours</td>
<td>L2, L3, L5</td>
</tr>
<tr>
<td>6</td>
<td><strong>Plastering and Pointing:</strong> purpose, materials and methods of plastering and pointing, defects in plastering-Stucco plastering, lathe plastering Damp proofing - causes, effects and methods. <strong>Paints:</strong> Purpose, types, ingredients and defects,</td>
<td>10 Hours</td>
<td>L4, L5</td>
</tr>
</tbody>
</table>
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.

Program Objectives (as per NBA)
o
Engineering Knowledge.
o
Problem Analysis.
o Interpretation of data.

Question paper pattern:
• The question paper will have Ten questions, each full question carrying 16 marks.
• There will be two full questions (with a maximum Three sub divisions, if necessary) from each module.
• Each full question shall cover the topics under 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:
2. National Building Code(NBC) of India
4. Building Materials and Components, CBRI, 1990, India
Course Title: BUILDING MATERIALS TESTING LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III

Subject Code  15CVL37  IA Marks  20
Number of Lecture Hours/Week  03  Exam Marks  80
Total Number of Lecture Hours  42  Exam Hours  03

CREDITS – 02

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tension test on mild steel and HYSD bars.</td>
<td>03 Hours</td>
<td>L2, L3, L5</td>
</tr>
<tr>
<td>2. Compression test on mild steel, cast iron and wood.</td>
<td>03 Hours</td>
<td>L1, L2, L3, L5</td>
</tr>
<tr>
<td>3. Torsion test on mild steel circular sections.</td>
<td>03 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>4. Bending Test on Wood Under two point loading</td>
<td>03 Hours</td>
<td>L1, L2, L3, L5</td>
</tr>
<tr>
<td>5. Shear Test on Mild steel- single and double shear</td>
<td>03 Hours</td>
<td>L1, L2, L3, L5</td>
</tr>
<tr>
<td>6. Impact test on Mild Steel (Charpy &amp; Izod)</td>
<td>03 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>7. Hardness tests on ferrous and non-ferrous metals – Brinell’s, Rockwell and Vicker’s</td>
<td>06 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>8. Tests on Bricks and Tiles</td>
<td>03 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>9. Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking</td>
<td>06 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>10. Tests on Coarse aggregates – Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis</td>
<td>06 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>11. Demonstration of Strain gauges and Strain indicators</td>
<td>03 Hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

NOTE: All tests to be carried out as per relevant latest BIS Codes
<table>
<thead>
<tr>
<th>Course outcomes:</th>
<th>Program Objectives (as per NBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>After successful completion of the course, the students will be able to:</td>
<td>1. Engineering Knowledge.</td>
</tr>
<tr>
<td>1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.</td>
<td>2. Evaluation of mechanical properties of structural materials.</td>
</tr>
<tr>
<td>2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.</td>
<td>3. Interpretation of test results.</td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question paper pattern:</th>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Two questions are to be set - One from group experiments and the other as individual experiment.</td>
<td>3. Fenner, “ Mechanical Testing of Materials”, George Newnes Ltd. London.</td>
</tr>
<tr>
<td>• Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.</td>
<td>4. Holes K A, “Experimental Strength of Materials”, English Universities Press Ltd. London.</td>
</tr>
<tr>
<td>• All exercises are to be included for practical examination.</td>
<td>5. Suryanarayana A K, “Testing of Metallic Materials”, Prentice Hall of India Pvt. Ltd. New Delhi.</td>
</tr>
<tr>
<td></td>
<td>7. Relevant IS Codes</td>
</tr>
</tbody>
</table>
Course Title: BASIC SURVEYING PRACTICE

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

SEMESTER – III

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CVL38</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
</tbody>
</table>

Number of Lecture Hours/Week: 03
Total Number of Lecture Hours: 42

CREDITS – 02

Course objectives: This course will enable students to

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

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..

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>03</td>
<td>L3, L4</td>
</tr>
<tr>
<td>2. Obstacles in chaining and ranging – Chaining but not ranging, ranging but not chaining, both ranging and chaining.</td>
<td>03</td>
<td>L3</td>
</tr>
<tr>
<td>3. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.</td>
<td>03</td>
<td>L3</td>
</tr>
<tr>
<td>4. Measurement of bearings of sides of a closed traverse and adjustment of closing error by Bowditch method.</td>
<td>03</td>
<td>L3</td>
</tr>
<tr>
<td>5. Determination of distance between two inaccessible points using compass and accessories</td>
<td>03</td>
<td>L4</td>
</tr>
<tr>
<td>6. Determination of reduced levels of points using dumpy level/auto level (simple leveling)</td>
<td>03</td>
<td>L4</td>
</tr>
<tr>
<td>7. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling)</td>
<td>03</td>
<td>L4</td>
</tr>
<tr>
<td>8. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error</td>
<td>03</td>
<td>L4</td>
</tr>
<tr>
<td>9. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale</td>
<td>03</td>
<td>L3</td>
</tr>
<tr>
<td>10. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.</td>
<td>03</td>
<td>L4</td>
</tr>
</tbody>
</table>
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 like 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 and 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.[L3,L4][PO5]  

Program Objectives (as per NBA)  
1. Engineering Knowledge.  
2. Problem Analysis.  
3. Interpretation of data.  

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.  

Text Books:  

Reference Books:  
**Course Title:** Analysis of Determinate Structures  
*As per Choice Based Credit System (CBCS) scheme*  
**SEMESTER – IV**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV42</td>
<td>20</td>
</tr>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>Exam Marks</td>
</tr>
<tr>
<td>04</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>Exam Hours</td>
</tr>
<tr>
<td>50</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 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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction and Analysis of Plane Trusses</td>
<td>10 Hours</td>
<td>L2, L4, L5</td>
</tr>
<tr>
<td>Structural forms, Conditions of equilibrium,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatibility conditions, Degree of freedom,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear and non linear analysis, Static and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kinematic indeterminacies of structural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>systems, Types of trusses, Assumptions in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>analysis, Analysis of determinate trusses by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>method of joints and method of sections.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deflection of Beams</td>
<td>10 Hours</td>
<td>L2, L4, L5</td>
</tr>
<tr>
<td>Definition of slope, Deflection and curvature,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign conventions, Derivation of moment-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>curvature equation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double integration method and Macaulay’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>method: Slope and deflection for standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>loading cases and for determinate prismatic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>beams subjected to point loads, UDL, UVL and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>couple.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moment area method: Derivation, Mohr’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>theorems, Sign conventions, Application of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>moment area method for determinate prismatic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>beams, Beams of varying section, Use of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>moment diagram by parts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conjugate beam method: Real beam and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conjugate beam, conjugate beam theorems,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application of conjugate beam method of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>determinate beams of variable cross sections.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Principles and Energy Theorems</td>
<td>10 Hours</td>
<td>L2, L4, L5</td>
</tr>
<tr>
<td>Principle of virtual displacements, Principle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of virtual forces, Strain energy and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>complimentary energy, Strain energy due to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>axial force, bending, shear and torsion,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deflection of determinate beams and trusses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>using total strain energy, Deflection at the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>point of application of single load,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Castigliano’s theorems and its application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>to estimate the deflections of trusses, bent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>frames, Special applications-Dummy unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>load method.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Module -4

**Arches and Cable Structures**

<table>
<thead>
<tr>
<th>10 Hours</th>
<th>L2, L4, L5</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

### Module -5

**Influence Lines and Moving Loads**

<table>
<thead>
<tr>
<th>10 Hours</th>
<th>L2, L4, L6</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

**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.

**Program Objectives (as per NBA)**

- Engineering Knowledge.
- Problem Analysis.
- Interpretation of Data.

**Question paper pattern:**

- The question paper will have ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum Three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under 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: Applied Hydraulics  
[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER - IV**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV43</td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>03</td>
</tr>
</tbody>
</table>

**Total Number of Lecture Hours**: 50

**CREDITS - 04**

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1: Dimensional and Model analysis</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Dimensional analysis</strong></td>
<td>03</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham (\pi) theorem, dimensional analysis, choice of variables, examples on various applications.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Model analysis</strong></td>
<td>04</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>Model analysis: Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds 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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Buoyancy and Flotation</strong></td>
<td>03</td>
<td>L1, L2, L3, L4</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 2: Open Channel Flow Hydraulics</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Uniform Flow</strong></td>
<td>06</td>
<td>L3, L4</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Specific Energy and Specific energy curve</strong>, Critical flow and corresponding critical parameters, Metering flumes, Numerical Problems</td>
<td>04</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Module 3: Non-Uniform Flow</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Hydraulic Jump</strong></td>
<td>03</td>
<td>L2, L3, L4</td>
</tr>
<tr>
<td>Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gradually varied flow</strong>, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical,</td>
<td>04</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical,</td>
<td>03</td>
<td>L2, L3</td>
</tr>
</tbody>
</table>
horizontal and adverse slope profiles, Numerical problems, Control sections

**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

| 05 | L2,L3 |

**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

| 05 | L1, L2, L3, L4 |

**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.

| 06 | L1, L2, L3, L4 |

**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, Compute water surface profiles at different conditions
4. Design turbines for the given data, and to know their operation characteristics under different operating conditions

**Program Objectives**

1. PO1: Engineering Knowledge
2. PO2: Problem analysis
3. PO3: Analyse and development of Solutions

**Question Paper Pattern:**

- Total number of Questions to be set is 10. Two full questions are to be set from each module.
- Not more than 3 sub questions are to be set under any main question
- Questions are to be set such that the entire module is covered and further, should be answerable for the set marks.
- Each question should be set for 16 marks
- Students should answer 5 full questions selecting at least 1 from each module.
Text Books:

Reference Books:
## Course Title: Concrete Technology

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

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Total Number of Lecture Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV44</td>
<td></td>
<td>80</td>
<td>04</td>
<td>50</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.

<table>
<thead>
<tr>
<th>Contents</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1: Concrete Ingredients</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-2: Fresh Concrete</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-3: Hardened Concrete</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IS-456. Insitu testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

**Module -4: Concrete Mix Proportioning**

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

| 10 Hours | L1, L2, L3, L4 |

**Module -5: Special Concretes**

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

| 10 hours | L1, L2, L3, L4 |

**Course Outcomes:**

After studying this course, students will be able to:

CO1: Relate material characteristics and their influence on microstructure of concrete. (L2,L3)(PO1)

CO 2: Distinguish concrete behaviour based on its fresh and hardened properties. [L2, L4] (PO1, PO2)

CO 3: Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes. [L3] (PO1, PO2, PO3)

**Program Objectives (as per NBA):**

- Engineering Knowledge (PO1)
- Problem Analysis (PO2)
- Design / development of solutions (PO3)

**Question paper pattern:**

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

**Text Books:**

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

**Reference Books:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC</td>
</tr>
<tr>
<td>6.</td>
<td>Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House</td>
</tr>
</tbody>
</table>
Course Title: Basic Geotechnical Engineering
[As per Choice Based Credit System (CBCS) scheme]

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV45</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
</tbody>
</table>

SEMESTER - IV

Number of Lecture Hours/Week 04
Total Number of Lecture Hours 50

CREDITS – 04

Course objectives: This course will enable students

- 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.
- 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.
- To determine the improvement in mechanical behaviour by densification of soil deposits using compaction.
- To know how the properties of soils that can be measured in the lab

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>Module -2 : Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor’s compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control - compactive effort &amp; method of compaction, lift thickness and number of passes, Proctor’s needle, Compacting equipments and their suitability.</td>
<td>10 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>
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 \(C_c, a_v, m_v\) and \(C_v\). Laboratory one dimensional consolidation test, characteristics of \( e-log(\sigma')\) 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.

| 10 Hours | L1, L2, L3, L4 |

**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.

| 10 Hours | L2, L3 |

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

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

Text Books:

Reference Books:
Course Title: Advanced Surveying  
[As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV46</td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

Total Number of Lecture Hours: 50
Exam Hours: 03

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1: Curve Surveying</td>
<td>10 Hours</td>
<td>L1, L3, L5</td>
</tr>
</tbody>
</table>


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. | 10 Hours | L1, L2, L3 |

Module -3: Introduction to Field Astronomy

Earth, celestial sphere, earth and celestial coordinate systems, spherical triangle, astronomical triangle, Napier’s rule | 10 Hours | L4, L5 |

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. | 10 Hours | L2, L3, L5 |
**Module -5: Modern Surveying Instruments**

| **Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).** | **10 Hours** | **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.

**Program Objectives (as per NBA)**
- Engineering Knowledge.
- Problem Analysis.
- Interpretation of data.

**Question paper pattern:**
- The question paper will have Ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum Three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under 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:**
2. Kanetkar T P and S V Kulkarni, Surveying and Levelling Part 2, Pune Vidyarthisi Griha Prakashan,

**Reference Books:**
3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers
5. T.M Lillesand,, R.W Kiefer,, and J.W Chipman, Remote sensing and Image interpretation, 5th edition, John Wiley and Sons India
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
Course Title: Fluid Mechanics and Hydraulic Machines Laboratory (0:1:2)

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

SEMESTER - IV

Subject Code: 15CVL47
IA Marks: 20
Exam Marks: 80
Exam Hours: 03

Number of Lecture Hours/Week: 03 (1hr tutorial + 2hr laboratory)

Total Number of Lecture Hours: 42

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Verification of Bernoulli’s equation</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>2. Determination of ( C_d ) for Venturimeter and Orifice meter</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>3. Determination of hydraulic coefficients of small vertical orifice</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>4. Calibration of Rectangular and Triangular notch</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>5. Calibration of Ogee and Broad crested weir</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>6. Determination of ( C_d ) for Venturiflume</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>7. Experimental determination of force exerted by a jet on flat and curved plates (Hemispherical Vane).</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>8. Experimental determination of operating characteristics of Pelton turbine</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>9. Determination of efficiency of Francis turbine</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>10. Determination of efficiency of Kaplan turbine</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>11. Determination of efficiency of centrifugal pump.</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>12. Determination of Major and Minor Losses in Pipes</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>13. Demonstration Experiments:</td>
<td>6 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>a. Reynold’s experiment to understand laminar and turbulent flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Flow Visualization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Calibration of Sutro-weir</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Question paper pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All experiments are to be included in the examination except demonstration exercises.</td>
</tr>
<tr>
<td>• Candidate to perform experiment assigned to him</td>
</tr>
<tr>
<td>• Marks are to be allotted as per the split up of marks shown on the cover page of answer script</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
Course Title: Engineering Geology Laboratory (0:1:2)

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

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>15CVL48</th>
<th>IA Marks</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03 (1hr tutorial + 2hr laboratory)</td>
<td>Exam Marks</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>42</td>
<td>Exam Hours</td>
<td>03</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 a geophysical techniques and watershed management.
5. To visit the civil engineering projects like dams, reservoirs, tunnels, quarry sites 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</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>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>L4</td>
</tr>
<tr>
<td>4. Bore hole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining. Triangular and Square land, assuming ground is horizontal.</td>
<td>6 Hours</td>
<td>L3, L4, L5</td>
</tr>
<tr>
<td>5. Calculation of Vertical, True thickness and width of the outcrops.</td>
<td>6 Hours</td>
<td>L4, L5</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>8 Hours</td>
<td>L5, L6</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 hard rock 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:
- 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 (80)</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>20 (5 x 4)</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>20 (5 x 4)</td>
</tr>
<tr>
<td>3</td>
<td>Dip and strike problems</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Bore hole problems (3 point method)</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Thickness of strata problems including calculation of vertical, true thickness and its width of outcrop.</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Electrical resistivity curves drawing and its interpretation for Geotechnical and Aquifer investigations.</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Interpretation of Toposheets</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Geological maps, their cross sections and description</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>Viva voce</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=20: By conducting at least one test for 10 marks and remaining 10 marks for record.

Reference Books:
1. M P Billings, Structural Geology, CBS Publishers and Distributors, New Delhi
**Course Title:** Design of RC Structural Elements  
*As per Choice Based Credit System (CBCS) scheme*

**SEMESTER-V**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV51</td>
<td>20</td>
<td>80</td>
<td>50</td>
<td>03</td>
</tr>
</tbody>
</table>

**CREDITS - 04  Total Marks-100**

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit State Analysis of Beams: Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear</td>
<td>8 Hours</td>
<td>L₂, L₄</td>
</tr>
<tr>
<td>Module-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>10 Hours</td>
<td>L₂, L₄</td>
</tr>
<tr>
<td>Module-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L₂, L₄</td>
</tr>
</tbody>
</table>
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  

| 10 Hours | L_2, L_4 |

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

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

Text Books:

Reference Books:
**Course Title:** Analysis of Indeterminate Structures  
[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER-V**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV52</td>
<td>20</td>
<td>04</td>
<td>80</td>
<td>50</td>
<td>03</td>
</tr>
</tbody>
</table>

**CREDITS - 04**  
**Total Marks - 100**

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

1. Ability to 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. Ability to identify, formulate and solve problems in structural analysis.
3. Ability to analyze structural system and interpret data.
4. Ability to use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. Ability to communicate effectively in design of structural elements

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>10 hours</td>
<td>L₂, L₄, L₅</td>
</tr>
<tr>
<td><strong>Module-2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3</td>
<td>08 Hours</td>
<td>L₂, L₄, L₅</td>
</tr>
<tr>
<td><strong>Module-3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>08 Hours</td>
<td>L₂, L₄, L₅</td>
</tr>
<tr>
<td><strong>Module-4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>12 Hours</td>
<td>L₂, L₄, L₅</td>
</tr>
<tr>
<td><strong>Module-5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>12 Hours</td>
<td>L₂, L₄, L₅</td>
</tr>
<tr>
<td>Course outcomes: After studying this course, students will be able to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope deflection method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Construct the bending moment diagram for beams and frames by Kani’s method.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Construct the bending moment diagram for beams and frames using flexibility method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Analyze the beams and indeterminate frames by system stiffness method.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Engineering knowledge</td>
</tr>
<tr>
<td>• Problem analysis</td>
</tr>
<tr>
<td>• Interpretation of data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question paper pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</td>
</tr>
<tr>
<td>• There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.</td>
</tr>
<tr>
<td>• Each full question shall cover the topics as a module</td>
</tr>
<tr>
<td>• 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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
**Course Title: Applied Geotechnical Engineering**

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

**SEMESTER-V**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>15CV53</th>
<th>IA Marks</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>04</td>
<td>Exam Marks</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>50</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
</tbody>
</table>

**Credits - 04**  
**Total Marks - 100**

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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).</td>
<td>10 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td><strong>Module-2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>10 Hours</td>
<td>L2,L3,L4</td>
</tr>
<tr>
<td><strong>Module-3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine’s theory for cohesionless and cohesive soils, Coulomb’s theory, Rehmann’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- (Method of slices) soils, Fellineous method for critical slip circle</td>
<td>10 Hours</td>
<td>L2,L4,L5</td>
</tr>
</tbody>
</table>
Module-4

**Bearing Capacity of Shallow Foundation:** Types of foundations, 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)  

| 10 Hours | 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)  

| 10 Hours | L2,L3,L4 |

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

Program Objectives

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.
- Use of IS: 6403 shall be permitted.

Text Books:

4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India
<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley &amp; Sons</td>
</tr>
<tr>
<td>2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi</td>
</tr>
<tr>
<td>4. Debashis Moitra, “Geotechnical Engineering”, Universities Press,</td>
</tr>
</tbody>
</table>
Course Title: Computer Aided Building Planning and Drawing  
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: V

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV54</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>04 (1hr Instructions + 3hr Drawing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Lecture/Practice Hours</td>
<td>50</td>
</tr>
</tbody>
</table>

C R E D I T S - 04  Total Marks-100

Course objectives: Provide students with a basic understanding

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1</td>
<td>12 Hours</td>
<td>L1,L2</td>
</tr>
</tbody>
</table>

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

Simple engineering drawings with CAD drawing tools: Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customising toolbars, Working with multiple drawings

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

12 Hours  L2,L3,L4,L5,L6
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.

**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

**Program Objectives**

- Engineering knowledge
- Problem analysis
- Interpretation of data

**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 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 Book:**

**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)
## Course Title: Air Pollution and Control

Professional Elective-1

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

**SEMESTER-V**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV551</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
</tbody>
</table>

**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

- Study the sources and effects of air pollution
- Learn the meteorological factors influencing air pollution.
- Analyze air pollutant dispersion models
- Illustrate particular and gaseous pollution control methods.

### Modules

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td>8 hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td><strong>Introduction</strong>: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation &amp; materials. Types of inversion, photochemical smog.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-2</strong></td>
<td>8 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td><strong>Meteorology</strong>: Temperature lapse rate &amp; stability, wind velocity &amp; 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</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-3</strong></td>
<td>8 Hours</td>
<td>L2, L3, L4</td>
</tr>
<tr>
<td><strong>Sampling</strong>: Sampling of particulate and gaseous pollutants (Stack, Ambient &amp; indoor air pollution), Monitoring and analysis of air pollutants (PM$<em>{2.5}$, PM$</em>{10}$, SO$_X$, NO$_X$, CO, NH$_3$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-4</strong></td>
<td>8 Hours</td>
<td>L3, L4</td>
</tr>
<tr>
<td><strong>Control Techniques</strong>: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters &amp; ESP.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-5</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
### 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. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

### 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:

1. Noel De Nevers, “Air Pollution Control Engineering”, Waveland Pr Inc.
Course Title: Railways, Harbour, Tunneling and Airports
Professional Elective-1
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: V

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>IA Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV552</td>
<td>20</td>
<td>80</td>
<td>03</td>
<td>03</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>8 hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-2</td>
<td>8 Hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Module-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 4</td>
<td>Module 5</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td></td>
</tr>
</tbody>
</table>


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

8 Hours | L1,L2,L3

**Module-4**

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

8 Hours | L1,L2,L3

**Module-5**


8 Hours | L1,L2,L3

**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, 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.

**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:**

4. C Venkatramaiah, “Transportation Engineering”, Volume II: Railways, Airports, Docks and Harbours, Bridges and...
5. Bindra S P, “A Course in Docks and Harbour Engineering”, Dhanpat Rai and Sons, New Delhi,

Reference Books:
2. Mundrey J.S. “A course in Railway Track Engineering”. Tata McGraw Hill,

Course Title: Masonry Structures
Professional Elective-1
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: V

Subject Code: 15CV553  IA Marks: 20
Number of Lecture Hours/Week: 03  Exam Marks: 80
Total Number of Lecture Hours: 40  Exam Hours: 03
CREDITS - 03  Total Marks: 100

Course Objectives: This course will enable students to
1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>8 hours</td>
<td>L1,L2,L3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module-2</th>
<th>8 Hours</th>
<th>L1,L2,L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module -3</td>
<td>Design 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.</td>
<td>8 Hours</td>
</tr>
<tr>
<td>Module -4</td>
<td>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.</td>
<td>8 Hours</td>
</tr>
<tr>
<td>Module -5</td>
<td>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.</td>
<td>8 Hours</td>
</tr>
</tbody>
</table>

**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.

**Program Objectives:**

- Engineering knowledge
- Problem analysis
- Interpretation of data

**Question Paper Pattern:**

- The question paper will have Ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under 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.
- Use of IS 1905-1987 “Code of practice for structural use of un-reinforced masonry” may be permitted.

**Text Books:**

Reference Books:

Course Title: Theory of Elasticity
Professional Elective-1
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER: V

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>15CV554</th>
<th>IA Marks</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>Exam Marks</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
<tr>
<td>C R E D I T S</td>
<td>03</td>
<td>Total Marks</td>
<td>100</td>
</tr>
</tbody>
</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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concepts of continuum, Stress at a point, Components of stress, Differential equations of equilibrium, Stress transformation, Principal stresses, Maximum shear stress, Stress invariants.</td>
<td>08 hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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).</td>
<td>08 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>Module-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>08 Hours</td>
<td>L3, L4</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Course outcomes: On the completion of this course students are expected to attain the following outcomes;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum</td>
</tr>
<tr>
<td>2. Ability to formulate boundary value problems; and calculate stresses and strains</td>
</tr>
<tr>
<td>3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints;</td>
</tr>
<tr>
<td>4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.</td>
</tr>
</tbody>
</table>

Module 5

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

<table>
<thead>
<tr>
<th>Program Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Engineering knowledge</td>
</tr>
<tr>
<td>• Problem analysis</td>
</tr>
<tr>
<td>• Interpretation of data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question Paper Pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</td>
</tr>
<tr>
<td>• There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.</td>
</tr>
<tr>
<td>• Each full question shall cover the topics as a module</td>
</tr>
<tr>
<td>• 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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
Course Title: Traffic Engineering
Open Elective-1
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:V

Subject Code: 15CV561
IA Marks: 20
Number of Lecture Hours/Week: 03
Exam Marks: 80
Total Number of Lecture Hours: 40
Exam Hours: 03

CREDITS - 03
Total Marks-100

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>8 hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

| Module-2 | 8 Hours | L1, L2, L3, L4, L5 |
| 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, |
### 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.

| 8 Hours | L1,L2,L3,L4 |

### 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.

| 8 Hours | L1,L2,L3 |

### 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.

| 8 Hours | L1,L2,L3,L4 |

### 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.

### 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:
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

Course Title: Sustainability Concepts in Engineering
Open Elective 1
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: V

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>15CV562</th>
<th>IA Marks</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>Exam Marks</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
<tr>
<td>CREDITS - 03</td>
<td>Total Marks - 100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>8 hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

| Module-2 | 8 Hours | L1, L2, L3 |
| Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and |

<table>
<thead>
<tr>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L1, L2, L3</td>
<td></td>
</tr>
</tbody>
</table>
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


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

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:
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

Course Title: Remote Sensing and GIS
Open Elective 1
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: V

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>15CV563</th>
<th>IA Marks</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>Exam Marks</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
<tr>
<td>CREDITS - 03</td>
<td>Total Marks-100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>8 hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

| Module-2 | 8 Hours | L2, L3, L4 |
temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity, Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching), image filtering.

Module -3


8 Hours

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.

8 Hours

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 Services And Its Applications.

8 Hours

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

1. Collect data and delineate various elements from the satellite imagery using their spectral signature.
2. Analyze different features of ground information to create raster or vector data.
3. Perform digital classification and create different thematic maps for solving specific problems
4. Make decision based on the GIS analysis on thematic maps.

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: Occupational Health and Safety
Open Elective 1
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER:V

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV564</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>8 hours</td>
<td>L1,L2,L3</td>
</tr>
</tbody>
</table>

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

| Module-2 | 8 Hours         | L2,L3,L4,L5 |

### Module-3

**Fire Prevention and Protection:** Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.

**Electrical Safety, Product Safety:** Technical Requirements of Product safety.

8 Hours

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

8 Hours

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

8 Hours

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.

### 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:**

---

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CVL57</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

**Course Title: Geotechnical Engineering Lab**

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

**SEMESTER: V**

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>03 (1hr tutorial + 2hr laboratory)</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Number of Lecture Hours</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

**Course Objectives:** Provide students with a basic understanding
- To carry out laboratory tests and to identify soil as per IS codal procedures
- To perform laboratory tests to determine index properties of soil
- To perform tests to determine shear strength and consolidation characteristics of soils

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Grain size analysis</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>i. Sieve analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Hydrometer analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. In-situ density tests</td>
<td>3 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>i. Core-cutter method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Sand replacement method</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
<th></th>
</tr>
</thead>
</table>
Course Title: Concrete and Highway Materials Laboratory
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: V

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CVL58</td>
<td>20</td>
<td>03 (1hr tutorial + 2hr laboratory)</td>
<td>80</td>
<td>42</td>
<td>03</td>
</tr>
</tbody>
</table>

CREDITS - 02 Total Marks - 100

Course objectives:
- 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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A: Concrete Lab</td>
<td>6 Hours</td>
<td>L1, L2</td>
</tr>
</tbody>
</table>
| 1. Tests on Cement:  
  a. Normal Consistency  
  b. Setting time  
  c. Compressive strength  
  d. Finess by air permeability test  
  e. Specific gravity | 9 Hours | L2, L3 |
| 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: | | |
### 3. Tests on Self Compacting Concrete:
- Design of self compacting concrete,
- Slump flow test,
- V-funnel test,
- J-Ring test,
- U Box test and
- L Box test

### Part B: Highway materials Lab

#### 1. Tests on Aggregates
- Aggregate Crushing value
- Los Angeles abrasion test
- Aggregate impact test
- Aggregate shape tests (combined index and angularity number)

#### 2. Tests on Bituminous Materials
- Penetration test
- Ductility test
- Softening point test
- Specific gravity test
- Viscosity test by tar viscometer
- Bituminous Mix Design by Marshall Method (Demonstration only)

#### 3. Tests on Soil
- Wet sieve analysis
- CBR test

### Course outcomes:
After studying this course, students will be able to:
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 subgrade soil for pavements.

### Reference Books:
5. Relevant BIS codes.
8. Relevant IRC Codes
9. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi
**Course Title: Construction Management and Entrepreneurship**  
As per Choice Based Credit System (CBCS) scheme

<table>
<thead>
<tr>
<th>SEMESTER: VI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject Code</strong></td>
</tr>
<tr>
<td><strong>IA Marks</strong></td>
</tr>
<tr>
<td><strong>Number of Lecture Hours/Week</strong></td>
</tr>
<tr>
<td><strong>Exam Marks</strong></td>
</tr>
<tr>
<td><strong>Total Number of Lecture Hours</strong></td>
</tr>
<tr>
<td><strong>Exam Hours</strong></td>
</tr>
<tr>
<td><strong>CREDITS</strong></td>
</tr>
<tr>
<td><strong>Total Marks</strong></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans</td>
<td>10 hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource Management: Basic concepts of resource management, class of labour, Wages &amp; statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials: material management functions, inventory management.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction to engineering economy: Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comparison of alternatives: Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module -5</td>
<td>10 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>---------</td>
</tr>
</tbody>
</table>

**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

**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:**
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**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV62</td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CREDITS</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>100</td>
</tr>
</tbody>
</table>

### 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 unsupported steel beams.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td><strong>Module-3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td><strong>Module-4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td><strong>Module-5</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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 unsupported steel beams.
<table>
<thead>
<tr>
<th>Program Objectives:</th>
<th>Engineering knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Problem analysis</td>
</tr>
<tr>
<td></td>
<td>Interpretation of data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question Paper Pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</td>
</tr>
<tr>
<td>There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.</td>
</tr>
<tr>
<td>Each full question shall cover the topics as a module</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
**Course Title:** Highway Engineering  
**As per Choice Based Credit System (CBCS) scheme**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV63</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>03</td>
</tr>
</tbody>
</table>

| Total Number of Lecture Hours | 50       |

| CREDITS | 04       |

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
</table>

**Module -1**

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

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

10 hours L1,L2

**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

10 Hours L2,L3,L4

**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

10 Hours L3,L4,L5

**Module -4**


10 Hours L2,L3,L4
| 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 | 10 Hours |
| **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 | L1,L2,L3 |
| **Course outcomes:** After studying this course, students will be able to: | |
| 1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data. | |
| 2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction. | |
| 3. Design road geometrics, structural components of pavement and drainage. | |
| 4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts. | |
| **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:** | |
| 1. Relevant IRC Codes | |
Course Title: Water Supply and Treatment Engineering  
As per Choice Based Credit System (CBCS) scheme

<table>
<thead>
<tr>
<th>SEMESTER: VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject Code</td>
</tr>
<tr>
<td>IA Marks</td>
</tr>
<tr>
<td>Number of Lecture Hours/Week</td>
</tr>
<tr>
<td>Exam Marks</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
</tr>
<tr>
<td>Exam Hours</td>
</tr>
<tr>
<td>CREDITS</td>
</tr>
<tr>
<td>Total Marks</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>10 hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

| Module-2 | 10 Hours | L1, L2, L3 |
| 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. |

| Module-3 | 10 Hours | L1, L2, L3 |

| Module-4 | 10 Hours | L1, L2, L3 |

| Module-5 | 10 Hours | L1, L2, L3 |
### Course Outcomes:
After studying this course, students will be able to:
1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

### 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: Solid Waste Management
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VI

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
<th>CREDITS -03</th>
<th>Total Marks- 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV651</td>
<td></td>
<td>03</td>
<td>80</td>
<td>40</td>
<td>03</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

**Revised Modules Teaching Bloom’s Hours Taxonomy (RBT) Level**

<table>
<thead>
<tr>
<th>Module</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>8 hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Module -2</td>
<td>8 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>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).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module -3</td>
<td>8 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Module -4</td>
<td>8 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Sources, collection, treatment and disposal of :- Biomedical waste ,E-waste ,Hazardous waste and construction waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module -5</td>
<td>8 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Incineration -3Ts factor affecting incineration ,types of incinerations , Pyrolysis ,design criteria for incineration Energy recovery technique from solid waste management</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
Course Title: Matrix Method of Structural Analysis
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VI

Subject Code: 15CV652
IA Marks: 20
Exam Marks: 80
Exam Hours: 03

Total Number of Lecture Hours: 40

CREDITS: 03
Total Marks: 100

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>08 hours</td>
<td>L2, L4, L5</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Module -2 | 08 Hours | L2, L4, L5 |
| Element Flexibility Method: Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses. |

| Module -3 | 08 Hours | L2, L4, L5 |
| Element Stiffness Method: Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses. |

| Module -4 | 08 Hours | L2, L4, L5 |
| Effects of Temperature Changes and Lack of Fit: Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3. |

| Module -5 | 08 Hours | L2, L4, L5 |
| 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 |

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

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: Alternative Building Materials
As per Choice Based Credit System (CBCS) scheme

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV653</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>Total Number of Lecture Hours</th>
<th>CREDITS</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>40</td>
<td>-03</td>
<td>100</td>
</tr>
</tbody>
</table>

#### 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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>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 &amp; solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions</td>
<td>8 hours</td>
</tr>
<tr>
<td>Module -2</td>
<td>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 &amp; 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.</td>
<td>8 Hours</td>
</tr>
<tr>
<td>Module -5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment for Production of Alternative Materials: Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.</td>
<td>8 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>Course Outcomes:</strong> After studying this course, students will be able to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Program Objectives:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 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:**                                                                                                                                                                                                                                                                         |        |        |
| 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

<table>
<thead>
<tr>
<th>SEMESTER: VI</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>15CV654</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA Marks</td>
<td>20</td>
</tr>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
</tr>
<tr>
<td>Exam Marks</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40</td>
</tr>
<tr>
<td>Exam Hours</td>
<td>03</td>
</tr>
<tr>
<td>CREDITS - 03</td>
<td></td>
</tr>
<tr>
<td>Total Marks - 100</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>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.</td>
<td>8 hours</td>
</tr>
<tr>
<td>Module -2</td>
<td>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.</td>
<td>8 hours</td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>Program Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering knowledge</td>
</tr>
<tr>
<td>Problem analysis</td>
</tr>
<tr>
<td>Interpretation of data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question Paper Pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</td>
</tr>
<tr>
<td>There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.</td>
</tr>
<tr>
<td>Each full question shall cover the topics as a module</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
Course Title: Water Resources Management
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: VI

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV661</td>
<td></td>
<td>80</td>
<td>03</td>
<td>40</td>
<td>03</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>8 hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Module -2</td>
<td>8 Hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Module -3</td>
<td>8 Hours</td>
<td>L3, L4</td>
</tr>
<tr>
<td>Integrated Water Resources Management: Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types and Forms of Private Sector Involvement.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module -4</td>
<td>8 Hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Module -5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

Question paper pattern:
1. The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
2. There will be two full questions (with a maximum of two subdivisions) from each module.
3. Each full question shall cover the topics as a module.
4. 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: Environmental Protection and Management
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VI

Subject Code | 15CV662 | IA Marks | 20
--- | --- | --- | ---
Number of Lecture Hours/Week | 03 | Exam Marks | 80
Total Number of Lecture Hours | 40 | Exam Hours | 03

CREDITS | 03 | Total Marks | 100

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

### Modules

**Module - 1 Environmental Management Standards**

---|---|---|

**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 | 8 Hours | 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. | 8 Hours | 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 | 8 Hours | 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. | 8 Hours | 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

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.

Reference Books:

Course Title: Numerical Methods and Applications
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VI

Subject Code: 15CV663

<table>
<thead>
<tr>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>03</th>
<th>Exam Hours</th>
<th>03</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>03</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
</table>

**Module - 1**

| 8 hours | L1,L2,L3 |

**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.

| 8 Hours | L1,L2,L3 |

**Module - 3**

| 8 Hours | L1,L2,L3 |

**Module - 4**

| 8 Hours | L1,L2,L3 |

**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.

| 8 Hours | L1,L2,L3 |

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

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

<table>
<thead>
<tr>
<th><strong>Reference Books:</strong></th>
</tr>
</thead>
</table>
## Course Title: Finite Element Method of Analysis
### As per Choice Based Credit System (CBCS) scheme]
### SEMESTER: VI

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>15CV664</th>
<th>Exam Marks</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>Exam Hours</td>
<td>03</td>
<td></td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40</td>
<td>Total Marks- 100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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.

### Revised Modules
<table>
<thead>
<tr>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
</table>

#### 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

### 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:** Software Application Lab  
**As per Choice Based Credit System (CBCS) scheme**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CVL67</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>11+2P</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Number of Lecture Hours</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>L1,L2,L3</td>
</tr>
</tbody>
</table>

**Module 1**

**Use of civil engineering softwares:**

Use of softwares for:
1. Analysis of plane trusses, continuous beams, portal frames
2. 3D analysis of multistoried frame structures

18 hours  
L1,L2,L3

**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)
   12 hours  
L1,L2,L3

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

10 Hours  
L1,L2,L3

**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

Subject Code: 15CVP68
IA Marks: 20
Exam Marks: 80

Number of Practice Hours/Week: 04
Exam Hours: 03

Total Number of Practice Hours: 50

CREDITS – 04 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. Reconnaissance survey for selection of site and conceptualization of project.
   b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   c. Preparation of village map by using total station.
   d. Survey work required for laying of water supply and UGD
   e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   f. 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
Course Title: Municipal and Industrial Waste Water Engineering
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV71</td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

Number of Lecture Hours/Week: 04
Total Number of Lecture Hours: 50

Credits: 04
Total Marks: 100

Course objectives: This course will enable students to:
1. Understand sewerage network and influencing parameters.
2. Understand and design different unit operations involved in conventional and biological treatment process.
3. Apply the principles of Industrial effluent treatment process for different industrial wastes.
4. Evaluate self purification of streams depending on hydraulic and organic loading of sewage into receiving waters.

Revised Modules

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>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,</td>
<td>10 hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>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</td>
<td>10 Hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td>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</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>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 in to streams</td>
<td>10 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

Course outcomes: After studying this course, students will be able to:
1. Acquires capability to design sewer and Sewerage treatment plant.
2. Evaluate degree of treatment and type of treatment for disposal, reuse and recycle.
3. Identify waste streams and design the industrial waste water treatment plant.
4. Manage sewage and industrial effluent issues.
<table>
<thead>
<tr>
<th>Program Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering knowledge</td>
</tr>
<tr>
<td>Problem analysis</td>
</tr>
<tr>
<td>Interpretation of data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question paper pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</td>
</tr>
<tr>
<td>There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.</td>
</tr>
<tr>
<td>Each full question shall cover the topics as a module</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
### Course Title: Design of RCC and Steel Structures
**As per Choice Based Credit System (CBCS) scheme**

**SEMESTER: VII**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV72</td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>50</td>
<td>03</td>
</tr>
</tbody>
</table>

**Credits - 04**

<table>
<thead>
<tr>
<th>Total Marks</th>
<th>100</th>
</tr>
</thead>
</table>

**Course Objectives:**

1. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures.
2. Identify, formulate and solve engineering problems in RC and Steel Structures.
3. 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.
4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>25 hours</td>
<td>L1,L2,L3</td>
</tr>
</tbody>
</table>

| **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 | 25 Hours | L1,L2,L3 |

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

- Students will acquire the basic knowledge in design of RCC and Steel Structures.
- 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.

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

The above charts shall be provided during examinations

**Text Books:**

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

**Reference Books:**

# Course Title: Hydrology and Irrigation Engineering

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

## SEMESTER: VII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV73</td>
<td>20</td>
<td>04</td>
<td>80</td>
<td>50</td>
<td>03</td>
</tr>
</tbody>
</table>

**CREDITS: 04**  
**Total Marks: 100**

## 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.

## Revised Bloom’s Modules

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrology: Introduction, Importance of hydrology, Global and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton’s) qualitative and engineering representation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precipitation: Definition, Forms and types of precipitation, measurement of rain fall using Symon’s and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.</td>
<td>10 hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td><strong>Module-2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>10 Hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td>Evapo-transpiration: Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infiltration: Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton’s infiltration equation, infiltration indices.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.</td>
<td>10 Hours</td>
<td>L2, L4</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Module -4


**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.  

<table>
<thead>
<tr>
<th>10 Hours</th>
<th>L2, L4</th>
</tr>
</thead>
</table>

### Module -5


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

<table>
<thead>
<tr>
<th>10 Hours</th>
<th>L2, L4</th>
</tr>
</thead>
</table>

#### 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

#### 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: Design of Bridges  
As per Choice Based Credit System (CBCS) scheme]  
SEMESTER: VII |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject Code</td>
<td>IA Marks</td>
<td>Exam Marks</td>
</tr>
<tr>
<td>15CV741</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td></td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40</td>
<td>03</td>
</tr>
<tr>
<td>Credits</td>
<td>03</td>
<td>Total Marks- 100</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth</td>
<td>8 hours</td>
<td>L1,L2</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design of Slab Bridges: Straight and skew slab bridges</td>
<td>8 Hours</td>
<td>L2,L3</td>
</tr>
<tr>
<td><strong>Module-3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design of T beam bridges(up to three girder only)</td>
<td>8 Hours</td>
<td>L2,L3,L4</td>
</tr>
<tr>
<td>Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load &amp; 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 B M &amp; S F using IRC Class AA Tracked vehicle. Structural design of main girder.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Bridges: Design of Box culvert (Single vent only)</td>
<td>8 Hours</td>
<td>L2,L3,L4</td>
</tr>
<tr>
<td>Design of Pipe culverts</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module-5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substructures - Design of Piers and abutments, Introduction to Bridge bearings, Hinges and Expansion joints.(No design)</td>
<td>8 Hours</td>
<td>L2,L2,L3,L4</td>
</tr>
</tbody>
</table>

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

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

**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:**

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

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>15CV742</th>
<th>IA Marks</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>Exam Marks</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
</tbody>
</table>

CREDITS - 03  
Total Marks-100

Course objectives: This course will enable students
1. To characterize the properties of ground water and aquifers.
2. To quantify the ground water flow.
3. To locate occurrence of ground water and augment ground water resources.
4. 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 isotropic, 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 fluid logging.

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:
1. find the characteristics of aquifers.
2. estimate the quantity of ground water by various methods.
3. locate the zones of ground water resources.
4. select particular type of well and augment the ground water storage.

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: Design Concept of Building Services
As per Choice Based Credit System (CBCS) scheme

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV743</td>
<td>20</td>
<td>03</td>
<td>80</td>
<td>40</td>
<td>03</td>
<td>03</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.

<table>
<thead>
<tr>
<th>Module-1</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply, Drainage and Solid Waste Disposal:</td>
<td>8 hours</td>
<td>L1,L2</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module-2</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Ventilation and Air Conditioning (HVAC):</td>
<td>8 Hours</td>
<td>L1,L2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module-3</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical and Fire Fighting Services:</td>
<td>8 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module-4</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plumbing and Fire Fighting Layout of Simple Buildings:</td>
<td>8 Hours</td>
<td>L2,L3</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module -5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td><strong>Engineering Services:</strong> 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. <strong>Building Maintenance:</strong> Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Program Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering knowledge</td>
</tr>
<tr>
<td>Problem analysis</td>
</tr>
<tr>
<td>Interpretation of data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question paper pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</td>
</tr>
<tr>
<td>There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.</td>
</tr>
<tr>
<td>Each full question shall cover the topics as a module</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. National Building Code</td>
</tr>
<tr>
<td>2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers,</td>
</tr>
<tr>
<td>7. V.K.Jain, Fire Safety In Building 2edition, New Age International Publishers</td>
</tr>
<tr>
<td>10. Handbook for Building Engineers in Metric systems, NBC, New Delhi</td>
</tr>
</tbody>
</table>
**Course Title: Structural Dynamics**  
*As per Choice Based Credit System (CBCS) scheme*

**SEMESTER: VII**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV744</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03</td>
<td>Total Number of Lecture Hours</td>
<td>40</td>
</tr>
<tr>
<td>CREDITS -03</td>
<td></td>
<td>Total Marks- 100</td>
<td></td>
</tr>
</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.

**Revised Modules**

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>08 hours</td>
<td>L1,L2</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-2</td>
<td>08 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-3</td>
<td>08 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-4</td>
<td>08 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Module-5</td>
<td>08 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Dynamic analysis of base stiffness matrices, Lumped mass and consistent mass formulation, Equations of motion.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

1. Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.
2. Basic understanding of fundamental analysis methods for dynamic systems
3. Interpret dynamic analysis results for design, analysis and research purposes
4. Apply structural dynamics theory to earthquake analysis, response, and design of structures

**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.
<table>
<thead>
<tr>
<th><strong>Text Books:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Vinod Husur, “Earth Quake resistant design of building structures”, WILE EASTERN India Publications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Reference Books:</strong></th>
</tr>
</thead>
</table>
Course Title: Urban Transportation and Planning
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV751</td>
<td>20</td>
<td>03</td>
<td>80</td>
<td>40</td>
<td>03</td>
</tr>
<tr>
<td>CREDITS</td>
<td>04</td>
<td>Total Marks- 100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>08 hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Module-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.</td>
<td>08 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Module-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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, 08 Hours</td>
<td>L2,L3,L4,L5</td>
<td></td>
</tr>
</tbody>
</table>

Course outcomes: After studying this course, students will be able to:
1. Design, conduct and administrate 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:
- 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: Prefabricated Structures  
As per Choice Based Credit System (CBCS) scheme  
SEMESTER: VII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
<th>CREDITS</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV752</td>
<td>20</td>
<td>03</td>
<td>80</td>
<td>40</td>
<td>03</td>
<td>03</td>
<td>100</td>
</tr>
</tbody>
</table>

Course objectives: This course will enable students to
1. Understand modular construction, industrialised construction
2. Design prefabricated elements
3. Understand construction methods.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.</td>
<td>08 hours</td>
<td>L1,L2</td>
</tr>
<tr>
<td>Module-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREFABRICATED COMPONENTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behaviour of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels–Columns–Shear walls</td>
<td>08 Hours</td>
<td>L1,L2</td>
</tr>
<tr>
<td>Module-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DESIGN PRINCIPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disuniting of structures–Design of cross section based on efficiency of material used–Problems in design because of joint flexibility–Allowance for joint deformation.</td>
<td>08 Hours</td>
<td>L2,L3</td>
</tr>
<tr>
<td>Module-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOINT IN STRUCTURAL MEMBERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joints for different structural connections–Dimensions and detailing–Design of expansion joints</td>
<td>08 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Module-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DESIGN FOR ABNORMAL LOADS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,–Importance of avoidance of progressive collapse.</td>
<td>10 Hours</td>
<td>L2,L3</td>
</tr>
</tbody>
</table>

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

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:
1. CBRI, Building materials and components, India, 1990

Reference Books:
Course Title: Rehabilitation and Retrofitting of Structures
As per Choice Based Credit System (CBCS) scheme

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV753</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

SEMESTER: VII

Course Objectives: This course will enable students to:
1. Investigate the cause of deterioration of concrete structures.
2. Strategise different repair and rehabilitation of structures.
3. Evaluate the performance of the materials for repair

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>08 hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>Module-2</td>
<td>08 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-3</td>
<td>08 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-4</td>
<td>08 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-5</td>
<td>08 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fibre 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</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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:** Reinforced Earth Structures  
As per Choice Based Credit System (CBCS) scheme

**SEMESTER:** VII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
<th>CREDITS</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV754</td>
<td>20</td>
<td>03</td>
<td>80</td>
<td>40</td>
<td>03</td>
<td>03</td>
<td>100</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module-2</strong> 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 &amp; 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</td>
<td>08 Hours</td>
<td>L1,L2,L3,L4</td>
</tr>
<tr>
<td><strong>Module-3</strong> 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.</td>
<td>08 Hours</td>
<td>L2,L3,L4</td>
</tr>
<tr>
<td><strong>Module-4</strong> 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</td>
<td>08 Hours</td>
<td>L2,L3,L4</td>
</tr>
<tr>
<td><strong>Module-5</strong> GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS: Filter &amp; 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 &amp; cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems)</td>
<td>08 Hours</td>
<td>L2,L3,L4</td>
</tr>
</tbody>
</table>
### 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. assess the use of Geosynthetics in drainage requirements and landfill designs.

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

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
<th>CREDITS</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CVL76</td>
<td>20</td>
<td>11+2P</td>
<td>80</td>
<td>40</td>
<td>03</td>
<td>02</td>
<td>100</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Experiments</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Determination of pH, Acidity and Alkalinity</td>
<td>02 Class</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>2. Determination of Calcium, Magnesium and Total Hardness.</td>
<td>02 Class</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>3. Determination of Dissolved Oxygen.</td>
<td>02 Class</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>4. Determination of BOD.</td>
<td>02 Class</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>5. Determination of Chlorides</td>
<td>01 Class</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>6. Determination of percentage of available chlorine in bleaching powder,</td>
<td>01 Class</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>Determination of Residual Chlorine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Determination of Solids in Sewage:</td>
<td>02 Class</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>I) Total Solids,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II) Suspended Solids,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III) Dissolved Solids,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV) Volatile Solids, Fixed Solids,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V) Settle able Solids.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Determination of Turbidity by Nephelometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Determination of sodium and potassium using flame photometer.</td>
<td>01 Class</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>11. Determination Nitrates by spectrophotometer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Determination of COD.</td>
<td>Demonstration</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>14. Air Quality Monitoring (Ambient, stack monitoring, Indoor air pollution)</td>
<td>Demonstration</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>15. Determination of Sound by Sound level meter at different location</td>
<td>Demonstration</td>
<td>L1,L2,L3</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 8th semester in the field of environmental engineering.

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

**Reference Books:**
Course Title: Computer Aided Detailing of Structures
As per Choice Based Credit System (CBCS) scheme

SEMESTER: VII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>15CVL77</th>
<th>IA Marks</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>03 (1L+2D)</td>
<td>Exam Marks</td>
<td>80</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>40</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
</tbody>
</table>

Credits: 02

Total Marks: 100

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1 Detailing of RCC Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Beams – Simply supported, Cantilever and Continuous.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Slab – One way, Two way and One-way continuous.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Staircase – Doglegged</td>
<td>20 hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>4. Cantilever Retaining wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Counter Fort Retaining wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Circular Water Tank, Rectangular Water Tank.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-2 Detailing of Steel Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Built-up Columns with lacings and battens</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Column bases and Gusseted bases with bolted and welded connections.</td>
<td>20 Hours</td>
<td>L1,L2,L3</td>
</tr>
<tr>
<td>4. Roof Truss – Welded and Bolted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Beams with Bolted and Welded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Gantry Girder</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Course outcomes: After studying this course, students will be able to:
 Prepare detailed working drawings

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

Question paper pattern:
- Two questions shall be asked from each Module.
- One full question should be answered from each Module.
- 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
# Course Title: Quantity Surveying and Contracts Management

As per Choice Based Credit System (CBCS) scheme

**SEMESTER: VIII**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Subject Code</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV81</td>
<td>20</td>
<td>15CV81</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module - 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>10 hours</td>
<td>L2, L3</td>
</tr>
<tr>
<td><strong>Module - 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td><strong>Module - 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td><strong>Module - 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Module - 5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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 &amp; 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.</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>
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

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:
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)
## Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1</td>
<td>10 hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>Module 2</td>
<td>10 Hours</td>
<td>L1, L2</td>
</tr>
<tr>
<td>Module 3</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>Module 4</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
<tr>
<td>Module 5</td>
<td>10 Hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

### Course Objectives:

This course will enable students to learn Design of Pre Stressed Concrete Elements.

### Course Outcomes:

After studying this course, students will be able to:

1. Understand the requirement of PSC members for present scenario.
2. Analyse the stresses encountered in PSC element during transfer and at working.
3. Understand the effectiveness of the design of PSC after studying losses.
4. Capable of analyzing the PSC element and finding its efficiency.
5. Design PSC beam for different requirements.

### 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.
<table>
<thead>
<tr>
<th><strong>Text Books:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Rajagopalan N, “Pre-stressed Concrete”, Narosa Publishing House, New Delhi</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Reference Books:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Praveen Nagarajan, “Advanced Concrete Design”, Person</td>
</tr>
<tr>
<td>6. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi</td>
</tr>
</tbody>
</table>
Course Title: Earthquake Resistant Design of Structures  
As per Choice Based Credit System (CBCS) scheme

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV831</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Lecture Hours/Week</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Number of Lecture Hours</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

CREDITS -03

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom's Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module -1</td>
<td>08 hours</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics of 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 | 08 Hours | L1, L2, L3 |

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 | 08 Hours | L1, L2, L3 |

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 | 08 Hours | L2, L3, L4 |


| Module -5 | 08 Hours | L2, L3, L4 |


**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:**

- 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:**

1. 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.
Course Title: Hydraulic Structures
[As per Choice Based Credit System (CBCS) scheme]

Semester: VIII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Number of Lecture Hours/Week</th>
<th>Exam Marks</th>
<th>Total Number of Lecture Hours</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV832</td>
<td>20</td>
<td>03</td>
<td>80</td>
<td>40</td>
<td>03</td>
</tr>
</tbody>
</table>

Credits - 03  Total Marks - 100

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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Taxonomy Level</th>
<th>Bloom’s (RBT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravity Dams:</td>
<td>10 hours</td>
<td>L2, L3</td>
<td></td>
</tr>
<tr>
<td>Earth Dams:</td>
<td>7 hours</td>
<td>L2, L3</td>
<td></td>
</tr>
<tr>
<td>Spillways:</td>
<td>10 hours</td>
<td>L2, L3, L4</td>
<td></td>
</tr>
<tr>
<td>Cross Drainage Works:</td>
<td>7 hours</td>
<td>L2, L3</td>
<td></td>
</tr>
<tr>
<td>Canal Regulation Works:</td>
<td>6 hours</td>
<td>L2, L3</td>
<td></td>
</tr>
<tr>
<td>Course outcomes: After studying this course, students will be able to:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Check the stability of gravity dams and design the dam.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Estimate the quantity of seepage through earth dams.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Design spillways and aprons for various diversion works.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Select particular type of canal regulation work for canal network.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering knowledge</td>
</tr>
<tr>
<td>Problem analysis</td>
</tr>
<tr>
<td>Interpretation of data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question paper pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</td>
</tr>
<tr>
<td>The questions of one 16 marks can be set, wherever required.</td>
</tr>
<tr>
<td>There will be two full questions (with a maximum of three subdivisions) from each module.</td>
</tr>
<tr>
<td>Each full question shall cover the topics as a module</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
Course Title: Pavement Design
As per Choice Based Credit System (CBCS) scheme
SEMESTER: VIII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Exam Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV833</td>
<td>20</td>
<td>80</td>
<td>03</td>
</tr>
</tbody>
</table>

Total Number of Lecture Hours: 40
Exam Hours: 03

CREDITS: 03
Total Marks: 100

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.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>08 hours</td>
<td>L2, L3, L4</td>
</tr>
<tr>
<td>Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq’s theory, Burmister theory and problems on above.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-2</td>
<td>08 Hours</td>
<td>L5, L6</td>
</tr>
<tr>
<td>Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above. Flexible pavement Design: Assumptions, Meleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-3</td>
<td>08 Hours</td>
<td>L4, L5</td>
</tr>
<tr>
<td>Module-4</td>
<td>08 Hours</td>
<td>L4, L5, L6</td>
</tr>
<tr>
<td>Module-5</td>
<td>08 Hours</td>
<td>L4, L5</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Revised Modules Teaching Hours Revised Bloom’s Taxonomy (RBT) Level


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

1. Systematically generate and compile required data’s for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq’s, burmister’s and westergaard’s theory.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

### 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:
2. L.R. Kadiyali and Dr. N. B. Lal, “Principles and Practices of Highway Engineering”, Khanna publishers
3. Yang H. Huang, “Pavement Analysis and Design”, University of Kentucky

### Reference Books:
2. Subha Rao, “Principles of Pavement Design”.
4. Relevant recent IRC codes
Course Title: Advanced Foundation Design
As per Choice Based Credit System (CBCS) scheme

**SEMESTER: VIII**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CV834</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Teaching Hours</th>
<th>Revised Bloom’s Taxonomy (RBT) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module-1</td>
<td>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, &amp; differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.</td>
<td>08 hours</td>
</tr>
<tr>
<td>Module-2</td>
<td>Design of combined footings by Rigid method, Combined footings (rectangular &amp; trapezoidal), strap footings. Types of rafts, bearing capacity &amp; settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure</td>
<td>08 Hours</td>
</tr>
<tr>
<td>Module-3</td>
<td>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.</td>
<td>08 Hours</td>
</tr>
<tr>
<td>Module-5</td>
<td>Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.</td>
<td>08 Hours</td>
</tr>
</tbody>
</table>

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

1. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
2. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles
3. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons
4. Understand basics of analysis and design principles of machine foundations

**Program Objectives:**
- Engineering knowledge
- Problem analysis
- Interpretation of data
<table>
<thead>
<tr>
<th>Question paper pattern:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks</td>
</tr>
<tr>
<td>There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.</td>
</tr>
<tr>
<td>Each full question shall cover the topics as a module</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Text Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donald P. Coduto, “Geotechnical Engineering Principles &amp; Practices”, Prentice-hall of India Ltd, India</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braja, M. Das, “Principles of Geotechnical Engineering”, Cengage Learning, India</td>
</tr>
<tr>
<td>Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.</td>
</tr>
</tbody>
</table>
Course Title: Internship/Professional Practice  
As per Choice Based Credit System (CBCS) scheme  
SEMESTER: VIII

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>15CV84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lecture Hours/Week</td>
<td>Industry Oriented</td>
<td>Exam Marks</td>
</tr>
<tr>
<td>Total Number of Lecture Hours</td>
<td>Industry Oriented</td>
<td>Exam Hours</td>
</tr>
<tr>
<td>CREDITS</td>
<td>02</td>
<td>Total Marks</td>
</tr>
</tbody>
</table>

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 RMCPIS 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.