Scheme and Syllabus of
B.E. (Civil Engineering)

3rd TO 8TH Semester 2017 -2018

PANJAB UNIVERSITY, CHANDIGARH
Vision
To establish an outstanding centre of excellence for providing a quality engineering education to the students and services to the professional and the community; to produce highly competent Civil Engineers and to employ principles of continual quality improvement to enhance its programme and faculty.

Mission
a) To serve the people of the Society by providing a broad and high quality education to its student for a successful professional career.
b) To conduct strong base and knowledge for innovation.
c) To serve the Construction Industry; Civil Engineering Profession through dissemination of knowledge and technical services.

Program Education Objectives (PEO)
1. To train the students so that they can work and contribute to the infrastructure development projects being undertaken by Govt. and Private or any other sector companies.
2. To train students in such a way that they can pursue higher studies and contributes to the teaching profession/ research and development of Civil Engineering and other allied fields.
3. To train students in a manner that they should function effectively in the multicultural and multidisciplinary groups for the sustainable development and growth of civil engineering projects and profession.

Program Outcomes (PO)
A. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
B. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
C. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
D. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
E. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
F. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
G. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
H. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
I. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
J. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
K. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
L. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
### Scheme of Examination in B.E. Civil Engineering

#### Second Year – Third semester

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Four weeks Industrial training after 6th semester.

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Four weeks Industrial training after 6th semester.
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<th>Subject Title</th>
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<td>Industrial Training</td>
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OPTIONAL: INDUSTRIAL TRAINING IN EIGHTH SEMESTER
THIRD SEMESTER

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Surveying-I</th>
<th>Credits</th>
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<tr>
<td>Course Code</td>
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<td>Contact Hours</td>
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<td>Assessment-50</td>
<td>Elective</td>
<td>N</td>
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<tr>
<td>Pre-Requisite</td>
<td>Knowledge about various surveys needed for any type of construction</td>
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<tr>
<td>Course Objectives</td>
<td>The objective of the subject is to study the maps and plans and also to learn the techniques for drawing maps in plane areas and in hilly areas using different instruments.</td>
<td></td>
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</tr>
<tr>
<td>Course Outcomes</td>
<td>Students will be able to understand the concept behind surveying and learn the use of various instruments related to surveying.</td>
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</table>

**Note for Examiner**- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

**PART – A**

1. **INTRODUCTION**
   Basic principles of Surveying, Plans, Scales, Maps, Different types of surveys, various steps involved in chain surveying. (4-hours)

2. **COMPASS SURVEY**
   Principle, Traverses, Meridians, Bearings, Included angles from bearing and vice versa, Prismatic Compass, Surveyor's compass, Magnetic declination, local attraction, Field work for compass traverse, Plotting and adjustment errors. (6-hours)

3. **LEVELLING**
   Basic definitions, Dumpy level, Levelling staffs, Simple Levelling, Terms in Levelling, Precautions, Differential Levelling. Field Book for Levelling, Profile leveling & Cross-sectioning (6-hours)

4. **CONTOURING**
   Contour characteristics, direct and indirect methods of contouring, Contour gradients and automatic levels. (6-hours)

**PART – B**

5. **PLANE TABLING**
   Plane Table and its accessories, Telescopic alidade, Principle, Basic definitions, setting and orienting the plane table, methods of plane tabling, Three point problem, Two point problem. (6-hours)

6. **THEODOLITE TRAVERSING**
   Vernier Theodolite, Basic definitions, Temporary and permanent adjustments, Measuring horizontal and vertical angle, Optical Theodolites, Electronic Digital Theodolites, Selection and marking of stations for traversing, Angular measurements. (6-hours)

7. **TRAVERSE ADJUSTMENTS**
   Balancing angles of the traverse, computation of latitudes & departures, consecutive & independent coordinates, Checks for open and closed traverses, Adjustment methods for a traverse, Gales traverse table, Omitted measurements. (6-hours)

8. **TACHEOMETRIC SURVEY**
   Introduction, Tacheometer and stadia rods, Determination of constants, Purpose of using Anallatic lens without derivation. Tacheometric equations for inclined sights. Tangential Methods. Auto Reduction Tacheometers. (7-hours)

**TEXT BOOKS RECOMMENDED:**
1. Measurement of distance, ranging a line, plotting of details in chain survey.
2. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
3. Different methods of levelling, height of instrument, rise & fall methods.

**Note for Examiner:** The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

**PART- A**

1. **CONCEPT OF EQUILIBRIUM**
   Load, reaction; General equilibrium equations; Equilibrium of a point in space; Equilibrium of a member; Concept of free body diagrams; Important mechanical properties- Elasticity, Plasticity, Ductility, Britteness, Malleability, Toughness, Hardness, Strength. (4 hours)

2. **SIMPLE STRESS AND STRAINS**
   Introduction, Concept of stress and strain, Stress-strain curves for ductile, brittle materials, Generalized Hooke’s law, Stress-strain diagram of ductile and brittle material, statically determinate and indeterminate problems, compound and composite bars, thermal stresses. Elastic constants, relations between various elastic constants and its use, Lateral strain, volumetric strain, poisons ratio. (7 Hours)

3. **COMPLEX STRESS AND STRAINS**
   Introduction, Normal stress, tangential stress, Rectangular block subjected to normal stress along and across two planes, combination of normal and tangential stress, Concept of principal stress and its computation, Mohr circle, Principal strains, computation of principal stresses from the principal strains. (6 Hours)

4. **SHEAR FORCE AND BENDING MOMENT DIAGRAMS**
   Introduction to the concept of reaction diagrams—shear force and bending moment, Role of sign conventions, Types of load, beams, supports, Shear force and bending moment diagrams: simply supported, overhang and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load, and moment, Relationship between load, shear force and bending moment, Different methods for plotting a bending moment and shear force diagrams. (8 Hours)

**PART- B**

5. **STRAIN ENERGY**
Introduction, Load deflection curve, Resilience and Impact Loading, Strain energy for gradually applied, Strain energy for suddenly applied, Strain energy for impact loading and shear stress. (4 Hours)

6. BENDING AND SHEAR STRESSES
Introduction, Assumptions and derivation of flexural formula for straight beams, Centroid of simple and built up section, second moment of area, Bending stress calculation for beams of simple and built up section, composite sections (flitched sections), Shear stress, Variation of bending and shear stress along the depth of section. Combined direct and bending stresses, Middle third rule, Analysis for various sections. (8 Hours)

7. TORSION OF CIRCULAR SHAFTS
Torsion, basic assumptions, derivation of torsion equation, Power transmitted by shafts, analysis and design of solid and Hollow shafts based on strength and stiffness, Sections under combined bending and torsion, equivalent bending and torsion. (6 Hours)

8. FAILURE THEORIES
Maximum principal stress theory, Maximum shear stress theory, Distortion Energy theory, Strain Energy theory. (2 Hours)

TEXT BOOKS RECOMMENDED
1. Strength of Material : S. Ramamrutham by TMH
4. Strength of Materials : Sadhu Singh, Khanna Publisher

OTHER RECOMMENDED BOOKS

2. Strength of Materials : Gere, Cengage Learning

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<th>Solid Mechanics Lab</th>
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<td>CIV- 352</td>
<td>Max. Marks-50</td>
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Note: All the Experiments are to be performed in the Lab.
1. To determine the Hardness of the given Specimen using Rockwell hardness test.
2. To determine the Hardness of the given specimen using Brinell hardness test.
3. To determine the Impact strength through Izod test and Charpy test
4. Draw Stress Strain curve for Ductile and Brittle material in tension.
5. Draw Stress Strain curve for Ductile and Brittle material in compression.
6. Draw shear stress, shear strain curve for ductile and brittle material in torsion strength testing
7. Draw load deflection curve for spring in loading and unloading conditions.
8. To determine the load carrying capacity of the leaf spring.

<table>
<thead>
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<th>Course Title</th>
<th>Structural Analysis-I</th>
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<td>Contact hrs</td>
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<tr>
<td>Pre-requisites</td>
<td>Analysis of Statically Determinate structures</td>
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Course Objectives
1. Equations of static equilibrium.
2. Bending of columns under different conditions.
3. Deflection of statically determinate structures
4. Stresses and strains in spherical and cylindrical shell
5. Analysis of determinate trusses
6. Influence lines and rolling Loads
7. Analysis of arches and suspension bridges

Course Outcome (s)
1. Explaining the Equations of static equilibrium.
2. Explaining the Euler’s theory of columns buckling.
3. Equating the deflection in statically determinate structures.
4. Equating the Stresses and strains in spherical and cylindrical shell
Note: The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt two questions from each part.

**PART A**

1. **INTRODUCTION**
   Classification of structures, equations of static equilibrium, Free body diagrams, static determinacy and stability of structure, Principle of superposition. (03 hours)

2. **COLUMN & BUCKLING**
   Definitions and examples of instability of columns; criteria for stability of columns, Euler’s theory of columns buckling, Euler’s equation for various end restraints, Rankine formula. (03 hours)

3. **DEFLECTION OF STATICALLY DETERMINATE BEAMS**
   Double Integration Method and Macaulay’s Method, moment area method, conjugate beam method, unit method and strain energy method. Maxwell’s reciprocal theorem. (05 hours)

4. **THIN CYLINDERS AND SPHERES**
   Introduction, stresses and strains in thin cylinders and spherical shell, volumetric change, thin vessels subjected to internal pressure. (04 hours)

5. **ANALYSIS OF DETERMINATE TRUSSES**
   Introduction, Determination of forces in member of trusses by method of joints, method of sections. (05 hours)

**PART B**

6. **ANALYSIS OF DAMS AND RETAINING WALLS**
   Introduction, limit of eccentricity for no tension in the section, core of the section, middle third rule. (04 hours)

7. **ROLLING LOADS**
   Introduction to rolling loads and influence lines, Determination of shear force, bending moment at a section and absolute shear force and bending moment due to single point load, uniformly distributed load, several point loads etc. (05 hours)

8. **INFLUENCE LINES**
   Construction of Influence lines for reaction, shear forces and bending moment for simply supported beams, Influence lines for forces in members of frames. (06 hours)

9. **ARCHES**
   Introduction, Analysis of three hinged arches, Influence lines for horizontal thrust, shear force, bending moment, radial shear and normal thrust for three hinged arch. (05 hours)

10. **CABLES AND SUSPENSION BRIDGES**
    Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, suspension bridge with two hinged and three hinged stiffening girders. (05 hours)

**BOOKS:**
Course Title: Transportation Engg.-I
Credits: 04

Course Code: CIV-304
L T P: 4 0 2

Contact Hours: 45
Max Marks: 50
Internal Assessment: 50
Elective: N
Pre-Requisite: Knowledge about various surveys needed for any type of construction

Course Objectives: The objective of the subject is to study highway project planning and to design various elements of roads.

Course Outcomes: Students will be able to understand the basic concepts of various fields of transportation engineering.

Note for Examiner: Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART - A

1. HIGHWAY PLANNING
   (4 Hours)

2. HIGHWAY GEOMETRIC DESIGN
   (4 Hours)

3. HIGHWAY MATERIALS
   Properties of Sub-grade and Pavement Component Materials, Tests on Sub-grade Soil, Aggregates and Bituminous Materials.
   (4 Hours)

4. HIGHWAY CONSTRUCTION
   Earthen/Gravel Road, Water Bound Macadam, Wet Mix Macadam, Bituminous Pavements, Cement Concrete Pavements.
   (4 Hours)

5. HIGHWAY DRAINAGE
   Importance, Surface Drainage and Subsoil Drainage, Construction in Water-logged areas.
   (4 Hours)

PART - B

6. HIGHWAY MAINTENANCE
   (4 Hours)

7. HIGHWAY ECONOMICS & FINANCING
   Total Transportation Cost, Economic Analysis, Sources of Highway Financing.
   (4 Hours)

8. TRAFFIC CHARACTERISTICS
   Road User Characteristics, Driver Characteristics, Vehicular Characteristics
   (3 Hours)

9. TRAFFIC STUDIES
   Volume and Speed Studies, O-D Survey, Parking Study
   (3 Hours)

10. TRAFFIC SAFETY
    Cause and Type of Accidents, Use of Intelligent Transport System
    (4 Hours)

11. TRAFFIC CONTROL MEASURES
    Signs, Markings, Islands, Signals
    (7 Hours)

TEXT BOOKS RECOMMENDED:

<table>
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<th>Course Title</th>
<th>Transportation Engg.-I</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Course Code</td>
<td>CIV 354</td>
<td>Max marks 50</td>
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**AGGREGATE TESTS**
1. Sieve Analysis of fine and coarse aggregates
2. Aggregate Crushing Value Test.
3. Aggregate Impact Value Test.
4. Los Angeles Abrasion Value Test.
5. Aggregate Soundness Test.
6. Flakiness Index and Elongation Index Test.
7. Specific Gravity and Water Absorption Test.

**BITUMEN TESTS**
1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Viscosity Test.
5. Flash Point and Fire Point Test.

**TEXT BOOKS RECOMMENDED :**
2. Relevant IS Standards

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<td>L T P</td>
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<tr>
<td>Contact Hours</td>
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<td>Max. Marks-50 Internal Assessment-50</td>
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**Pre-requisites:** Knowledge of geological features of Earth

**Course Objectives**
The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to:
1. study the geological features of Earth
2. study the Engineering properties of different rocks
3. study about application of Geology in planning and designing of different Civil Engineering Projects.

**Course Outcome (s)**
The theory should be taught along with examples in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:
1. Understand the geological features based upon the available documents.
2. Understand the engineering properties of the rocks
3. Understand the application of knowledge of Geology in planning and designing of different Civil Engineering Projects

**Note:** The examiner shall set total seven questions. First Question is compulsory covering whole syllabus(ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

**PART A**

1. **GENERAL GEOLOGY**
   Importance of Engg. Geology applied to Civil Engg. Practices. Weathering, definition, types and effect. Geological works of rivers, wind, glaciers as agents of erosion, transportation and deposition. (4 Hours)

2. **ROCKS & MINERALS**
   Minerals, their identification, igneous, sedimentary & metamorphic rocks. Classification of rocks for engineering purposes. Rock quality designation (RQD). (4 Hours)
3. STRUCTURAL GEOLOGY
Brief idea about stratification, apparent dip, true dip, strike and in conformities. Folds, faults & joints : definition, classification relation to engineering operations. (4 Hours)

4. ENGINEERING GEOLOGY
Geological considerations in the Engg. Projects like tunnels, highways, foundation, dams, reservoirs. (2 Hours)

5. EARTHQUAKE
Definition, terminology, earthquake waves, intensity, recording of earthquake. (2 Hours)

6. ENGINEERING PROPERTIES OF ROCKS AND LABORATORY MEASUREMENT
Uniaxial compression test, tensile tests, permeability test, shear tests, size and shape of specimen rate of testing, Confining pressure, stress strain curves of typical rocks. Strength of intact and fissured rocks, effect of anisotropy, effect of saturation and temperature (5 Hours)

7. IN-SITU DETERMINATION OF ENGG. PROPERTIES OF ROCK MASSES
Necessity of in-situ tests, uniaxial load tests in tunnels and open excavations, cable tests, flat jack test, shear test, pressure tunnel test. Simple methods of determining in situ stresses, bore hole test. (5 Hours)

8. IMPROVEMENT IN PROPERTIES OF ROCK MASSES
Pressure grouting for dams and tunnels, rock reinforcement rock bolting. (4 Hours)

BOOKS:
5. Engineering Geology : D.S.Arora
6. Engineering Geology : Parbin Singh
8. Engineering Geology : Parbin Singh

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<tr>
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Course Objectives
1. The objective of the course is to give information about the application of different types of flows studied in Fluid Mechanics-I and also to study how the hydraulic energy can be used in hydraulic machines.
2. The course will detail about the variations in the design of the channels based on the type of flow and obstructions carried by them such as contractions and humps etc. The various designs of irrigation structures to be learnt are based on the basics studied in this class.

Course Outcomes
1. The student would be able to learn the basic equations and concepts related to their application for designing various types of open channels.
2. Apart from study of channels, the students will also learn about the impact of free jets on various types of plates and apply this information on the topics of turbines and pumps and hence the hydroelectric generation plant.
3. Overall, this course will give a general overview of fluid processes taking place within channels and will be helpful to apply in other courses of Civil engineering.

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.
1. UNIFORM FLOW IN OPEN CHANNELS
Flow classifications, Basic resistance Equation for open channel flow, Chezy, Manning, Bazin and Kutter formulae. Variation of roughness coefficient, Conveyance and normal depth, Velocity Distribution. Most efficient flow sections; rectangular, trapezoidal and circular. (5-hours)

2. ENERGY AND MOMENTUM PRINCIPLES AND CRITICAL FLOW
Energy and specific Energy in an open channel; Critical depth for rectangular and trapezoidal channels. Momentum and specific force in open channel flow, Alternate depths and Sequent depths, Applications of specific energy to transitions and Broads crested weirs. (5-hours)

3. GRADUALLY VARIED FLOW
Different Equation of water surface profile; limitation, properties and classification of water and surface profiles with examples, Computation of water surface profile by graphical, numerical and analytical approaches. (5-hours)

4. GRADUALLY VARIED FLOW
Theory of Jump, Elements of jump in a rectangular Channel, length and height of jump, location of jump, Energy dissipation and other uses, Surge as a moving hydraulic jump. Positive and negative surges. (5-hours)

5. FLOW PAST IMMERSED BODIES
Drag and lift: deformation Drag and pressure drag. Drag on a sphere, cylinder and Airfoil: Lift-Magnus Effect and circulation, lift on a circular cylinder. (5-hours)

6. IMPACT OF FREE JETS
Force exerted by fluid jet on stationary flat plate, Force exerted by fluid jet on moving flat plate, Force exerted by fluid jet on stationary curved vane, Force exerted by fluid jet on moving curved vane. (5-hours)

7. HYDRAULIC TURBINES
Head and efficiencies of hydraulic turbines, Work done and efficiencies of Pelton Wheel, Francis and Kaplan turbines, Surge tanks. (5-hours)

8. RECIPROCATING PUMPS
Main components and working of reciprocating pumps, Work done by single and double acting pumps, Coefficients of discharge, slip, percentage slip and negative slip of reciprocating pumps. (5-hours)

9. CENTRIFUGAL PUMPS
Main components and working of centrifugal pumps, Work done by impeller Head of Pump, Losses and efficiencies, Specific speed, NPSH, Cavitation in centrifugal pumps. (5-hours)

TEXT BOOKS RECOMMENDED :
1. Hydraulic and Fluid Mechanics : Modi and Seth, Standard Book House, Delhi
2. Fluid Mechanics : R. J. Garde and A. Z. Mirjauaker
5. Fluid Mechanics & Hydraulic Power Engineering : D.S Kumar, Kataria & Sons
FOURTH SEMESTER

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<th>Credit</th>
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<tr>
<td>Pre-requisites</td>
<td>Knowledge of Basic Constituents of Reinforced Concrete</td>
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<td>Course Objectives</td>
<td>The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to:-</td>
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<tr>
<td></td>
<td>1. To learn about properties of materials used in RCC structures various methods of design RCC structures.</td>
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<td>2. To study about Limit State Method of design of RCC structures.</td>
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<td>3. To learn how to design various components of buildings such as beams, slabs, columns, isolated footings and staircases.</td>
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<td>4. To study concepts of earthquake engg. and various IS codes of earthquake resistant design of structures.</td>
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</table>

Note for Examiner- The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

Use of IS 456-2000, SP16(Charts only), IS 1893:2002 is allowed.

PART– A

1. INTRODUCTION TO RCC
   Reinforced concrete, definition, properties of materials, grades of concrete and reinforcing steel, stress-strain curves for concrete & steel , permissible stresses, design philosophies working stress design, ultimate strength and limit state design method. (06-hours)

2. LIMIT STATE DESIGN METHOD
   Introduction, Limit States, Characteristic values, characteristic strength, characteristic loads, design values for materials and loads, factored loads. (04-hours)

3. DESIGN OF BEAMS
   Design of singly reinforced & doubly reinforced rectangular beam sections in Flexure, Shear , Bond & Torsion using Limit State method, Development length & continuation of reinforcement beyond cut off points. Design of Flanged Sections (T-sections & L-sections), Check for Limit state of serviceability- deflection, Effective span to effective depth ratios, modification factors for singly reinforced, doubly reinforced and flanged beams. (08-hours)

4. DESIGN OF COLUMNS
   Limit State of Collapse (Compression) Columns and their classification, reinforcement in columns, assumptions, short and long (both tied and helical) columns subjected to axial load, short columns subject to axial, uniaxial and biaxial bending (using SP:16). (06-hours)

PART– B

5. DESIGN & DETAILING OF SLABS
   Design of one-way slab and two-way rectangular slab for various boundary conditions. (06-hours)

6. FOOTINGS
   Design of Isolated Footings under Axial Loads. (04-hours)

7. STAIRCASES
   Introduction to various types of stairs, Terminology, design of Single flight and dog legged stair. (06-hours)

8. EARTHQUAKE RESISTANT DESIGN

TEXT BOOKS RECOMMENDED
Course Title: Reinforced Concrete Design-I (Practical)  
Course Code: CIV-451  
Max. Marks: 50  
Credit: P  

1. To determine the Specific Gravity of cement.  
2. To determine the Standard Consistency.  
3. To determine Initial and Final Setting time of Cement.  
4. To determine Soundness of Cement.  
5. To determine the Compressive Strength of Cement.  
6. To determine the Compressive Strength of Bricks.  
7. To determine the Transverse Strength of Tiles.  
8. To determine the Compressive Strength of Concrete.  
9. To determine the Slump of Concrete.  
10. Non Destructive testing.

TEXT BOOKS RECOMMENDED:
1. V. V. Shastri and M. L. Gambhir, Laboratory Manual on Concrete Testing (Part-I).  
3. PD Kulkarni, LN Mittal & Hemant Sood, Laboratory Manual on Concrete Technology

Course Title: Structural analysis-II  
Course Code: CIV.402  
L T P: 4 0 0  
Credits: 04  

Pre-requisites: Analysis of Statically Determinate structures  

Course Objectives
1. Technical competence in the fundamental concepts of analysis of indeterminate structures.  
2. Application of displacement methods and force methods of statically indeterminate structures.

Course Outcome(s)
1. To understand the technical competence in the fundamental concepts of analysis of indeterminate structures.  
2. Application of displacement methods and force methods of statically indeterminate structures by the slope deflection moment, moment distribution method and method of strain energy.

Note: The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

PART – A

1. STATICALLY INDETERMINATE STRUCTURES
   Introduction to statically indeterminate structures, Static and Kinematic indeterminacy, Equation of Equilibrium, Compatibility Equations, Principle of Superposition, Influence lines for indeterminate structures using Muller Breslau Principle. Methods of analysis (04 hours)

2. FORCE METHOD OF ANALYSIS
   Method of Consistent Deformation, Three moment theorem, Analysis of Fixed and Continuous beams subjected to different loading conditions, sinking and rotation of support. (04 hours)

3. DISPLACEMENT METHOD OF ANALYSIS - SLOPE-DEFLECTION METHOD
   Introduction, slope-deflection equations, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements. (06 hours)

4. DISPLACEMENT METHOD OF ANALYSIS - MOMENT-DISTRIBUTION METHOD
   Introduction, absolute and relative stiffness of members, stiffness and carry-over factors, distribution factors, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements. (06 hours)
5. APPROXIMATE METHODS OF STRUCTURAL ANALYSIS
Lateral load analysis of multistory frames, portal method and cantilever method. (06 hours)

6. METHOD OF STRAIN ENERGY
Strain energy for linear elastic system, Castigliano’s first theorem and its application for deflection calculation in beams and rigid frames, minimum strain energy theorem, Castigliano’s second theorem and its application for analysis of beams and rigid frames, unit load method and its application for analysis of beams and frames. (08 hours)

7. REDUNDANT FRAMES
Analysis and deflection calculation using Minimum Strain Energy Theorem, Castigliano’s theorems and Unit load Method, Lack of fit of member, temperature stresses. (04 hours)

8. TWO HINGED ARCHES
Types of Arches, Analysis of two Hinged Arches, Shear Force and Normal Thrust, Effect of Rib Shortening, Parabolic Arch subjected to concentrated load and UDL, Temperature Stresses, Circular Arches, Reaction Locus, Influence lines. (05 hours)

BOOKS:
1. Indeterminate Structures : R. L. Jindal, S. Chand
3. Indeterminate Structural Analysis : Kinney, Edison Wesley
4. Indeterminate Structures : C.K Wang, TMH
5. Basic Structural Analysis : C.S. Reddy, TMH
6. Indeterminate Structures : A.K. Jain, TMH
7. Structural Analysis (I&II) : S.S. Bhavikatti, Vikas Publishing House

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NOTE: The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

PART - A

1. CURVES
Types of horizontal curves, Basic definitions, Degree of curve, elements of a curve, Peg interval, setting out curves with and without theodolite, Obstacles in curve setting. (6 Hours)

2. TRANSITION CURVES
Combined circular and Transition Curves and their setting out in field. Vertical curves, Setting out vertical curves by chord gradient and tangent correction methods. (6 Hours)

3. SURVEY ADJUSTMENTS
Definitions, Law of Weights, Theory of least squares, normal equations, Most probable values by normal equations, by method of differences and by method of correlates, Triangulation Adjustments by least square method. (4 Hours)

4. ELEMENTS OF PHOTOGRAMMETRY
Introduction, types of photographs, types and geometry of aerial photograph, flying height and scale, relief (elevation) displacement in vertical photographs. Stereoscopy, measurement of parallax and height determination, flight planning. (6 Hours)
PART – B

5. GIS
Definition of GIS, Components of GIS, Application areas & advantages of GIS, Uses of GIS (6 Hours)

6. DIGITAL REPRESENTATION OF GEOGRAPHIC DATA
Raster & Vector data representation, acquiring & handling Raster geographic data, Raster based GIS data analysis, Characteristics of vector based GIS data processing. (5 Hours)

7. GPS
Introduction, working principle, various application of GPS related to Civil Engg., components of GPS i point positioning and differential positioning. (6 Hours)

8. REMOTE SENSING
Introduction, principles of electromagnetic remote sensing, remote sensing system classifications, imaging characteristics, extraction of metric information from remotely sensed images, integration of remote sensing & GIS, Introduction of Total station instrument. (6 Hours)

TEXT BOOKS RECOMMENDED:
5. Understanding GPS, Principles & Applications: Kaplan, E.D, Taylor & Francis
6. Advanced surveying Education: Satheesh Gopi, R. Sathikumar, N. Madhu, Pearson

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1. Remote Sensing: Pocket and Mirror Stereoscopes, Stereo Vision test for 3-D studies, Study of aerial photograph under stereoscopes
2. Triangulation using total station: Plotting of Traverse
3. Use of GIS softwares: Vectorizing the scanned files and layering, Editing and projection systems of the data, analyzing the geographical data
4. Use of GPS softwares: To determine the coordinates of a station by point positioning, To determine the area of a triangulation figure, to locate the alignment of a road
5. Setting out a simple circular curve by offsets from long chord,
6. Setting out a simple circular curve by offsets from tangents,
7. Setting out a simple circular curve by Rankine’s method,
8. Setting out a simple circular curve by Two theodolite method

BOOKS:
1. Surveying Vol. I & II: Dr. K.R. Arora
2. Surveying Vol. II: Dr. B.C. Punmia

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<tr>
<td>Pre-Requisite</td>
<td>Basic knowledge about railways and airports.</td>
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<td>Course Objectives</td>
<td>The objective of the subject is to provide knowledge about basics and design aspects of Railway tracks and Airports.</td>
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<td>Course Outcomes</td>
<td>Students will be able to learn the railway track and its components as well as airport and its different parts.</td>
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Note for Examiner: Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.
PART– A

1. INTRODUCTION TO RAILWAY ENGINEERING
   Development of Indian Railway, Organization of Indian Railway (2 Hours)

2. RAILWAY GAUGES
   Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge. (2 Hours)

3. RAILWAY TRACK
   Requirements of a Good Track, Track Specifications on Indian Railways, Detailed Cross-Section of Single/Double Track on Indian Railways. (3 Hours)

4. COMPONENTS OF RAILWAY TRACKS
   Rails: functions, composition of rail steel, requirement, types of rail sections, selection of rails & buckling of rails, Sleepers; functions, requirement, classification, Ballast; functions, requirement & types, Track Fixtures & Fastenings; purpose and types, Coning of Wheels, Tilting of Rails, Rail Joints; an ideal rail joint, types of rail joints, Creep of Rails. (3 Hours)

5. GEOMETRIC DESIGN OF RAILWAY TRACK
   Alignment, Gradients, Horizontal Curve, Super-elevation, Equilibrium Cant, Cant Deficiency, Transition Curves. (4 Hours)

6. POINTS AND CROSSINGS
   Functions, Various structures provided in a turnout and its working, Various types of Track Junctions and their layouts. (3 Hours)

7. RAILWAY STATIONS & YARDS
   Site Selection, Classification & Layout of Stations, Marshalling Yard, Locomotive Yard, Equipment at Railway Stations. (3 Hours)

8. SIGNALLING AND INTERLOCKING
   Objectives, Classification of Signals, Types of Signals in Stations and Yards, Automatic Signalling, Principal of Interlocking. (4 Hours)

9. MODERNIZATION OF RAILWAY TRACKS
   Development of High Speed Tracks, Ballastless Track, MAGLEV Track. (3 Hours)

PART– B

10. AIRPORT PLANNING
    Aircraft Characteristics, Factors for Site Selection, Airport Classification, General Layout of an Airport. (3 Hours)

11. OBSTRUCTIONS AND ZONING LAWS
    Imaginary Surfaces, Approach Zones and Turning Zones. (3 Hours)

12. RUNWAY ORIENTATION AND DESIGN
    Wind Rose Diagram, Basic Runway Length, Corrections, Geometric Design Elements, Runway Configuration. (5 Hours)

13. TAXIWAY DESIGN
    Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons. (3 Hours)

14. VISUAL AIDS
    Marking and Lighting of Runway, Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR. (4 Hours)

TEXT BOOKS RECOMMENDED:
<table>
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<th>Course Title</th>
<th>Concrete Technology</th>
<th>Credit</th>
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<td>Course Code</td>
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<td>Contact Hours</td>
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<td>Pre-requisites</td>
<td>This course requires the student to know about the basic of civil engineering, fundamentals of chemistry, building materials.</td>
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| Course Objectives    | 1. To prepare the graduates as best civil engineers with an excellent comprehension of fundamentals of concrete structure at micro and macro levels and applications of different types of cement and concretes, besides keeping them abreast with latest developments in concrete technology at the National and International levels.  
2. To give them all inputs required to help them attain professional expertise and establish themselves as renowned concrete technologists.  
3. To enable them develop interest in concrete technology area and pursue academic / research assignments by providing information regarding innovative developments on special concretes, eco-friendly and smart concretes, sustainable development and special concretes in concrete technology. |
| Course Outcome (s)   | 1. To identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy.  
2. To acquire and apply fundamental knowledge in the fresh and hardened properties of concrete.  
3. To evaluate the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure.  
4. To develop an awareness of the utilization of waste materials as novel innovative materials for use in concrete.  
5. To design a concrete mix which fulfills the required properties for fresh and hardened concrete. |

**Note For Examiner**: Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

**PART – A**

1. **PROPERTIES OF CONCRETE**  
Workability, strength, shrinkage and temperature effects, creep, permeability, fire resistance, thermal properties and durability of concrete, stress strain characteristics of concrete, sulphate attack, acid attack. Rheology of concrete, factors effecting rheological properties.  

2. **CHEMICAL AND MINERAL ADMIXTURES**  

3. **QUALITY CONTROL OF CONCRETE**  
Need of quality control, factors causing variation in quality of concrete, field control, advantages of quality control, statistical quality control, acceptance criteria, quality management in concrete construction, tools for quality management  

4. **CONCRETING UNDER SPECIAL CIRCUMSTANCES**  
Hot weather concreting, cold weather concreting, under ground concreting, under water construction.  

**PART –B**

5. **DETERIORATION OF CONCRETE AND ITS PREVENTION**  
Corrosion of reinforcement in concrete, factors influencing corrosion, damages caused by corrosion, preventive measures in construction, tests for existing structures, remedial measures.  

6. **SPECIAL CONCRETES**

7. SELF COMPACTING CONCRETE
Materials for SCC, requirements for SCC, workability requirements for fresh SCC, production and placing, slump flow test, J-ring test, V-funnel test, L box test, U box tests, full box test, oriment test, SCC mix design. (8 hours)

8. MIX DESIGN
Design of concrete mixes as per IS:10262:2009. (5 hours)

TEXT BOOKS RECOMMENDED:

OTHER RECOMMENDED BOOKS:
1. A.M.Neville, "Properties of Concrete" English Language Book Society/Longman Pub, 1988

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<td>Pre-requisites</td>
<td>Knowledge of Advance Surveying and Buildings Construction</td>
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<td>Course Objectives</td>
<td>1. To create awareness amongst students to basic issues of natural and manmade disasters.</td>
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<td>2. To ensure the understanding of the disaster management cycle and relationship amongst vulnerability, preparedness, prevention and mitigation.</td>
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<td>3. To invoke minimum ability and sensitivity amongst students to respond to disasters in their area of living and working.</td>
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<td>4. To develop technical prowess and to mitigate the effects of disasters by capacity building amongst engineering fraternity towards formulation and implementation of disaster management strategies.</td>
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<td>5. To relate amongst the basic approaches adopted in disaster risk reduction and institutional mechanism adopted in country towards creating resilient society</td>
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Course Outcome(s)
1. Understand genesis and causes of natural and manmade disaster within the framework of fundamental concepts of basic sciences and engineering.
2. Perceive the vulnerability of their living and working places and level of preparedness within the existing setup of disaster management.
3. Analyze and critically examine the vulnerability of a region and to employ adequate strategy and tools of intervention.
4. Build capacity to use specialized problem solving skills, methodologies and technology.
5. Setup priorities to develop coherent and adaptable disaster management plan.

Note for Examiner: Examiners will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART – A

1. INTRODUCTION, DISASTER MITIGATION, RISK ASSESSMENT, MANAGEMENT SYSTEM
Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management. Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle. Natural Hazards: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought etc. Man-made hazards: causes, consequences mitigation measures for various industrial hazards/disasters. Preparedness for natural disasters in urban areas. Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems. Emergency medical and
essential public health services, response and recovery operations, reconstruction and rehabilitation. (15 hours)

2. CAPACITY BUILDING
Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines. (7 hours)

PART - B

3. EARTHQUAKE ENGG. NATURAL DISASTERS AND MITIGATION
Performance of Buildings and Structures : Main causes of damage : Intensity of earthquake forces, lack of strength and integrity in buildings, quasi- resonance, lack of ductility, lack of detailing. Earthquake Effects: On ground and soil liquefaction, buildings, structures, power plants, switch yards, equipments and other lifeline structures, release of poisonous gases and radiation. Lessons Learnt from the Past Earthquakes. (10 hours)

4. APPLICATION OF GEO-INFORMATICS AND ADVANCED TECHNIQUE
Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems. (7 hours)

5. INTEGRATION OF PUBLIC POLICY
Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management. (6 hours)

TEXT BOOKS RECOMMENDED:

OTHER RECOMMENDED BOOKS:
2. B C Bose, “Modern Encyclopaedia of Disaster and Hazard Management” Rajat publications.

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Design and detailing of following structural components designed in RCC-I through AUTOCAD:
1. Design and detailing of Singly reinforced beams and doubly reinforced beams along with the detailing of stirrups.
2. Design and detailing of columns with different types of reinforcements.
3. Cross sectional view and plan for one way slabs along with the detailing of reinforcement bars showing the clear distance between the bars, bent up bars and extra bars used for negative reinforcement.
4. Design and detailing of single flight and dog legged stair case along with the reinforcement details for the stair case inclined slab.
5. Ductile Detailing of beams & columns as per IS 13920:1993
## FIFTH SEMESTER

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<td>Knowledge of Project Planning and its Management</td>
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<td>Course Objectives</td>
<td>The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to: - 1. make the students well acquainted with the basics of Steel structural elements 2. Study design procedures of various components used in fabrication of Steel structures. 3. Introducing the students with IS 800:2007 &amp; steel tables.</td>
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<td>Course Outcome(s)</td>
<td>The theory should be taught along with examples in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes: 1. Understanding the designs of joints in bolted connections and welded connection. 2. Understanding the design of tension, compression and flexural members using application of bolted and welded connections. 3. Understanding the different types of columns bases and foundations. 4. Understanding the design of trusses using all the concepts learnt in this subject.</td>
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**Note:** The examiner shall set total seven questions. First Question is compulsory covering whole syllabus(ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.Use of IS-800-2007 & Steel Tables is allowed.

### PART A

1. **BOLTED & WELDED JOINTS**
   Terminology, Specifications for bolted & welded connections, Types of joints, Efficiency of bolted joint, Framed Connections (Beam to Beam & Beam to Column, Types of welds & welded joints, stresses in welds, design of welds. (08-hours)

2. **TENSION MEMBERS**
   Types of tension members, net & gross areas, permissible stresses. Design of members subjected to axial loads, tension member splice. (08-hours)

3. **COMPRESSION MEMBERS**
   Failure modes of columns, end conditions & effective length of columns, various empirical formulae. IS code formula, General codal provisions for design of compression members. Built up compression members, lacing and battening of compression members, splicing of compression members. (08-hours)

### PART B

4. **COLUMN BASES AND FOUNDATIONS:**
   Types of column bases, design of slab base, Gusseted base & grillage foundations. (08-hours)

5. **DESIGN OF FLEXURAL MEMBERS**
   Failure modes permissible stresses, design of laterally supported and unsupported beams. (05-hours)

6. **DESIGN OF ROOF TRUSS**
   Design and Drawing details of a steel roof truss bolted/welded with given forces in various members. (08-hours)

### BOOKS:

3. Design of steel structures N. Subramanian, Oxford University Press
4. Design of steel structures K.S. Sai Ram, Pearson Education
7. Steel Tables
Course Title | SSD Drawing-I | Credits  
---|---|---
Course Code | CIV 551 | 01
Max marks- 50 | P | 02

Detailed working drawing for using AUTOCAD
1. Steel roof truss.
2. Plate girder (welded)
3. Stanchion beam connections.
4. Grillage foundation.
5. Composite column with lacings

Course Title | Irrigation Engineering-I | Credits  
---|---|---
Course Code | CIV 502 | 04
Max marks- 50 | L T P | 4 0 0
Internal Assessment-50 | Elective | N

Pre-requisites | Fluid Mechanics I

Course Objectives
1. The objective of this course is to introduce the students with various methods of Irrigation, regarding canal losses, tube wells, Irrigation projects & investigations and important concept of River training works.

Course Outcomes
1. The student would be able to learn the basics about necessity of irrigation, its importance, various methods of surface and sub-surface irrigation, equations and theories in design of canals, methods to reduce losses and deal with current issues to improve efficiency of irrigation.
2. The course will also teach the students about taking up the irrigation projects, their design and execution process.
3. The students will also learn basics of river training works and tube well irrigation which will increase their knowledge related to concepts of groundwater engineering.

Note for Examiner-
Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART –A

1. METHODS OF IRRIGATION
Advantages and disadvantages of irrigation, Water requirements of crops, Factors affecting water requirement, Consumptive use of water, water depth or delta and crop relation, Duty of water, relation between delta, duty and base period, Soil crop relation-ship and soil fertility, Sprinkler irrigation advantages & limitations. Planning and design of sprinkler irrigation, Drip irrigation advantages & limitations, suitability. (8-hours)

2. CANAL IRRIGATION
Classifications of canals, canal alignment, Inundation canals, Bandhara irrigation, advantages and disadvantages, Silt theories-Kennedy's theory, Lacey's theory, Drawbacks in Kennedy's & Lacey's theories, comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy & Lacey's theories, suspended and bed loads. (5-hours)

3. LINED CANALS
Types of lining, selection of type of lining, Economics of lining, Maintenance of lined canals, Silt removal, Strengthening of channel banks, Measurement of discharge in channels, Design of lined canals, Methods of providing drainage behind lining. (6-hours)

4. LOSSES IN CANALS, WATER LOGGING AND DRAINAGE
Losses in canals-Evaporation and seepage, Water logging, causes and ill effects of water logging-anti water logging measures. Drainage of land Classification of drains - surface and subsurface drains Design considerations for surface drains, Advantages and maintenance of tile drains. (6-hours)
PART –B
5. INVESTIGATION AND PREPRRATION OF IRRIGATION PROJECTS
Classification of project, Project preparation-investigations, Design of works and drawings, concept of multi-purpose projects, Major, Medium and minor projects, Planning of an irrigation project, Economics & financing of irrigation works. Documentation of project report. (6-hours)

6. TUBE- WELL IRRIGATION
Force exerted by fluid jet on stationary flat plate, Force exerted by fluid jet on moving flat plate, Force exerted by fluid jet on stationary curved vane, Force exerted by fluid jet on moving curved vane. Types of tube - wells - strainer type, cavity type and slotted type. Type of strainers, Aquifer, porosity, uniformity coefficient, specific yield & specific retention, coefficients of permeability, transmissibility and storage. Yield or discharge of a tube well, Assumptions, Theim & Dupuit's formulae. Interference of tube wells with canal or adjoining tube-wells, optimum capacity, Duty and delta of a tube well. Rehabilitation of tube well. (7-hours)

7. RIVER TRAINING WORK
Objectives, classification of river-training works, Design of Guide Banks, Groynes or spurs - Their design and classification ISI. Recommendations of Approach embankments and afflux embankments, pitched Islands, Artificial cut-off objects and Design Considerations River control - objectives and methods. (5-hours)

TEXT BOOKS RECOMMENDED :
3. Irrigation Engg. & Hydrauloc Structure Varshney, Gupta & Gupta

<table>
<thead>
<tr>
<th>Course Title</th>
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<tbody>
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Pre-requisites Learning the properties of soil

Course Objectives
1. Classification and characteristics of soils
2. Compaction
3. Consolidation
4. Effective stress principle
5. Permeability and seepage
6. Shear strength
7. Earth pressure

Course Outcome (s)
1. Introduction to the classification and characteristics of soils
2. Understanding the Compaction and Consolidation
3. Principles of effective stress principle
4. Description of permeability and seepage
5. Concept of shear strength and earth pressure

Note: The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

PART - A
1. BASIC CONCEPTS
Basic definitions in soil mechanics. Weight volume relationship, phase diagrams, Particle Size Analysis, Types of soil water, capillary action, Frost heave, frost boil, Prevention of frost action, Shrinkage & swelling of soils, Slaking of clay, Bulking of sand (04 hours)

2. CLASSIFICATION AND CHARACTERISTICS OF SOILS
Indian Standard classification System, Consistency limits & their use and determination, various indices, shrinkage parameters, sensitivity, thixotropy & activity of soils. (06 hours)
3. **COMPACTION**  
Definition and object of compaction Standard proctor test & Modified proctor test, Compaction curve. Factors affecting compaction, Effect of compaction on soil properties. Field compaction methods their comparison of performance and relative suitability. Field compactive effort. Field control of compaction by proctor needle. (06 hours)

4. **CONSOLIDATION**  
Definition and object of consolidation difference between compaction and consolidation. Concept of various consolidation characteristics i.e. av, mv and Cv primary and secondary consolidation. Terzaghi’s method for one-dimensional consolidation. Consolidation test. Normally consolidated and over consolidated clays importance of consolidation settlement in the design of structures. (07 hours)

5. **EFFECTIVE STRESS PRINCIPLE**  
Concept of effective stress principle, effect of water table fluctuations on effective stress, Seepage pressure, critical hydraulic gradient and quick sand condition. (04 hours)

6. **PERMEABILITY AND SEEPAGE**  
Darcy’s law and its validity seepage velocity. Co-efficient of permeability and its determination, Factors affecting and brief discussion average permeability of stratified soil deposits. (06 hours)

7. **SHEAR STRENGTH**  
Stress analysis of a two-dimensional stress system by Mohr circle, Coulomb - Mohr strength theory, Revised Mohr-Coulomb Equation, Relations between principle stresses at failure, Shear strength tests - Direct shear Test, Triaxial test, Unconfined Compression test, Different types of soils, Liqefaction of sands, Shear characteristics of Cohesive & Cohesionless soils. (05 hours)

8. **EARTH PRESSURE**  
Terms and symbols used for a retaining wall. Movement of wall and the lateral earth pressure. Rankine’s and Coulomb’s theory for lateral earth pressure. Culmann’s graphical construction and Rehbann’s graphical construction. (06 hours)

**BOOKS :**  

**Course Title** | **Geotechnical Engineering Lab** | **Credits** | **Max marks**  
--- | --- | --- | ---  
**Course Code** | CIV 553 | P | 02  
1 Determination of water content.  
2 Determination of field density by Core cutter method  
3 Determination of field density by Sand replacement method  
4 Grain size Analysis by Mechanical Method.  
5 Grain size Analysis by Hydrometer Method.  
6 Determination of Specific Gravity by Pycnometer.  
7 Determination of Liquid Limit, Plastic limit.  
8 Determination of Permeability of soils.  
9 Determination of In-Situ California Bearing Ratio of soil.  
10 Determination of optimum moisture content & maximum dry density of soil by Standard Proctor Compaction Test (SPCT).


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<thead>
<tr>
<th>Course Title</th>
<th>Environmental Engineering - I</th>
<th>Credits</th>
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<tr>
<td>Contact Hours</td>
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<tr>
<td>Pre-requisites</td>
<td>Knowledge Of Sources Of Water Supply, Quality Of Water, Water Supply Systems, Pumps And Pumping, Water Treatment, Tools For Clean Productions</td>
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<tr>
<td>Course Objectives</td>
<td>To aware the students about science and engineering principles to study &amp; improve the sources, quality, supply and treatment of water.</td>
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</tbody>
</table>
| Course Outcome                  | 1. To learn the concepts of water supply systems.  
2. To learn sources of water supply.  
3. To learn water treatment & how clean water by using different tools.  
4. To learn how pumps are used for pumping water. |         |

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART – A

1. SOURCES OF WATER SUPPLY
Measurement of rainfall and runoff variations; mass diagram; Definition and Design factors, Groundwater and springs Definition - various types of wells - well construction and development - specific yield and various tests - Infiltration wells and galleries; choice of source of water supply. (07 hours)

2. QUALITY OF WATER
Testing of various physical-chemical and biological characteristics and their significance; standards of quality for different uses of water (07 hours)

3. WATER SUPPLY SYSTEMS
Municipal water demands and demand variations, Population forecasting and water demand estimations; Intakes and transmission systems, pipes for transporting water and their design, water distribution systems and appurtenances; Data and background information for the design of water supply system; Water supply network design and design of balancing and service reservoirs; operation and maintenance of water supply systems. (08 hours)

PART – B

4. PUMPS AND PUMPING
Necessity of pumping, classification of different type of pumps and their characteristics and selection criteria, economical diameter of the rising main, pumping stations. (08 hours)

5. WATER TREATMENT
Water treatment schemes; Basic principles of water treatment; Design of plain sedimentation, coagulation and flocculation, filtration: slow, rapid and pressure; Disinfection units; Fundamentals of water softening, fluoridation and defluoridation, and water desalination and demineralization. (08 hours)

6. TOOLS FOR CLEAN PRODUCTIONS
Reuse, recycle, recovery, source reduction life cycle analysis; environmental cost accounting, EIA. Air and Noise pollution (source, effects and control), noise level standards. Small scale and household level water purification system and water fixtures (05 hours)
7. MISCELLANEOUS:
Urban rain water disposal/rain water harvesting; Control of Water-borne diseases Indoor Pollution
(02 hours)

BOOKS:
7. Waste water Engineering : S.N. Paul & Arvind Kumar, APH Publishing House

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<td>Max Marks-50</td>
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Note: At least seven experiments are to be performed.
1) Determination of Color & Turbidity.
2) Determination of Solids: Total, Dissolved and Suspended solids.
3) Determination of Alkalinity and its species.
4) Determination of pH, and Acidity and its species.
5) Determination of Hardness (different types)
6) Determination of Chlorides.
7) Determination of Fluorides.
8) Jar test for optimum coagulant dose estimation.
9) Determination of residual chlorine and chlorine dose.

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<th>Course Title</th>
<th>Estimating And Costing</th>
<th>Credit</th>
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<td>Contact Hours</td>
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<td>Internal Assessment-50</td>
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Pre-requisites: Knowledge of Building Materials & Construction Techniques

Course Objectives
4. The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to:
5. To learn about methods of preparing preliminary estimate for buildings, RCC works and Roads from the available plans.
6. To analyze the rates of various items of work from the quantity of various materials in a building and its probable cost.
7. To study about the specifications for the various items of work.
8. To develop an awareness of those factors that affect the cost of construction work and to analyze the influences that effect change in these factors.
9. To learn about P.W.D accounts and procedures of work.

Course Outcome (s)
The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:
1. Estimating the cost of and assisting with determining the feasibility of projects.
2. Preparing documentation for competitive tendering.
3. Tendering and negotiating for contracts.
4. Managing and exercising financial control over contracts to ensure cash flow and the profitability of projects.
5. Controlling and managing sub-contractors and suppliers.
6. Finalising financial aspects of contracts upon completion of projects.

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.
PART – A

1. ESTIMATES
   Method of building estimates, types, site plan index plan, layout plan, plinth area, floor area, Technical sanction, administrative approval, estimate of buildings, roads, earthwork, R.C.C. works, sloped roof, roof truss, masonry platform, masonry water tank, sanitary and water supply work, complete set of estimate. (16 hours)

2. SPECIFICATIONS
   For different classes of building and Civil engineering works. (6 hours)

PART – B

3. ANALYSIS OF RATES
   For earthwork, brickwork, concrete work, D.P.C., stone masonry, plastering, pointing, roadwork, Door and windows, whitewashing, painting, Varnishing, Centering and shuttering. (12 hours)

4. CONTRACTS, WORKS AND TENDER
   Tenders, tender form, submission and opening of tenders, Classification of contracts, Classification of works, Different type and methods of work types of measurement book, muster roll, piecework agreement and work order. (4 hours)

5. ACCOUNTS
   P.W.D. accounts, cash, receipt of money, cash book, temporary advance, imprest, accounting procedure, arbitration, arbitration act. (3 hours)

6. BUILDING BYE LAWS
   Building Byelaws, Definitions, Procedure for submission of building application and execution of works, Siting Planning and Architectural control. (4 hours)

TEXT BOOKS RECOMMENDED:
**SIXTH SEMESTER**

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<tr>
<td>Pre-requisites</td>
<td>Knowledge of Basic Constituents of Reinforced Concrete Design-I</td>
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<tr>
<td>Course Objectives</td>
<td>The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to:-</td>
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<td>1. To learn about design of continuous beams.</td>
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<td>2. To study about design of RCC structures subjected to torsion.</td>
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<td>3. To learn about types and design of various types of footings.</td>
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<td>4. To study the ultimate load theory for design of RCC slabs.</td>
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<td>5. To study retaining walls, domes and water tanks.</td>
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<td>Course Outcome(s)</td>
<td>Upon successful completion of this course, it is expected that students will be able to:</td>
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<td>1. To access the suitability of footing for the structure.</td>
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<td>2. To calculate the ultimate load for the different type of slabs.</td>
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<td>3. To design complex structures like members subjected to torsion, retaining walls, domes and water tanks.</td>
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<tr>
<td>Note for Examiner-</td>
<td>The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.Use of IS 456-2000 is allowed.</td>
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**PART– A**

1. **CONTINUOUS BEAMS**
   Design of continuous beams using I.S. Code method. (06-hours)

2. **BEAMS CURVED IN PLAN**
   Introduction, Design of circular and semicircular beams. (06-hours)

3. **DESIGN OF FOUNDATIONS**
   Design of isolated footing under eccentric loading, Design of Combined footings (rectangular and trapezoidal), strap footings, raft footing. (08-hours)

**PART– B**

4. **YIELD LINE ANALYSIS OF SLABS**
   Introduction, Assumption, Locations of Yield lines, Method of Analysis, Analysis of one way slabs and two way slabs. (06-hours)

5. **RETAINING WALLS**
   Types, behaviour, stability requirements, design of cantilever and counterfort type retaining walls. (06-hours)

6. **DOMES**
   Design of Spherical and conical domes. (07-hours)

7. **WATER TANKS**
   Design of water tanks on no crack basis, circular and rectangular tanks resting on ground, underground water tanks. (07-hours)

**TEXT BOOKS RECOMMENDED**
3. Punmia & Jain, ÒReinforced Concrete StructuresÓ Luxmi Publications.
5. Syal & Goel, ÒReinforced Concrete StructuresÓ Wheeler Publisher Allahabad.
1. Detailed Working Drawings of Following (Using AUTOCAD)
2. Drawing and detailing of reinforcement in combined (rectangular and trapezoidal) and strap footing.
3. Drawing and detailing of reinforcement in continuous beam with typical Sections.
4. Drawing and detailing of reinforcement in curved beam with typical Sections.
5. Drawing and detailing of retaining walls (cantilever and counter fort type).
6. Drawing and detailing of reinforcement in Rectangular and Circular water tanks resting on ground.
7. Drawing and detailing of Spherical and conical domes with a typical cross section.

**Course Title**: Construction Planning And Management  
**Course Code**: CIV. 602  
**Contact Hours**: 30  
**Max. Marks**: 50  
**Internal Assessment**: 50  
**Elective**: N  
**Pre-requisites**: Knowledge of Project Planning and its Management

**Course Objectives**
The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to:-
1. to apprise the students about planning the project
2. to get the knowledge about works management
3. to know about various types of construction equipments and their applications.

**Course Outcome(s)**
The theory should be taught along with examples in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:
1. Employ appropriate practices to organize and manage personnel, materials, equipment, costs, time, and quality of a construction project
2. Understand construction project control processes
3. Understand construction quality assurance and control
4. Apply scheduling techniques to project planning activities
5. Analyze methods, materials, and equipment used to construction projects

**Note:** The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

**PART A**

**WORKS MANAGEMENT**

1. **INTRODUCTION**
   Need for project planning and management, Three phases of project planning, Bar Chart, Milestone Chart, Uses and Drawbacks, Evolution of networks, Terminology. (2 Hours)

2. **PERT PROGRAMME (EVOLUTION AND REVIEW TECHNIQUE)**
   Brief History of Evolution of PERT Salient features, construction of PERT network, multiple time estimates and network analysis, earlier events time, latest even time, forward pass and backward pass, event slack, concept of critical path and its identification, data reduction, Application of statistics to probability of achieving a target data, suitability of PERT for research projects. (4 Hours)

3. **CPM (CRITICAL PATH METHOD)**
   Definitions, network construction. Fundamental rules, assignment of duration of activities, determination of project schedule, activity time estimates earliest start and earliest finish, latest start and latest finish time-float types-free float, independent float, Interfering float -0 their significance in project control, identification of critical path, Updating. (4 Hours)

4. **PROJECT COST ANALYSIS**
   Types of project costs direct and indirect cost-time relationships, cost slopes straight-line and segmented approximations, optimum cost and optimum duration, examples on crashing, Comparison of CPM and PERT. (4 Hours)
PART- B

5. CONSTRUCTION ENGINEERING
6. FACTORS AFFECTING SELECTION OF CONSTRUCTION EQUIPMENT
   Types of equipment; cost of owning and operating equipment depreciation cost; obsolescence cost; investment
   cost; operating cost; economic life of equipment; maintenance and repair cost. (4 Hours)

6. EARTH MOVING MACHINERY
   Tractor and related equipment; bulldozers; angle dozers; rippers; scrappers; power shovels; dragline; slack line;
   clamshells hoes; trenching machines. (4 Hours)

7. CONSTRUCTION EQUIPMENTS
   Cement concrete plants for grading, batching, mixing, types of mixers, handling and transporting concrete,
   concrete pumps, placing concrete, compacting concrete, bituminous mix plants, pavers and finishers. (4 Hours)

8. HOISTING AND TRANSPORTING EQUIPMENT
   Hoists winches, cranes, belt conveyors, ropeways trucks and wagons, balancing the capacity of hauling units with
   the size of excavator. (4 Hours)

BOOKS:
3. Construction Equipment, Planning and Application : Mahesh Verma

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<tr>
<td>Pre-requisites</td>
<td>Knowledge of subjects of structural analysis</td>
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</table>
| Course Objectives            | 1. To expand the knowledge in the field of structures
|                              | 2. To introduce the various methods for analysis of multi storey buildings.
|                              | 3. To relate the numerical theories with the designing software. |
| Course Outcome(s)            | 1. Students will learn the basic concepts of equilibrium, compatibility and principle of superposition etc.
|                              | 2. Students will be able to analyze the beams and frame with the help of flexibility and
|                              | Stiffness matrices.
|                              | 3. Student will be competent to analyze the beams with the element approach. |

Note for Examiner: The examiner shall set total seven questions. First Question is compulsory covering whole
syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from
Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

PART- A

1. BASIC CONCEPTS
   Equations of static Equilibrium, Degree of static Indeterminacy, Degree of kinematic Indeterminacy ,Actions and
   Displacements, equilibrium, compatibility, principle of superposition, Equivalent joint loads (5 Hours)

2. FLEXIBILITY AND STIFFNESS MATRICES
   Flexibility and stiffness, Flexibility matrix, Stiffness Matrix, Relationship between Flexibility matrix and
   Stiffness Matrix, Force and displacement Methods (6 Hours)

3. CONTINUOUS BEAMS
   Force method, Displacement Method, Comparison of Methods (6 Hours)

PART- B

4. RIGID JOINTED PLANE FRAMES
   Force method, Displacement Method, Comparison of Methods (8 Hours)

5. PIN JOINTED PLANE FRAMES
   Displacement of a Pin jointed Plane frame, Stiffness of a Pin joint , Member forces ,Force method, Displacement
   Method, Comparison of Methods (8 Hours)
6. TRANSFORMATION MATRICES-ELEMENT APPROACH
Force Method, Displacement Method, Analysis of Continuous Beams, Portal Frame and Pin Jointed Frames
Effect of axial deformation of Members (5 Hours)

TEXT BOOKS RECOMMENDED
1. Matrix Methods in structure analysis: Pandit & Gupta, TMH

OTHER RECOMMENDED BOOKS
1. Matrix Analysis of framed Structures: Weaver & Gere, CBS Publishers

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<td>Contact Hours</td>
<td>Max</td>
<td>Internal Assesment-50</td>
<td>Elective</td>
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<tr>
<td>Pre-requisites</td>
<td>Knowledge Of Treatment Of Sewage, Industrial Waste, Solid Waste &amp; Landfill Technologies.</td>
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<tr>
<td>Course Objectives</td>
<td>To teach the students about the sewerage system and its construction.</td>
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<tr>
<td>Course Outcomes</td>
<td>1. To be able to design various unit of waste water &amp; industrial waste treatment plant.</td>
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<td>2. To be able to select and design various types of solid waste management &amp; disposal techniques.</td>
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Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART – A

1. INTRODUCTION
Terms & definitions, systems of sanitation and their merits and demerits, system of sewerage, choice of sewerage system and suitability to Indian conditions. (03 hours)

2. DESIGN OF SEWER
Quantity of sanitary and storm sewage flow, forms of sewers. Conditions of flow in Sewers, sewers of equivalent PART, self cleansing and limiting velocity, hydraulic formula for flow of sewerage in sewers and their design. (04 hours)

3. CONSTRUCTION & MAINTENANCE OF SEWERS
Sewer appurtenances, Materials for sewers. Laying of sewers, joints in sewers, testing of sewers pipes. Maintenance, operation and precaution before entering a sewer. (04 hours)

4. HOUSE DRAINAGE
Principles of House drainage, traps, Inspection chamber Indian and European type W.C. Flushing cisterns, soilwaste and anti-syphorage pipes, plumbing system. (03 hours)

5. CHARACTERISTICS & TESTING OF SEWAGE
Composition of sewage, sampling, physical & chemical analysis of sewerage, biological decomposition of sewage, kinetics of organic waste stabilization. (03 hours)

PART - B

6. TREATMENT OF SEWAGE
Unit processes o waste water treatment, screens, grit-chambers, detritus tank, skimming tank, grease traps, sedimentation, chemical treatment, aerobic biological treatment, trickling filter (LRTF & HRTF),
activated sludge processes, anaerobic treatment, units-sludge digesters and biogas plant.

7. **INDUSTRIAL WASTE TREATMENT**
   Nature and characteristics of industrial wastes; Control and removal of specific pollutants in industrial wastewaters, i.e., oil and grease, cyanide, fluoride, toxic organics, heavy metals. (04 hours)

8. **GROUND WATER CONTAMINATION**
   Design and Management of landfills, environmental control through liners, covers, leachate management and gas management, control and remedial measures for contaminated sites; pollution control regulations. (03 hours)

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**Note:** At least seven experiments are to be performed.
1. Determination of DO.
2. Determination of BOD.
3. Determination of COD.
4. Determination of Sulphates.
5. Determination of Nitrite and Nitrate nitrogen.
7. Determination of phosphorus (total and available).
8. Determination of SVI (including MLSS and MLVSS estimations).

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<thead>
<tr>
<th>Course Title</th>
<th>Foundation Engineering</th>
<th>Credits</th>
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<tr>
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<td>L T P</td>
<td>4 0 2</td>
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<tr>
<td>Pre-requisites</td>
<td>Geotechnical Engineering</td>
<td></td>
</tr>
<tr>
<td>Course Objectives</td>
<td>The course will strengthen the basics learnt by students in the field of geotechnical engineering and will guide them to apply them in field.</td>
<td></td>
</tr>
<tr>
<td>Course Outcomes</td>
<td>The student would be able to learn types of slope failures, design and types of foundations, distribution of stress in horizontal and vertical directions under the ground surface and about site investigation required to be done before taking decisions about the foundation and its related arrangements.</td>
<td></td>
</tr>
</tbody>
</table>

**Note for Examiner:** Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

**PART –A**

1. **STABILITY OF SLOPES**
   Necessity, causes of failure of slopes. Stability analysis of infinite and finite slopes in sand and clay. Taylor’s stability number and its utility. (4-hours)

2. **SHALLOW FOUNDATION**
   Introduction to the type of shallow foundations, Factors causing failure of foundation, Definitions of bearing capacities, Factors affecting bearing capacity, Terzaghis analysis for bearing capacity of soil, Skemptions equation, B. I. S. recommendations for shape, depth and inclination factors, Plate Load Test and Standard Penetration Test. Contact pressure distribution. Causes of settlement of structures, comparison of immediate and consolidation settlement, Calculation of settlement by plate load test and Static Cone Penetration Test data, Allowable settlement of various structures according to IS Code. Situation most suitable for provision of rafts foundation, Proportioning of rafts in sand and clays, Various methods of designing raft, Floating foundation. (6-hours)
3. MACHINE FOUNDATIONS
Basic definition of theory of vibration terms, Analysis of theory of single degree system for:
- Free vibrations,
- Damped Free vibrations,
- Forced vibrations with constant Harmonic Excitation (Frequency response curves)
Dynamic soil properties (Equivalent spring constants) Determination of Cu by cyclic plate load test and Block vibration test. Natural frequency of foundation-soil system by Barkans Method, Co-relation between Cu and other dynamic properties of soil. Type of machine Foundations - Neat sketches and brief description.

4. STRESS DISTRIBUTION
Boussinesq’s equation for a point load, uniformly loaded circular and rectangular area, Pressure distribution diagrams. New marks chart and its construction. Two - to one method of load distribution Comparison of Boussinesq and Westergaard analysis for a point load. Limitations of elastic formula.

PART – B

5. SOIL INVESTIGATION
Objective of soil investigation for new and existing structures, Depth of exploration for different structures, Spacing of bore holes, Methods of soil exploration and relative merits and demerits.

6. PILE FOUNDATION-I
Necessity and uses of piles, classification of piles, Types of pile driving hammers & their comparison, Effect of pile driving on adjacent ground. Use of Engineering news formula and Hiley’s formula for determination of allowable load, Pile Load Test, separation of skin friction and point resistance using cyclic pile load test data. Related Numerical problems.

7. PILE FOUNDATION-II
Determination of point resistance and frictional resistance of a single pile by static formula, Piles in clay, safe load on a friction and point bearing pile. Pile in sand spacing of piles in a group, factors affecting capacity of a pile group. Efficiency of pile group bearing capacity of a pile group in clay, Settlement of pile groups in clay and sand Negative skin friction.

8. CAISSONS AND WELLS

TEXT BOOKS RECOMMENDED:

<table>
<thead>
<tr>
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<th>Foundation Engineering Lab</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Course Code</td>
<td>CIV 655</td>
<td>Max marks- 50</td>
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</table>

1. Determination of Unconfined Compressive Strength of soil.
2. Determination of shear parameters by Direct Shear Test.
3. Determination of shear parameters by Triaxial Test.
4. Determination of undrained shear strength of cohesive soils by Vane Shear Test.
5. Determination of void ratio of cohesionless soil in loosest & densest state by Relative Density apparatus.
7. To collect data about bearing capacity and frictional resistance of soil by Static Cone Penetration Test.
8. Determination of Consolidation parameters.

TEXT BOOKS RECOMMENDED:
1. Laboratory Manual in soil engineering by A.K.Duggal, NITTTR, Chandigarh
2. Engineering soil testing by Shamsher Prakash & P.K.Jain, Nem Chand & Bros, Roorkee
Civil Engineering Softwares like STAAD PRO, Auto Civil 3D, ANSYS, ATENA, MX ĲROADS, ArchView, GIS etc.

1. Analysis of Beams with different support conditions and loading conditions.
2. Analysis of 2- D Portal Frame for vertical and horizontal loading ( Multi storeyed and Multi Bay)
3. Design of foundations using STAAD Foundation.
5. Analysis and Design of Dam using ANSYS
6. Testing of Cylindrical & flexural Members using ATENA.
7. Design of flexible Pavement using MX-Roads
8. Introduction to Arch View and GIS softwares.
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Steel Structures Design -II</th>
<th>Credit</th>
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<tr>
<td>Course Code</td>
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<tr>
<td>Pre-requisites</td>
<td>Knowledge of Project Planning and its Management</td>
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</table>
| Course Objectives    | The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to:-
|                      | 1. Make the students well acquainted with the advancement in the design of Steel structural elements
|                      | 2. Study design procedures of various components used in fabrication of Steel bridges.
|                      | 3. Use of concepts learnt in Design of steel structures I.I. |
| Course Outcome(s)    | The theory should be taught along with examples in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:
|                      | 1. Understanding the advanced structures in steel design.
|                      | 2. Understanding the design of tubular structures and steel foot bridges.
|                      | 3. Understanding the complete design of an industrial building.
|                      | 4. Understanding the analysis and design of various components of single track through type Railway Bridge. |

Note: The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part. I.S. 800-2007, Suitable tables are allowed.

**PART A**

1. **DESIGN OF ROUND TUBULAR STRUCTURES**
   Introduction, round tubular sections, permissible stresses, tube columns and compression members, tube tension members, tubular roof trusses, Design of tubular beams, Design of tubular purlins. (08 hours)

2. **DESIGN OF STEEL FOOT BRIDGE**
   Introduction, design of flooring, cross girders, analysis of N-type truss, design of various members of truss, design of joints, design of bearings. (07 hours)

3. **DESIGN OF COMPLETE INDUSTRIAL BUILDING WITH DESIGN OF**
   Gantry Girder
   Column bracket.
   Mill bent with constant moment of inertia
   Lateral and longitudinal bracing for column bent etc. (15 hours)

**PART B**

4. **DESIGN OF A SINGLE TRACK THROUGH TYPE RAILWAY BRIDGE WITH LATTICE GIRDERS HAVING PARALLEL CHORDS**
   Design of stringers
   Design of cross girders
   Design of connection between stringer and cross girder
   Design of main girders
   Design of bottom lateral bracing and top lateral bracing
   Design of portal bracing and sway bracing
   Design of bearings
   Design of welded plate girder with static load u.d.l. over whole span and concentrated load at fixed points. (15 hours)

**BOOKS:**
3. Raz S A ŐStructural Design in Steel鸵 New Age International (P) Ltd., New Delhi, 2002

<table>
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<th>Steel Drawing-II</th>
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<tr>
<td>Course Title</td>
<td>Irrigation Engineering II</td>
<td>Credits</td>
<td>04</td>
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<tr>
<td>Course Code</td>
<td>CIV.702</td>
<td>L T P</td>
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</table>

Contact Hours 45 Max marks- 50 Internal Assessment - 50 Elective N

Pre-requisites Irrigation Engineering I

Course Objectives The objective of this course is to introduce the students with various theories of seepage and design of various important irrigation based structures.

Course Outcomes 1. The student would be able to learn various theories of seepage, requirements of various structures at various locations within the overall layout of irrigation system and their differences and importance in irrigation engineering.
2. The course will also teach the design of various important irrigation based structures such as distributary regulators, weirs, barrages, sloping glacis weir, canal falls, aqueducts etc.

Note for Examiner - Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART - A

1. THEORIES OF SEEPAGE
Seepage force and exit gradient, Salient features of Bligh’s Creep theory, Lane’s weighted Creep theory and Khosla’s theory. Determination of uplift. Pressures and floor thickness.

(5-hours)

2. DESIGN OF WEIRS
Weirs versus barrage, Design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir.

(3-hours)

3. ENERGY DISSIPATION DEVICES
Use of hydraulic jump in energy dissipation, Factors affecting design, Types of energy dissipators and their hydraulic design.

(6-hours)

4. DIVERSION HEAD WORKS
Functions and investigations: component parts of a diversion head work and their design considerations, Silt control devices.

(7-hours)

PART- B

5. DISTRIBUTORY REGULATORS
Offtake alignment, Cross-regulators і their functions and design, Distributory head regulators, their design, Canal escape.

(7-hours)
6. CANAL FALLS
   Necessity and location, types of falls and their description, selection of type of falls, Principles of
design, Design of Sarda type, straight glacis and Inglis or baffle wall falls. (5-hours)

7. CROSS-DRAINAGEWORKS
   Definitions, choice of type, Hydraulic design consideration, Aqueducts their types and design, siphon
   aqueducts their types and design considerations, super passages, canal siphons and level crossing. (6-hours)

8. CANAL OUTLETS
   Essential requirements, classifications, criteria for outlet behaviours, flexibility, proportionality,
sensitivity, sensitiveness, etc. Details and design of non-modular, semi-modular and modular outlets. (6-hours)

TEXT BOOKS RECOMMENDED:

<table>
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<tr>
<th>Course Title</th>
<th>Irrigation Engineering –II Drawing</th>
<th>Credits</th>
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<tr>
<td>Course Code</td>
<td>CIV 752</td>
<td>Max marks- 50</td>
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</table>

DESIGN AND DRAWING OF THE FOLLOWING (USING AUTOCAD)
1. Design and detailing of both lined and unlined canals with typical sections of both types of canals
   clearly indicating the stone pitching etc.
2. Design and detailing of Guide bank along with the cross sections at the u/s and d/s end of guide banks.
3. Design and detailing of Weir or barrage along with the various cross sections.
4. Design and detailing of any one type of cross head regulator with a typical cross section.
5. Design and detailing of A.P.M. Outlet along with a typical cross section.
6. Design and detailing of siphon aqueduct along with a typical cross section.

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Advanced Transportation Engineering</th>
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<tr>
<td>Course Code</td>
<td>CIV - 703</td>
<td>Max Marks- 50</td>
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<td>Contact Hours</td>
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<td>0 0</td>
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<tr>
<td>Pre-requisites</td>
<td>TE-I &amp; TE-II</td>
<td>Elective</td>
<td>N</td>
</tr>
</tbody>
</table>
| Course Objectives            | 1. To give knowledge about design of flexible & rigid pavements
   2. To give basic knowledge of docks, harbours & tunnels.
| Course Outcome(s)            | 1. Students will learn the principles and elements of Design of pavements.
   2. Students will learn the bituminous design methods.
   3. Student will learn about various water transportation measures and facilities available in them.

Note for Examiner: The examiner shall set total seven questions. First Question is compulsory covering whole
syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from
Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

PART A

1.INTRODUCTION
   Types of pavements, Importance and functions of various components of pavement structures, design factors-design
   wheel load, Equivalent single wheel load, Repetition of loads, climatic variations.
   (04 Hours)

2.DESIGN OF FLEXIBLE PAVEMENTS
   Flexible pavement design methods: CBR method, Group Index method, IRC method of design of flexible
   pavements.
   (04 Hours)
3. DESIGN OF RIGID PAVEMENTS
   General design considerations, Wheel load stresses, Westergaard’s stress equation for wheel loads, evaluation of wheel load stresses, temperature stresses, design of joints, design of dowel and tie bars, IRC method of design of rigid pavements. (05 Hours)

4. BITUMINOUS MIX DESIGN
   Requirement of bituminous mixes, Marshall method of bituminous mix design. (04 Hours)

PART B

5. HARBOURS
   Harbours & Ports, Natural phenomenon; Tides, wind & waves, Classification, Facilities at a major port, Protection facilities: wall type & special breakwater, Planning & layout of ports. (04 Hours)

6. DOCKS
   General, Classification of Docks, Docking facilities, Repairing facilities-Fixed Form & Movable Form, Approach facilities, loading and unloading facilities. Guiding facilities-Light house & Signals, Storing Facilities. (05 Hours)

7. TUNNELS
   General, Basic definitions, Advantages & Disadvantages of tunnels & open cuts, Selection of alignment of tunnels, Classification of tunnels, Tunnel approaches. (02 Hours)

8. PROBLEMS IN TUNNELING
   Introduction to various stages in tunnel construction, Methods of Tunnelling in Soft soils & Rocks, Tunnel Lining-Necessity & Materials used, Drainage in Tunnels, Health protection in tunnels. (02 Hours)

BOOKS:

<table>
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<th>Course Title</th>
<th>Bridge Engineering</th>
<th>Credit</th>
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<td>Course Code</td>
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<td>Contact Hours</td>
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<td>Max. Marks-50 Internal Assessment-50</td>
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<tr>
<td>Pre-requisites</td>
<td>Knowledge of Basics of Structural Analysis and RCC</td>
<td>Elective</td>
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</table>

Course Objectives
The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to:
1. To discuss basic definitions, types, and components of bridges.
2. To discuss sub-surface investigations required for bridge construction.
3. To understand standard specification for bridge design.
4. To perform design of slab type reinforced concrete bridge.
5. To perform design of bridges sub-structures, bearings and joints.
6. To have knowledge of quality control and maintenance aspect.

Course Outcome(s)
Upon successful completion of this course, it is expected that students will be able to:
1. Relate different design philosophies of the bridges.
2. Understand the structural behaviour of different components of a reinforced concrete bridges.
3. Analyze and design different components of a highway bridges, to meet desired needs within realistic constraints such as economy, environment friendly, safety, viable construction and its sustainability under loads standardised by Indian Road Congress (IRC) and submit the designs in complete and concise manner.
Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part. Use of IRC: 21:2014 and IS 456-2000 is allowed.

PART- A

1. INTRODUCTION
   Definition, Investigation of Bridges: Need for investigations, selection of bridge site, choice of bridge type, preliminary data to be collected, design discharge and its determination, linear waterway, choice of span, economical span, vertical clearance above HFL, afflux, scour depth.

2. STANDARD SPECIFICATIONS
   I.R.C. loadings for road bridges, Codal provisions on width of carriage way, clearances, loads considered etc.

3. REINFORCED CONCRETE BRIDGES
   Classification of bridges, Pre-stressed concrete bridges, Balanced cantilever bridges, Design of R.C.C Solid Slab bridge, Courbonâ theory for load distribution.

PART- B

4. SUB STRUCTURE
   Types of piers and abutments, design forces, design of piers and abutments.

5. BEARING AND JOINTS
   Various types of expansion bearing and fixed bearings, elastomeric bearings, joints and their types.

6. LESSONS FROM BRIDGE FAILURES
   Major causes, Flood and scour failures, Brittle failures, erection errors, design deficiencies, earthquake effects, failures due to wind, fatigue, corrosion.

7. RECENT TRENDS IN BRIDGE ENGINEERING
   Urban Flyovers and elevated roads, High performance concrete and steel, Durability considerations.

TEXT BOOKS RECOMMENDED

Course Title: Hydropower Engineering  Credit: 3
Course Code: CIV-705  L T P: 3 0 0
Contact Hours: 45  Max. Marks-50  Internal Assessment-50
Pre-requisites: IE-I & IE-II  Elective: Y

Course Objectives
The course content should be taught and learning imparted with the aim to develop theoretical knowledge and skills so that they are able to:
1. To discuss basic definitions, types, and components of bridges.
2. To discuss sub-surface investigations required for bridge construction.
3. To understand standard specification for bridge design.
4. To perform design of slab type reinforced concrete bridge.
5. To perform design of bridges sub-structures, bearings and joints.
6. To have knowledge of quality control and maintenance aspect.

Course Outcome(s)
Upon successful completion of this course, it is expected that students will be able to:
1. Relate different design philosophies of the bridges.
2. Understand the structural behaviour of different components of a reinforced concrete bridges.
3. Analyze and design different components of a highway bridges, to meet desired needs within realistic constraints such as economy, environment friendly, safety,
viable construction and its sustainability under loads standardised by Indian Road Congress (IRC) and submit the designs in complete and concise manner.

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART A

1. INTRODUCTION
   Waterpower Development - its types, distribution and use World's largest hydropower generating plants, Potential of hydropower in India - its development and future prospect. (4 Hours)

2. ANALYSIS OF STREAM FLOW AND DEMAND
   Flow duration curve, firm power, Secondary power, Load factor and Load duration curves, firm capacity, reservoir capacity, capacity factor etc. (4 Hours)

3. TYPES OF HYDRO POWER PLANTS
   Classification of hydro power plants, Run-of-river plants, Valley dam plants, High head diversion plants, Diversion Canal Plants, Pumped storage plants, Tidal power plants (5 Hours)

4. WATER CONVEYANCE SYSTEM
   Power Canals, Alignment, Design of Power canals, Flumes, Covered conduits and Tunnels. Penstocks- Alignment, types of penstocks, Economic Diameter of penstocks, Anchor blocks. (5 Hours)

5. SPILLWAYS
   Selection of site, Preliminary Investigations, Final Investigations, Spillway capacity, classification of Spillways, Design of Ogee Spillway, Stilling Basins, Spillways crest gates. (5 Hours)

PART B

6. INTAKE STRUCTURES
   functions, location, intake type, trash rack, dimension, design, spacing of bars, method of cleaning, shape of inlet, power canal, location, site, forebay, size, capacity, gates and valves. (5 Hours)

7. TUNNELS.
   geometric and hydraulic design, penstock, location, type, Economical diameter of penstock (5 Hours)

8. SURGE TANK
   Functions, type, Design of Surge tank, methods of surge analysis, restricted orifice and differential surge tanks, downstream surge tanks. (4 Hours)

9. POWER HOUSE DETAILS
   Location, site and general arrangements, draft tubes, tail trace and their hydraulic design, turbines, number, make, size, type, characteristics and efficiency, pumps, Generators, exciters, switchboard, transformers and other accessories. (6 Hours)

10. TRANSMISSION SYSTEMS
    General introduction, financial implications of Hydro Power plants (3 Hours)

BOOKS:
6. Hydro Power an Indian Perspective, Author-Cum-Editor Dr. B.S.K. Naidu, Director General, NPTI.
<table>
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<td>Internal Assessment</td>
<td>Elective</td>
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<tr>
<td>Pre-requisites</td>
<td>Knowledge Of Environmental Issues In India, Biological Environment, Soil &amp; Agricultural Pollution, Global Issues, Eia &amp; Environmental Audit, Industrial Pollution, Waste Water From Industries, Solid Waste Management, Legal Requirements</td>
<td></td>
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<tr>
<td>Course Objectives</td>
<td>To make student updated about the recent environmental trends and global environmental issues comes across domestic and industrial life.</td>
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<tr>
<td>Course Outcome</td>
<td>1. Students will be able to apply the knowledge and understanding gained through the course to the practical projects 2. Students will be able to analyse &amp; audit environmental issue like biological, soil &amp; agricultural etc.</td>
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</table>

Note for Examiner: Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART A

1. ENVIRONMENTAL ISSUES IN INDIA
   Forest and agricultural degradation of land, resource depletion (water, mineral, forest, sand, rocks etc. environmental degradation, public health, loss of biodiversity, loss of resilience in ecosystems, Land pollution, Greenhouse emissions, Environmental issues and Indian law, Conservation, Specific issues (04 Hours)

2. BIOLOGICAL ENVIRONMENT
   Community health-significance, disease transmission, Health Education, occupational health, hazards, plan prevention and control, Water borne disease. (05 Hours)

3. SOIL & AGRICULTURAL POLLUTION
   Top soil, pollution, parameter of soil analysis, remedial measures, related disease, Green construction & Eco renovation, CO2 Pollution and Global Warming, Compact Fluorescent Lights (CFLs), radiation/nuclear/radioactive pollution. (04 Hours)

4. EIA & ENVIRONMENTAL AUDIT
   Environmental Impact Assessment, social and economic aspects, Brief study of Environmental audit, audit items, audit procedure, Safety audit. (04 Hours)

PART B

5. INDUSTRIAL POLLUTION
   Paper and pulp, cane sugar and distilleries, dairy plant, petrochemical and refineries, and other industrial units. (05 Hours)

6. WASTE WATER FROM INDUSTRIES
   Waste characteristics, harmful effects, Pre treatment of industrial waste, reduction of waste strength and volume equalization and neutralization. (04 Hours)

7. LEGAL REQUIREMENTS
   Municipal solid waste rules; Hazardous waste rules; Biomedical waste rules; Rules related to recycled plastics, used batteries, fly ash, etc. function of pollution control board and legal aspects (04 Hours)
8. SOLID WASTE MANAGEMENT
Properties of solid wastes, management of solid wastes in India, disposal of wastes, sanitary land filling including leachate collection and treatment, recovery of methane from landfill sites for power generation.

(05 Hours)

BOOKS:
1. Waste Water Engineering : Metcalf and Eddy Inc. TMH.
4. Industrial Wastewater Treatment: A Guidebook : Joseph D. Edwards

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Course title | Computational Methods | Credit | 4
---|---|---|---
Course Code | CE-802 | L T P | 4 0 0
Contact Hours | 45 | Max Marks-50 | Internal Assessment-50 | Elective | N
Pre-requisites | Knowledge of Basics of Matrices, Algebra and Differential equations.

Course Objectives
The development of fast, efficient and inexpensive computers has significantly increased the range of engineering problems that can be solved reliably. The course aims at:
1. Use computers to solve problems by step-wise, repeated and iterative solution methods, which would otherwise be tedious or unsolvable by hand-calculations.
2. To formulate engineering problems using systems approach and optimization, develop awareness of the shortcomings, approximations and uncertainties associated with numerical methods and modeling.
3. To give an overview of computational techniques of interest to process engineer. The focus being on the techniques themselves, rather than specific applications.

Course Outcome(s)
1. Students can able to solve problem sets relevant to civil engineering through problem formulation, solution algorithm design and programming application.
2. To improve computational skills and be proficient in programming language required to solve engineering problems and recognize the need for life-long learning, and advancement of computational skills for solving complex civil engineering problems.

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART A

1. MATRICES & LINEAR SYSTEM OF EQUATIONS

(15 hours)

2. SEQUENCES & SERIES

(12 hours)
PART B

3. NUMERICAL METHOD


(18 hours)

TEXT BOOKS RECOMMENDED:


<table>
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<th>Maintenance Of Buildings</th>
<th>Credits</th>
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<td>Max 50</td>
<td>Marks</td>
</tr>
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<td>Pre-requisites</td>
<td>Learning the objectives and methods for maintenance of buildings</td>
<td>Internal Assessment 50</td>
<td>Elective N</td>
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<tr>
<td>Course Objectives</td>
<td>1. Importance of maintenance</td>
<td>2. Maintenance management</td>
<td>3. Repair materials</td>
</tr>
<tr>
<td>Course Outcomes</td>
<td>1. To understand the importance of maintenance</td>
<td>2. Learning the methods for maintenance management</td>
<td>3. Introduction to repair materials</td>
</tr>
</tbody>
</table>

Note: The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part

PART A

1. PRINCIPLES OF MAINTENANCE

Importance of maintenance, deterioration and durability, factors affecting decision to carryout maintenance, maintenance and GNP, agencies causing deterioration, effect of deterioration agencies on materials. (06 hours)

2. DESIGN AND ECONOMIC CONSIDERATION IN MAINTENANCE

Factors to reduce maintenance at design stage, consideration if maintenance aspects in preparing tender document and specifications, sources of error in design which enhances maintenance and its importance at design stage. Economic consideration in maintenance: physical life, functional life, economic life of different types of buildings, discounting technique for assessment of economic life. (06 hours)

3. MAINTENANCE MANAGEMENT

Definition, organization structure, work force for maintenance, communication needs, building inspections, maintenance budget and estimates, property inspections and reports, specification for maintenance jobs, health and safety in maintenance, quality in maintenance, maintenance manual and their importance. (08 hours)

4. MATERIALS FOR MAINTENANCE

Compatibility of repair materials, durability and maintenance, types of materials, their specification and application, criteria for selection of material, use of commercial available materials in maintenance. (06 hours)
PART B

5. INVESTIGATION AND DIAGNOSIS FOR REPAIR OF STRUCTURES
Basic approach to investigations, physical inspection, material tests, non-destructive testing for diagnosis, estimation of actual loads and environmental effects, study of design and construction practices used in original construction, retrospective analysis, and confirmation and repair steps. (05 hours)

6. MAINTENANCE PROBLEMS AND ROOT CAUSES
Classification of defects, need for diagnosis, type of defects in building elements and building materials defect location, symptoms and causes. (06 hours)

7. REMEDIAL MEASURES FOR BUILDING DEFECTS
Preventive maintenance and special precautions considerations, preventive maintenance for floors, joints, wet areas, water supply and sanitary systems, termite control, common repair techniques, common methods of crack repair.
Repair of existing damp proofing systems in roofs, floors and wet areas.
Protection, repair and maintenance of RCC elements.
Repair of finishes.
Repair of building joints.
Repair of water supply and sanitary systems, under ground and over head tanks.
Common strengthening techniques. (04 hours)

8. MAINTENANCE OF MULTISTOREY BUILDINGS
Specials features for maintenance of multi-storeyed buildings, including fire protection system, elevators, booster pumps, generator sets. (02 hours)

9. MAINTENANCE OF SERVICES
Leakage detection techniques in pipes, cleaning of pipes, replacement of pipes, clogging of sewer pipes, cleaning and their repairs, special precaution required in sewer pipe maintenance, maintenance of septic tanks, maintenance of AC and electrical system in buildings. (02 hours)

BOOKS:
3. Repair and Rehabilitation of Concrete Structures, ACI Compilation 10.
4. Gahlot & Sharma, CBS, Publications
8. W.H. Ransom; Building Failures: Diagnosis and Avoidance, New Age Publications (P) Limited

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Hydrology and Dams</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Course Code</td>
<td>CIV 804</td>
<td>L T P</td>
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<td>Contact Hours</td>
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<td>Max marks-50</td>
<td>Internal Assessment -50</td>
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<tr>
<td>Pre-requisites</td>
<td>Fluid Mechanics I and II</td>
<td>The objective of this course is to introduce the students with basics of science of hydrology such as precipitation, runoff, flood control etc. The course will also emphasize on various types of dams and spillways with their design considerations.</td>
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<tr>
<td>Course Outcomes</td>
<td>1. The student would be able to learn the basic concepts related to hydrology and dams.</td>
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<td>2. The course will also detail about the hydrological parameters such as interception, evaporation etc and know their importance in design of various hydraulic structures. The various designs of irrigation structures to be learnt are based on the basics studied in this class.</td>
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<td>3. Apart from study of basics of hydrology, the students will also learn about the dams</td>
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</table>
and their types and apply this information on the topics of gravity, arch and buttress
dams.
4. Overall, this course will give a general overview of hydrological processes taking
place within our environment and will be helpful to apply in other courses of Civil
engineering.

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole
syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be
divided into two parts having three questions each and the candidate is required to attempt at least two
questions from each part.

PART- A

1. PRECIPITATION
Importance of hydrological data in water resources planning. The hydrologic cycle, Mechanics of
precipitation, types and causes, Measurement by rain gauges, gauge net works. Hyetograph, averaging
depth of precipitation over the basin, mass-rainfall curves, intensity duration frequency curves, depth
area-duration curves.

2. INTERCEPTION, EVAPO-TRANSPARATION AND INFILTERATION
Factors affecting interception, Evaporation from free water surfaces and from land surfaces.
Transpiration, Evapo-transpiration. Factors Affecting infiltration rate, infiltration capacity and its
determination.

3. RUNOFF
Factors affecting runoff, Runoff hydrograph, Unit hydrograph theory, S-curve hydrograph, Snyderâ€™
Synthetic unit hydrograph, Principles of flood routing through a reservoir by I.S.D. method (description
only).

4. PEAK FLOWS
Estimation of Peak flow-rational formula, Use of unit hydrograph, Frequency analysis, Gumbleâ€™ method, Design
flood and its hydrograph.

PART- B

5. INTRODUCTION TO DAMS
Choice of type of dam, site selection, investigation, foundation treatment.

6. GRAVITY DAMS
Non-over flow and over flow section of dams, Forces acting on dams, Stability factors, stresses on the
faces of dam. Design of profile by the method of zoning. Elementary profile of a dam, upstream lip and
approach ramp. Discharge characteristics of spillways. General principles of design of spillways - Ogee,
Chute, side channel and siphon.

7. EARTHEN DAMS
Components of earthen Dams and their functions; Phreatic line determination by analytical and
graphical methods. Seepage determination and control.

8. ARCH AND BUTTRESS DAMS
Classification of arch dams constant, radius, constant angle and variable radius types, Cylinder theory, Expression
relating central angle and cross-sectional area of arch. Types of buttress dams, Advantages of buttress dams.

TEXT BOOKS RECOMMENDED:
Company
3. Earth Dams : Bharat Singh, Nem Chand and Bros., Roorkee
Company, New Delhi
**Course Title**: Prestressed Concrete Design  
**Credit**: 3

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Contact Hours</th>
<th>Max. Marks</th>
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<td>3 0 0</td>
<td>45</td>
<td>50</td>
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</table>

**Pre-requisites**: Knowledge of Basics of Structural Analysis and RCC

**Course Objectives**
1. To learn the principles, materials, methods and systems of prestressing.
2. To know the different types of losses and deflection of prestressed members.
3. To learn the design of prestressed concrete beams for flexural, shear and tension.
4. To calculate ultimate flexural strength of beam.
5. To learn the design of anchorage zones.

**Course Outcome(s)**
On completion of the course, the students will be able:
1. To differentiate between Reinforced Concrete and Prestressed Concrete.
2. To design a prestressed concrete beam for flexural, shear and torsion after accounting for losses.
3. To design the anchorage zone for post tensioned members.

**Note for Examiner**: Examiners will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

**PART- A**

1. **INTRODUCTION**
   Basis concepts, Materials used, advantages of prestressed Concrete, Applications of prestressed concrete. (05-hours)

2. **MATERIALS FOR PRESTRESSED CONCRETE**
   High strength concrete, strength requirements permissible stresses in concrete, creep & shrinkage, deformation characteristics, high strength steel, strength requirements, permissible stress in steel. (05-hours)

3. **PRESTRESSING SYSTEMS**
   Introduction, prestressing systems, post-tensioning systems, chemical prestressing. (05-hours)

4. **LOSS OF PRESTRESS**
   Nature of losses, different types of losses and their assessment. (05-hours)

5. **ANALYSIS OF PRESTRESS & BENDING STRESS**
   Basic assumptions, Resistant stresses at a section, pressure line, and concept of land balancing, stresses in grading moment. (05-hours)

**PART-B**

6. **FLEXURAL SHEAR STRENGTH OF PRESTRESSED CONCRETE SECTIONS**
   Types of flexural failure, strain compatibility method, code procedures, shear and principal stresses, ultimate shear resistance of pressed concrete members, prestressed concrete members in torsion. (08-hours)

7. **TRANSFERS OF PRESTRESS IN PRE-TENSIONED AND POST-TENSIONED MEMBERS**
   Transmission Length, bond structures, Transverse tensile stress End-zone reinforcement, stress distribution in end block. (06-hours)

8. **DESIGN PRESTRESSED CONCRETE SECTIONS**
   Design of section for flexure, Axial tension compression & bending, shear, bond and torsion. (06-hours)

**TEXT BOOKS RECOMMENDED**
Course Title | Town Planning And Architecture | Credit | 03
---|---|---|---
Course Code | CIV-806 | L T P | 3 0 0
Contact Hours | 30 | Max Marks | 50 | Internal Assessment | 50 | Elective | Y
Pre-requisites | Knowledge of basic building services and utilities

Course Objectives
1. To expand the knowledge of basic principles of Architecture
2. To relate the work of civil engineer and architect

Course Outcome(s)
1. Students will learn the principles and elements of architecture
2. Students will learn the new concepts of planning.
3. Student will understand the requirement of various services in town planning.

Note for Examiner: The examiner shall set total seven questions. First Question is compulsory covering whole syllabus (ten questions carrying one mark each). Three questions will be set from Part A and three questions from Part B (carrying 10 marks each) and students are required to attempt 2 questions from each part.

PART- A

1. ELEMENTS OF DESIGN
   Line direction. Shape, size, texture, value and colour, balance, scale and proportion. (3 Hours)

2. PRINCIPLES OF DESIGN
   Repetition, gradation, harmony, contrast and unity, creation of 2 D and 3 D compositions. (3 Hours)

3. THE INDUSTRIAL REVOLUTION
   The emergence of engineer, new materials and techniques and the evolution of balloon frame and steel frame. (3 Hours)

4. ORIGIN OF MODERN ARCHITECTURE
   Definition and concept of modern architecture, various pioneers of modern architecture (3 Hours)

5. TOWN PLANNING
   Definition and meaning, age of planning, scope and motives of planning, brief history of town planning Ŋ its origin and growth, historically development of town planning in ancient valley Civilizations. Indus Nile Tigris and Euphrates, Greek Roman, Medieval and Renaissance town planning (3 Hours)

PART- B

6. NEW CONCEPTS
   Garden city movement, Linear city and concentric city concepts, Neighbourhood and Radburm, Radiant city to present day planning (3 Hours)

7. PLANNING PRINCIPLES
   Types of town and their functions, types of town planning Ŋ Grid Iron, Radial, Spider webs, Irregular and Mixed, their advantages and disadvantages. (3 Hours)

8. PLANNING PRACTICE AND TECHNIQUES
   Zoning Ŋ its definition, procedure and districts, height and bulk zoning, F. A. R., Master Plan Ŋ Meaning, preparation and realization, the scope of city planning Ŋ city rehabilitation and slum clearance (4 Hours)

9. BUILDING SERVICES
   Water Supply, Sewerage and drainage systems, sanitary fittings and fixtures, Plumbing systems, principles of internal & external drainage systems, Principles of electrification of buildings, Intelligent buildings, elevators and escalators, their standards and uses, air-conditioning systems, fire-fighting systems, building safety and security systems. (5 Hours)

TEXT BOOKS RECOMMENDED

**OTHER RECOMMENDED BOOKS**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Concrete Technology Lab</th>
<th>Credits</th>
<th>Max marks</th>
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<tr>
<td>Course Code</td>
<td>CIV 853</td>
<td>01</td>
<td>02</td>
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</tbody>
</table>

1. To determine quality of hardened concrete by ultrasonic pulse velocity method.
2. To determine the size and location of bars using profometer.
3. To determine flexural strength of concrete.
4. Mix design of M20 concrete.
5. Mix design of M20 concrete using admixtures
6. Mix design of M20 using fly ash.
7. To determine the permeability of concrete.
8. To determine the workability of SCC by slump flow test.

**BOOKS:**
1. Laboratory Manual on Concrete Testing (Part-I) : V. V. Shastri and M. L. Gambhir
2. Laboratory Manual on Concrete Testing (Part-I) : C. B. Kukreja
3. Laboratory Manual on Concrete Technology : PD Kulkarni, LN Mittal & Hemant Sood