COURSE CODE AND DEFINITIONS:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Lecture</td>
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<tr>
<td>T</td>
<td>Tutorial</td>
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<tr>
<td>P</td>
<td>Practical</td>
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<tr>
<td>BSC</td>
<td>Basic Science Courses</td>
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<tr>
<td>ESC</td>
<td>Engineering Science Courses</td>
</tr>
<tr>
<td>HSMC</td>
<td>Humanities and Social Sciences including Management courses</td>
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<tr>
<td>PCC</td>
<td>Professional Core Courses</td>
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<tr>
<td>LC</td>
<td>Laboratory Courses</td>
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<tr>
<td>MC</td>
<td>Mandatory Courses</td>
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<tr>
<td>PT</td>
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<td>S</td>
<td>Seminar</td>
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<tr>
<td>TH</td>
<td>Theory</td>
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<tr>
<td>Pr</td>
<td>Practical</td>
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</tbody>
</table>
General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3\(^{rd}\) students of the class should opt for it.
## Scheme of Studies and Examination

**B.TECH (Civil Engineering) – 5th Semester**  
**w.e.f. 2020-21**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>CourseCode</th>
<th>CourseTitle</th>
<th>Hours per Week</th>
<th>Contact Hours per Week</th>
<th>Credit</th>
<th>Examination Schedule (Marks)</th>
<th>Duration of Exam (Hours)</th>
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<tr>
<td></td>
<td>PCC-CE-301</td>
<td>Hydrology and Water Resource Engineering</td>
<td>2-1-0</td>
<td>3</td>
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<td>2</td>
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<td>Highway Engineering-I</td>
<td>2-1-0</td>
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<td>25, 75, -</td>
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<td>3</td>
<td>PCC-CE-305</td>
<td>Soil Mechanics</td>
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<td>4</td>
<td>PCC-CE-307</td>
<td>Water Supply and Treatment</td>
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<td>5</td>
<td>PCC-CE-309</td>
<td>Design of Steel Structure</td>
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<td>25, 75, -</td>
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<td>11</td>
<td>PT-CE-321</td>
<td>Survey camp</td>
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<td>12</td>
<td>PT-CE-323</td>
<td>Practical Training-I</td>
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**Note:**

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded ‘F’ grade is required to repeat Practical Training.

**Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.**
## Scheme of Studies and Examination

### B.TECH (Civil Engineering) – 6th Semester

**w.e.f. 2020-21**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Code</th>
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<th>L-T-P</th>
<th>Hours per Week</th>
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<td>9.</td>
<td>LC-ESC-314</td>
<td>Computer aided Civil Engineering Design</td>
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### Course Codes and Titles

<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>PEC-CEEL-302</td>
<td>1. Waste Water Treatment</td>
</tr>
<tr>
<td>PEC-CEEL-304</td>
<td>2. Air &amp; Noise Pollution Control</td>
</tr>
<tr>
<td>PEC-CEEL-306</td>
<td>3. Environmental Impact Assessment</td>
</tr>
<tr>
<td>PEC-CEEL-308</td>
<td>1. Advanced Concrete Structure</td>
</tr>
<tr>
<td>PEC-CEEL-310</td>
<td>2. Pre-Stressed Concrete</td>
</tr>
<tr>
<td>PEC-CEEL-312</td>
<td>3. Repair &amp; Rehabilitation Of Structure</td>
</tr>
</tbody>
</table>

**Note:**

1. Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.
Course Objectives

- To provide knowledge in the hydrological cycle, precipitation, evapotranspiration, infiltration and its measurements.
- To understand the physics of translate of rainfall into runoff modelling of various runoff techniques.
- To estimate the floods.
- To develop ability to apply the analytical and numerical techniques to ground and surface water models.
- To understand hydrographs and its methods.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction


Module 2: Precipitation

Forms of Precipitation, Characteristics of Precipitation in India, Measurement of Precipitation, Rain Gauge Network, Mean Precipitation over an Area, Depth Area-Duration Relationships, Frequency of Point Rainfall, Intensity-Duration-Frequency Curves, Probable Maximum Precipitation (PMP), Rainfall Data in India.

Unit-II

Module 3: Hydrological Abstractions


Module 4: Runoff

Unit-III

Module 5: Hydrograph

Discharge Hydrograph, Components and Factors Affecting Shape of Hydrograph, Effective Rainfall, Base Flow Separation, Unit Hydrograph(UH)-Definition, Assumptions and its Derivation; Unit Hydrograph of Different Durations, Use and Limitations of UH, Snyder’s Synthetic UH

Module 6: Floods and its Estimation


Unit-IV

Module 7: Water Resource Planning-I


Module 8: Water Resource Planning-II


Course outcomes

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

- Demonstrate the concepts of hydrograph, unit hydrograph and flood estimation.
- Estimate the hydrological parameters.
- Carry out statistical and probability analysis of hydrological data.
- Demonstrate the concepts of hydrological systems.
- Gain the basic knowledge of water resource planning.

References:

- Engineering Hydrology by K.Subramanya.
- Hydrology by H.M.Raghunath.
- Water Resources Engineering by Linseley and Franzini
- Optimisation Theory and Applications by S.S.Roy
- Water Resources Systems Planning & Economics by R.S.Varshney.
Course Objectives

- To understand the importance of transportation and characteristics of road transport.
- To know about the history of highway development, surveys and classification of roads.
- To study the geometric design of highways.
- To study about traffic characteristics and design of intersections.
- To know about the pavement materials and design.
- To know about the different type of bituminous material and design.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I


Module 1: Introduction

Modes of Transportation, History of Road Development, Scope of Highway Engineering, Road Development Plans in India, PMGSY and other Highway Projects, Classification of Highways, Locations and Functions, Road Patterns.

Module 2: Highway Development and Planning


Unit-II

Module 3: Highway Geometric Design

Urban, Rural Roads and their Cross-Sections, Design of Cross Section Elements- Right of Way and Width Considerations, Roadway, Shoulders, Kerbs Traffic Barriers, Medians, Frontage Roads; Facilities for Pedestrians, Bicycles, Buses and Trucks, Traffic Separators and Road Margin, Design of Sight Distances, IRC Recommended Values.

Module 4: Design of Horizontal and Vertical Alignment

Super-Elevation and its Design, Extra-Widening, Radius of Circular Curves, Length of Transition Curves, Gradient, Summit and Valley Curves, Introduction to Software like MXROAD.
Unit-III

Module 5: Highway Material: Soil and Aggregate


Module 6: Highway Material: Bituminous Materials and Bituminous Mixes


Unit-IV

Module 7: Traffic Engineering and Control


Module 8: Intelligent Transportation Systems (ITS)

Objectives of Intelligent Transportation Systems, Historical Background, Benefits of ITS, Data Collection Techniques for ITS-Detectors, Automatic Vehicle Location, Automatic Vehicle Identification, Geographic Information Systems and Video Data Collection.

Course Outcomes

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

- Carry out surveys involved in planning and highway alignment.
- Design cross-section elements, sight distance, horizontal and vertical alignment.
- Implement traffic studies, traffic regulations and control, and intersection design.
- Determine the characteristics of pavement materials.

References:

Course Objectives:

- To provide Civil Engineering students with the basic knowledge regarding soil formation and composition.
- To explain the importance of three phase system of soil and how soil is properties estimated using three phase system.
- To impart knowledge on the various factors governing the Engineering behaviour of soils and carry out soil classification.
- To explain role of water in soil behaviour and how soil stresses, permeability and quantity of seepage are estimated.
- To determine shear parameters and stress changes in soil due to foundation loads.
- To estimate the magnitude and time-rate of settlement due to consolidation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Soil Formation and its Basic Soil Properties

Module 2: Classification and Permeability of Soils
Necessity of Classification, Classification on the Basis of Grain Size and on the Basis of Plasticity, Plasticity Chart, Textural Classification, Unified Soil Classification, IS Classification System Soil. Permeability, Darcy’s Law and its Validity, Discharge Velocity and Seepage Velocity, One Dimensional Flow, Factors Affecting Permeability, Laboratory and Field Determination of Permeability, Indirect Methods, Permeability of Stratified Deposits.

Unit-II

Module 3: Effective Stress Concept

Module 4: Compressibility and Compaction
Definitions, Role of Moisture and Compactive Effort in Compaction, Moisture Density Relationship, Compaction in Laboratory and Field Conditions, Compactive Effect on Soil Properties, Compaction of Cohesionless Soils, Moderately Cohesive Soils and Clays, Field Control of Compaction.

Unit-III

Module 5: Vertical Stress below Applied Loads
Boussinesq’s Equation, Vertical Stress Distribution Diagrams, Pressure Bulb, Vertical Stress Beneath Loaded Areas, Newmark’s Influence Chart, Westergaard’s Analysis, Contact Pressure, Approximate Stress Distribution Methods for Loaded Areas.

Module 6: Consolidation
Consolidation Process and its Types, Components of Total Settlement, One-Dimensional Consolidation Test, Typical Void Ratio-Pressure Relationships for Sands and Clays, Consolidation Parameters, Normally Consolidated and Over Consolidated Clays, Casagrande’s Graphical Method of Estimating Pre-Consolidation Pressure, Terzaghi’s Theory of One- Dimensional Consolidation, Determination of Coefficients of Consolidation, Time Rate of Consolidation.

Unit-IV

Module 7: Shear Strength
Mohr Stress Circle, Mohr-Coulomb Failure-Criterion, Relationship Between Principal Stresses at Failure, Drainage Conditions, Shear Strength Parameters and their Determination, Advantages and Disadvantages of Different Shear Tests, Shear Strength Characteristics of Clay and Sand, Partially Saturated Soils.

Module 8: Earth Pressure
Types of Lateral Earth Pressure, Rankine’s Active, Passive States of Plastic Equilibrium and Rankine’s Theory, Coulomb’s Wedge Theory, Coulomb’s Active and Passive Earth Pressure Theory, Culmann’s Graphical Construction.

Course Outcomes
At the end of the course, the students will be able to:
- Solve three phase system problems.
- Able to carry out soil classification.
- Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram.
- Estimate the stresses under any system of foundation loads.
- Solve practical problems related to consolidation settlement and time rate of settlement.

References:
- Geotechnical Engineering, by P. Purshotam Raj, Tata McgrawHill.
- Principles of Geotechnical Engineering by B.M. Das, PWS KENT,Boston.
Course Objectives

- To quantify the water demands and its variations.
- To analyze the different characteristics of water.
- To study the different units of treatment.
- To deal with water supply and water distribution to consumers.
- To develop basic knowledge about the water pollution and its control.

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**COURSE CONTENT**

**Unit-I**

**Module 1: Introduction**


**Module 2: Water Characteristics**

Sources of Impurities, Type of Impurities in Water and their Sanitary Significance, Physical, Chemical and Bacteriological Analysis of Water, Indian and Global Standards of Water Quality, Effluent Standards.

**Unit-II**

**Module 3: Water Treatment**

Necessity of Water Treatment, Flow Diagram of Different Treatment Units; Constructional Details, Working and Operation of Preliminary Units, Aeration Units, Sedimentation Units and their Types, Features and Design Aspects; Mixing Basins, Flocculation; Filtration – Mechanisms, Characteristics and Design of Slow and Rapid Sand Filtration Unit; Disinfection - Theory, Methods and Practices.

**Module 4: Advanced Water Treatment**

Unit-III

Module 5: Water Conveyance System

Methods of Supply - Intermittent and Continuous, Pipes and Conduits for Water, Pipe Materials, Laying, Jointing and Testing of Pipes, Valves and Appurtenances

Module 6: Pumps and Pumping Stations

Need of Pumping, Terminology used, Classification of Pumps, Different Type of Pumps used in Water Supply, Power of Pumping, Total Lift of Pump, Location of Pumping Station, and Site Selection.

Unit-IV

Module 7: Water Distribution System


Module 8: Water Pollution and Control

Sources of Water Pollution, Types and their Effects, Preventive Measures and Control of Water Pollution, Description of Legislation Related to Water Pollution Control.

Course Outcomes

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

- Understand the sources of water and characterization of water including physical, chemical and biological water quality parameters.
- Develop basic knowledge about the transmission, storage and distribution of water.
- Knowledge of water pollution and its control.
- Recommend the degree of treatment required for the water.

References:

- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
Course Objectives

- To learn IS 800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections.
- To study and design of various connections.
- To understand behaviour of flexural members and the design laterally restrained and unrestrained beams.
- To impart practical knowledge of steel structures and their application.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Stress Strain Curve for Steel, Composition and Properties of Structural Steel, Types of Steel Structures, Types of Sections, Stresses in Structural in Steel, Design Consideration, Codes and Specification, Introduction of Design Philosophies, Different Kind of Loads and their Combination.

Module 2: Connections

Terminology. Various Types of Connections and their Joints-Riveted, Bolted, Pin, Welded Connections; their Design for Different Loads, Modes of Failure

Unit-II

Module 3: Design of Tension Member

Types of Tension Members, Factors Affecting Strength of Tension Member, Design of Tension Members, Lug Angles, Splices, Gussets as per Indian Codal Provision.

Module 4: Design of Compression Members

Behaviour of Compression Members, Types of Compression Member, Effective Length, Slenderness Ratio, Sections Used for Compression Member, Flexural-Torsional Buckling, Prevention of Buckling Failure, Design of Compression Members, Design of Built Up Columns- laced and battened columns including the design of lacing and battens, Design of Compression Members Composed of Two Components Back-To-Back.
Unit-III

Module 5: Design of Beams


Module 6: Design Column Bases and Footings

Types of Column, Bases-Slab Bases, Gusset Base, Design of Base plate and Gusseted Base, Design of Bases for Eccentrically Loaded Columns, Anchor Bolts and Shear Connectors, Grillage Foundation

Unit-IV

Module 7: Plastic Analysis and Design


Module 8: Design of Gantry Girder

Loading Consideration, Selection Criteria of Gantry Girder, Specification, Design of Gantry girder

Course Outcomes

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

- Apply the IS code of practice for the basic design of steel structural elements.
- Design compression and tension members using simple and built-up sections.
- Analyze the behaviour of bolted connections and design them.
- Design welded connections for both axial and eccentric forces
- Students will be able to understand the basic of steel structure with practical application.

References:

- Design of steel structures (LSM), N.,Subramanian, Oxford Publication.
Course Objectives

- To make the students familiar interior of Earth.
- To aware about different geological maps, different organizations related with geological study.
- To provide knowledge about geological forces and formation of Superficial Deposits.
- To make students study various minerals
- To aware about the basics of various types of rocks and their formation
- To provide adequate knowledge about geological considerations in civil engineering projects

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction
Scope, Subdivision of Geology, Interior of Earth, Importance of Geological Studies in Various Civil Engineering Projects, Department Dealing with this Subject in India and their Scope of Work- GSI, Granite Dimension Stone Cell, NIRM; Use of Geological Maps and Interpretation of Data.

Module 2: Physical Geology
External and Internal Geological Forces Causing Changes, Weathering, Erosion and Denudation of the Surface of the Earth; Factors Affecting Weathering and Product of Weathering; Superficial Deposits and its Geotechnical Importance: Water Fall and Gorges, River Meandering, Alluvium, Glacial Deposits, Desert Landform, Loess, Mudflows, Coastal Deposits.

Unit-II

Module 3: Mineralogy

Module 4: Petrology
Unit-III

Module 5: Structural Geology

Forms and Structures of Rocks, Stress and Strain in Rocks, Deformation and Tectonics, Dip and Strike, Bedding Planes and Outcrops; Fold- Types and Nomenclature, Criteria for Their Recognition in Field; Faults: Classification, Recognition in Field.

Module 6: Properties of Rock Masses


Unit-IV

Module 7: Geology of Dam and Reservoir Site

Geological Consideration for Selecting Dam and Reservoir Site, Causes of Failure of Reservoir, Favourable and Unfavourable Conditions in Different Types of Rocks in Presence of Various Structural Features, Precautions to Counteract Unsuitable Conditions.

Module 8: Geological Hazards

Rock Instability and Slope Movement; Concept of Sliding, Consequences of Land Sliding, Prevention by Surface Drainage, Slope Reinforcement by Rock Bolting and Rock Anchoring; Earthquake: Magnitude and Intensity of Earthquake, Seismic Waves; Seismic Zones in India.

Course Outcomes

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

- To identify different minerals, their physical properties and rock forming minerals.
- To understand the basics of various types of rocks and their formations, texture, composition.
- To determine different geological forces and formation of Superficial Deposits.
- Conduct geological survey by knowing the interior of Earth.
- To study different geological maps with geological symbols.
- To acquire the knowledge about geological considerations in civil engineering projects.

References:

- A textbook of Geology by P.K Mukherjee
- Physical and General Geology by SK Garg
- Engineering and General Geology by Prabin Singh.
- Introduction of physical Geology by A.holmes
Course Objectives

- To understand the characterization of highway materials as per IRC/IS codes.
- To learn the mix designs of granular, bituminous and CCMixes
- To learn the use of modern equipment for traffic studies and pavement evaluation

List of Experiments

1. To determine the flakiness index and elongation index of aggregates.
2. To determine the California Bearing Ratio (CBR) value of soil and aggregate.
3. To determine the impact value of aggregate and composite material.
4. To determine the crushing strength of aggregate and composite material.
5. To determine the abrasion and attrition value of aggregate by using:
   a) Deval abrasion test.
   b) Los Angeles abrasion test
   c) Dory abrasion test.
6. To determine the water absorption of aggregate.
7. To find out the durability of aggregate.
8. To determine the mechanical and wear properties of tiles/blocks:- a) Flexural strength b) Abrasion value of tiles/blocks.
9. Traffic volume and speed study using videography technique.(Demonstration only)

Course Outcomes

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

- Gain Engineering knowledge of the subject and apply it for judging the suitability of highway materials.
- Make investigations, use modern test tools and develop solutions to use highway materials for sustainable development that preserves the environment.
- Understand the norms of engineering practice and the need for life-long learning as per their exposure to relevant IS/IRC specifications.

References:

Course Objectives

- To estimate index properties of soil.
- To estimate consistency limit of fine grained.
- To estimate shear strength of soils by direct shear test & unconfined compressive test.
- To estimate the engineering properties of the soils by density test, permeability test and consolidation test

List of Experiments

1. Visually classify the soil and to determine the moisture content (water content) of a given soil sample.
2. Determination of specific gravity of given soil sample.
3. To classify the coarse grained soil by sieve analysis using particle size distribution curve.
4. To determine liquid limit and plastic limit.
5. To determine field density of soil by
   a. Sand replacement method
   b. Core cutter method
6. To determine the optimum moisture content and maximum dry density of soil by Standard Proctor Test.
7. To determine the coefficient of permeability of soil sample at desired density by suitable method.
8. To determine the Unconfined compressive strength of cohesive soil sample.
9. To determine the shear strength parameters of the given granular soil sample at known density and moisture content by Direct shear test.
10. To determine the shear strength parameters of fine grained soil sample by unconsolidated undrained (UU) Triaxial test.

Course Outcomes

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

- Determine index properties of soils.
- Students will learn and acquire knowledge to classify soils.
- To understand the techniques, skills and modern engineering tools necessary for engineering practice.
- Determine engineering properties of soils solutions.
- Classify soil by physical observation of the soils.
- Carry out interpolation among the estimated soil design parameters.

References:

- Soil Testing for Engineers by S.Prakash, PK Jain, Nem Chand & Bros., Roorkee.
- Soil Engineering in Theory and Practice, Vol.II.
- Geotechnical Testing and Instrumentation by Alam Singh, CBSPub.
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**Course Objectives**

- To draw various steel connection.
- To draw various beam and column connections.
- Drawing of girders, different trusses and joints.
- To draw various steel members i.e. tension and compression members.

**List of Experiments**

1. To Prepare Detailed Drawing for various types of Bolted Connection.
2. To Prepare Detailed Drawing for various types of Welded Connection.
3. To Prepare Detailed Drawings for Laced And Battened Columns.
4. To Prepare Detailed Drawings of Built Up Beams.
5. To Prepare Detailed Drawing of Column Bases–Slab Bases–Gusset Base.
7. To Prepare Detailed Drawing of Beam to Column Connections.
8. To Prepare Detailed Drawings of Gantry Girder.
9. To Prepare Drawing of Plate Girder.
10. To Prepare Drawing of Circular and Rectangular Water Tank.
11. To Prepare Drawing of various types of Roof Trusses.

**Course Outcomes**

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

- Understand the study of drawing for various components like connection, trusses, girders, joints etc.
- Implementation of design in drawing forms with by laws.
- Apply relevant Indian Standard provisions to ensure safety and serviceability of structural steel elements.

**References:**

- Structural design & Drawing, S. Krishnamurthy, Volume-3.
- Design & Drawing of steel Structure, Sajjan V. Wagh.
- Structural design & Drawing, reinforced concrete & Steel, N. Krishna Raju.
- Steel Structures (Design & Drawing), A.K. Upadhayay.
Course Objectives

- To study and identify different minerals with their physical properties.
- To aware about different types of rocks and rock forming minerals.
- To study the different geological formations.

List of Experiments

1. To Study physical properties of minerals.
2. To study and identify different minerals: Silica group, Feldspar group, Carbonate group and Pyroxene group.
3. To study and identify rocks forming silicate and ore minerals.
6. Identification of Metamorphic Petrology: Marble, Slate etc.
7. To determine Dip and strike of formations using
   a) Clinometer
   b) Brunton compass
9. Study of models of Geological structures and outcrops patterns of different types of rocks and landforms.

Course Outcomes

At the end of the course, students would be able to:

- To identify different materials and their physical properties.
- To identify different types of rocks on the basis of their formation.
- To identify geological symbols and make geological maps.
- To measure geological formations of different types.

References:

- A textbook of Geology by P.K Mukherjee
- Engineering and General Geology by Prabin Singh.
SURVEY CAMP

| Course Code | PT-CE-321 | External marks: | 25 |
| Credits     | 2         | Internal marks: | 25 |
| L-T-P       | 0-0-0     | Total marks:    | 50 |

Course Objectives

- Survey camp emphasizes on field application of basic survey task such as triangulation, base line measurement, leveling, contouring and topographic surveying of land using plane table methods.
- It imparts knowledge of projection of land features on a plane sheet on a chosen scale.
- To make the student capable of drawing survey site plans and maps independently of a chunk of land of hilly area.

COURSE CONTENT

The survey camp is to be carried out by the students at suitable site. Different group of students will be asked to survey a particular area by using appropriate instruments issued to them. They will use different methods of surveying i.e. leveling, base line measurement, contouring, triangulation, plane table method to locate different control points. The students will plot important objects and features of the area under consideration on plane table sheet and prepare topographic map of the area.

Course Outcomes

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

- Use instruments like Auto level, Total station, Tachometer and other important survey instrument.
- They will gain experience of preparing site maps of the objects in the area under consideration with contours.
- Make significant survey decisions on survey works whenever necessary especially when facing problems at sites.
- To carry out engineering survey work confidently.

Reference Books

- Punmia B.C., Surveying, Volume 1, Laxmi Publications.
- Punmia B.C. Surveying, Volume 2, Laxmi Publications.
- N N Basak, Surveying and Levelling TMH Private Ltd.
Course Objectives

- To make the students conversant with introduction to irrigation and national policies.
- To understand the basic methods of irrigation and soil water relation.
- To expose the students to water logging and land reclamation.
- To provide adequate knowledge regarding river training and canal outlet.
- To have adequate knowledge of drainage work.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction
Scope and Necessity of Irrigation, Different Water Resources, Development of Irrigation in India, Irrigation Systems and its various types, Benefits of Irrigation, National Water Policy, Impacts of Irrigation

Module 2: Water Requirement of Crops
Crops and Crop Seasons in India, Field Capacity, Wilting Point, Duty and Delta, Soil-Water Relationship- root zone soil water, infiltration, frequency of irrigation; Methods of Irrigation: Flooding Methods, Border Strip Method, Check Basin and Furrow Method, Sprinkler and Drip Irrigation Methods and their Design.

Unit-II

Module 3: Canal Regulation Works
Canal Fall- Necessity and Location, Types of fall, Cross Regulator and Distributory Head Regulators, Silt Control Devices, Canal Escapes and its Types.

Module 4: Cross Drainage Works
Classification, Site Selection Criteria, Factors Affecting the Selection of Cross Drainage Works, Hydraulic Design of- aqueducts, syphon aqueducts, super passage, canal syphon and level crossing
Unit-III

Module 5: Canal Outlets

Essential Requirements for an Outlet, Classification and Types of Outlets, Salient Features and Design: Pipe Outlet, APM Outlet and Open Flume Outlet; Flexibility Proportionality, Setting and Sensitivity of Outlet.

Module 6: Spillways and Energy Dissipations

Essential Requirements of Spillway and Spillway's Capacity, Types of Spillways and their Suitability, Ogee Spillways, Chute, Side Channel, Shaft and Syphon Spillways, Energy Dissipaters and its types; Stilling Basins, USBR and IS Stilling Basins.

Unit-IV

Module 7: River Training

Objectives and Classification of River Training Works, Methods and Planning of River Training, Marginal Embankments, Guide Banks, Spurs, Cut Offs, Bank Protection and Launching Apron.

Module 8: Water Logging and Drainage


Course Outcomes

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

- Learn historical development of irrigation in India and the policies framed
- Learn about various methods of irrigation
- Understand water logging effects and methods of land reclamation
- Know about river training, classification and requirement of canal outlets and cross drainage works.

References:

- Sharma, S.K., Principles and Practice of Irrigation Engineering, S.Chand & Co., latest edition
# FOUNDATION ENGINEERING

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## Course Objectives

- To emphasize the importance of soil investigations.
- To provide the knowledge for carrying out field investigations and to identify soils in geotechnical engineering practice.
- To identify factors controlling soil behaviour and methods of dewatering.
- To understand different types of foundations and their importance in field.
- To identify different parameters for determining the bearing capacity of soil.
- To explain under which conditions deep foundation is needed and how to estimate pile and pile group capacity.
- To understand dynamic loading on soil foundation system and provide knowledge to lay out caissons and well foundation.

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

## COURSE CONTENT

### Unit-I

**Module 1: Sub-Surface Exploration**

**Module 2: Drainage and Dewatering**

### Unit-II

**Module 3: Shallow Foundations**

**Module 4: Settlement of Foundations**

### Unit-III
Module 5: Bearing Capacity of foundations

Module 6: Pile Foundations

Module 7: Drilled Piers and Caisson Foundations
Drilled Piers- Types, Uses, Bearing Capacity, Settlement and Construction Procedure; Caissons- Types, Bearing Capacity, Settlement and Construction Procedure

Module 8: Well Foundations
Shapes, Depth of Well Foundations, Components, Factors Affecting Well Foundation Design Lateral Stability, Construction Procedure, Sinking of Wells, Rectification of Tilts and Shifts, Recommended Values of Tilts & Shifts as per IS: 3955

Course Outcomes
At the end of the course, the students will be able to:

- To understand the importance of soil investigation and carry out sub-surface explorations for any civil engineering construction.
- To evaluate Bearing capacity factors and estimate bearing capacity using suitable methods.
- To do proper foundation proportioning for any kind of shallow foundation system.
- To estimate pile and pile group capacity for any kind of soils including group efficiency.
- To determine safe bearing capacity for various foundation system by considering shear and settlement criterion.

References:

- P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, latest edition
**Course Objectives**

- To understand the design of flexible and rigid pavements.
- To know the construction techniques of highways pavements.
- To understand the pavement failures and maintenance of pavements including strengthening.
- To learn economic evaluation of highway projects and sources of financing.

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**COURSE CONTENT**

**Unit-I**

**Module 1: Design of Flexible Pavements**


**Module 2: Design of Rigid Pavements**

Westergaard’s Theory and Assumption, Critical Locations of Loading, Load and Temperature Stresses, Critical Combination of Stresses, Joints: Types, Requirements and Patterns, Spacing of Expansion and Contraction Joints; Design and Functions of Dowel and Tie Bars, IRC and AASHTO Methods of Rigid Pavement Design.

**Unit-II**

**Module 3: Construction of Bituminous Pavements**

Various Types of Bituminous Constructions, Prime Coat, Tack Coat, Seal Coat and Surface Dressing; Construction of BUSG, Premix Carpet, BM, DBM and BC, Mastic Asphalt, Functions of Rollers, Paver and Hot Mix Plants, Introduction to Various IRC and MoRTH Specifications

**Module 4: Highway Construction: Non-Bituminous Pavements**

Subgrade and Embankment construction, Construction of GSB, WBM, WMM; Construction of DLC and PQC, Fixed Form and Slip-Form Paving Techniques
Unit-III

Module 5: Pavement Failure and Remedies

Classification of Distresses in Pavements (Functional and Structural); Different Types of Distresses in Flexible and Rigid Pavements along with the Causes and Remedial Measures; Various Types of Maintenance of Pavements; Evaluation of Pavements: Functional and Non-Destructive Evaluation

Module 6: Strengthening of Existing Pavement

Objective of Strengthening, Different Types of Overlay, Design of Flexible Overlays on Flexible Pavement using Effective Thickness Approach and Deflection Approach, Benkelman Beam Method, Design of Other Types of Overlays.

Unit-IV

Module 7: Highway Drainage and Hill Roads

Necessity and Significance of Drainage, Mode of Ingress of Water in Highway Structure, Surface Drainage: -Types and Brief Design, Types of Sub-Surface Drainage, Drainage Inclining for the Roads in Hilly Areas, Special Characteristics of Hill Roads: Geometrics and Hair Pin Bends.

Module 8: Highway Economics and Finance


Course Outcomes

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

- Gain Engineering knowledge of the subject and apply it for the solution of problems related to pavement engineering.
- Design flexible and rigid pavements, make investigations, use modern tools and develop solutions to problems related to highway pavements.
- Understand the engineering solutions in societal context for sustainable development that preserve the environment and economical use of resources.
- Understand the norms of engineering practice and the need for life-long learning as per their exposure to relevant latest IS/IRC/MoRTH specifications.

Reference:

- Principles of Pavement Design by Yoder, E.J&Witczak, M.W., John Wiley and Sons, USA.
Course Objectives

- To quantify the water and wastewater pollutant.
- To analyze the physical characteristics of water and wastewater.
- To analyze the chemical characteristics of water and wastewater

List of Experiments

1. Determination of Turbidity of water by using suitable method
2. Determination of pH of given water sample.
3. Determination of Hardness of given water sample.
4. Determination of Residual Chlorine in given sample of water
5. Determination of Total Suspended and Dissolved Solids in given water sample.
7. Determination of chemical oxygen demand of waste water sample.
8. Determination of Conductivity of given water sample.
9. Determination of Chlorides of given water sample
10. Determination of Alkalinity and Acidity of a given water sample.

Course Outcomes

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

- Quantify the water and wastewater pollutant.
- Estimate the physical characteristics of water and wastewater.
- Analyze the chemical characteristics of water and wastewater

References:

- Guide manual: Water & wastewater analysis, Central Pollution Control Board, Govt. of India.
- APHA standard methods for the examination of water and wastewater
- Water supply engineering, S.K. Garg
Course Objectives

- To aware the students about hydrometer method.
- To estimate the relative density and maximum dry density of soils.
- To aware the importance of SPT, consolidometer and Triaxial test for selection of foundation.
- To estimate shear strength parameters of soil by Triaxial shear test.
- To estimate consolidation parameters of clayey soil.
- To aware about the importance of sampling and aware about the significance of plate load test.

List of Experiments

1. To determine grain size analysis using Hydrometer method.
2. To determine relative density of granular Soils.
3. To determine shrinkage limit of fine grained soil
4. To determine shear strength properties for consolidated drained conditions using Triaxial test.
5. To determine shear strength properties for consolidated undrained condition using Triaxial test.
6. To determine consolidation parameters using consolidometer.
7. To determine bearing capacity parameters using Standard Penetration Test.
8. Demonstration of Undisturbed Sampling.
10. To study of Model Plate Load Test.

Course outcomes

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

- Classify soil using hydrometer method and estimate relative density of soils.
- To perform Triaxial test under different conditions.
- To understand the procedure and calculations of SPT and prepare soil investigation report.
- Carry out interpolation tests to determine consolidation and estimate shear strength parameters.
- To obtain soil sampling by suitable method.
- Determine essential parameters of plate load test.

References:

- P. Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, latest edition
HIGHWAY ENGINEERING-II LAB

| Course Code | LC-CE-312 | External marks: | 25 |
| Credits | 1 | Internal marks: | 25 |
| L-T-P | 0-0-2 | Total marks: | 50 |

Course Objectives

- To understand the characterization of highway materials.
- To learn the mix designs of granular, bituminous, CC mixes and composite materials.
- To learn the use of modern equipment for traffic studies & pavement evaluation.
- To know the standard specifications of IS/IRC/MoRTH for judging suitability of these materials

List of Experiments

1. To determine the flash and fire point of bituminous material.
2. To determine the softening point of paving bitumen.
3. To determine the specific gravity of bituminous material.
4. To determine ductility of bitumen.
5. To determine the hardness of bitumen.
6. To determine the grade of a given binder.
7. To determine the viscosity of bituminous material.
8. To determine the granular mix design.
9. To determine the bituminous mix design by Marshall’s method.
10. To determine the cement concrete mix design for pavements.
11. Demonstration of BBD & Bump Integrator.

Course Outcomes

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

- Gain engineering knowledge of the subject and apply it for judging the suitability of highway materials.
- Make investigations, use modern test tools and develop solutions to use highway materials for sustainable development that preserves the environment.
- Understand the norms of engineering practice and the need for life-long learning as per their exposure to relevant IS/IRC specifications.

References:

Course Objectives

- To develop, analyze and design the various structural members in the fields of Civil Engineering using AutoCAD, STAAD Pro.
- To understand the design of structures using IS codes
- To provide the knowledge about methods of analysis and design of RCC and steel frames.

List of Experiments

1. To study the commands used in plans of buildings using AutoCAD.
2. To prepare 2D architectural drawing
3. To prepare 3D architectural drawing
4. To prepare the drawing of grillage foundation using Auto cad.
5. To study the commands used in modelling and design of structure using STAAD-Pro.
6. Analysis of 2D Frames.
8. Design of 2D RCC frames and 2D Steel frames according to IS codes.
9. Design of 3D RCC frames and 3D Steel Frames according to IS codes.
10. Design of beams.
11. Analysis of truss frames.

Course Outcomes

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

- To understand and learn the various codal provisions.
- Ability to prepare 2D and 3D plans of buildings.
- To efficiently analyze and design of beams, truss frames and staircase.
- To perform various methods of analysis of 2D, 3D frames.

References:

- IS 456, IS 1893, IS 800, IS 875.
WASTE WATER TREATMENT

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**Course Objectives**

- To learn basics of sewage collection and design of sewers
- To learn the basics of sewage composition and its characteristics
- To have adequate knowledge about various sewage treatment processes and its design
- To provide adequate information on various disposal standards for treated effluents

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**COURSE CONTENT**

**Unit-I**

**Module 1: Introduction**


**Module 2: Design of Sewers**

Types of Sewers and their Hydraulic Design, Material used for Sewer Construction, Joints and Sewer Appurtenances, Layout, Construction and Testing of Sewer Lines, Velocity in Sewers, Storm Water Sewers

**Unit-II**

**Module 3: House Drainage**


**Module 4: Wastewater Characteristics**

Quality Parameters- Physical, Chemical and Biological Characteristics, Oxygen Demand, Indian Standards for Disposal of Effluents into Inland Surface Sources and on Land, Guidelines for Reuse of Treated Wastewater
Unit-III

Module 5: Primary Sewage Treatment

Objectives, Flow chart of Conventional Treatment Units and their Efficiencies, Preliminary Treatment, Screening and Grit Removal Units, Principle, Types and Design of Primary Sedimentation Tank, Coagulation Aided Sedimentation Tank, Flocculation,

Module 6: Secondary Sewage Treatment


Unit-IV

Module 7: Sludge Treatment

Objectives, Sludge Digestion, Digestion and Disposal of Primary and Secondary Sludge, Factors Affecting Sludge Digestion, Thickening of Sludge, Anaerobic Digestion of Sludge, Sludge Digestion Tank, Sludge Conditioning and Dewatering, Sludge Drying Bed

Module 8: Sludge Disposal

Standards of Wastewater Disposal, Modes of Disposal of Treated Sludge, Self-Purification of Streams, Oxygen Sag Curve, Sewage Farming, Sodium Hazards, Soil Dispersion System

Course Outcomes

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

- Estimate quantity of sewage and design sewerage system
- Determine the various characteristics of sewage
- Design various sewage treatment units
- Plan reuse of treated effluent and select appropriate disposal option

References:

- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Wastewater Engineering, Collection, Treatment and Disposal: Metcalf and Eddy
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie
- Sewage and Sewage Treatment: S.K. Garg.
- Sewage and Sewage Treatment: S.R. Krishansagar.
### Course Objectives

- Understanding of basic concepts of air pollution.
- To understand the basic characteristics of air pollutants.
- To provide adequate knowledge about the noise pollution.
- To have adequate knowledge on various type of sounds.

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

#### COURSE CONTENT

**Unit-I**

**Module 1: Air Pollution**

Composition and Structure of Atmosphere, Air Pollution and Global Climate, Air Quality Criteria, Emission Standards, National Ambient Air Quality Standards, Air Quality Management in India

**Module 2: Sources, Classification and Effects**

Sources and Classification of Air Pollutants, Type of Air Pollutants, Pollution due to Automobiles, Analysis of Air Pollutants – Chemical, Instrumental and Biological Methods; Air Pollution and its Effects on Human health, plants, animals and microbes, archaeological monuments and aesthetics.

**Unit-II**

**Module 3: Pollutant Dispersion**

Concept of Atmospheric Stability, Adiabatic and Environmental Lapse Rate, Plume Behaviour, Terrain and Structure on Pollutant Dispersion, factors affecting Pollutant Dispersion, Concept of Maximum Mixing Depth and Ventilation Coefficient, Plume Rise and Effective Stack Height.

**Module 4: Air Quality**

Objectives, Time and Space Variability in Air Quality; Air Sampling Design, Analysis and Interpretation of Air Pollution Data, Introduction to Air Quality Index and Comprehensive Environmental Pollution Index and its Application, Sampling and Measurement of Air Pollutants Guidelines of Network Design in Urban and Rural areas, Stack Monitoring.
Module 5: Dispersion Modelling and Impacts of Air Pollution


Module 6: Air Pollution Control


Module 7: Noise Pollution

Sound and Noise, Sources of Noise Pollution – Environmental and Industrial, Characteristics of Sound and its Measurement, Levels of Noise, Noise Rating Systems, Noise Level Standards, Outdoor and Indoor Noise Propagation; Psychoacoustics and Noise Criteria Curves

Module 8: Effects of Noise and Control Methods

Effects on Human and Environment, Infra-Sound, Ultrasound, Impulsive Sound and Sonic Boom; Noise Standards and Permissible Values; Instrumentation and Monitoring Procedure, Noise Indices and Control Methods

Course Outcomes

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

- To understand various air pollutants
- Analyze various types of noises.
- To understand various methods of control of air pollution.
- To understand various methods of control of noise pollution.

References:

- Air and Noise Pollution Control : Lawrence K. Wang
- Advanced Air and Noise Pollution Control: Volume 2 : Lawrence K. Wang
- Environmental Pollution and Health : V. K Ahluwalia
- Atmospheric pollution: Mark Z. Jacobson
Course Objectives

- To know the various types of environmental pollution.
- To understand various EIA techniques.
- To provide adequate knowledge about the noise pollution.
- To have adequate knowledge on various type of sounds.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction


Module 2: Sustainable Development

Present and Future Development Needs; Exploitation of Natural Resources, Environmental Harmony, Economic Efficiency and Social Justice, Symbiotic Relationship, Concept of Carrying Capacity

Unit-II

Module 3: Environmental pollution

Environmental pollution due to increasing growth rate, population and human interaction; Air Pollution: Sources, Effects and its Control Measures; Water Pollution: Point and Non-point Source of Pollution, Major Pollutants of Water, Impact of pollutants and its Control Measures; Noise Pollution: Sources, Effects and its Control Measures

Module 4: Evolution of EIA

Scope, Preliminary Screening Requiring EIA of projects, Impact identification, Assessment of Impact; Impact Evaluation, Types of EIA, rapid and comprehensive, Plan for mitigation of adverse impact on environment – Options for mitigation of impact on water, air and land, energy, flora and fauna; addressing the issues related to the project affected people
Unit-III

Module 5: EIA Methodology

Impact Analysis: identification, predication, evaluation; Impact Identification Methods: overlays method, ad-hoc method, Checklist method, Matrices method, Fault Tree Analysis, Event Tree Analysis, Role of an Environmental Engineer,

Module 6: Environmental Audit

Cost Benefit Analysis; Life Cycle Assessment; Resource Balance, Energy Balance, management Review of Environmental Audit; Operational Control;

Unit-IV

Module 7: Case Studies of EIA

Standards for Water, Air and Noise Quality and their indices - Environmental Management Plan, EIA case studies for new and expansion projects: township projects, river valley projects, thermal power plants and industrial plants.

Module 8: Environmental Management


Course Outcomes

At the end of the course, the students will be able to
- Analyze various EIA techniques
- Analyze various types of pollutions.

References:
- Environmental Impact Assessment: Cutting Edge for the 21st Century : Alan Gilpin
- Environmental Impact Assessment : Larry W Canter
Course Objectives

At the end of this course, the student should be able to impart understanding of designing specialized RCC structures. To prepare the detailed structural drawings for execution purpose.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module1: Continuous Beams

Basic Assumptions, Moment of inertia, Settlements, Modification of Moments, Maximum Moments and Shear, Design Examples.

Module2: Curved Beams


Unit-II

Module 3: Flat Slab

Advantages of Flat Slab, General Design Considerations, Indian Code Recommendations, Approximate Direct Design Method, Equivalent Frame method, Design of Flat Slabs, Openings in Flat Slab

Module 4: Yield Line Theory

Basic Assumptions, Yield Line Patterns and Failure Mechanisms, Ultimate Load on Slab, Design Example.

Unit-III

Module 5: Liquid Retaining Structure

Design Concepts of Liquid Retaining Structures, Design of Tanks Resting on Ground, Underground Tanks and Overhead Service Reservoirs, Staging and Foundation Design.

Module 6: Stair Case

Various Types of Staircases, General Notes on Design of Stair, Design Examples.
Unit-IV

Module 7: Design of Joints


Module 8: Building Frames


Course Outcomes

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

- Design advanced RCC structures.
- Prepare detailed structural drawings for the designed RCC structures using software.

References:

- “Plain & Reinforced Concrete,” Jain & Jai Krishan (Vol. I & Vol-II), Nem Chand and Bros.
- “Reinforced Concrete Structures”, Syal and Goel, S. Chand & Company Pvt. Ltd.
- "Reinforced Concrete Limit State Design" A.K. Jain, Nem Chand and Bros.
Course Objectives

- To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students.
- Students will be introduced to the design of pre-stressed concrete structures subjected to flexure and shear.
- To make them familiar with design of typical pre-stressed concrete structural elements and to have a knowledge of the codal provisions.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Material Properties and Prestressing Systems

Introduction of Prestressing system- history, types, source, advantages and its limitations, Prestressing Systems and Devices
Materials properties- Constituents of Concrete and their Properties, Stress-Strain Curves for Concrete, Constituents of Prestressing Steel and their Properties, Types of Prestressing Steel, Stress-Strain Curves for Prestressing Steel, Relaxation of Steel, Fatigue, Codal Provisions.

Module 2: Losses in Prestress

Elastic Shortening, Pre-Tensioned & Post-Tensioned - Axial & Bending Members, Losses in Prestress - Friction, Anchorage Slip, Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Total Time-Dependent Loss, Force Variation Diagram.

Unit-II

Module 3: Analysis and Design for Shear and Torsion

Analysis for Shear- Introduction, Types of Cracks, Components of Shear Resistance, Modes of Failure, Effect of Prestressing Force, Stress in an Uncracked Beam, Design and Detailing Requirement for Shear, Design of Transverse Reinforcement.
Module 4: Calculations of Deflection and Crack Width


Unit-III

Module 5: Analysis of Members

Analysis of Members under Axial and Flexural Load- Based on Stress, Force and Load Balancing Concept. Cracking Moment, Kern Point, Pressure Line, Analysis for Ultimate Strength, Variation of Stress in Steel Condition at Ultimate Limit State, Analysis of Rectangular Sections, Flanged Sections, Partially Pre-Stressed Sections, Un-Bonded Post-Tensioned Beams.

Module 6: Design of Members

Design of Members for Axial Tension, Flexure Type I and Type II, Choice of Sections, Determination of Limiting Zone, Post-Tensioning in Stages, Magne’s Graphical Method, Guyon’s Method

Unit-IV

Module 7: Composite and Continuous Beams


Module 8: Miscellaneous Structures

Design of Tension and Compression Members, Tanks, Pipes and Poles, Partial prestressing – definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

Course Outcomes

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

- Analyse prestressed concrete members
- Design prestressed concrete members using codal provisions
- Design for shear and torsion of prestressed concrete members
- Design end blocks and provide detailing of reinforcements
- Design composite members and other applications
- Design continuous members

References:

- IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards,
Course Objectives:

This course has been designed with an aim to give the students an insight into the subject of concrete repair, its protection and strengthening

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction
Overview of Distress, Deterioration in Concrete Structures, Global Scenario of Distressed Structures, Need for Repairs and Upgrading of Structures, Process for Durable Concrete Repair

Module 2: Deterioration of concrete structures

Unit-II

Module 3: Visual deterioration of structures
Types of Cracks, Causes & Characteristic of Cracking in Various Structural Components, Measurement of Cracks and Interpretation of the Cracking Phenomena

Module 4: Conditional/damage assessment & Evaluation of structures
Structural Assessment- importance, objective, various stages, conditional evaluation of the structure, Damage Assessment Procedure, Preliminary & Detailed Investigation – scope, objectives, methodology & rapid visual inspection of structures, Damage Assessment Allied Tests (Destructive, Semi-Destructive and Non-Destructive), Field & Laboratory Testing Procedures- strength, corrosion activity, performance & Integrity, Durability.

Unit-III

Module 5: Repairs of concrete structures
Repairing Materials- criteria, selection of repair materials, methodology, performance requirements, preparatory stage of repairs, different types of repair materials & their application and repair techniques

Module 6: Retrofitting/Strengthening
Need for Retrofitting, Design Philosophy of Strengthening Structures, Conventional and Advanced Techniques Available for Strengthening, Seismic Retrofit of Concrete Structures- deficiencies in
structure requiring seismic retrofit and its design philosophy, Latest Techniques to Enhance the Seismic Resistance of Structures.

Unit-IV

Module 7: Protection & maintenance of structures

Importance of Protection & Maintenance, Categories of Maintenance, Building Maintenance, Corrosion Mitigation Techniques

Module 8: Structural health monitoring (SHM)

Definition and Motivation for SHM, Basic Components of SHM and its Working Mechanism, SHM as a Tool for Proactive Maintenance of Structures

Course Outcomes

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

- Identify and define all the terms and concepts associated with deterioration of concrete structures.
- Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause/source of deterioration.
- Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.
- Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

References:

- Concrete microstructure, Properties and materials – P Kumar Mehta and Paulo J.M.Monterio.
- V. M. Malhotra, Nicholas J. Carino 2004 “Handbook on Nondestructive Testing of Concrete”
- “Repair and Strengthening of Concrete structures”, FIP guide, Thomas Telford, London.
- Concrete Structures, Protection, Repair and Rehabilitation by R.Dodge Woodson.
- Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.