



**B. TECH CIVIL ENGINEERING – R20**

**SEMESTER VII**

S.No	Class	Course Code	Name of the Subject	L	T	P	C
1	PC	C17PC1	Estimation & Costing	3	0	0	3
2	PE-III	C17PE2	Water Resources Engineering - II	3	0	0	3
			Ground Improvement Techniques				
			Bridge Engineering				
3	PE-IV	C17PE3	Ground Water Development and Management	3	0	0	3
			Foundation Engineering				
			Finite Element Analysis				
4	PC	C17PC4	Geographic Information Systems Lab	0	0	2	1
5	PC	C17PC5	Environmental Engineering Lab	0	0	2	1
6	OE-II	C17OE6	<b>Open Elective – II</b>	3	0	3	3
7	PW	C17PW7	Major Project Phase–I	0	0	7	5
8	MC	MC007	Competitive Exams	0	0	0	S
<b>Total Credits</b>							<b>19</b>

S - Satisfactory

**SEMESTER VIII**

S.No	Class	Course Code	Name of the Subject	L	T	P	C
1	PE-V	C18PE1	Prestressed Concrete Structures	3	0	0	3
			Advanced Structural Design				
			Structural Analysis by Matrix Methods				
2	PE-VI	C18PE2	Traffic Engineering & Management	3	0	0	3
			Rehabilitation and Retrofitting of Structures				
			Construction Project Planning & Management				
3	OE-III	C18OE3	<b>Open Elective – III</b>	3	0	0	3
4	PW	C18PW4	Comprehensive Viva	0	0	2	2
5	PW	C18PW5	Major Project Phase–II	0	0	16	8
<b>Total Credits</b>							<b>19</b>

S - Satisfactory



**B.TECH CIVIL ENGINEERING – R20**

**ESTIMATION & COSTING – C17PC1**

**SEMESTER VII**

**L/T/P/C  
3/0/0/3**

**COURSE OBJECTIVES:**

1. Determination of Quantities of Items and Labour Requirement of Civil Engineering Works.
2. Preparation of Estimate of the Civil Engineering Works.
3. Preparation of Specification of Construction Items.
4. To Introduce the students In-depth Knowledge of Professional Practice as well the Quantity Analysis of Construction Works like, Multi-storied Structures, Water Works & Sanitary Works, Irrigation Works, Road Estimates, Culverts etc.

**COURSE OUTCOMES:**

1. The Students will get a Diverse Knowledge of Estimating, Costing.
2. The Professional Practice, Which will be use Full in Tackling Real Life Problems.
3. The Students will be able to understand the procedure to carry out the estimation and steps to prepare Reports of Construction Works.
4. The Students will earn the Purpose and Importance of Valuation.
5. The Students will get Adverse Knowledge of Bar Bending Schedules in Real Life Problems.

**UNIT-I**

Introduction - Type of Estimates - Elements of Estimate - Methods of Estimating - Standard Units - Data Required for Preparation of Estimates - Technical terms used in Preparation of Estimation - Specification Report on Estimate - Principles of Working out Quantities for Detailed and Abstract Estimates - Schedule Items - Non-schedule Items - Problems on Approximate Method.

**UNIT-II**

Detailed Estimates for Buildings - Estimation of Quantities for Water supply & Sanitary works - Culverts - Road Works - Earthwork Calculations for Roads, Embankments and Canals.

**UNIT-III**

Specifications - Objectives and Importance of Specifications - Standard Specifications, Specifications for non-schedule Items - Specifications for Different Items of Work - Language for Writing Specifications.

Rate Analysis - Introduction and Principles of Rate Analysis - SSR-DSR - Lead Statement - Overhead Charges - Rate Analysis for Schedule items and Non-schedule items - Supplementary items of work - Working-out Rate Analysis for various items of work - Overhead and Contingent Charges.



#### **UNIT-IV**

Reinforcement Bar Bending Schedule for Beams, Columns and Slabs - Preparation of Work Bills - Record of Measurements - Methods of Measurements of Civil Engineering Works - IS Code Provisions - Preparation of Revised Estimates - Contracts and Types of Contracts.

#### **UNIT-V**

Valuation of Buildings - Purpose of Valuation, Types of Property - Depreciation, Sinking fund, Lease Hold and Free Hold Property, obsolescence, Gross income, Outgoing and Net Income, Capitalized Value and Year's Purchase. Rental Method of Valuations and Typical Problems.

#### **TEXT BOOKS:**

1. Estimating and Costing by B.N. Dutta, UBS Publishers.
2. Estimating and Costing by G.S. Birdie, Dhanpat Rai Publications.

#### **REFERENCE BOOKS:**

1. Standard Schedule of Rates and Standard Data Book by Public Works Department.
2. IS-1200 (Parts I to XXVIII 1974, Method of Measurement of Building and Civil Engineering Works - B.I.S).
3. Estimation, Costing and Specifications by M. Chakraborti, Laxmi Publications.
4. National Building Code.
5. CPWD Standard Specifications Vol - 1&2, Government of India.



**B.TECH CIVIL ENGINEERING – R20**

**WATER RESOURCES ENGINEERING-II – C17PE2**

**SEMESTER VII**

**L/T/P/C  
3/0/0/3**

**PRE-REQUISITES:** Water Resources Engineering-I

**COURSE OBJECTIVES:**

1. Introduce Students to the Structure of the Dams, Earth Dam, Canals, Spillways and Cross Drainage Works.
2. Learn to Estimate the Capacity of Reservoir using Mass Curve.
3. Design the Principle of Sarda Type, Trapezoidal Notch, Straight Glacis Fall.
4. Necessity and Importance of Diversion, Storage Head Works, Weir and Barrages.
5. Determine the Uplift Pressure, Impervious Floors using the theory.

**COURSE OUTCOMES:**

1. To know the types of Reservoirs, Zones of Storages of a Reservoir.
2. Know about the Merits and Demerits of Dams, Factor Effecting Selection of Dams, Gravity Dams, Earth Dams, Canals, and Spillways.
3. The Causes of Failure of the Dams, Canals and Spillways.
4. The design of Reservoir, Canals, Diversion; Storage Headworks by the Bligh's and Khosla's theory.
5. Understand about Types of Falls in Canals and its application which have designed in all the Cases.

**UNIT-I**

Storage Works Reservoirs: Types of Reservoirs, Selection of Site for Reservoir, Zones of Storage of a Reservoir, Reservoir Yield, Estimation of Capacity of Reservoir using Mass Curve - Reservoir Sedimentation - Life of Reservoir. Types of Dams, Factors Affecting Selection of Types of Dam, Factors Governing Selection of Site for a Dam.

**UNIT-II**

Gravity Dams: Forces acting on a Gravity Dam, Causes of Failure of a Gravity Dam, Elementary Profile and Practical Profile of a Gravity Dam, Limiting Height of a Low Gravity Dam, Factors of Safety - Stability Analysis, Foundation for a Gravity Dam, Drainage and Inspection Galleries.

**UNIT-III**

Earth Dams: Types of Earth Dams, Causes of failure of Earth Dam, Criteria for Safe Design of Earth Dam, Seepage through Earth Dam - Graphical Method, Measures for Control of Seepage. Spillways: Types of Spillways, Design Principles of Ogee Slipways - Spillway Gates. Energy Dissipaters and Stilling Basins, Significance of Jump, Height Curve and Tail Water Rating Curve - USBR and Indian Types of Stilling Basins.



#### **UNIT-IV**

Diversion Hand Works: Types of Diversion Head Works - Weirs and Barrages, Layout of diversion Head Work - Components. Causes and Failure of Weirs and Barrages on Permeable Foundations, Silt Ejectors and Silt Excludes, Weirs on Permeable Foundations - Creep Theories – Bligh's Lane's and Khosla's theories. Determination of Uplift Pressure - Various Correction Factors - Design Principles of Weirs on Permeable Foundations using Creep Theories. Exit Gradient, U/s and D/s Sheet Piles - Launching Apron.

#### **UNIT-V**

Canal Falls: Types of Falls and Their Location, Design Principle of Notch Fall. Canal Regulation Works, Design Principles of Distributors and Head Regulators, Cross Regulators - Canal Outlets, Types of Canal Modules, Cross Drainage Works Types - Selection of a Site.

#### **TEXT BOOKS:**

1. Irrigation Engineering and Hydraulic Structures, Santosh Kumar Garg, Khanna Publishers.
2. Irrigation and Water Power Engineering, Dr. B. C. Punmia, Dr. Pande B., B. Lal, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publication Pvt. Ltd., New Delhi.
3. Irrigation Water Power and Water Resource Engineering, K.R. Arora, Standard Publishers Distributors.

#### **REFERENCE BOOKS:**

1. Irrigation and Water Resources Engineering by G.L Asawa, New Age International Publishers.
2. Theory and Design of Irrigation Structures by R. S. Varshney, Gupta & Gupta, Nem Chand & Bros.
3. Irrigation Engineering by R.K. Sharma and T.K.Sharma, S.Chand Publishers.
4. Introduction to Hydrology by Warren Viessvann Jr, Gary L Lewis, Prentice Hall (India).
5. Engineering Hydrology by C.S.P. Ojha, R. Berndtsson and P. Bhunya, Oxford University Press.



## **B. TECH CIVIL ENGINEERING – R20**

### **GROUND IMPROVEMENT TECHNIQUES – C17PE2**

**SEMESTER VII**

**L/T/P/C  
3/0/0/3**

**PRE-REQUISITES:** Soil Mechanics

#### **COURSE OBJECTIVES:**

1. Principles of Treatment for Granular and Cohesive Soils and Various Stabilization techniques.
2. Apply Knowledge on Ground Improvement Techniques such as Reinforced Earth, Drainage and Dewatering and Grouting Techniques on Stabilization of Expansive Soils.
3. Impart Knowledge of Mechanical Modification Techniques such as Deep Compaction, Blasting, Vibro-compaction, Dynamic Tamping and Compaction Piles.
4. Familiarize with different Ground Improvement Techniques for Cohesive and Granular Soils.
5. Understand the Concept of Reinforced Earth, Geo-synthetic and Soil Reinforcement in Ground Improvement.

**COURSE OUTCOMES:** At the end of the course, the student will be able to:

1. Identify the Type of Problems in Problematic Soils and their Solutions by using different Ground Improvement Techniques.
2. Understand the Importance of Vibro-compaction and Compaction Piles on In-situ Densification of Soil.
3. Apply Dewatering Methods using Well Point System and Electro-Osmotic methods.
4. Apply Physical and Chemical Ground Improvement Techniques Using Thermal Modification like Grouting, Shotcreting and Guniting Technology.
5. Design Soil Reinforcement by Using Ground Anchors, Rock Bolting.

#### **UNIT-I**

Introduction to Ground Modification: Need and Objectives, Identification of Soil Types, In-situ and Laboratory Tests to Characterize Problematic Soils; Mechanical, Hydraulic, Physico-Chemical, Electrical, Thermal Methods and their Applications.

#### **UNIT-II**

Mechanical Modification - Deep Compaction Techniques - Blasting Vibro Compaction, Dynamic Temping and Compaction Piles.

#### **UNIT-III**

Hydraulic Modification - Objectives and Techniques, Traditional Dewatering Methods and their Choice, Design of Dewatering System, Electro-Osmosis, Electro-Kinetic Dewatering. Filtration, Drainage and Seepage Control with Geo-Synthetic, Preloading and Vertical Drains.



#### **UNIT-IV**

Physical and Chemical Modification - Modification by Admixtures, Shotcreting and Guniting Technology, Modification at Depth by Grouting, Crack Grouting and Compaction Grouting, Jet Grouting, Thermal Grouting, Ground Freezing.

#### **UNIT-V**

Modified by Inclusion and Confinement - Soil Reinforcement, Reinforcement with Strip and Grid Reinforcement Soil. In-situ Ground Reinforcement, Ground Anchors, Rock Bolting and Soil Nailing.

#### **TEXT BOOKS:**

1. Ground Improvement Techniques by P. Purushotham Raj, Laxmi Publications.
2. Engineering Principles of Ground Modifications, Hausmann, M.R, McGraw Hill.
3. An Introduction to Ground Improvement Engineering by S Mittal, Medtech Publisher.

#### **REFERENCE BOOKS:**

1. Design with Geosynthetic by Koerner R. M, Prentice Hall, New Jersey.
2. Earth Reinforcement and Soil structures by Jones C. J. P, Butterworth's, London.
3. Ground Control and Improvement by Petros Xianthakos, Lee W. Abramson, Donald A. Bruce.



## **B.TECH CIVIL ENGINEERING – R20**

### **BRIDGE ENGINEERING – C17PE2**

**SEMESTER VII**

**L/T/P/C  
3/0/0/3**

**PRE-REQUISITES:** Structural Analysis, Reinforced Cement Concrete,  
Design of Steel Structures

**COURSE OBJECTIVES:** The Objective of this Course is to

1. Introduce the theory and Application of Analysis and Design of Reinforced Concrete and Steel Bridges.
2. Designing and Understanding the Structural Behaviour of Reinforced Concrete and Steel Components of Highway and Railway Bridges Subjected to Static and Dynamic Loads.
3. To Carry out of Design of Bridge starting from Conceptual Design, Selecting Suitable Bridge Geometry to Sizing of its Elements.

**COURSE OUTCOMES:** After learning the course, the students should be able

1. To Develop an Understanding of Appreciation for Basic Concepts in Proportioning and Design of Bridges in terms of Aesthetics, Geographical Location and Functionality.
2. To Understand the Load Carrying Capacity of Various Types of Bridges with Different Kinds of Loads.
3. To Understand and Appreciate Significance of Bridge Engineering in Different Fields of Engineering.
4. To Carry out Design of Bridge starting from Conceptual Design, Selecting Suitable Bridge, Geometry to Sizing of its Elements.
5. To Understand the Load Flow Mechanism and Identify Loads on Bridges.

#### **UNIT-I**

Introduction - Types of Bridges, Economic Spans, Aesthetics, Selection of Suitable type of Bridge.

#### **UNIT-II**

Design Loads and their Distribution, IRC Loads, Railway Loading, Analysis of Deck Slab and IRC Loads, Load Distribution among Longitudinal Beams of a Bridge.

#### **UNIT-III**

Design of Superstructures - Design of Balanced Cantilever Concrete Bridge, Introduction to Design of RC Arch Bridge, Prestressed Concrete and Box Girder Bridge. Design of Lattice Girder Railway Bridge.

#### **UNIT-IV**

Design of Substructure - Different types of Foundations, their choice and method of Construction, Design of Well Foundation, Design of Piers and Abutments, Various Types of





Bearings and their Design.

### **UNIT-V**

Construction Methods - Erection of bridge Superstructures, Cantilever Construction.

### **TEXT BOOKS:**

1. Design of Bridges by N Krishna Raju, Oxford & IBH.
2. Principles and Practice of Bridge Engineering S.P. Bindra, Dhanpat Rai Publications.
3. Bridge Engineering by Ponnuswamy S, Tata McGraw Hill.
4. Concrete Bridge Practice by Raina V K, Tata McGraw Hill.
5. Essentials of Bridge Engineering by Jhonson D Victor, Oxford & IBH.

### **REFERENCE BOOKS:**

1. Design of Concrete Bridges by M.G. Aswani and V.N. Vazirani and MM Ratwani, Khanna Publishers.
2. Bridge Deck Behavior by E C Hambly, CRC Press.
3. Design of Bridges by VV Sastry, Dhanpat Rai & Co.
4. Concrete Bridge Design and Practice by VK Raina
5. IRC 6, 22, 24: Standard Specifications and Code of Practice for Road Bridges.
6. IRC 112-2011: Code of Practice for Concrete Road Bridges.
7. IS 456-2000: Plain and Reinforced Concrete - Code Practice.



## **B.TECH CIVIL ENGINEERING – R20**

### **GROUND WATER DEVELOPMENT & MANAGEMENT – C17PE3**

**SEMESTER VII**

**L/T/P/C  
3/0/0/3**

#### **COURSE OBJECTIVES:**

1. Appreciate Ground Water as an Important Natural Resource.
2. Understand Flow towards Wells in Confined and Unconfined Aquifers.
3. Understand the Principles Involved in Design and Construction of Wells.
4. Create Awareness on Improving the Ground Water Potential using Various Recharge Techniques.
5. Know the Importance of Saline Water Intrusion in Coastal Aquifers and its Control Measures.
6. Appreciate Various Geophysical Approaches for Ground Water Exploration.

**COURSE OUTCOMES:** At the end of the course, the student will be able to

1. Estimate Aquifer Parameters and Yield of Wells.
2. Analyse Radial Flow towards Wells in Confined and Unconfined Aquifers.
3. Design Wells and Understand the Construction Practices.
4. Interpret Geophysical Exploration Data for Scientific Source Finding of Aquifers.
5. Determine the Process of Artificial Recharge for increasing Ground Water Potential.
6. Take effective Measures for Controlling Saline Water Intrusion.
7. Apply Appropriate Measures for Ground Water Management.

#### **UNIT-I**

Ground Water Occurrence: Ground Water Hydrologic Cycle, Origin of Ground Water, Rock Properties effecting Ground Water, Vertical Distribution of Ground Water, Zone of Aeration and Zone of Saturation, Geologic formation of Aquifers, Types of Aquifers, Porosity, Specific Yield and Specific Retention.

#### **UNIT-II**

Ground Water Movement: Permeability, Darcy's law, Storage Coefficient. Transmissivity, Differential Equation Governing Ground Water Flow in three dimensions (3D) Derivations, Ground Water Flow Equation in Polar Coordinate System. Ground Water Flow, Contours - Applications.

#### **UNIT-III**

Steady Groundwater Flow towards a Well in Confined and Unconfined Aquifers - Dupuit's and Theim's Equations, Assumptions, Formation Constants, Yield of an Open Well Interface and Well Tests - Recuperation Test.

Unsteady Flow towards a Well - Non-equilibrium Equations - Theis Solution - Jacob and Chow's Simplifications, Leaky Aquifers - Well Interference.



#### **UNIT-IV**

Surface and Subsurface Investigation: Surface Methods of Exploration - Electrical Resistivity and Seismic Refraction methods. Subsurface methods - Geophysical Logging and Resistivity Logging. Aerial Photogrammetry Applications along with Case Studies in Subsurface Investigation.

Artificial Recharge of Ground Water: Concept of Artificial Recharge - Recharge Methods, Relative Merits, Applications of GIS and Remote Sensing in Artificial Recharge of Ground Water along with Case Studies.

#### **UNIT-V**

Well Construction: Drilling Equipment used for Well Construction - Bore log, Interpretation of Log Data.

Saline Water Intrusion in Aquifer: Occurrence of Saline Water Intrusions, Ghyben-Herzberg Relation, Shape of Interface, Control of Seawater Intrusion.

Groundwater Basin Management: Concepts of Conjunction Use, Case Studies.

#### **TEXT BOOKS:**

1. Ground Water Hydrology by David Keith Todd and Larry W. Mays, John Wiley & Sons.
2. Ground Water by H. M. Raghunath, New Age International Publishers.

#### **REFERENCE BOOKS:**

1. Ground Water Systems: Planning & Management, William W.G, Yen, Prentice Hall.
2. Applied Hydrogeology by C.W. Fetta, CBS Publishers & Distributors.
3. Ground Water Assessment, Development and Management by K.R. Karanth, Tata McGraw Hill.



## **B.TECH CIVIL ENGINEERING – R20**

### **FOUNDATION ENGINEERING – C17PE3**

**SEMESTER VII**

**L/T/P/C  
3/1/0/3**

**PRE-REQUISITES:** Soil Mechanics

**COURSE OBJECTIVES:** The objective of this course is to,

1. Provide the Knowledge about Soil Exploration.
2. Provide the Knowledge on Stability of Slopes and Earth Pressure theories.
3. Provide the Knowledge on Various types of Foundations.

**COURSE OUTCOMES:** Upon completion of this course, students will be able to

1. Understand the Concepts Involved in Soil Investigations.
2. Analyse the Stability of Slopes by using Different Methods.
3. Analyse the Earth Pressure under Different Soil Conditions.
4. Evaluate the Safe Bearing Capacity (SBC) of Shallow Foundations.
5. Understand the Concepts of Pile and Well Foundations.

#### **UNIT-I**

Site Investigation and Soil Exploration: Needs - Methods of Soil Exploration - Boring and Sampling methods - Penetration Tests - Plate Load Test - Pressure Meter - Planning of Programme and Preparation of Soil Investigation Report - Selection of Foundation on Soil Conditions.

#### **UNIT-II**

Slope Stability: Infinite and Finite Earth Slopes - Types of Failures - Factor of Safety of Infinite Slopes - Stability Analysis by Swedish Arc Method, Standard Method of Slices, Bishop's Simplified Method - Taylor's Stability Number - Stability of Slopes of Earth Dams under Different Conditions.

#### **UNIT-III**

Earth Pressure Theories: Lateral Earth Pressure theories - Rankine's theory and Coulomb's theories - Earth Pressures for different Soils and Layered Soils - Culmann's Graphical Method - Trial Wedge Methods.

Retaining Walls: Types of Retaining Walls - Stability of Retaining Walls against Overturning, Sliding, Bearing Capacity, Drainage from Backfill.

#### **UNIT-IV**

Shallow Foundations - Strength Criteria: Types - Choice of Foundation - Location of Depth - Safe Bearing Capacity - Terzaghi, Meyerhof, Skempton and IS Methods.

Shallow Foundations - Settlement Criteria - Safe Bearing Pressure based on N-Value - Allowable Bearing Pressure; Safe Bearing Capacity - Allowable Settlements of Structures.



## **UNIT-V**

Pile Foundations: Types of Piles - Load Carrying Capacity of Piles based on Static Pile formulae in different Soils - Dynamic Pile formulae - Pile Load Tests - Load Carrying Capacity of Pile Groups in Sands and Clays - Settlement of Pile Groups - Negative Skin Friction.

Well Foundations: Types - Different Shapes of Wells - Components of Wells - Sinking of Wells - Tilts and Shifts.

### **TEXT BOOKS:**

1. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers and Distributors, Delhi.
2. Soil Mechanics and Foundation by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications Pvt. Ltd., New Delhi.
3. Soil Mechanics and Foundation Engineering by V.N.S Murthy, CBS Publishers and Distributors.
4. Foundation Engineering by PC. Varghees, Prentice Hall (India).
5. Basic Soil Mechanics and Foundations by Alam Singh, CBS Publishers and Distributors.

### **REFERENCE BOOKS:**

1. Analysis and Design of Substructures by Swami Saran, Oxford & IBH Publishing Pvt. Ltd.
2. Geotechnical Engineering by C. Venkataramaiah, New Age International Pvt. Ltd.
3. Geotechnical Engineering Principles and Practices by Donald P. Coduto, Prentice Hall (India).
4. Principles of Foundation Engineering by B.M. Das, PWS Publishing, Singapore.
5. Foundation Analysis and Design by Joseph Bowles, McGraw Hill Education.



## **B.TECH CIVIL ENGINEERING – R20**

### **FINITE ELEMENT ANALYSIS – C17PE3**

**Semester VII**

**L/T/P/C  
3 0/0/3**

**PRE-REQUISITES:** Structural Analysis – I & II

**COURSE OBJECTIVES:** The Subject Provides Introduction to Finite Element Methods to Analyse Structural Elements.

**COURSE OUTCOMES:** At the end of the course, the Student will able to Analyse Simple Structural Elements using Finite Element Approach.

#### **UNIT-I**

Introduction to Finite Element Method (FEM) - Basic Equations in Elasticity Stress-Strain equation - Concept of Plane Stress - Plane Strain - Advantages and Disadvantages of FEM. Element Shapes - Nodes - Nodal Degree of Freedom - Displacement Function - Natural Coordinates - Strain Displacement Relations.

#### **UNIT-II**

Lagrangian - Serendipity Elements - Hermite Polynomials - Regular, Irregular 2D & 3D - Elements - Shape Functions up to Quadratic Formulation. Finite Element Analysis (FEA) of one Dimensional (1D) Problem - Bar Element - Shape Functions - Stiffness Matrix - Stress-Strain Relation.

#### **UNIT-III**

FEA Beam Elements - Stiffness Matrix - Shape function - Analysis of Continuous Beams.

#### **UNIT-IV**

FEA 2D Problem - CST-LST Elements - Shape function - Stress-Strain. Iso-parametric formulation - Concepts of Isoparametric Elements for 2D Analysis - formulation of CST element.

#### **UNIT-V**

Solution Techniques: Numerical Integration, Static Condensation, Assembly of Elements and Solution Techniques for Static loads.

#### **TEXT BOOKS:**

1. Finite Element Analysis by S. S. Bhavikatti, New Age International Publishers.
2. Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla, and Ashok D. Belegundu, Prentice Hall (India).
3. A First Course in Finite Element Method by Daryl L. Logan, Cengage Learning (India).



**REFERENCE BOOKS:**

1. Finite Element Analysis by P. Seshu, Prentice Hall (India).
2. Concepts and Applications of Finite Element Analysis by Robert D. Cook et al., Wiley India Pvt. Ltd.
3. Applied Finite Element Analysis by G. Ramamurty, I.K. International Publishers.



## **B. TECH CIVIL ENGINEERING – R20**

### **GEOGRAPHIC INFORMATION SYSTEMS LAB – C17PC4**

**SEMESTER VII**

**L/T/P/C**

**0/0/3/2**

**PRE-REQUISITES:** Surveying, Remote Sensing & GIS Concepts

**COURSE OUTCOMES:** At the end of the course, the student is exposed to spatial technologies, mapping the field problems and getting solutions through GIS.

**GIS SOFTWARE USED:** QGIS

#### **UNIT-I**

Introduction to Various GIS Software

Development of Geo-referencing of maps either from Cadastral or AutoCAD based maps using QGIS.

#### **UNIT-II**

Identification of Best Locations of Ground Control Points and Mosaicking the Different Sources of Maps of Information like Topo Sheets & Satellite Data and other Drawings.

#### **UNIT-III**

Digitization and GIS Coordination

#### **UNIT-IV**

GIS Interface and Features using Open Source Software QGIS.

#### **UNIT-V**

Case Example on Mapping like Water Distinguish, Road Alignment, Road Network etc.

#### **TEXT BOOKS:**

1. Geographic Information Systems: A Management Perspective by Aronoff, Stanley.
2. Concepts and Techniques of Geographic Information Systems by Lo, C.P. & Yeung A.K.W., Prentice Hall (India).
3. Principles of Geographical Information Systems by Burrough, P.A., Oxford Publications.
4. Getting Started with Geographic Information Systems by K. Clarke, Prentice Hall, New Jersey.
5. Fundamentals of Geographic Information Systems by M.N. DeMers, John Wiley & Sons, New York.
6. Geo Information Systems - Applications of GIS and Related Spatial Information Technologies, Aster Publication Co., Chestern (England).





**B.TECH. CIVIL ENGINEERING – R20**

**ENVIRONMENTAL ENGINEERING LAB – C17PC5**

**SEMESTER VII**

**L/T/P/C  
0/0/2/1**

**PRE-REQUISITES:** Engineering Chemistry, Environmental Engineering

**COURSE OUTCOMES:**

1. To Quantify the Pollutant Concentration in Water and Wastewater.
2. To Recommend the Degree of Treatment Required for the Water and Wastewater.
3. To Analyze the Survival Conditions for the Micro-organism and its Growth Rate.
4. To Study the Growth of Micro-organism and its Quantification.
5. To Analyze the Characteristics of Water and Wastewater.

**LIST OF EXPERIMENTS:**

1. Characteristics, Sampling and Preservation methods and Significance of Characterization of Water and Waste Water.
2. Determination of pH
3. Determination of Electrical Conductivity
4. Determination of Acidity and Alkalinity
5. Determination of Hardness
6. Determination of Chlorides
7. Determination of Turbidity
8. Determination of Optimum Coagulant Dosage
9. Determination of Suspended, Dissolved and Fixed Solids
10. Determination of available Chlorine in Bleaching Powder
11. Determination of Iron
12. Determination of Phosphate and Nitrates
13. Determination of Dissolved Oxygen
14. Determination of B.O.D
15. Determination of C.O.D Test
16. Introduction to Bacteriological Analysis

**REFERENCE BOOKS:**

1. IS 10500: 2012 - Indian Standards - Drinking Water Specifications
2. Manual for Water & Waste Water Treatment - CPHEEO.
3. Water Supply and Sanitary Engineering by G.S Birdie, Dhanpat Rai & Sons.
4. Water and Waste Water Technology by Mark J. Hammer, Mark J. Hammer Jr, Prentice Hall (India).



## **B. TECH CIVIL ENGINEERING – R20**

### **PRESTRESSED CONCRETE STRUCTURES – C18PE1**

**SEMESTER VIII**

**L/T/P/C**

**3/0/0/3**

**PRE-REQUISITES:** Reinforced Cement Concrete Structures - Analysis & Design, IS 456.

**COURSE OBJECTIVES:** The objective of this course is to provide:

1. The Knowledge on Concepts of Prestressing of Concrete Structural Elements.
2. The Exposure in Various Prestressing Methods and Construction Sequences.
3. The Knowledge in Analysis and Designing of Prestressing Concrete Structural Elements.

**COURSE OUTCOMES:** At the end of the course, the student will be able to

1. Understand the Concepts of Prestressing in Concrete Structures and Identify the Materials for Prestressing.
2. Understand the Concept of Transfer of Prestress in Prestressed Concrete Members and the Methods and Systems of Prestressing.
3. Assess the Loss of Prestress in Pre-tensioned and Post-tensioned Members.
4. Analyse the Prestressed Concrete Structural Elements for Flexure and Shear.
5. Able to Design the Prestressed Concrete Structures.

#### **UNIT-I**

Introduction: Historic Development - General Principles of Prestressing - Pre-tensioning and Post-tensioning - Advantages and Limitations of Prestressed Concrete - Classification and types of Prestressing - Materials - High Strength Concrete and High Tensile Steel and their Characteristics.

Methods and Systems of Prestressing: Concept of Transfer of Prestress - Pre-tensioning and Post-tensioning methods and Systems of Prestressing like Hoyer System, Magnel-Blaton System, Freyssinet System and Gifford-Udall System and Lee-McCall System.

#### **UNIT-II**

Loss of Prestress: Loss of Prestress in Pre-tensioned and Post-tensioned members due to Elastic Shortening of Concrete, Shrinkage of Concrete, Creep of Concrete, Relaxation of Stress in Steel, Slip in Anchorage and Frictional Losses - Provisions for Loss of Prestress in IS 1343 - 2012 Code.

#### **UNIT-III**

Flexure: Analysis of Sections for Flexure - Beams Prestressed with Straight, Concentric, Eccentric, Bent and Parabolic Tendons, Kern Line, Stress Diagrams - Elastic Design of Beams of Rectangular and I Sections.

Shear: General Considerations - Shear and Principal Stresses - Ultimate Shear Resistance of Prestressed Concrete Members - Improving Shear Resistance of Concrete by Horizontal and Vertical Prestressing and by using Inclined or Parabolic Cables - Analysis of Rectangular and I



Beams for Shear - Design of Shear Reinforcement - IS 1343-2012 Code Provisions.

#### **UNIT-IV**

Transfer of Prestress in Pre-tensioned Members: Transmission of Prestressing force by Bond - Transmission length - Flexural Bond Stresses, IS Code Provisions - Anchorage Zone Stresses in Post-tensioned Members - Stress Distribution in End Block - Analysis by Guyon, Magnel, Zielinski and Rowe's Methods - Anchorage Zone Reinforcement - IS 1343-2012 Code Provisions.

#### **UNIT-V**

Composite Beams: Different Types - Propped and Un-propped - Stress Distribution- Differential Shrinkage - Analysis of Composite Beams - General Design Considerations.

Deflections: Importance of Control of Deflections - Factors Influencing Deflections - Short Term Deflections of Un-cracked Beams - Prediction of Long Term Deflections - IS 1343-2012 Code Requirements.

#### **TEXT BOOKS:**

1. Prestressed Concrete by N. Krishna Raju, Tata McGraw Hill.
2. Prestressed Concrete by K U Muthu, Azmi Ibrahim, Maganti Janardhana and M.Vijayanand, Prentice Hall (India).

#### **REFERENCE BOOKS:**

1. Prestressed Concrete by S. Ramamrutham, Dhanpat Rai & Sons, Delhi.
2. Prestressed Concrete by N. Rajagopalan, Narosa Publishing House.
3. Fundamentals of Prestressed Concrete by Dr. N C Sinha and Dr. SK Roy, S Chand Publishers.
4. Prestressed Concrete Design by Praveen Nagarajan, Pearson.
5. Design of Prestressed Concrete Structures by T. Y. Lin and Burn, Wiley Student Edition.



**B.TECH CIVIL ENGINEERING – R20**

**ADVANCED STRUCTURAL DESIGN – C18PE1**

**SEMESTER VIII**

**L/T/P/C  
3/0/0/3**

**PRE-REQUISITES:** Reinforced Cement Concrete Design

**COURSE OBJECTIVES:**

1. Understand the Applications of Concrete, Requirements of Concrete Structures and Learn the Design of RCC Structures.
2. Understand the Behaviour of Structural Elements that are Subjected to Different External Loadings.

**COURSE OUTCOMES:** At the end of the course, the student will be able to

1. Design and Detailing of Cantilever Structures elements.
2. Design the Reinforced Circular and Rectangular Water tanks.
3. Design the Flat, Raft and Pile Foundations.
4. Design the Concrete bridges.
5. Design the Industrial Structures like Bunkers, Silos and Chimneys.

**UNIT-I**

Design and Detailing of Cantilever type of Retaining Walls - Stability Check. Principles of Counterfort Retaining Walls.

**UNIT-II**

Design of Circular and Rectangular Water Tanks at Ground Level and Elevated with Staging.

**UNIT-III**

Design of Flat Slabs - Design of Raft Foundations.

**UNIT-IV**

Designs of Concrete Bridges - IRC Loading, Design of Stab Bridge, T - Beam Girder Bridge.

**UNIT-V**

Design of RCC Chimneys, Bunkers & Silos.

**TEXTBOOKS:**

1. Advanced Reinforced Concrete Structures by Varghese, Prentice Hall (India).
2. Bridge Engineering by S Ponnuswamy, Tata McGraw Hill.
3. Reinforced Concrete Design by S.A Pillai and D. Menon, Tata McGraw Hill.
4. Advanced Reinforced Concrete Structures by N. Krishna Raju, CBS Publishers & Distributors Pvt. Ltd.



## **REFERENCE BOOKS:**

1. Reinforced Concrete Structures Vol.2 by B.C. Punmia, Ashok Kumar Jain and Kumar Jain, Laxmi, Publications Pvt. Ltd. New Delhi.
2. Essentials of Bridge Engineering by D. Johnson Victor, Oxford and IBM Publication Co, Pvt. Ltd.
3. IRC 6: Standard Specifications and Code of Practice for Road Bridges.
4. IRC 112-2011: Code of Practice for Concrete Road Bridges.
5. SP 34-1987: Hand Book on Concrete Reinforcement and detailing.
6. IS 456-2000: Plain and Reinforced Concrete - Code of Practice.



## **B.TECH. CIVIL ENGINEERING – R20**

### **STRUCTURAL ANALYSIS BY MATRIX METHODS - C18PE1**

**SEMESTER VIII**

**L/T/P/C**

**3/0/0/3**

**PRE-REQUISITES:** Structural Analysis, Mathematical Knowledge on Matrix Methods.

**COURSE OBJECTIVES:** To Impart Knowledge on the Analysis of Indeterminate Structures like Continuous Beams, Trusses and Portal Frames by Matrix Methods.

#### **COURSE OUTCOMES:**

1. To Understand the Importance of Degrees of Freedom and the Concept of Principle of Superposition.
2. To Know about the Concept of Strain Energy and Principle of Virtual Work.
3. To Study the Transformation of System Matrices and Element Matrices for the determinate and Indeterminate Structures.
4. To Analyze the forces in Structures like Continuous Beams, Trusses and Frames using Flexibility Method.
5. To Analyze Plane Truss, Plane Frame by Stiffness Method.

#### **UNIT-I**

Introduction to Matrix Methods of Analysis (System Approach) - Static Indeterminacy and Kinematic Indeterminacy - Degree of Freedom - Coordinate System - Structure Idealization Stiffness and Flexibility Matrices - Suitability - Element Stiffness Equations - Elements Flexibility Equations - Mixed Force - Displacement Equations - for Truss Element, Beam Element and Tensional Element. Transformation of Coordinates - Element Stiffness Matrix - and Load Vector - Local and Global Coordinates - System Approach.

#### **UNIT-II**

Strain Energy - Stiffness and Flexibility Matrices from Strain Energy - Symmetry and other Properties of Stiffness and Flexibility Matrices - Betti's law and its Applications - Strain Energy in Systems and in elements - System Approach.

#### **UNIT-III**

Assembly of Stiffness Matrix from element Stiffness Matrix - Direct Stiffness Method - General Procedure - Band matrix - Semi Bandwidth - Computer Algorithm for Assembly by Direct Stiffness Matrix Method - System Approach.

#### **UNIT-IV**

Analysis of Plane Truss - Continuous Beams - Plane frame and grids by Flexibility Methods - System Approach.

#### **UNIT-V**

Analysis of Plane Truss - Continuous Beams - Plane Frames and Grids by Stiffness Methods.



**TEXT BOOKS:**

1. Matrix Analysis of Frames Structures by William Weaver J.R and James M. Gere, CBS Publications.
2. Advanced Structural Analysis by Ashok. K. Jain, Nem Chand Brothers.

**REFERENCE BOOKS:**

1. Basic Structural Analysis by C.S. Reddy, Tata McGraw Hill.
2. Matrix Structural Analysis by Madhu B. Kanchi, John Willey Publishers.
3. Indeterminate Structural Analysis by K.U. Muthuet al., I.K. International Publishers.
4. Matrix Methods of Structural Analysis by J.L. Meek, McGraw Hill.



**B.TECH. CIVIL ENGINEERING – R20**

**TRAFFIC ENGINEERING & MANAGEMENT – C18PE2**

**SEMESTER VIII**

**L/T/P/C  
3/0/0/3**

**RE-REQUISITES:** Transportation Engineering

**COURSE OBJECTIVES:**

1. To Give an Overview of Traffic Engineering, Traffic Regulation, Management and Traffic Safety with Integrated Approach of Traffic Planning.
2. To give Basic Knowledge about the Traffic Studies and Issues.
3. To Solve Traffic Related Problems.

**COURSE OUTCOMES:** On completing this course, the students will be able to

1. Analysis Traffic Problems and Plan for Traffic Systems Various Uses.
2. Design Channels, Intersections, Signals and Parking Arrangements.
3. Students will be able to Study about the Traffic and Congestions.
4. Implement Traffic Regulations and Control Measures at Intersections.
5. To minimize the Road Accident Rate by using Traffic Monitoring Systems.

**UNIT-I**

Traffic Characteristics Measurement and Analysis: Basic traffic Characteristics - Speed, Volume and Concentration. Relationship between Flow, Speed and Concentration. Traffic Measurement and Analysis - Volume Studies - Objectives, Methods; Speed studies - Objectives, Definition of Spot Speed, Time Mean Speed and Space Mean Speed; Methods of Conducting Speed Studies; Presentation of Speed Study Data; Headways and Gaps; Critical Gap; Gap Acceptance Studies.

**UNIT-II**

Highway Capacity and Level of Service: Basic Definitions related to Capacity; Level of Service Concept; Factors affecting Capacity and Level of Service; Computation of Capacity and Level of Service for two-lane highways, Multi-lane Highways and Freeways.

**UNIT-III**

Parking Analysis and Traffic Safety: Types of Parking Facilities - On-street Parking and Off-Street Parking Facilities; Parking Studies and Analysis of Parking Inventory Study, Parking Usage Study by Patrolling, Questionnaire Survey, Cordon Surveys; Evaluation of Parking Parameters; Parking Accumulation, Parking Load, Parking Turnover, Parking Index, Parking Volume. Traffic Safety - Accident Studies and Analysis; Causes of Accidents - The Road, The Vehicle, the Road User and the Environment; Engineering, Enforcement and Education measures for the Prevention of Accidents.





#### **UNIT-IV**

Traffic Control, Regulation Signal Coordination: Traffic Signals - Types of Signals; Principles of Phasing; Timing Diagram; Design of Isolated Traffic Signal by Webster method, Warrants for Signalization. Signal Coordination - Signal Coordination Methods, Simultaneous, Alternate, Simple Progression and Flexible Progression Systems.

#### **UNIT-V**

Traffic Management: Area Traffic Management System - Traffic System Management (TSM) With IRC Standards - Traffic Regulatory Measures - Travel Demand Management (TDM) - Direct And Indirect Methods - Congestion And Parking Pricing - All Segregation Methods - Coordination Among Different Agencies - Intelligent Transport System For Traffic Management, Enforcement & Education.

#### **TEXT BOOKS:**

1. Traffic Engineering and Transport Planning by L.R. Kadiyali, Khanna Publishers.
2. Traffic Engineering - Theory & Practice by Louis J. Pignataro, Prentice Hall Publications.
3. Traffic Management: Planning, Operations and Control by Tyworth, John E.; Cavinato, Joseph L.; Langley, C. John, Jr., Addison Wesley Publishing Company.

#### **REFERENCE BOOKS:**

1. Fundamentals of Transportation Engineering by C.S. Papacostas, Prentice Hall (India).
2. Principles of Highway Engineering and Traffic Analysis by Fred Mannering & Walter Kilareski, John Wiley & Sons Publications.
3. Transportation Engineering - An Introduction by C. Jotin Khisty, Kent Lall, Prentice Hall Publications.



## **B.TECH CIVIL ENGINEERING - R20**

### **REHABILITATION AND RETROFITTING OF STRUCTURES - C18PE2**

#### **SEMESTER VIII**

**L/T/P/C**

**3/1/0/3**

**COURSE OBJECTIVES:** To get the Knowledge on Quality of Concrete, Durability Aspects, Causes of Deterioration, Assessment of Distressed Structures, Repairing of Structures and Demolition Procedures.

#### **COURSE OUTCOMES:**

1. Understand the Causes and Prevention Deterioration of Structures.
2. Interpret the Types of Damages and Understand their Mechanism.
3. Categorize the Causes and Prevention of Corrosion in Steel Reinforcement and Fire Induced Damages.
4. Examine to Inspect and Assess the Structures using Techniques of Visual Inspection and Non-Destructive Testing (NDT).
5. Make use of the Latest Health Monitoring and Building Instrumentation Methods.

#### **UNIT-I**

Introduction - Deterioration of Structures - Distress in Structures - Causes and Prevention. Mechanism of Damage - Types of Damages.

#### **UNIT-II**

Corrosion of Steel Reinforcement - Causes - Mechanism and Prevention. Damage of Structures due to Fire - Fire Rating of Structures - Phenomena of Desiccation. Repairs to Overcome Low Member Strength, Deflection, Cracking, Chemical Disruption, Weathering Corrosion, Wear, Fire, Leakage and Marine Exposure.

#### **UNIT-III**

Inspection and Testing - Symptoms and Diagnosis of Distress - Damage Assessment - NDT. Maintenance, Repair and Rehabilitation - Facets of Maintenance, Importance of Maintenance Various Aspects of Inspection.

#### **UNIT-IV**

Repair of Structure - Common Types of Repairs - Repair in Concrete Structures - Repairs in Underwater Structures - Guniting - Shotcrete - Under Pinning. Strengthening of Structures - Strengthening Methods - Retrofitting - Jacketing.

#### **UNIT-V**

Health Monitoring of Structures - Use of Sensors, Building Instrumentation. Engineered Demolition Techniques for Dilapidated Structures - Case Studies.



**TEXT BOOKS:**

1. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
2. Concrete Technology by A.R. Santa Kumar, Oxford University Press.
3. Maintenance, Repair and Rehabilitation and Minor Works of Buildings by PC. Varghese, Prentice Hall (India).

**REFERENCE BOOKS:**

1. Defects and Deterioration in Buildings, EF & N Spon, London.
2. Non-Destructive Evaluation of Concrete Structures by Bungey, Surrey University Press.
3. Concrete Repair and Maintenance Illustrated by W.H. Ranso, RS Means Company.
4. Building Failures: Diagnosis and Avoidance, EF & N Spon, B.A. Richardson, London.



## **B.TECH CIVIL ENGINEERING – R20**

### **CONSTRUCTION PROJECT PLANNING & MANAGEMENT - C18PE2**

**SEMESTER VIII**

**L/T/P/C  
3/0/0/3**

#### **COURSE OBJECTIVES:**

1. To Learn the Fundamental Significance of Construction Project Planning.
2. To Know about the Functions of Construction Management and Network Techniques.
3. To Study about the Resource Management and Schedule of Construction.
4. To Study about the Contract and Tender Information.
5. To Know about the Labour Administration, Safety Measures.

#### **COURSE OUTCOMES:** Students will be able to

1. Understand the Process of Planning and Management.
2. Understand the Construction Stages and Network Techniques.
3. Apply the Concept of Resource Planning & Scheduling.
4. Formulate and Execute Various Contract Documents and Tenders.
5. Understand the Labour Safety and Financial Aspects of Accidents.

#### **UNIT-I**

Introduction to Construction Project Planning and Management, Management Process - Roles. Management Theories. Social Responsibilities. Planning and Strategic Management - Strategy Implementation - Decision Making, Tools and Techniques - Organizational Structure, Human Resource Management - Motivation Performance - Leadership.

#### **UNIT-II**

Classification of Construction Projects, Construction Stages, and Resources - Functions of Construction Management and its Applications. Preliminary Planning - Collection of Data - Contract Planning - Scientific Methods of Management, Network Technique in Construction Management - Bar Chart, Ghant Chart, CPM & PERT - Cost & Time Optimization.

#### **UNIT-III**

Resource Planning - Planning for Manpower, Material, Costs, Equipment, Class of Labour, Labour Productivity, Classification of Construction Equipment - Scheduling. Forms of Scheduling - Resources Allocation, Budget and Budgetary Control Methods.

#### **UNIT-IV**

Contract - Types of Contract, Contract Document, Specification, Important Conditions of Contract - Tender and Tender Document - Deposits by the Contractor - Arbitration, Negotiation - M Book - Muster Roll Stores.



## **UNIT-V**

Management Information System - Labour Regulations; Social Security - Welfare Legislation- Law Relating to Wages, Bonus and Industrial Disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act - other Labour Laws - Safety in Construction; Legal and Financial aspects of Accidents in Construction, Occupational and Safety Hazard Assessment.

### **TEXT BOOKS:**

1. Construction Project Management by Kumar Neeraj Jha, Pearson Publications.
2. PERT and CPM Principles and Applications by L.S. Srinath, Affiliated East West Press.
3. Project Planning and Control with PERT and CPM by B. C. Punmia, Laxmi Publications.
4. Construction Project Management, Planning, Scheduling and Control, K.K. Chitkara, Tata McGraw Hill.

### **REFERENCE BOOKS:**

1. Construction Planning, Equipment and Methods by Robert Peurifoy, McGraw Hill.
2. Project Management for Construction Fundamentals by Chris Hendrickson and Tung Au.
3. Scheduling Construction Projects by Willis. E.M., John Wiley & Sons.
4. Financial and Cost Concepts for Construction Management by D.W. Halpin, John Wiley & Sons.

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