SIPNA COLLEGE OF ENGINEERING & TECHNOLOGY, AMRAVATI

An Autonomous Institute Affiliated to

Sant Gadge Baba Amravati University, Amravati, Maharashtra (India)

(Approved by AICTE, New Delhi and Recognized by DTE, Maharashtra)

(Accredited With 'A+' Grade by NAAC)

Department of Civil Engineering

Syllabus for Semester – V and VI

Effective from Academic Year 2026-27

Prepared by: Board of Studies - Civil Engineering

Approved by: Academic Council - Sipna COET, Amravati

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Chairman Board of Studies	Dean Academics	Chairman Academic Council	Date of Release	Version

SEMESTER: V

Program:	B. Tech. (Civil Engineering)			Semester:			V	
Course:	Design of Concrete Structures			Code:			BTCEPC14CE5T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Attendance, Assignment, Class test.

Course Objectives: To understand basic design philosophies and thereby design different structural components for various load conditions.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Explain the fundamental concepts of Limit State Method and analyze the capacity of singly reinforced beam sections.	L4
CO-2	Analyze the moment of resistance and structural behavior of doubly reinforced rectangular sections.	L4
CO-3	Design one-way and two-way slabs for various loading and boundary conditions as per IS codes.	L6
CO-4	Identify staircase components and design a dog-legged staircase for functional and structural requirements.	L6
CO-5	Design short columns subjected to axial loads and uniaxial bending using interaction curves.	L6
CO-6	Design isolated footings for columns subjected to axial loads and uniaxial bending moments.	L6

Unit I: Introduction to Limit State Method **(6 Hrs.)**

Concept of limit state, limit state of collapse, limit state of serviceability, limit state of durability, Characteristic strength and characteristic load, partial safety factors for loads and material strength. Singly reinforced section: Concept, Basic assumptions, Derivation of stress block parameters, Modes of failures, Properties of balanced and under reinforced sections. Analysis of Singly reinforced section.

Unit II: Doubly reinforced sections **(6 Hrs.)**

Introduction, Concept and Derivation of stress block parameters, Analysis of Doubly reinforced section.

Unit III: Design of Slabs **(6 Hrs.)**

Concept of One-way slab, Load distribution on beam from one way slab, Design of One-way simply supported slab, Concept of two-way slab, Load distribution on beam from two-way slab, Design of two-way slab.

Unit IV: Design of Staircase **(6 Hrs.)**

Introduction, Components of stairs, Design of dog legged type staircase.

Unit V: Design of Column **(6 Hrs.)**

Assumptions, minimum eccentricity, design of short column for axial load, combined axial compression and uniaxial bending using interaction curves.

Unit VI: Design of Footing **(6 Hrs.)**

Design of isolated column footing for axial load and uniaxial bending.

Total: 36 Hours

Approved in 04th Academic Council Meeting Dated: 30.03.2026

Textbooks:

1. Illustrated Reinforced Concrete Design by Dr. V. L. Shah and Dr. S. R. Karve, Structures Publications, Pune
2. Limit State Design of Reinforced Concrete by P. C. Varghese, PHI, New Delhi.
3. Comprehensive Design of R.C. Structures by Punmia, Jain and Jain, Standard Book House, New Delhi.

Reference Books:

1. Illustrated Design of Reinforced Concrete Buildings (G+3) by Dr. V. L. Shah and Dr. S. R. Karve, Structures Publications, Pune.
2. RCC Analysis and Design by Sinha and Roy, S. Chand and Co. New Delhi.
3. Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.
4. Limit State Analysis and Design by P. Dayaratnram, Wheeler Publishing Company.
5. Comprehensive Design of R.C. Structures by Punmia, Jain and Jain, Standard Book House, New Delhi.
6. Reinforced Concrete Design by S. U. Pillai and D. Menon, Tata McGraw Hill, Delhi.
7. Design of Reinforced Concrete Structures by M. L. Gambhir, PHI, New Delhi

Approved in 04th Academic Council Meeting
Dated 30.03.2026

Program:	B. Tech. (Civil Engineering)			Semester:	V	
Course:	Structural Design Lab			Code:	BTCEPC15CE5P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To make students aware about detailing concepts and be able to draw structural drawings of buildings.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Recall the functional requirements, structural components, and relevant code provisions involved in the design of residential buildings.	L1
CO-2	Explain the structural behavior and load transfer mechanism of various components in a residential building.	L2
CO-3	Apply design principles and code provisions to analyze loads and determine design parameters for residential building components.	L3
CO-4	Analyze structural systems and detailing practices observed during site visits and interpret structural drawings.	L4
CO-5	Evaluate the adequacy of structural design and construction practices of residential buildings based on field observations and technical standards.	L5
CO-6	Design a complete residential building including structural components and prepare detailed structural drawings.	L6

Experiments List

(Any two experiments from list)

1. Design of (G+3) residential building covering all structural components with structural drawings by using software.
2. Site visit to residential building. Detailed report to be submitted along with the structural drawing.
3. Design of Dog legged type staircase. (Detailing on half size drawing sheet)

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Program:	B. Tech. (Civil Engineering)			Semester:			V	
Course:	Building Planning & CAD			Code:			BTCEPC16CE5T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Attendance, Assignment, Class test, Group activity.

Course Objectives: To understand building drawings and to learn & apply various planning principles on residential and public buildings.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Understand basic concepts of building drawing.	L2
CO-2	Plan building as per the principles of planning.	L3
CO-3	Know about Bylaws, Town development authority rules and terms.	L2
CO-4	Draw various plans manually and computationally.	L3
CO-5	Plan public building as per the norms.	L3
CO-6	Understand basic command in AutoCAD.	L2

Unit I: Introduction **(6 Hrs)**

Importance of building drawing for Civil Engineering in construction & industry, estimation, Selection of scales for various drawings. Types of line and their application. Methods of dimensioning in architectural drawing. Abbreviations and graphical symbols used in Civil Engineering Drawing as per IS: 962. Layout of sheet for civil engineering drawing. Requirements of drawing and documents as per plan sanctioning authorities.

Unit II: Aspects of Planning **(6 Hrs)**

Introduction, general principles of planning viz. aspect, prospect, roominess, privacy, grouping, circulation, ventilation, furniture requirement.
Climate of India and its influence on Building planning: Solar radiation, air temperature, wind, humidity, Precipitation, earth & its motion, directions to their characteristics.
Orientation of buildings: factors affecting orientation, sun, wind, rain.

Unit III: Types of Buildings **(6 Hrs)**

Requirement of the owner, Alternatives of building types viz. individual bungalows, semidetached houses, row houses, apartments. Provision of mezzanine floor, balconies and porches in the building. Common utilities such as parking, security, water supply, sanitation, etc. for apartments. Building Bye-laws and Development Control Rules for D Class Municipal Corporations in the Maharashtra State under the provisions of the Maharashtra Regional & Town Planning Act, 1966. Conversion of land to non-agricultural lands, layout for a housing project. Types of public building and their requirements.

Unit IV: Working and Submission drawings **(6 Hrs)**

Concept of line plan, working and submission drawings of the building. Details to be incorporated in the working drawing. Necessity and use of working and submission drawing. Concept of site plan, block plan and layout plan. Importance and details to be incorporated. Concept of foundation plan, importance and use. Developing working and submission drawings for load bearing and framed structures building from the given line plan(Develop plan, elevation, LHSV, RHSV, back side view, section, foundation plan, site plan and

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their detail).

Unit V: planning of public building **(6 Hrs)**

planning of public building, Preparing line plans of different public buildings such as schools, commercial market, primary health center, workshop, college building, post-office. Free hand sketching of components of buildings and elevation features of building such as balconies, chajjas, etc., Staircase planning & drawing.

Unit VI: AutoCAD **(6 Hrs)**

Understanding basic concepts such as Absolute, relative & world Co-ordinates, Drawing units, drawing limits, extend, layers, line types, object snapping, and filter. Drawing entities in AutoCAD/Felix CAD, various drawing commands, use of object snaps & filters, Editing the drawing different editing commands, Dimensioning commands, Text commands, Hatching commands viewing the drawing different views, view ports, zooming in & out, panning, saving & printing in different scales.

Total: 36 Hours

Text Books:

1. Building Planning & Drawing by Shah, Kale &Patki, Tata McGraw-Hill publication
2. Building Planning & Drawing by Dr. Kumar Swamy& Rao Swamy, Charotar publications

Reference Books:

1. Auto cad Pocket reference by Chery R , BPB Publication.

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Program:	B. Tech. (Civil Engineering)			Semester:	V	
Course:	Building Planning & CAD Lab			Code:	BTCEPC17CE5P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To make students aware about drawing tools and use them to plan and draw various drawing.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Understand various lines and graphical symbols.	L2
CO-2	Apply planning principles to plan residential and public building.	L3
CO-3	Make use of different commands of AutoCAD.	L3
CO-4	Identify and describe the basic features and functions of AutoCAD software used for Civil engineering drawings.	L2
CO-5	Prepare line plans of various types of buildings.	L3
CO-6	Prepare submission drawings using AutoCAD.	L3

General Guidelines: Minimum 06 experiments are to be conducted covering entire syllabus.

Experiments List

1. Draw, on sketchbook, various types of lines, Graphical symbols for materials, doors, windows, sanitary and water supply installations, electrical installations, Abbreviations as per IS 962:1989, Location for bed, sofa, dining table with chairs, wardrobe, kitchen furniture, etc.
2. Draw, on sketchbook, line plans for five Residential Buildings with minimum three rooms and staircase in each with WC and Bath.
3. Draw, on sketchbook, line plans for any two Public Building from School Building, Primary Health Centre, Hospital Building, Bank, Post Office, Hostel, Canteen and Shopping Complex. Bar & Restaurant and Hotels, Saloon, Bus Station.
4. Draw, on sketchbook, Free hand sketches of Verandah, lobby, passage, corridor and balconies.
5. Draw Submission drawing, to the scale 1:100, of single storied Load Bearing Residential Building (4 Room) with Flat Roof and staircase showing developed plan, elevation, section passing through Stair or W.C. and Bath, site plan (1:200), foundation plan and section (1:50), area statement, schedule of openings , construction notes on AutoCAD.
6. Submission drawing, to the scale 1:100, of (G+1) Residential Building Framed Structure (2 BHK) with attached toilet to 1 bedroom showing the position of European type WC pan) showing developed plan, elevation, section passing through staircase, site plan (1:200), foundation plan and section (1:50), area statement, schedule of openings on AutoCAD. (Also Show the place for Washing machine, WHB, Pooja, store, bed, dining table with chairs, sofa, wardrobe etc.)
7. Submission drawing of Apartment / Multi storeyed building to the scale 1:100, showing developed plan, elevation, section passing through staircase or W.C. and Bath and Component Drawing of RCC Lintel and Chajjas. Shows detailed enlarge section on AutoCAD.

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Program:	B. Tech. (Civil Engineering)			Semester:			V	
Course:	Fluid Mechanics			Code:			BTCEPC18CE5T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: To equip students with fundamental knowledge and skills to analyse and solve problems in fluid mechanics, applying its principles to real-world engineering applications effectively.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Apply the fundamental concepts of fluid mechanics and properties of fluids to solve engineering problems.	L3
CO-2	Analyse and calculate hydrostatic forces on submerged surfaces.	L4
CO-3	Analyse and apply the principles of fluid kinematics to different types of fluid flow.	L4
CO-4	Apply the principles of fluid dynamics to solve problems involving fluid flow.	L3
CO-5	Interpret hydraulic gradient and total energy line to solve complex problems in pipe flow considering minor and major losses.	L4
CO-6	Design and optimize rectangular and trapezoidal channels for maximum efficiency using specific energy diagrams and discharge diagrams.	L4

Unit I: Properties of fluid **(6 Hrs.)**

Introduction to fluid mechanics, Properties of fluids: mass density, weight density, specific volume. specific gravity, viscosity, surface tension, capillarity, related problems. types of fluids.

Pressure and its measurement: Fluid pressure at a point, Pascal's Law, pressure variation in a fluid at rest, absolute gauge, atmospheric & vacuum pressures, measurement of pressure, simple manometers, differential manometers, related problems.

Unit II: Hydrostatics **(6 Hrs.)**

Hydrostatic forces on surfaces: Introduction, total pressure & centre of pressure for horizontal plane surface, vertical plane surface and inclined plane surface submerged in static fluid and their related problems.

Unit III: Fluid Kinematics **(6 Hrs.)**

Fluid Kinematics Types of Flow: steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible. Rotational & Irrotational flow, Velocity components, convective and local acceleration, velocity potential, stream function, continuity equation in Cartesian co-ordinates. Laplace equation in velocity potential, related Problems

Unit IV: Fluid Dynamics **(6 Hrs.)**

Fluid Dynamics: Momentum equation, Euler's equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem. Application of Bernoulli's theorem such as venturimeter, orifice meter, rectangular and triangular notch, pitot tube, orifices, related numerical.

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Unit V: Flow through pipes **(6 Hrs.)**

Flow through pipes: Loss of Energy in Pipes, Darcy-Weisbach equation (no proof), major and minor losses in pipes, pipes in series and parallel, Equivalent Pipe, Hydraulic Gradient and Total Energy Line, Momentum equation and its application to horizontal pipe bends.

Unit VI: Open Channel flow **(6 Hrs.)**

Uniform flow, Open channel flow, Types of flow, geometric, elements of rectangular & trapezoidal sections, Chezy's & Mannings equations, most efficient rectangular & trapezoidal section specific energy diagram, discharge diagram related problems.

Total: 36 Hours

Textbooks:

1. Fluid Mechanics by Joseph H. Spurk & Nuri Aksel, Springer Publication
2. Fluid Mechanics and Hydraulic Machines by Dr. R. K. Bansal, Laxmi Publications (P) Ltd.
3. Hydraulics and Fluid Mechanics including Hydraulic Machines by Dr. P. M. Modi, & Dr. S. M. Seth, Rajsons Publications Pvt. Ltd

Reference Books:

1. Fluid Mechanics by Robert A. Ganger, Dover Publications, INC, New York
2. Fluid Mechanics by Frank M. White Mc Graw Hill Publications
3. Fluid Mechanics An Introduction by E. Rathakrishnan, PHI, Second Edition

MOOCs Links and additional reading, learning, video material

https://nptel.ac.in/courses/112105269

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Program:	B. Tech. (Civil Engineering)			Semester:	V	
Course:	Fluid Mechanics Lab			Code:	BTCEPC19CE5P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To enable students to experimentally verify and apply fundamental principles of fluid mechanics, developing skills to analyze and interpret results for real-world engineering applications.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Understand the application of Euler's equation.	L2
CO-2	Determine loss of energy for flow through pipes.	L5
CO-3	Recognize the type of flow.	L2
CO-4	Understand the concept of measuring discharge in case of open channel flow.	L6
CO-5	Comprehend the importance of friction coefficient of bed of channel.	L4
CO-6	Understand the application of momentum equation.	L2

General Guidelines: Minimum 08 experiments are to be conducted covering entire syllabus.

Experiments List

(Experiment no. 1 & 2 are compulsory and perform any six from experiment no. 3 to 11)

1. Verification of Bernoulli's theorem.
2. Determination of friction factors for GI pipe.
3. Determination of coefficient of discharge for Venturimeter.
4. Determination of coefficient of discharge for Orifice meter.
5. Identify the type of flow with respect to Reynold's Number.
6. Determination of coefficient of discharge for rectangular notch.
7. Determination of coefficient of discharge for triangular notch.
8. Determination of Chezy's coefficient.
9. Determination of coefficient of discharge of Venturiflume.
10. Verification of momentum equation.
11. Design a most efficient trapezoidal channel section for the given data.

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Program:	B. Tech. (Civil Engineering)			Semester:			V	
Course:	PE-I (Advanced Structural Analysis)			Code:			BTCEPE01CE5T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	1	4	4	10	15	15	60	100

Methods of Teacher Assessment (TA): Attendance, Assignment, Class test.

Course Objectives: To make students aware about advanced methods of structural analysis.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Analyze single bay, single storey portal frames with side sway using the slope deflection method to determine member end moments.	L4
CO-2	Apply the moment distribution method to solve for internal forces in portal frames undergoing lateral displacement (side sway).	L3
CO-3	Evaluate the horizontal thrust, shear, and bending moments in two-hinged circular and parabolic arches under various loading conditions.	L4
CO-4	Estimate the approximate internal forces in multi-storey frames subjected to horizontal wind or seismic loads using the cantilever method.	L3
CO-5	Solve for rotations and moments in continuous beams using the iterative Kani's method for structural efficiency.	L3
CO-6	Determine the tension and geometry of cables subjected to concentrated and uniformly distributed loads with supports at equal or varying elevations.	L4

Unit I: Slope Deflection Method **(8 Hrs.)**

Analysis of single bay, single storey portal frame with side sway.

Unit II: Moment Distribution Method **(8 Hrs.)**

Analysis of single bay, single storey portal frame with side sway.

Unit III: Arches **(8 Hrs.)**

Analysis of Two hinged circular and parabolic arch.

Unit IV: Analysis of frames **(8 Hrs.)**

Analysis of frames subjected to horizontal forces by Cantilever method.

Unit V: Kani's Method **(8 Hrs.)**

Analysis of continuous beams by Kani's method.

Unit VI: Cables **(8 Hrs.)**

Introduction, cable supports at same level and at different levels, Analysis of cables subjected to concentrated loads, uniformly distributed load.

Total: 48 Hours

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Textbooks:

1. Analysis of Structures Vol. I by Prof. V.N. Vazirani, Dr. M.M. Ratwani, Dr. S.K. Duggal, Khanna Publishers
2. Mechanics of Structures Vol. II by S. B. Junnarkar, Dr. H. J. Shah

Reference Books:

1. Theory of Structures by Dr. B. C. Punmia, Dr. A. K. Jain, Ashok K. Jain, Laxmi Publications(P) Ltd.
2. Structural Analysis by R. C. Hibbeler, Pearson India Education Services Pvt. Ltd.

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Program:	B. Tech. (Civil Engineering)			Semester:			V	
Course:	PE-I (Advanced Concrete Technology)			Code:			BTCEPE02CE5T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	1	4	4	10	15	15	60	100

Methods of Teacher Assessment (TA): Attendance, Assignment, Class test, Group activity.

Course Objectives: To understand detailed properties of cement and concrete along with introduction to supplementary cementitious materials, admixtures etc.

Course Outcomes: After completion of the course, the students will be able to:

CO	Course Outcomes	BT Level
CO-1	Understand the chemistry of cement and its effect on properties of concrete.	L2
CO-2	Apply the knowledge of supplementary cementitious materials to produce sustainable concretes.	L3
CO-3	Understand the mechanism of working of admixtures and their effect on properties of concrete.	L2
CO-4	Evaluate the characteristic properties of fiber reinforced concrete.	L5
CO-5	Understand the durability properties of concrete.	L2
CO-6	Interpret the properties of concrete through advance testing methods.	L2

Unit I: Cement and Concrete **(8 Hrs.)**

Types of cements, Bogue's compounds, structure of a hydrated cement paste, volume of hydrated product, porosity of cement paste, interfacial transition zone in concrete (ITZ), influence of ITZ on properties of concrete, types of elastic moduli, factors affecting elastic modulus of concrete.

Unit II: Supplementary Cementitious Materials **(8 Hrs.)**

Fly ash, blast furnace slag, silica fume, rice husk ash, metakaolin, industrial waste or byproducts, chemical composition and classification, effect on hydration process of portland cement, effect on workability of concrete, effect on the properties of hardened concrete, effect on durability of concrete.

Unit III: Chemical Admixtures **(8 Hrs.)**

Classification of admixtures, chemistry and mechanism, effect of admixtures on plastic properties and hardened properties of concrete, applications, specialty admixtures - viscosity modifying admixtures, corrosion-inhibiting admixtures, shrinkage-reducing admixtures.

Unit IV: Fiber Reinforced Concrete **(8 Hrs.)**

Types of fibers, matrix, stress transfer mechanism, steel fiber reinforced concrete (SFRC) –types of steel fibers, balling effect, effect on properties of hardened concrete, applications, slurry infiltrated fiber concrete (SIFCON) - fresh and hardened properties of SIFCON, applications, synthetic fiber reinforced concrete – types of synthetic fibers, properties of fibers, effect of fibers on properties of concrete, applications.

Unit V: Durability of Concrete **(8 Hrs.)**

Plastic shrinkage, autogenous shrinkage, drying shrinkage, mitigation strategies, transport properties of concrete, permeability, corrosion, chloride penetration, carbonation, sulphate attack and acid attack.

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Unit VI: Testing of Concrete **(8 Hrs.)**

Ultrasonic pulse velocity method: theory of pulse propagation through concrete, interpretation of results, corrosion: half-cell potential measurement, electrical resistivity method, permeability and absorption tests, concrete cores – core location and size, drilling, testing and interpretation of results, in-situ load testing.

Total: 48 Hours

Textbooks:

1. Concrete Technology by A.R. Santhakumar, Oxford University Press
2. Concrete Technology by Job Thomas, Cengage Publications

Reference Books:

1. Properties of Concrete by A. M. Neville, Pearson Education
2. Concrete: Microstructure, Properties, and Materials by P. Kumar Mehta and Paulo J.M. Monteiro, McGraw Hill Education

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Program:	B. Tech. (Civil Engineering)			Semester:			V	
Course:	PE-I (Solid Waste Management)			Code:			BTCEPE03CE5T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	1	4	4	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: To provide students with comprehensive knowledge of solid waste sources, characteristics, collection, environmental impacts, treatment, disposal methods, and relevant legal frameworks for effective solid waste management.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Identify and classify solid wastes by source, origin, and characteristics.	L1
CO-2	Explain methods of collection, segregation, storage, and transportation of municipal and industrial solid wastes.	L2
CO-3	Apply appropriate techniques for size reduction, handling, and separation of solid wastes.	L3
CO-4	Analyze environmental, social, and aesthetic impacts of improper solid waste management.	L4
CO-5	Evaluate biological and mechanical treatment methods such as composting, vermicomposting, and incineration.	L5
CO-6	Interpret solid waste management rules and assess the role of regulatory bodies like CPCB and MPCB in sustainable waste management.	L3

Unit I: Sources and Classification of Solid Wastes **(8 Hrs.)**

Solid Waste definition and concept, Classification of Solid Wastes – Source based classification – Residential, Commercial, Institutional, Industrial, Agricultural, Hospital etc., Type based classification – Garbage, ashes and residues, Combustible and non-combustible wastes, Biodegradable and non-biodegradable wastes.

Unit II: Collection and Transportation of Solid Waste **(8 Hrs.)**

Collection Methods - Communal system, block Collection, kerbside/alley, door to door collection, Handling and segregation of solid waste at source, Methods of separation- Mechanical, magnetic and screening, Mode of Transportation of solid waste, Solid waste size reduction methods (compacting, shredding, pulping, granulating, etc.), Storage of solid waste (MSW/ Biomedical/Industrial).

Unit III: Effects of Solid Waste **(8 Hrs.)**

Factors influence the quantity of solid wastes generated: Geographic location, Season of the year, Collection frequency, Characteristics of population, Extent of salvaging and recycling, Public attitudes, Legislation, Environmental Impact of solid waste – Air pollution, contamination of surface water, Contamination of ground water, Land degradation, global warming, Ocean dumping of solid waste. Social and aesthetic impacts of solid waste.

Unit IV: Treatment and disposal-I **(8 Hrs.)**

Solid waste management hierarchy and Solid waste prevention and reduction techniques, Concept, principal and Factors affecting composting of waste, Method of composting – Manual composting, Mechanical composting, Vermicomposting and Open dumping.

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Unit V: Treatment and disposal-II **(8 Hrs.)**

Land fill method – Land fill, Sanitary- landfill, Trench method and Ramp method. Advantages and disadvantages of landfill method, Incineration and pyrolysis – Flash, Multiple chamber incinerators and pyrolysis- Advantages and disadvantages.

Unit VI: Legal aspects of solid waste **(8 Hrs.)**

Solid waste management rule 2016, Role of Central Pollution Control Board and Maharashtra Pollution Control Board in Management of solid waste from various sources

Total: 48 Hours

Textbooks:

1. Integrated Solid Waste Management by George Techobanoglous, McGraw-Hill Publication, 1993
2. Solid Waste Management in Developing Countries by Bhide A. D., Tata McGraw-Hill, New Delhi.

Reference Books:

1. CPHEEO manual on MSW, GoI, New Delhi

MOOCs Links and additional reading, learning, video material

1. https://nptel.ac.in/courses/120108005

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Program:	B. Tech. (Civil Engineering)			Semester:			V	
Course:	PE-I (Highway Construction & Management)			Code:			BTCEPE04CE5T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	1	4	4	10	15	15	60	100

Methods of Teacher Assessment (TA): Attendance, Assignment, Class test, Group activity.

Course Objectives: To make students aware about various equipment, specification and construction practices for highway construction.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Understand the various equipment used for road construction and difficulties associated with highway.	L2
CO-2	Understand specifications and construction practices for road formation in embankment and cutting.	L2
CO-3	Describe the base course thickness and selection of materials as base layer for CC pavements.	L1
CO-4	Apply project management tools and techniques for effective planning and control.	L3
CO-5	Use value engineering to optimize costs while maintaining project quality.	L3
CO-6	Understand road administration and regulatory mechanisms.	L2

Unit I: Introduction to Highway Construction and Construction Equipment's **(8 Hrs.)**

Components of road and pavement structure including subgrade, drainage system, functions, requirements and sequence of construction operations.
Plants and equipment for production of materials - crushers, mixers, bituminous mixing plants, cement concrete mixers (various types, advantages and choice).
Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers (their uses and choice)

Unit II: Pre-construction surveys and marking on ground **(8 Hrs.)**

Specifications and steps for the construction of road formation in embankment and cutting, construction steps for subgrade (preparation of subgrade) in cutting, filling and at grade. Construction of subgrade in marshy areas and weak / expansive soils and water- logged - areas. Construction steps for granular sub-base, quality control tests. Different types of granular base course – WMM, CRM, WBM, specifications, construction method and quality control tests.

Unit III: Different types of sub-base and base course for cement concrete (CC) pavement (8 Hrs.)

Construction of cement concrete pavements and joints, quality control during construction. Construction of special Cement concrete pavements like interlocking concrete block pavements (ICBP), Continuously reinforced cement concrete pavements (CRCP), Fibre reinforced cement concrete pavements (FRCP).

General Aspects: Quality assurance, statistical approach, quality system for road construction. Safety aspects during road construction and maintenance works. Installation of various traffic safety devices and information system Principle of construction planning

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Unit IV: Introduction to Highway Project Management **(8 Hrs.)**

A systems Approach, Systems Theory and Concepts, Organization, Management Functions, Overview of Management Objectives, Tools and Techniques, Project Management – (Processes and Organizational Structures, Team Management, Project Manager as a Team Leader, Leadership Qualities), Project Management Information System (PMIS), application of CPM and PERT(Problems not included).

Unit V: Construction Cost and Value Engineering **(8 Hrs.)**

Types of Estimates, Implementation of Cost Controls, Project Cost Forecasting, Cost Optimisation and Resources Planning - Value Engineering, Techniques for Project Selection, Break-Even Analysis, Cost Modelling, Energy Modelling, Life Cycle Cost Approach.

Unit VI: Financing of road projects **(8 Hrs.)**

Administration of roads, Private Public Partnership (PPP) models, Toll collection, Economic viability of Design-Build-Operate, Risk Analysis (Road safety audit), Value for Money analysis - Case Studies

Total: 48 Hours

Textbooks:

1. Project Management by S. Choudhary, Tata McGraw Hill Publishing Co., Ltd.
2. Construction management Practices by UK Raina, Tata Mc Graw hill Publishing Company Ltd.
3. Construction Equipment and its Management by Sharma S.C., Khanna Publishers.
4. Highway Engineering by Khanna, S.K. & Justo, C.E.G., NemChand & Bros, Roorkee (U.A).
5. Traffic Engineering & Transport Planning by Kadiyali L.R, Khanna Publishers, New Delhi.

Reference Books:

1. CRRI, Road User Cost Study in India, New Delhi, 1982.
2. IRC, Manual on Economic Evaluation of Highway Projects in India, SP30, 2007

MOOCs Links and additional reading, learning, video material

1. http://www.cdeep.iitb.ac.in/nptel
2. http://www.nptel.iitm.ac.in

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Program:	B. Tech. (Civil Engineering)			Semester:	V	
Course:	Field Project			Code:	BTCEFP01CE5P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	50	-	50

Internal Evaluation: Evaluation will be done by continuous assessment and will be based on involvement of the student in the field project. Students should conduct a detailed survey/Design/Drawing, maintain the filed visit diary & submit the detail report.

Course Objectives: To develop the ability of students to apply civil engineering principles in real-world problem solving through planning, surveying, analysis, design, and preparation of technical reports and drawings, while fostering teamwork, independent learning, and professional ethics.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Identify and formulate a suitable civil engineering problem based on field requirements and constraints.	L3
CO-2	Conduct detailed field surveys, data collection, and analysis using appropriate methods and instruments.	L4
CO-3	Develop engineering designs based on relevant codes, standards, and assumptions.	L6
CO-4	Prepare detailed drawings, layouts, and plans using appropriate drafting tools/software.	L5
CO-5	Compile and present a comprehensive technical report including methodology, analysis, design, and results.	L4
CO-6	Demonstrate teamwork, project management skills, and professional responsibility during execution and evaluation of the project work.	L3

Field Project will be allotted to a group of students, if at all possible, as per their area of interest and previous exam scores. The project work will be carried out by the students based on the syllabus of Ist to IVth semester, as directed by respective faculty. Evaluation will be done by continuous assessment and will be based on involvement of the student in the work. Students should conduct a detailed survey, Design & Submit Report & Drawing sheets.

Total: 24 Hrs

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SEMESTER: VI

Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	Environmental Engineering - I			Code:			BTCEPC20CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Attendance, Assignment, Class test, Group activity.

Course Objectives: Students will be taught to provide a safe, adequate, and reliable supply of water to meet the community's needs, public health and economic development.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Estimate the demand of water and concept of sources.	L3
CO-2	Explain and determination water quality characteristics.	L2
CO-3	Understand relevant preliminary water treatment processes.	L2
CO-4	Analyze and design filtration process.	L4
CO-5	Select proper methods of disinfection of water	L5
CO-6	Understanding of various water distribution systems	L2

Unit I: Quantity Estimation of water **(6 Hrs.)**

Introduction & Necessity of water supply scheme. Demand of water: Types of demand, Per capita demand, factors affecting consumption, Fluctuation in demand. Design period, methods of population forecasting. Sources: Surface & ground water sources, Intakes- type, location, requirement & suitability for site selection.

Unit II: Water quality **(6 Hrs.)**

Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis- physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment work.

Unit III: Aeration and Sedimentation **(6 Hrs.)**

Purpose & types of aerators (gravity aerators & spray).
Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, Flocculation, clarrifloculator. Design criteria for sedimentation tanks, surface loading, simple problems on design of sedimentation tanks.

Unit IV: Filtration **(6 Hrs.)**

Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process. Control system, Negative head, operating difficulties, pressure filter; Simple design problems on rapid sand filters.

Unit V: Disinfection **(6 Hrs.)**

Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination, forms of chlorine. Use of bleaching powder - Simple problems. Introduction to tertiary treatments-Softening and Defloridation.

Unit VI: Distribution system **(6 Hrs.)**

Types of supply: Continuous, and intermittent. Types of system: Gravity, Pumping and combined gravity and pumping, Layouts of distributions system. Maintenance of distribution system. Type of storage

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reservoirs, capacity. Types of conduits, joints, appurtenances. Pipe laying and testing.

Total: 36 Hours

Textbooks:

1. Water Supply and Sewerage by Steel E. W., Mc-Graw Hill.
2. Water Supply Engineering by Kshirsagar S. R., Roorkee Pub house, Roorkee.
3. Water Supply and Sanitary Engineering by Birde G. S., Dhanpat Rai and Sons, Delhi.

Reference Books:

1. Water Supply Engineering by Punmia B. C., Laxmi publication.
2. Water Supply Engineering by Garg S.K., Khanna Publishers

MOOCs Links and additional reading, learning, video material

1. https://nptel.ac.in/courses/105105201

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Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	Environmental Engineering - I Lab			Code:	BTCEPC21CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To understand the basic characteristics of water and its determination.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Determine of Turbidity, Electrical conductivity, pH of water sample.	L3
CO-2	Analyse solids in water sample.	L4
CO-3	Decides optimum coagulant dose of water sample.	L5
CO-4	Measure temporary and permanent Hardness.	L2
CO-5	Diagnose of Acidity & Alkalinity of water sample	L4
CO-6	Determine of Iron and Manganese, residual chlorine in water sample.	L3

General Guidelines: Minimum 08 experiments are to be conducted covering entire syllabus.

Experiments List

(Experiment no. 1 & 2 are compulsory and perform any six from experiment no. 3 to 11)

1. Determination of Turbidity of water sample.
2. Determination of Electrical Conductivity water sample.
3. Determination of pH of water sample.
4. Analysis of Dissolved, Suspended and Total solids of water sample.
5. Analysis of Volatile and Fixed solids of water sample.
6. Decides Optimum coagulant dose of water sample.
7. Determination of Temporary and Permanent Hardness of water sample.
8. Determination of Acidity & Alkalinity of water sample
9. Determination of Iron and Manganese in water sample.
10. Determination of residual chlorine in the given water sample.
11. Total Count of Bacteria Test

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Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	Water Resource Engineering			Code:			BTCEPC22CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Attendance, Assignment, Class test.

Course Objectives: To equip students with knowledge of hydrology, irrigation, dams, canals, and spillways, enabling them to design, analyze, and evaluate water resource systems, applying principles of hydraulics, seepage, and sustainability.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Apply knowledge of hydrological cycle, precipitation, and runoff to analyse and compute hydrological data, and design water resource systems.	L3
CO-2	Apply knowledge of irrigation principles, crop water requirements, and duty-delta relationships to design and evaluate irrigation systems.	L4
CO-3	Design and evaluate gravity dams, analyzing forces, stability, and structural components, applying principles of dam engineering.	L6
CO-4	Design and evaluate earth dams, applying principles of seepage analysis, stability, and design criteria, using methods like Casagrande's and Laplace equation.	L6
CO-5	Apply Lacey's and Kennedy's theories to design and evaluate canal systems, analyzing channel stability and irrigation requirements.	L3
CO-6	Design and evaluate spillways and diversion headworks, applying principles of hydraulics and seepage analysis, using theories like Bligh's Creep theory.	L6

Unit I: Hydrology **(6 Hrs.)**

Hydrology: Hydrological cycle, Hydrological data, Precipitation, types of Precipitation, forms of Precipitation, Rainfall in India, Measurement of rainfall, raingauge network, computation of average rainfall over a basin, estimation of missing data, Runoff, factor affecting runoff.
Types of aquifers, well hydraulics, Darcy's law, Dupuilt's theory for unconfined and confined aquifer.

Unit II: Irrigation **(6 Hrs.)**

Irrigation, necessity and importance of irrigation, advantages & disadvantages of irrigation, types of irrigation.
Principal Crops and crop seasons, duty and delta, relation between duty and delta, factor affecting duty, methods for improving duty, related numerical.

Unit III: Dam **(6 Hrs.)**

Dam: Introduction, classification of dam, factors governing selection of type of dam, Requisite of good site for dam.
Gravity Dam: Basic definitions, forces acting on a gravity dam, Elementary and practical profile of gravity dam, modes of failure of gravity dam, galleries and shafts, Joints, keys and water seals in gravity dam.

Unit IV: Earth dam **(6 Hrs.)**

Earth dam, types of earthen dam, design criteria for earth dam, preliminary section of earth dam, causes of failure of earth dam, Seepage analysis, Laplace equation, rate of seepage, Phreatic line in earth dam, Casagrande's Method for determining phreatic line, seepage control through embankment.

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Unit V: Canal **(6 Hrs.)**

Canal, Classification of canal, canal alignment, types of irrigation channels, Kennedy's Theory, Kennedy's method of channel method, drawbacks of Kennedy's theory, Lacey's regime theory, channel design by Lacey's theory, drawback of Lacey's theory.

Unit VI: Spillway **(6 Hrs.)**

Spillway, Location of spillway, practical profile of spillway, Types of spillways: side channel, chute, conduct, shaft and siphon spillway.
Diversion headworks, site selection, components of a diversion headworks, The Weir, causes of failure of weirs, design of impervious floor for sub-surface flow by Bligh's Creep theory

Total: 36 Hours

Textbooks:

1. Irrigation and Waterpower Engineering by Dr. B. C. Punmia, Dr. Pande B. B. Lal, Laxmi Publication
2. A textbook of Hydrology by Dr. P. Jaya Rami Reddy, University Science Press
3. Irrigation and Waterpower Engineering by Madan Mohan Das, Mini Das Saikia, PHI Learning Private Limited

Reference Books:

1. Irrigation Theory and Practices by Dr. A. M. Michael, Vikas Publishing House Pvt. Ltd.
2. Irrigation and drainage Engineering by Peter Waller & Muluneh Yitayew, Springer Publication

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Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	Water Resource Engineering Lab			Code:	BTCEPC23CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To enable students to apply water resource engineering principles, analyze case studies, and design irrigation structures, demonstrating skills in hydrological analysis, structural design, and graphical representation.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Analyze and evaluate an irrigation project, applying hydrological and engineering principles, and present findings in a detailed case study	L5
CO-2	Create and represent gravity dam profiles, applying principles of dam design and graphical representation.	L6
CO-3	Apply Bligh's creep theory to calculate and graphically represent average hydraulic gradients for seepage analysis.	L3
CO-4	Understand the Construction details and working of a canal head regulator.	L6
CO-5	Create and represent spillway sections, applying principles of hydraulic design and graphical representation.	L6
CO-6	Represent unconfined and confined aquifers graphically, applying principles of hydrogeology and groundwater flow.	L2

General Guidelines: Minimum 08 experiments are to be conducted covering entire syllabus.

Experiments List

(Experiment no. 1 & 2 are compulsory and perform any six from experiment no. 3 to 10)

1. Write a detail case study on any one of the following irrigation projects in India.
   (Bhakra Nangal Project, Koyna dam, Gandhi Sagar Dam (M. P.), Hirakud Dam (Odisha), Krishnaraja Sagara dam Karnataka, Tehri dam, Uttarakhand)
   The case study includes Hydrological data, Type of construction, spillway and reservoir details, Power generation details (if applicable), etc.
2. Visit to the irrigation project nearby the district, and write the detail engineering report.
3. Draw the elementary and practical profile of a gravity dam on half imperial drawing sheet.
4. Draw the typical C/S of earth dam on half imperial drawing sheet.
5. Calculate and draw the average hydraulic gradient by using Bligh's creep theory.
6. Draw a typical section of a vertical drop weir.
7. Draw a typical section of a Canal Head Regulator.
8. Draw the maximum spillway section of Bhakra Nangal Dam with suitable scale showing all levels.
9. Draw a typical section of a unconfined aquifer.
10. Draw a typical section of a confined aquifer.

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Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	PE-II (Hydraulic Engineering)			Code:			BTCEPE05CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credit	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: To equip students with advanced knowledge and skills to analyse and solve complex problems in hydraulic engineering, and hydraulic machines, applying their principles of to real-world engineering applications.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Analyze turbulent flow through pipes, interpret Nikuradse's experiments, and apply velocity distribution laws and Moody's diagram to calculate flow characteristics in hydrodynamically smooth and rough pipes.	L-4
CO-2	Apply and similitude principles to analyse problems involving dimensional analysis, interpret dimensionless numbers and design geometrically similar models for hydraulic structures, applying Reynold's law and Froude's Law	L-4
CO-3	Identify different types of GVF profiles and apply various methods to determine the length of GVF profiles.	L-3
CO-4	To understand the criteria for formation hydraulic jump.	L-2
CO-5	Apply principles of Hydraulics engineering to analyse and calculate forces exerted by free jets on stationary and moving plates, including vertical, inclined, curved, and hinged surfaces, and interpret results to solve problems.	L-3
CO-6	To enable students to understand and identify the components, working principles, and performance characteristics of hydraulic machines, including turbines and pumps, applying knowledge to real-world applications.	L-2

Unit I: Turbulent flow through pipes **(6 Hrs.)**

Turbulent flow through pipes, Nikuradse's experiments on artificially rough pipes, hydro dynamically smooth and rough pipes, Moodys diagram, velocity distribution laws

Unit II: Dimensional Analysis **(6 Hrs.)**

Dimensional Analysis; Buckingham's Pie theorem, its application, similitude, Dimensionless numbers, Re, Fr, We, Predominant forces & their ratio, Model Analysis - Geometrically similar models, Reynold's law, Froude's law, Model study of spillway

Unit III: Gradually varied flow (GVF) in open channel **(6 Hrs.)**

Gradually varied flow (GVF) in open channel, Dynamic equation of GVF, Dynamic equation of GVF in wide rectangular channel, Relation between water surface slope and channel bottom slope, Classification of channel bottom slope, classification of surface profile, Characteristics of surface profiles, Integration of the varied flow equation (only step method)

Unit IV: Rapidly varied flow **(6 Hrs.)**

Rapidly varied flow, Theory of Hydraulic jump, hydraulic jump in horizontal rectangular channel, Types of Hydraulic Jump, elements of hydraulic jump, relation between conjugate depths

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Unit V: Impact of Free jets **(6 Hrs.)**

Impact of Free jets: Introduction, Force exerted by jet on a stationary vertical, inclined and curved plate, Force exerted by a jet on hinged plate, Force exerted by a jet on moving plates when plate is vertical and moving in the direction of plate and away from plate, Force exerted by a jet on Incline plate moving in the direction of plate.

Unit VI: Hydraulic Machines **(6 Hrs.)**

Hydraulic Machines: General layout of hydroelectric power plant, Definitions of heads and efficiencies of turbine, classification of hydraulic machine, Introduction to Pelton wheel and Francis's turbine. Centrifugal Pump: Main parts of centrifugal pump, definitions of heads and efficiencies of a pump, Reciprocating Pump: Main Parts and working of reciprocating pump. (No Numerical on this unit)

Total: 36 Hours

Textbooks:

1. Fluid Mechanics by Joseph H. Spurk & Nuri Aksel, Springer Publication
2. Fluid Mechanics and Hydraulic Machines by Dr. R. K. Bansal, Laxmi Publications (P) Ltd.
3. Hydraulics and Fluid Mechanics including Hydraulic Machines by Dr. P. M. Modi, & Dr. S. M. Seth, Rajsons Publications Pvt. Ltd.

Reference Books:

1. Fluid Mechanics by Robert A. Ganger, Dover Publications, INC, New York
2. Fluid Mechanics by Frank M. White Mc Graw Hill Publications
3. Fluid Mechanics An Introduction by E. Rathakrishnan, PHI, Second Edition

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Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	PE-II Lab (Hydraulics Engineering Lab)			Code:	BTCEPE06CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To enable students to experimentally verify and apply fundamental principles of fluid mechanics, developing skills to analyze and interpret results for real-world engineering applications.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Calculate the height of hydraulic jump, length & energy loss	L4
CO-2	Determine force exerted by jet on vane.	L4
CO-3	Understand the concept of Coefficient of roughness for the bed of a channel.	L2
CO-4	Understand the characteristics & working of turbine.	L2
CO-5	Calculate the output power of turbines.	L4
CO-6	Understand the characteristics & working of pump.	L2

General Guidelines: Minimum 08 experiments are to be conducted covering the entire syllabus.

Experiments List

(Experiment no. 1 & 2 are compulsory and perform any six from experiment no. 3 to 9)

1. Study of hydraulic jump, calculations of height of jump, length & energy loss.
2. Determination of force exerted by jet of water on vane.
3. Determination Manning's Coefficient of roughness for the bed of given flume.
4. Study the characteristics & working of Pelton wheel turbine.
5. Determination of output power of Pelton wheel turbine.
6. Study the characteristics & working of Francis turbine.
7. Determination of output power of Francis turbine.
8. Studying the working & characteristics Centrifugal Pump.
9. Studying the working & characteristics reciprocating pump.

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Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	PE-II (Foundation Engineering)			Code:			BTCEPE07CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credit	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: To expertise to plan subsurface exploration and the stability analysis of foundations and retaining structures using ground improvement and engineering codes.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Explain various objectives, and methods of soil exploration and their suitability for engineering projects.	L2
CO-2	Determine the bearing capacity and settlement of shallow foundation for various field situations.	L3
CO-3	Determine the earth pressures and retaining structures for various fields situations and determine the stability of such structures.	L4
CO-4	Determine the capacities of pile and pile groups for various field situations and design the pile from the given data.	L6
CO-5	Apply IS code provisions to determine allowable settlement limits for safe foundation design.	L3
CO-6	Differentiating the raft foundations and retaining structures while selecting appropriate ground improvement techniques to mitigate challenging soil conditions	L4

Unit I: Soil Exploration **(6 Hrs)**

Objectives and methods of exploration, soil boring, boring log, hand augers, wash boring, percussion drilling, rotary drilling, Type of samples and samplers, area ratio, inside and outside clearance, Field Tests and geophysical methods, Soil investigation report, Planning of sub surface programs, Stages in sub-surface exploration, Reconnaissance, Lateral extent and depth of exploration.

Unit II: Bearing Capacity **(6 Hrs)**

Bearing capacity, its types, Bearing capacity analysis by Terzaghi, types of bearing capacity failures, Effect of shape of footing, water table, eccentricity and inclination of load on bearing capacity, IS Code method, Field test -Plate load test results, SPT, SCPT.

Unit III: Earth Pressure **(6 Hrs)**

Earth Pressure, Active, passive and earth pressure at rest, Rankin's and Coulombs theory of earth pressure, influence of surcharge, water table, wall friction, Graphical methods - Rebhann's and Culmann's method. Explain the objectives, methods, and planning involved in subsurface soil exploration and interpret boring logs, sampling quality, and field/geophysical test data.

Unit IV: Pile Foundation **(6 Hrs)**

Classification of piles, Pile capacity - Static analysis, dynamic pile formula, Pile load test, Negative skin friction, Piles groups, spacing of piles in group, Pile group capacity, group efficiency, factors affecting group efficiency, settlement of pile group, Under-reamed pile.

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Unit V: Settlement **(6 Hrs)**

Types of settlement, immediate, primary and secondary settlement, concept of differential settlement, factors and causes for differential settlement, Permissible settlements as per IS code, Proportioning of footing for uniform settlement.

Unit VI: Raft Foundation and Retaining Structures **(6 Hrs)**

Raft Foundation: Its Purpose, advantages, situation, classification of raft, criteria for rigid and flexible raft. Retaining Structures: Different types of retaining structures, stability analysis of rigid walls, Ground Improvement Techniques: Introduction and Methods.

Total: 36 Hours

Text Books:

1. Soil Mechanics and Foundation Engineering by Murthy, V. N. S., CBS Publisher and Distributors.
2. Foundation Engineering by Kasmalkar. Pune Vidyarthi Griha Publishers.
3. Foundation Engineering by Arora K. R., Standard Publishers and Distributors.
4. Soil Mechanics and Foundation Engineering by Venkataramiah, New Age International Publishers.

Reference Books:

1. Craig, Soil Mechanics
2. Bowles, J. E., Foundation Design Analysis
3. Peck and Hanson, Foundation Engineering
4. Prakash S., Analysis and Design of Foundation and Retaining Structure

MOOC Links:

1. https://onlinecourses.nptel.ac.in/noc26_ce50

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Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	PE-II Lab (Foundation Engineering Lab)			Code:	BTCEPE08CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To investigate subsoil characteristics through field and geophysical testing in order to design safe shallow and deep foundations and evaluate the stability of slopes and retaining structures using analytical and software based methods.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Determine bearing capacity of soil by analytical approach.	L3
CO-2	Perform standard penetration test to determine soil characteristics.	L3
CO-3	Perform static cone penetration test to determine soil characteristics.	L3
CO-4	Recognize subsoil strata based on soil resistivity or seismic refraction test results.	L1
CO-5	State the analytical and graphical methods used to determine earth pressure.	L3
CO-6	Identify commonly used software tools for bearing capacity analysis, earth pressure analysis, or retaining-wall stability analysis.	L1

General Guidelines: Minimum 8 experiments are to be conducted covering entire syllabus.

Experiments List

(Experiment no. 1 and 2 are compulsory and perform any six from experiment no. 3 to 9)

1. Determination of safe and allowable Bearing capacity and settlement of shallow foundation from given data / results of field tests by analytical methods.
2. Soil characteristic by conducting standard penetration test
3. Soil characteristic by conducting static cone penetration test.
4. Subsoil strata identification by conducting soil resistivity / seismic refraction method.
5. Design of a pile group foundation from given data / results of field tests by analytical methods,
6. Determination of earth pressure by analytical, graphical method.
7. Stability analysis of retaining wall by analytical method.
8. Slope stability analysis by graphical method and using software.
9. Introduction to any software for bearing capacity analysis or earth pressure analysis or stability analysis of retaining wall.

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Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	PE-II (Prestressed Concrete)			Code:			BTCEPE09CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credit	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: To make students aware of prestressed concrete concept and to make them familiar with the analysis and design of prestressed concrete structures.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Apply the basic concepts of prestressed concrete fundamentals, including pre- and post- tensioning processes	L3
CO-2	Determining the stresses and various losses in prestressed concrete members	L5
CO-3	Design the prestressed concrete structures.	L6
CO-4	Design the prestressed concrete slab.	L6
CO-5	Design the prestressed concrete flat slab.	L6
CO-6	Analysis and design the prestressed continuous beams	L4, L6

Unit I: Prestressing Systems, Material Properties and Composite Sections **(6 Hrs)**

Basic concept, early attempts of prestressing, brief history, development of building materials, definitions, advantages of prestressing, limitations of prestressing, types of prestressing, prestressing systems and devices, introduction of composite sections of prestressed concrete beam and cast in-situ RC slab

Unit II: Analysis of Prestressed Members and Losses in Prestress **(6 Hrs)**

Analysis of prestressed concrete member, stress calculations and concept of cable profile and losses in prestressed concrete.

Unit III: Design of Determinate Beam **(6 Hrs)**

Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure and shear including end block.

Unit IV: Design of Slab **(6 Hrs)**

Design of one way and two way post tensioned slabs.

Unit V: Design of Flat Slab **(6 Hrs)**

Introduction to flat slab, design of prestressed two way flat slab by direct design method.

Unit VI: Statically Indeterminate PSC Beams **(6 Hrs)**

Analysis and design of two span continuous beams, choice of cable profile, linear transformation and concordancy.

Total: 36 Hours

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Textbooks:

1. Advanced Design of Structures by Krishnaraju, Mc Graw Hill.
2. Prestressed Concrete by N. Krishna Raju, Tata Mc Graw Hill Publication Co.

Reference Books:

1. Prestressed Concrete: A Fundamental Approach by Edward Nawy, PHI.
2. Design of Prestressed Concrete Structures by T Y Lin and N H Burns.

Approved in.....04th.....
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Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	PE-II (Prestressed Concrete Lab)			Code:	BTCEPE10CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To provide students with fundamental and practical knowledge of prestressed concrete technology, including materials, systems, and construction practices.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Understand the principles, materials, and construction techniques involved in prestressed concrete systems through theoretical study and site exposure.	L2
CO-2	Analyze and design pre-tensioned concrete beams for given spans and loading conditions in accordance with relevant design codes.	L4
CO-3	Analyze and design post-tensioned concrete beams by considering prestress losses, tendon profiling, and serviceability requirements.	L4
CO-4	Design rectangular prestressed concrete sections under flexure, ensuring compliance with permissible stress and ultimate strength criteria.	L6
CO-5	Design post-tensioned concrete slabs by selecting appropriate tendon layout, slab thickness, and prestressing force while satisfying serviceability and strength limits.	L6
CO-6	Design and detail the end block (anchorage zone) of prestressed concrete members to safely resist bursting and spalling stresses.	L6

General Guidelines: Minimum 04 experiments are to be conducted covering the entire syllabus.

Experiments List

(Experiment No. 1 is compulsory & Perform any three from experiment no. 2 to 6)

1. Compulsory site visit to prestressing plant and submission of detailed report.
2. Design a pre-tensioned concrete beam for a given span and loading.
3. Design a post-tensioned concrete beam.
4. Design a rectangular prestressed concrete section under flexure.
5. Design a post-tensioned concrete slab for the data.
6. Design of End Block for Prestressed Concrete Member.

Approved in....04th.....
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Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	PE-II (Remote Sensing & GPS Surveying)			Code:			BTCEPE11CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA):

Course Objectives: To develop foundational knowledge and practical skills in remote sensing and GPS technologies for effective acquisition, processing, interpretation, and application of geospatial data.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Understand the basic components of remote sensing, electromagnetic radiation, and different types of resolutions.	L2
CO-2	Apply basic geometric and radiometric corrections and identify different sensors and satellite platforms.	L3
CO-3	Analyze remote sensing images using enhancement, transformation, and classification techniques.	L4
CO-4	Understand the basic concepts, working, and segments of GPS systems.	L2
CO-5	Use GPS receivers to collect positioning data and explain their advantages and limitations.	L3
CO-6	Evaluate GPS surveying methods, identify major errors, and choose suitable applications.	L5

Unit I: Remote sensing basics **(6 Hrs.)**

Remote sensing components- Various parts of electro-magnetic spectrum (EMS), Interaction of EMS with the atmosphere, Scattering process and Spectral signature of objects, Various types of resolutions and their need

Unit II: Sensors, Satellites, and Image Corrections **(6 Hrs.)**

Types of sensors and their salient features, Types of satellite platforms and their characteristics, Properties of digital remote sensing data, Geometric and radiometric correction of satellite images.

Unit III: Image Enhancement and Classification **(6 Hrs.)**

Enhancement procedure to improve the quality of remote sensing images, Image transformations and their utility, Image classification methods, Accuracy assessment of thematic maps.

Unit IV: Global Positioning Systems basics **(6 Hrs.)**

Technical terms in GNSS, basic principle of GPS, Various segments of GPS- Space Segment, Control Segment, User Segment.

Unit V: GPS Signals and Receivers **(6 Hrs.)**

Signals of GPS, Advantages and disadvantages of GPS, Types of GPS receivers, Working of a GPS.

Unit VI: GPS Surveying and Applications **(6 Hrs.)**

GPS surveying techniques, Accuracy of GPS observations, Errors in GPS observations, Applications of GPS technology

Total: 36 Hours

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Textbooks:

1. Higher Surveying (Volumes II and III) by B. C. Punmia, A. K. Jain, and A. K. Jain, published by Laxmi Publications, New Delhi.
2. A Text Book on GPS Surveying (2015) by Dr. Jayanta Kumar Ghosh, ISBN 978-1522952749.
3. Surveying, Vol-I, II and III by Arora, K.R., Standard Book House, 2015.
4. Basics of Remote Sensing and GIS by S. Kumar, Laxmi Publications.

Reference Books:

1. Surveying and Geomatics by P. K. Garg, Khanna Publishers, New Delhi, ISBN 978-9382609675.
2. Advanced Surveying by R. Madhu and A. Gopi, published by Pearson India, ISBN 978-9332517017.

MOOC Links:

1. https://nptel.ac.in/courses/105108077
2. https://onlinecourses.nptel.ac.in/noc20_ce51/preview
3. https://onlinecourses.nptel.ac.in/noc22_ce84/preview

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Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	PE-II Lab (Remote Sensing & GPS Surveying Lab)			Code:	BTCEPE12CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To develop practical skills in topographic sheet reading, satellite image interpretation, GPS data collection, and preparation of thematic and updated base maps.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Interpret Survey of India topographic sheets and satellite images for identifying terrestrial features.	L2
CO-2	Perform geometric corrections, rectifications, and import spatial data from various sources.	L3
CO-3	Prepare base maps and thematic maps for geomorphology, forest, urban, and waterbody studies.	L3
CO-4	Operate GPS equipment, initialize it in the field, and use its key functions.	L3
CO-5	Collect spatial data using waypoints, track points, and map–compass navigation.	L4
CO-6	Process, transfer, and integrate GPS data for area calculation and updated map preparation.	L6

General Guidelines: Minimum 08 experiments are to be conducted covering the entire syllabus.

Experiments List

(Experiment no. 1 & 2 are compulsory and perform any six from experiment no. 3 to 15)

1. To study and interpret Survey of India topographical sheets for map reading.
2. To familiarize with the GPS receiver and understand its setup and operational units.
3. To import satellite and aerial data from various data sources into the system.
4. To perform geometric correction and rectification of spatial data.
5. To interpret satellite images for identification of various terrestrial features.
6. To prepare a base map using Survey of India topographical sheets.
7. To generate thematic maps such as geomorphology, forestry, urban areas, and water bodies.
8. To initialize and configure the GPS system for field operations.
9. To become acquainted with the various functions and features of the GPS receiver.
10. To use GPS in conjunction with map and compass for field navigation.
11. To calculate area using GPS measurements.
12. To perform navigation using waypoints.
13. To perform navigation using track points.
14. To transfer waypoints between GPS receiver and computer system.
15. To prepare and update maps using GPS and remote sensing data.

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Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	PE-III (Ground Improvement Techniques)			Code:			BTCEPE13CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: Ability to diagnose problematic soil conditions and cost-effective ground improvement solutions using stabilization, densification, grouting, and reinforcement techniques.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Identify major Indian soil deposits and assess the necessity for ground improvement based on hazardous, poor, or favorable conditions.	L3
CO-2	Apply principles of mechanical, cement, lime and fly-ash methods to improve soil properties for engineering applications.	L3
CO-3	Analyze and compare various densification methods for sands and clays, such as vibro-compaction, explosion, and the installation of sand compaction piles	L4
CO-4	Design accelerated preconsolidation systems using various types of drains and deep mixing methods for soft soil deposits.	L6
CO-5	Compare and select appropriate grouting methods for specific ground improvement applications and geotechnical challenges.	L5
CO-6	Apply principles of rock reinforcement and rock anchoring to stabilize fractured rock masses and secure heavy engineering structures	L3

Unit I: Introduction **(6 Hrs.)**

Major soil deposits in India, Ground Improvement potential –Hazardous, poor and favourable ground conditions, Necessity of Ground Improvement, Various mechanisms of Ground Improvement, Applications, Response of Sands and Clays to externally applied Stress.

Unit II: Soil Stabilization **(6 Hrs.)**

Principle, Different methods of soil stabilization, Mechanical stabilization – Principle, factors affecting, Proportioning of material, applications,

Cement stabilization - Mechanism, Factors influencing, Admixtures for soil-cement, Construction of soil-cement-different methods, Applications

Lime stabilization – Principle, factors affecting, Effect on soil properties,

Lime- Fly-ash stabilization,

Unit III: In-situ densification by Vibratory Compaction in Sands **(6 Hrs.)**

Vibro-compaction-Explosion in sands, Vibratory Probes, Vibro-displacement compaction-Displacement piles, sand compaction piles (Vibro compaction piles), Vibroflotation, Impact compaction of sands, Comparison of in-situ densification methods in sands, advantages and disadvantages.

Unit IV: Ground Improvement Techniques for Soft Clay Deposits **(6 Hrs.)**

Accelerated pre-consolidation of soil- Principle, preloading methods, Types of drains and their installation, Design of drains, Methodology, Construction requirements, monitoring of compression, instrumentation, Applications, Consolidation by Electro-osmosis. Deep mixing Stabilization of soft soil – Lime and cement columns, Method of construction, Bearing capacity of lime columns, Bearing capacity of lime column group, Application of lime column method.

Stone column- Vibro replacement process using Vibroflot, Rammed stone column process, Bearing

capacity of stone column, Design of stone columns, Applications

Unit V: Grouting **(6 Hrs.)**

Applications, Types of grouts and their suitability, Desirable characteristics of grouts, Groutability, Grouting methods – Permeation grouting, soil facture grouting, Compaction grouting, Jet grouting, their applications, Grouting Technology- single stage grouting, Descending and Ascending stage grouting, Sleeved Pipe Grouting, Grout plant and equipment, Grouting procedure- Pre-grouting site investigation, Grout hole pattern, Grouting arrangement, Grout injection measurements and monitoring.

Unit VI: Reinforced Soil **(6 Hrs.)**

Mechanism, Types of reinforcing elements, Reinforcement-soil interaction, Reinforced soil foundation bed, failure of reinforced soil bed (BinQuet & Lee theory), Rock Reinforcement, rock anchoring

Total: 36 Hours

Textbooks:

1. Geotechnical Engineering by Gulhati S. K., and Datta M., Tata McGraw Hill Publishing Company Ltd. 2005
2. Ground Improvement Techniques by P Purushothams Raj, University Science Press, 2011.

Reference Books:

1. Soil Mechanics and Foundation Engineering by Arora K. R., Standard Publishers and Distributors, New Delhi
2. Basic and Applied Soil Mechanics by Ranjan G. and Rao A. V. S.,New Age International Publishers
3. Geotechnical Engineering by Venkatramaiah C., New Age International (P) Ltd., Publishers, New Delhi
4. Textbook of Soil Mechanics and Foundation Engineering by Murthy V. N. S., CBS Publishers & Distributors Pvt. Ltd. India

MOOC Links:

1. nptel.ac.in/courses/105108075
2. nptel.ac.in/courses/105105210

Approved in 04th Academic Council Meeting
Dated:- 30.03.2026

Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	PE-III Lab (Ground Improvement Techniques Lab)			Code:	BTCEPE14CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To enable students to identify type of ground improvement technique and its applications.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Classify soils through sieve analysis per IS standards and interpret gradation curves.	L3
CO-2	Establish Atterberg limits to evaluate soil plasticity and consistency behaviour.	L4
CO-3	Examine shear stress–strain relationships to derive fundamental shear strength parameters.	L4
CO-4	Assess the Unconfined Compressive Strength (UCS) of soil–cement mixtures to quantify stabilization gains.	L5
CO-5	Measure the strength parameters of soil reinforced with geotextiles/geogrids and benchmark against unreinforced samples.	L4
CO-6	Determine California Bearing Ratio (CBR) values for soil-cement blends to evaluate their suitability for pavement design.	L5

General Guidelines: Minimum 08 experiments are to be conducted covering the entire syllabus.

Experiments List

(Experiment no. 1 & 2 are compulsory and perform any six from experiment no. 3 to 9)

1. Classify soil using sieve analysis (IS code method).
2. Determination of Atterberg's Limits.
3. Determination of CBR value.
4. Determination of shear strength parameters using direct shear test.
5. Determination of UCS strength of soil cement sample.
6. Determination of effect of Lime on Atterberg's limits of soil.
7. Determination of UCS of soil lime sample.
8. Determination of shear strength parameters of soil using geotextile/geogrid.
9. Determination of CBR value of soil cement sample.

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Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	PE-III (Structural Analysis by Matrix Methods)			Code:			BTCEPE15CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: To make students acquainted with matrix methods of analysis of structures.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Explain the structural behavior of trusses using the flexibility method.	L2
CO-2	Apply the flexibility method to analyze beams.	L2
CO-3	Analyze trusses using the member approach of the stiffness matrix method.	L4
CO-4	Analyze beams by developing transformation and global stiffness matrices using the stiffness method.	L4
CO-5	Evaluate rigid jointed frames using member approach of the stiffness matrix method.	L6
CO-6	Evaluate grid using structure approach of the stiffness matrix method.	L6

Unit I: Analysis of Trusses by Flexibility Method **(6 Hrs.)**

Review of degree of static indeterminacy for trusses, basic concept of flexibility, flexibility coefficients, selection of redundant, generation of flexibility matrix, analysis of trusses involving two unknowns only.

Unit II: Analysis of continuous Beams by Flexibility Method **(6 Hrs.)**

Review of degree of static indeterminacy for continuous beams, analysis of continuous beams involving not more than two unknowns.

Unit III: Analysis of Plane Trusses by Stiffness Method **(6 Hrs.)**

Review of degrees of freedom of trusses; concepts of stiffness and stiffness coefficients; local and global coordinate systems; formulation of member stiffness matrices for truss members; analysis of trusses using the member approach with not more than three unknowns.

Unit IV: Analysis of continuous Beams by Stiffness Method **(6 Hrs.)**

Review of degrees of freedom for continuous beam, analysis of continuous beams by member approach up to maximum three unknown.

Unit V: Analysis of Rigid Jointed Frame by Stiffness Method **(6 Hrs.)**

Review of degrees of freedom for rigid jointed frames, analysis of frame by member approach up to maximum three unknown.

Unit VI: Analysis of Grid by Stiffness Method **(6 Hrs.)**

Review of degrees of freedom for grid member, stiffness matrix method using structure approach for analysis of orthogonal grid structure, problems involving not more than three unknowns by structure approach.

Total: 36 Hours

Approved in 84th Academic Council Meeting
Dated:- 30.03.2026

Textbooks:

1. Structural Analysis - A Matrix Approach by Pandit G S and Gupta S P, Tata McGraw Hill
2. Matrix Methods of Structural Analysis by Meghre and Deshmukh, Charotar Publishing House, Anand.

Reference Books:

1. Matrix Analysis of Framed Structures by Weaver W and Gere G M, CBS Publisher, Delhi.
2. Matrix methods of structural analysis by C. K. Wang, International Textbook Co; 2nd edition.
3. Advanced Structural Analysis by Devdas Menon, Narosa Publication.
4. Matrix Methods of Structural Analysis: Theory and Problems by C. Natarajan and P. Revathi, Prentice Hall India Learning Private Limited
5. Matrix Methods of Structural Analysis by Bhavikatti S S, I K international Publishing house

Approved in....04th.....
Academic Council Meeting
Dated:-...30.03.2026.....

Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	PE-III Lab (Structural Analysis by Matrix Methods Lab)			Code:	BTCEPE16CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To make students acquainted with the structural analysis softwares.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Analyze portal frame using flexibility method.	L4
CO-2	Analyze beam member using stiffness method.	L4
CO-3	Analyze beam member using flexibility method.	L4
CO-4	Analyze portal frame using stiffness method.	L4
CO-5	Analyze grid using stiffness method.	L4
CO-6	Analyze truss using stiffness method.	L4

General Guidelines: Minimum 04 experiments are to be conducted covering the entire syllabus.

Experiments List

1. Analysis of portal frame using flexibility method and compare the analytical results with the solution of structural analysis software/ computer program/ excel program.
2. Analysis of beam member using stiffness method and compare the analytical results with the solution of structural analysis software/ computer program/ excel program.
3. Analysis of beam member using flexibility method and compare the analytical results with the solution of structural analysis software/ computer program/ excel program.
4. Analysis of portal frame using stiffness method and compare the analytical results with the solution of structural analysis software/ computer program/ excel program.
5. Analysis of grid using stiffness method and compare the analytical results with the solution of structural analysis software/ computer program/ excel program.
6. Analysis of truss using stiffness method and compare the analytical results with the solution of structural analysis software/ computer program/ excel program.

Approved in 04th Academic Council Meeting
Dated:- 30.03.2026

Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	PE-III (Geographic Information System (GIS) & Photogrammetry)			Code:			BTCEPE17CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credits	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: To provide students with fundamental knowledge and practical skills in GIS, photogrammetry, and digital elevation modelling for effective spatial data acquisition, processing, analysis, and interpretation.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Understand the basic concepts of GIS, its components, and different spatial data models.	L2
CO-2	Apply pre-processing techniques, spatial interpolation, and GIS analysis methods to spatial datasets.	L3
CO-3	Analyze DEMs and terrain parameters to interpret surface characteristics and evaluate data quality.	L4
CO-4	Understand the fundamentals, history, and types of aerial photographs used in photogrammetry.	L2
CO-5	Apply photogrammetric principles for interpretation of aerial photographs and comparison with maps.	L3
CO-6	Analyze flight planning parameters, image scale, and relief displacement in vertical aerial photographs.	L4

Unit I: Basics of GIS and Spatial Data **(6 Hrs.)**

Introduction to GIS and its components, Vector, raster, and TIN data models, Attribute data and data compression, Georeferencing and basic data pre-processing.

Unit II: Spatial Data Processing and GIS Analysis **(6 Hrs.)**

Advanced pre-processing of spatial data, Spatial interpolation methods, Basic and advanced GIS analysis techniques, Spatial databases, map projections.

Unit III: Digital Elevation Models and Terrain Analysis **(6 Hrs.)**

Introduction to DEMs and methods of DEM generation, DEM quality, derivatives, and terrain modelling, Applications of DEMs, Errors in GIS, map elements, and limitations of GIS.

Unit IV: Introduction to Photogrammetry **(6 Hrs.)**

Basic definition, Introduction to photogrammetry and its purpose, Historical developments in photogrammetry, Types of aerial photographs and their characteristics.

Unit V: Applications and Comparative Concepts **(6 Hrs.)**

Major applications of photogrammetry in mapping, surveying, and planning, Advantages and disadvantages of photogrammetry, Comparison of aerial photographs with conventional maps.

Unit VI: Flight Planning and Image Geometry **(6 Hrs.)**

Flight planning considerations for aerial photography, Important technical terms used in aerial photogrammetry, Scale of a vertical aerial photograph and factors affecting scale, Relief displacement in vertical photographs and its significance.

Total: 36 Hours

Approved in 06th Academic Council Meeting

Dated:- 30.03.2026

Textbooks:

1. Higher Surveying, Volumes II and III by B. C. Punmia, A. K. Jain, and A. K. Jain, published by Laxmi Publications, New Delhi.
2. Arora, K.R., Surveying, Vol II and III, Standard Book House, 2015.
3. Basics of Remote Sensing and GIS by S. Kumar, Laxmi Publications.

Reference Books:

1. Surveying and Geomatics by P. K. Garg, Khanna Publishers, New Delhi, ISBN 978-9382609675.
2. Advanced Surveying by R. Madhu and A. Gopi, published by Pearson India, ISBN 978-9332517017.

MOOC Links:

1. https://nptel.ac.in/courses/105107206
2. https://nptel.ac.in/courses/105107218

Approved in 04th Academic Council Meeting
Dated:- 30.03.2026

Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	PE-III Lab (Geographic Information System(GIS) & Photogrammetry Lab)			Code:	BTCEPE18CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To build practical skills in GIS software for spatial data creation, analysis, image processing, and automated geoprocessing.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Describe GIS software and georeferencing methods.	L2
CO-2	Create and edit spatial data using digitizing tools.	L3
CO-3	Analyze vector, raster, terrain, hydrology, and network data.	L4
CO-4	Apply supervised and unsupervised image classification.	L3
CO-5	Prepare professional map layouts.	L6
CO-6	Develop automated workflows using Model Builder.	L6

General Guidelines: Minimum 08 experiments are to be conducted covering the entire syllabus.

Experiments List

(Experiment no. 1 & 2 are compulsory and perform any six from experiment no. 3 to 12)

1. To introduce and familiarize students with GIS software.
2. To georeference and rectify aerial imagery and topographical sheets.
3. To digitize and edit spatial data in a GIS environment.
4. To perform querying and retrieval of spatial and attribute data.
5. To carry out vector data analysis using GIS tools.
6. To perform raster data analysis in GIS.
7. To conduct terrain analysis using Digital Elevation Models (DEM).
8. To design and prepare map layouts using GIS software.
9. To analyze surface hydrology using spatial data.
10. To perform network analysis using GIS techniques.
11. To carry out supervised and unsupervised image classification.
12. To develop and execute spatial models using Model Builder.

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Dated:- 30.03.2026

Program:	B. Tech. (Civil Engineering)			Semester:			VI	
Course:	PE-III (Industrial Wastewater Treatment)			Code:			BTCEPE19CE6T	
Teaching Scheme				Evaluation Scheme				
Lecture	Tutorial	Hours	Credit	TA	MSE-I	MSE-II	ESE	Total
3	-	3	3	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz & Class Attendance

Course Objectives: To equip students with knowledge and skills to analyse and solve complex problems related to the industrial wastewater.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Identify the Sources and characteristics of industrial wastewater & effect on environment.	L-4
CO-2	Process of Collection, Preservation and Characterization of industrial wastewater.	L-4
CO-3	Design treatment process of textile wastewater.	L-3
CO-4	Analysis and design treatment of Dairy & Slaughterhouse wastewater.	L-2
CO-5	Analysis and design treatment of Tannery & Sugar Mill Wastewater.	L-3
CO-6	Analysis and design treatment of Fertilizer, Pesticides waste & Radioactive wastes.	L-2

Unit I: Industrial wastewater: An Overview **(6 Hrs.)**

Water usage in industry, Sources and characteristics of industrial wastewater & effect on environment, Management- volume reduction, neutralization, equalization and proportioning.

Unit II: Flow Measurement **(6 Hrs.)**

Measurement of Flow, Collection, Preservation and Characterization of Samples Collection of Samples, Preservation of Samples, Characterization of Samples, Introduction to unit operations and unit Process.

Unit III: Textile Waste **(6 Hrs.)**

Cotton textile waste: Raw Material, manufacturing process, dyeing & printing, reuse & recycle, good housekeeping practices, characteristics and treatment of raw wastewater.

Wollen mill waste: Method of treatment of wool scouring waste, biological treatment.

Unit IV: Dairy & Slaughterhouse wastewater **(6 Hrs.)**

Operation in dairy waste, sources of dairy wastewater, treatment of dairy wastewater.

Slaughterhouse: Operations carried out in slaughterhouse, Characteristics of slaughterhouse wastewater, treatment of slaughterhouse wastewater.

Unit V: Tannery & Sugar Mill Wastewater **(6 Hrs.)**

Manufacturing process, disposal of wastewater, characteristics of tannery wastewater, treatment of tannery wastewater.

Sugar Mill wastewater: production from sugarcane, characteristics of wastewater, disposal of wastewater, treatment of wastewater.

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Unit VI: Fertilizer, Pesticides waste & Radioactive wastes **(6 Hrs.)**

Fertilizer: General manufacturing process for ammonia synthesis, urea synthesis, phosphoric sulphate, diammonium phosphate, sources of wastewater, disposal of wastewater, method of treatment, Pesticide Industry: manufacturing process, methods of treatment.

Radioactive wastes: Handling radioactive material, treatment and management of radioactive waste.

Total: 36 Hrs

Textbooks:

1. Industrial Wastewater Treatment by A. D. Patwardhan, Prentice-Hall of India Private Ltd., New Delhi
2. Industrial Wastewater Treatment by Prof Alok Sinha, Prof S K Gupta, IIT Kanpur.
3. Wastewater Treatment by M. Narayana Rao & Amal K. Datta, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi

Reference Books:

1. Advanced Technologies of Water and Wastewater Treatment by Athanasia K. Tolkou and George Z. Kyzas, Academic open access publishing
2. Industrial Wastewater Treatment by NG Wun Jern, Imperial College Press

MOOC Links:

1. https://nptel.ac.in/courses/105105350

Approved in.....04th.....
Academic Council Meeting
Dated:-.....30.03.2026.....

Program:	B. Tech. (Civil Engineering)			Semester:	VI	
Course:	PE-III Lab (Industrial Wastewater Treatment Lab)			Code:	BTCEPE20CE6P	
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Hours	Credit	INT	EXT	Total
2	-	2	1	30	20	50

Course Objectives: To enable students to experimentally identify various characteristics of Industrial wastewater.

Course Outcomes: After completion of the course, the students will be able to

CO	Course Outcomes	BT Level
CO-1	Identify the quantity and characteristics of industrial wastewater.	L2
CO-2	Understand the manufacturing process of sugar and able to identify the characteristics of wastewater generated during sugar manufacturing.	L5
CO-3	Identify alkalinity and acidity of a given industrial wastewater sample.	L2
CO-4	Understand how to compute Sludge Volume Index (SVI) of biological sludge.	L6
CO-5	Identify suspended, settleable, volatile & fixed solids of a given industrial wastewater sample.	L4
CO-6	Understand Manufacturing process and treatment process involves in tanning and paper pulp industry.	L2

General Guidelines: Minimum 08 experiments are to be conducted covering the entire syllabus.

Experiments List

(Experiment no. 1 & 2 are compulsory and perform any six from experiment no. 3 to 10)

1. Visit to Dairy/Textile/fertilizer/Pesticide industry and write a detail report including quantity of wastewater generated, characteristics of wastewater, treatment process, etc. with necessary drawing and photographs.
2. Draw a flow diagram for the sugar manufacturing process, showing the wastewater generated at each operation.
3. To determine the alkalinity and acidity of a given industrial wastewater sample.
4. To determine the Biochemical Oxygen Demand (B.O.D.) for the Industrial wastewater sample.
5. To determine the Chemical Oxygen Demand (C.O.D.) for the Industrial wastewater sample.
6. To determine Sludge Volume Index (SVI) of biological sludge.
7. To determine suspended, settleable, volatile & fixed solids of industrial wastewater.
8. To determine Phosphates and Sulphates of industrial wastewater.
9. Draw the flow diagram of a vegetable tanning process.
10. Draw the flow diagram for treatment of waste of a typical paper pulp mill.

Approved in...04th... Academic Council Meeting
Dated:-...30.03.2026...