

Department of Civil Engineering
III Semester – (II Year)

Code		Category	Course Title	Hours/Week			Total	Credits	Marks		
Department	University			L	T	P			CIE	SEE	Total
CE2301C	7-1-3-01R25	MA-BS	Complex Analysis & Partial Differential Equations	3	0	0	3	3	40	60	100
CE2302C	7-2-3-02R25	CE-PC	Strength of Materials	3	0	0	3	3	40	60	100
CE2303C	7-2-3-03R25	CE-PC	Fluid Mechanics and Hydraulic Machines	3	0	0	3	3	40	60	100
CE2304C	7-2-3-04R25	CE-BS	Engineering Geology	3	0	0	3	3	40	60	100
CE2305L	7-2-3-R25P1	CE-PC	Computer Aided Building Drawing	1	0	3	4	2.5	40	60	100
CE2306L	7-2-3-R25P2	CE-PC	Materials Testing Laboratory	0	0	2	2	1	40	60	100
CE2307L	7-2-3-R25P3	CE-PC	Fluid Mechanics Laboratory	0	0	3	3	1.5	40	60	100
CE2308L	7-2-3-R25P4	CE-BS	Engineering Geology Laboratory	0	0	2	2	1	40	60	100
CE2309C	7-2-3-R25S1	CE-SC	Design Thinking & Innovation	1	0	2	3	2	40	60	100
CE2310C	7-0-3-01R25	MG-HS	Managerial Economics and Financial Accountancy	3	0	0	3	3	40	60	100
				17	0	12	29	23	400	600	1000

All interested students are advised to **register for Minors degree or Honours degree** at the end of this semester by submitting filled in registration form available from the Head of the Department /Chair person, Board of Studies (UG) of the parent department.


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COMPLEX ANALYSIS AND PARTIAL DIFFERENTIAL EQUATIONS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	3-0-0	7-1-3-01R25	CH, CE, ME,

Course Objectives:

1. This course aims at providing the student to acquire the knowledge on the calculus of Functions of complex variables.
2. To understand power series and expansion of analytic function, poles, singular points, Residue Theorem and its applications.
3. To familiarize the students with the techniques of Fourier series and evaluating improper integrals.
4. The aim is to analyze the solutions of partial differential equations.
5. To discuss the boundary value problems, one dimensional wave equation, heat equation And Laplace Equation.

UNIT - I

Complex analysis - I: Analytical functions - Cauchy-Reimann equations – Construction of Analytic functions- Complex integration - Cauchy's theorem - Integral formula - Evaluation of integrals.

UNIT - II

Complex analysis - II: Sequences, series, convergence tests, Taylor's and Laurents' series- Singularities - Poles - Residues - Residue theorem – Contour integration- Evaluation of real integrals

UNIT – III

Fourier series: Fourier series-even and odd functions, periodic functions-half range sine and cosine Series- Gamma and Beta functions

UNIT - IV

Partial differential equations: Formation of differential equations - Classification - First order linear partial differential equations – Lagranges' linear equation - Method of multipliers - first order non-linear partial differential equations by Charpit's method.

UNIT- V

Partial differential equations - II: Method of separation of variables - One dimensional wave equation - Heat equation – Laplace's equation.


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Text Books:

1. Grewal B S, Higher Engineering Mathematics, 42th Edition, Khanna Publications, 2007.
2. Venkataraman M K, Engineering Mathematics, National Publishing Company, 1995.
3. Kreyszig E, Advanced Engineering Mathematics, 8th edition, Wiley, 1998.
4. Mathematics-III by T.K.V.Iyenger, B. Krishna Gandhi et al, S. Chand & Company Ltd
5. Mathematical Methods by T.K.V.Iyenger, B. Krishna Gandhi et al, S. Chand & Company Ltd

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

1. After the completion of course, students will be able to understand the analyticity of complex functions and apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
2. Compute the residue of a function and use the Residue Theory to evaluate a contour integral
Or an integral over the real line.
3. Find the Fourier Series to represent function as a series of constants sine and cosine Functions of different intervals and evaluate certain improper integrals to make them Simple with introduction of Gamma and Beta functions.
4. Formulation/solve/classify the solutions of Partial differential equations, Identify linear and Nonlinear PDE by different methods.
5. Apply Variables separable methods to solve boundary value problems and find the solution of one-dimensional wave equation, heat equation and Laplace equation.

Mapping of Course Outcomes with Program Outcomes:														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2
CO1	3	3	3	3	2	1	1	1	1	2	1	3	1	3
CO2	3	3	3	3	1	2	2	1	1	2	1	3	1	3
CO3	3	2	2	3	2	1	2	1	1	2	1	3	1	3
CO4	3	2	2	3	2	1	1	1	1	2	1	3	1	3
CO5	3	3	3	2	2	1	1	1	1	2	1	3	1	3

1 – Slightly; 2 - Moderately; 3 – Substantially


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STRENGTH OF MATERIALS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	3-0-0	7-2-3-02R25	CE

Pre-Requisites: Engineering Mechanics.**Course Educational Objective (CEOs):**

1. To impart concepts of shear force and bending moment on various types of beams and loading conditions
2. To impart concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections.
3. To analyze and design structural members (like columns, chimneys, and dams) subjected to eccentric loads.
4. To understand the behavior, failure mechanisms, and design principles of structural members subjected to compressive axial loads.
5. To classify cylinders based on their thickness and to obtain stresses across the cross section when subjected to internal and external pressure.

UNIT I

SHEAR FORCE AND BENDING MOMENT: Definition of beam - Types of beams - Concept of shear force and bending moment - S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load, uniformly varying load and combination of these loads - Point of contraflexure - Relation between S.F, B.M and rate of loading at a section of a beam.

UNIT II

FLEXURAL STRESSES AND SHEAR STRESSES: Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending Equation: $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular (Solid and Hollow), I, T and Channel sections – Design of simple beams. Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, I, T-sections.

UNIT III

COMBINED DIRECT AND BENDING STRESSES: Stresses under the combined action of direct loading and B.M - Core of a section – Circular and rectangular (solid and hollow) - Determination of stresses in the case of chimneys, retaining walls and dams.


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UNIT IV**COLUMNS AND STRUTS:**

Introduction – classification of columns – Axially loaded compression members – Euler's crippling load theory – derivation of Euler's critical load for various end conditions – Equivalent length – Slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Eccentric loading and Secant formula – Prof. Perry's formula.

UNIT V**CYLINDERS:**

Thin cylinders subjected to internal fluid pressure - Thick cylinders under internal and external pressure - Compound cylinders.

TEXT BOOKS:

1. Mechanics of Structures Vol.I&Vol.II by S.B.Junnarkar.
2. Analysis of Structures by Vazirani & Ratwani.
3. Strength of Materials by R. Subramanian, Oxford University Press
4. Mechanics of Materials by Dr. B.C Punmia, Dr. Ashok Kumar Jain and Dr. Arun Kumar Jain.

REFERENCES:

1. Mechanics of Solids by Egor. P. Popov.
2. Strength of Materials by Andrew Pytal and Ferdinand L.Singer (Longman).
3. Mechanics of Material by R.C. Hibbeler, Prentice Hall publications
4. Strength of Materials Vol.I&Vol.II by Timoshenko.
5. Mechanics of Material by R.C. Hibbeler, Prentice Hall Publications.

Course Outcomes (COs):

After completion of the course the student will be able to:

1. Draw the shear force and bending moment diagrams for various beams subjected to different load cases.
2. Compute the flexural and shear stresses for different load cases and different cross-sections.
3. Analyze dams, chimneys, and retaining walls and check the stability against failure.
4. Analyze and design slender compressive members by predicting their critical buckling load and identifying appropriate safety formulas.
5. Analyze pressure vessels and design pipelines.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO(1)	PSO(2)
CO1	3	2	2		2	1	1		1	2	1	1	3	2
CO2	3	3	1	2	1	1			1	2	1	1	3	2
CO3	3		2		2		2		1				3	2
CO4	3		2		2			2			1		3	2
CO5	3	3			2		1	2			1		3	2

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FLUID MECHANICS AND HYDRAULIC MACHINES**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	3-0-0	7-2-3-03R25	CE

Course Objectives:

1. To understand the significance of fluid properties
2. To apply the knowledge of fluid flow concepts and fundamental equations.
3. To solve the problems related to impacts of jets and flow measurements.
4. To apply the knowledge of laminar and turbulent flows.
5. To design the characteristics of turbines and pumps.

UNIT – I**FLUID PROPERTIES**

Definition of a fluid – Density, Specific weight, Specific volume, Specific gravity – Viscosity – Bulk modulus of elasticity – Vapour pressure – Surface tension and capillarity- Pressure at a point – Absolute and gauge pressures

FLUID STATICS

Pascal's law – Pressure measurement – Manometers- Mechanical gauges – Hydrostatic pressure and force: horizontal, vertical and inclined planes, Curved surfaces.

UNIT – II**FLUID FLOW CONCEPTS**

Flow characteristics – Velocity – Acceleration – Types of flow – Streamlines, Path lines, Streak lines – Stream function, Velocity potential, flow-net – Circulation and Vorticity.

FUNDAMENTAL EQUATIONS

Continuity equation – Energy Equation - Euler's equation of motion along a streamline – Bernoulli's equation – Applications of Bernoulli's Equation – Free jets and vortex flows.

UNIT III**IMPACTS OF JETS**

Linear momentum equation - Impacts of jets on free and fixed moving vanes – Moment of momentum equation.

FLOW MEASUREMENT

Velocity measurement – Pitot tubes – Flow measurements: Flow through pipes- Venturi meter, Orifice meter - Flow through Channels: Weir and notches – Flow through tanks: Orifice and Mouth pieces.


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UNIT IV**LAMINAR FLOW**

Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.

TURBULENT FLOW

Reynolds experiment, Transition from laminar to turbulent flow, Definition of turbulence, scale and intensity, Causes of turbulence, Turbulent flow in pipes. Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes,

UNIT V**HYDRAULIC TURBINES**

Classifications of turbines – Pelton Wheel, Francis Turbine and Kaplan Turbine velocity triangles at inlet and outlet – work done and efficiency– Draft Tube theory- Specific Speed – Characteristic curves.

CENTRIFUGAL PUMPS

Components – Working – Types – Work done – Heads – Losses and Efficiencies – Specific Speed – Multi Stage Pumps – Performance Characteristic Curves – Net positive Suction Head (NPSH).

Course Outcomes:

After completion of the course the student will be

1. Able to solve fluid flow problems using fundamental principles
2. Able to apply the knowledge of fluid flow concepts and fundamental equations for solving problems
3. Able to measure pressure, velocity and discharge, and apply the knowledge of impacts of jets.
4. Able to analyze the flow problems in laminar and turbulent flow conditions.
5. Able to analyze the characteristics of turbines and pumps.

Text Books

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N. Modi and S.M. Seth – twenty third edition 2022, Standard Book House, New Delhi.
2. Fluid Mechanics and Hydraulic Machines by R.K.Rajput – Sixth edition 2016, Publication, S.Chand& Company Ltd., New Delhi.
3. Fluid Mechanics and Hydraulic Machines by R.K.Bansal -Revised Ninth edition 2010, Laxmi Publications (P) Ltd., New Delhi.



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Reference Books

1. Fluid Mechanics by Victor L. Streeter and E. Benjamin Wylie, Keith W. Bedford – Edition 2010, Tata Mc Graw Hill Education Private Limited, New Delhi.
2. Fluid Mechanics and Turbo machines by Madan Mohan Das. – First Edition 2009, PHI Learning Pvt.Ltd., New Delhi.

PO/ CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO(1)	PSO(2)
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	2
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)


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ENGINEERING GEOLOGY**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	3-0-0	7-2-3-04R25	CE

1. To acquire the knowledge on various geological aspects
2. To understand the characteristics of minerals and suitability of rocks
3. To analyse the effects of geological structures in the construction area
4. To apply the knowledge of geological information for the construction of dams, reervoirs, tunnels, roads, bridges and other major civil engineering works.

UNIT - I:

Introduction of Geology and various branches of Geology - Importance of geology from Civil Engineering point of view - Application of geology and its role in Civil engineering operations-Weathering of earth material, Types of weathering, Agents of weathering, Effects of weathering - Origin, types and occurrence of soils.

UNIT - II:

Mineralogy: Different methods of study of minerals - Advantages of study of minerals by physical properties – minerals in the manufacture of construction materials - Quartz group- Feldspar group – Amphibole group – Mica Group – Calcite - Chlorite - Kyanite - Garnet- Talc – Clay minerals - Hematite, Magnetite, Pyrite - Bauxite Galena, Pyrolusite, Graphite, Magnesite.

UNIT - III:

Petrology: Internal structure of earth - Rock cycle – Geological classification of rocks into igneous, Sedimentary and metamorphic rocks -Common structures and textures of igneous. Sedimentary and metamorphic rocks.Study of important rocks :Granite, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

UNIT - IV:

Structural Geology: Out crop, strike and dip of rocks – Classification and types of geological structures associating with the rocks such as folds, faults, joints and unconformities. Role of Folds, faults, joints and unconformities in civil engineering works - Classification of geophysical methods - role of geophysical methods in Civil engineering works -Ground water exploration using geophysical studies.


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UNIT - IV:

Earth quakes, causes and effects, Seismic zones of India, Intensity scale and magnitude scale, Precautions and mitigation measures - Landslides, Causes and effects, Precautions and mitigation measures - Geological Considerations in the selection of a dam site, Analysis of failures of dams - Factors Contributing to the success of a reservoir -Tunnels, geological considerations in the selection of atunnels ,Effects of Tunnelling - Analysis of failures of Tunnels.

TEXT BOOKS:

1. Engineering Geology by N. Chennkesavulu,
2. Engineering and general geology by Parbinsingh
3. Principals of Engineering Geology by K.V.G.K Gokhale
4. Engineering Geology for Civil Engineering, P.C. Varghese

REFERENCES:

1. Engineering Geology by SubinoyGangopadhyay,
2. Principles of Engineering Geology, by S.K.Garg.
3. Principles of Engineering Geology &Geotechnics by Krynine& Judd,
4. Fundamental of Engineering Geology by F.G. Bell,
5. Geology for Engineers by Blyth & de freitaus
6. Fundamental of Engineering Geology by F.H.Bell

Course Outcomes (COs):

After completion of the course the student will have:

1. To apply the geological knowledge to Civil Engineering Constructions, at different stages.
The kind of study exposes the geological draw backs, if any.
2. To help the site engineers to take suitable precautionary measures to overcome the drawbacks but also to take advantage of the site geology findings wherever possible.
3. To take precautionary measures in civil engineering constructions based on geological parameters.
4. Explain geological processes such as weathering, erosion, and geological action of rivers, wind, glaciers, and oceans.
5. To assess the causes and preventive measures of geological hazards like earthquakes, landslides, and volcanoes.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	3	3	-	-	-	-	-	3	1
CO2	3	3	2	1	1	3	3	-	-	-	-	-	3	1
CO3	3	3	2	1	1	3	3	-	-	-	-	-	3	1
CO4	3	3	2	2	2	-	-	-	-	-	-	-	-	1
CO5	3	3	3	2	2	2	2	-	-	-	-	-	-	1

1: Slight(Low)2: Moderate (Medium)3: Substantial (High)


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COMPUTER AIDED BUILDING DRAWING**Credits: 2.5****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	1-0-3	7-2-3-R25P1	CE

Course Educational Objective (CEOs)

1. Understand the fundamentals of computer-aided drafting using CAD software.
2. Prepare 2D building drawings as per standard building codes and conventions.
3. Develop detailed plans, elevations, and sections of residential buildings.
4. Apply CAD tools for accurate dimensioning, layering, and annotation.
- 5 Interpret architectural drawings for real-world construction applications.

UNIT- I**INTRODUCTION:**

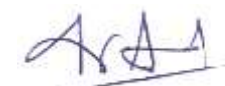
Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, coordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT-II**SYMBOLS AND SIGN CONVENTIONS:**

Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

UNIT-III**MASONRY BONDS:**

English Bond and Flemish Bond – Corner wall and Cross walls – One brick wall and one and half brick wall



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UNIT- IV**BUILDING COMPONENTS:**

Terms, Doors, Windows, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan.

UNIT- V**TYPICAL BUILDING DRAWINGS:**

A Building, An Office building, A Dwelling, A Residential House, Plan of a Secondary School, Bank, Primary Health Centre, Duplex House.

Text book:

Building Planning and Drawing – Dr. N. Kumaraswamy and A. Kameshwara Rao – CHARATOR PUBLISHING HOUSE.

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1: Understand and apply basic CAD commands for drafting.

CO2: Create 2D building plans using standard drafting practices.

CO3: Develop elevations and sectional views of residential buildings.

CO4: Apply dimensioning, text styles, layers, and plotting techniques.

CO5: Prepare complete working drawings for simple residential buildings.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	2	2	-	3	3	-	-	-	-	-	-	-		2	3
CO2	2	2	-	3	3	-	-	-	-	-	-	-		2	3
CO3	2	2	-	3	3	-	-	-	-	-	-	-		2	3
CO4	2	2	-	3	3	-	-	-	-	-	-	-		2	3
CO5	2	2	-	3	3	-	-	-	-	-	-	-		2	3

1 - Slightly; 2 - Moderately; 3 – Substantially


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MATERIAL TESTING LABORATORY**Credits: 1****Assessment: 40 + 60**

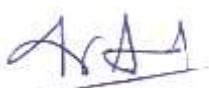
Semester	L-T-P	Course Code	Branches
III	0-0-2	7-2-3-R25P2	CE

Course Educational Objective (CEOs):

1. To make student understand the fundamental modes of loading of the structures
2. To train student in methods for determining mechanical properties of materials.

LIST OF EXPERIMENTS

1. Tension and Torsion Test on Mild Steel bar and HYSD bar
2. (a) Deflection Test on Simply Supported Beam
(b) Charpy Impact Test
3. (a) Deflection Test on Fixed Beam
(b) Izod Impact Test
4. (a) Compression Test on Wood
(b) Shear Test on Wood
5. (a) Test on Closed coil Helical Spring
(b) Bending Test on Carriage Spring
6. (a) Deflection Test on beam under Uniform Bending
(b) Bending Test on R.S. Joist
7. Sieve Analysis of coarse and fine aggregates
8. Bulking of Sand by Volume and Weight methods
9. Normal consistency, Initial and Final Setting Times of Cement
10. Tests on concrete
 - a) Slump Test
 - b) Compressive Strength of Concrete Cubes
 - c) Compaction Factor Test
 - d) Compressive Strength of Concrete Cylinders
11. (a) Specific gravity & Water absorption of Coarse aggregate
(b) Specific gravity of Cement
12. Water absorption and Compressive Strength of Bricks



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Course Outcomes (COs):

After completion of the course the student will be able to

1. Determine the properties of different building construction materials.
2. Analyse the behaviour of different construction materials.

PO/CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	1	2	1	1		1		1	1	1	2	
CO2	2	2	1					1	1	1	1	1

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FLUID MECHANICS LABORATORY**Credits: 1.5****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	0-0-3	7-2-3-R25P3	CE

Course Educational Objective (CEOs)

1. To determine the coefficient of discharge in flow measuring devices.
2. To determine the coefficients of different losses in pipe flow.
3. To draw the performance characteristic curves of pumps.

FLOW MEASUREMENT

1. Calibration of Small Orifice
2. Calibration of Venturi meter
3. Calibration of Orifice meter
4. Calibration of Bend meter
5. Calibration of Triangular Notch

HEAD LOSSES IN PIPES

6. Determination of Friction factor of the pipe material
7. Determination of Head loss coefficient due to Gate Valve in a pipe line
8. Determination of Head Loss coefficient due to Bend in a pipe line

HYDRAULIC MACHINES

9. Characteristic curves of 0.8 kW two stage centrifugal pump
10. Characteristic curves of variable speed centrifugal pump

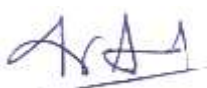
Course Outcomes (COs)

After completion of the course the student will be:

1. Able to calibrate the flow measuring devices.
2. Able to calculate loss coefficients for use in the pipe flow analysis.
3. Able to prepare the characteristic curves of the pumps.

PO&PSO / CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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ENGINEERING GEOLOGY LABORATORY**Credits: 1****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	0-0-2	7-2-3-R25P4	CE

Course Educational Objective (CEOs)

1. To identify and characterize intact rock/rock mass properties
2. To analyse suitability of rocks for construction purpose
3. To apply geological information (cross sections, maps and reports) in the design and construction process.
4. To report the role of minerals and rocks in failures of civil engineering works

List of Experiments

1. Megascopic identification of rock forming minerals and study of their physical and chemical properties.
2. Megascopic identification of rocks and study of their physical and chemical properties of rocks
3. Use of clinometers compass and Burton compass for measurement of dip and strike of formations.
4. Structural geology problems:
 - a) Problems on True thickness of rock layers
 - b) Problems on Vertical thickness of rock layers
 - c) Bore hole problems
5. Preparation of geological cross sections and study of geological maps.
6. Study of models of geological structures and out crops patterns of different types of rocks and land forms

Course Outcomes (COs)

After completion of the course the student will:

1. The study and identification of minerals, rocks and structures with their utilization in civil engineering works.

CO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	3	3	-	-	-	-	-	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)


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DESIGN THINKING & INNOVATION**Credits: 2****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	1-0-2	7-2-3-R25S1	CE

Course Educational Objective (CEOs)

1. To enable students to develop a foundational understanding of design by exploring the elements and principles of design, cultivating design thinking through its history and applications
2. To equip students with the ability to apply the design thinking process in driving inventions and social innovations
3. To develop students' ability to understand and apply the art of innovation
4. To enable students to develop the skills to identify and frame problems, design and plan products strategically
5. To prepare students to apply design thinking principles in business and strategic innovation by addressing corporate challenges

UNIT-I: Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II: Design Thinking Process

Design thinking process, implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

UNIT III: Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

UNIT IV: Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies Activity: Importance of modelling, how to set specifications, Explaining their own product design.


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UNIT V: Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startup- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Course Outcomes (COs)

After successful completion of the course, the student will be able to:

1. Understand the fundamentals of design thinking and innovation processes.
2. Identify user needs and analyze real-world problems using empathy and ideation techniques.
3. Develop creative and feasible solutions using design tools and methodologies.
4. Build prototypes and evaluate solutions through testing and feedback.
5. Work effectively in teams and communicate innovative ideas professionally.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	–	–	–	1	–	–	–	–	–	2
CO2	2	3	2	2	–	2	1	–	1	–	–	2
CO3	2	2	3	2	2	1	1	–	1	–	–	2
CO4	2	2	3	3	3	1	1	–	2	1	1	2
CO5	–	–	2	–	–	–	–	1	3	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTANCY**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
III	3-0-0	7-0-3-01R25	CE

COURSE DESCRIPTION

The objective of the Managerial Economics and Financial Accountancy is to equip students with the tools to make sound business and organisational decisions by analysing economic principles and financial data.

Managerial Economics objectives

1. Decision-making: To enable managers make optimal decisions to maximize a firm's profitability and success by integrating economic theory with business practices.
2. Analysis: To help in the analysis of business situations by providing insights into demand, supply, production functions and costs.
3. Problem-solving: To provide the tools to find optimal solutions for business problems such as those related to pricing, production, capital management, and profit planning.
4. Economic Concepts: To develop understanding of concepts like consumer behaviour, production and cost analysis and market structures.

Financial Accountancy objectives

5. Financial Analysis: To introduce students to financial accounting and analysis techniques, including the use of ratios like liquidity, activity, and profitability.
6. Historical Reporting: To understand how financial accounting records and reports on past performance through final accounts (income statement, balance sheet).
7. Financial Health Assessment: To provide a method for analysing and interpreting financial statements to understand a company's financial position and performance.
8. Informed Decisions: While primarily historical, the objective is to provide the information necessary for management and external stakeholders like investors to make informed decisions, even if it's for future forecasting.

Unit -I

Managerial Economics: Definition, Characteristics and Scope – Basic economic tools in Managerial Economics. Managerial Economics and its relation with other subjects – Demand and Supply: Concept and Analysis – Time value of money, Cash flow and Time Diagrams – Choosing among alternative investment proposals: Methods of Economic analysis (Pay Back, ARR, NPV, IRR and B/C ratio)


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Unit -II

Depreciation and methods of calculating depreciation (Straight line, Sum of the years digit method, Declining balance method, Annuity method, Sinking fund method) – National income accounting, Methods of estimation, Various concepts of National Income, Significance of National income Estimation and limitations.

Unit -III

Types of Industrial Organization: Characteristics of Industrial organization, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, State/Public Enterprises and their types – The Business cycles and their relevance to decision making – Inflation: Definition, Process of inflation and measure of controlling inflation – New Economic Policy 1991 (Industrial Policy, Trade Policy, Fiscal Policy). It's Impact on Industry.

Unit -IV

Accounting Principles, procedure, Double entry system, Journal, Ledger, Trial balance, Cashbook – Preparation of Trading account and Profit and Loss account, Balance sheet.

Unit –V

Cost Accounting: Introduction, Classification of costs, Methods of costing, Techniques of costing – Cost sheet and preparation of cost sheet – Break-even Analysis: Meaning, its application and Limitation.

Course Outcomes: After the completion of the course the student will be able to;

CO1: Understand the concepts of financial management and smart investment.

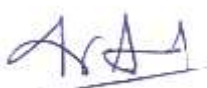
CO2: Identify various cost elements of the product and its effect on decision making.

CO3: Understand Economic and regulatory environment of the business and its impact on enterprises.

CO4: Prepare the Accounting records and interpret the data for Managerial Decisions.

CO5: Identify various cost elements of the product and its effect on financial decision making.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	1	2	1	1	2	1	3
CO2	3	3	2	2	1	2	2	1	1	2	1	3
CO3	3	2	1	1	1	1	1	1	1	2	1	3
CO4	3	2	2	1	1	1	1	1	1	2	1	3
CO5	3	3	3	2	2	1	1	1	1	2	1	3


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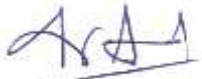

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Text Books

1. Gupta, G.S. (2018), Managerial Economics (2e), McGraw Hill Education (India) Pvt. Ltd., Chennai.
2. Dewett. K.K. (2006), Modern Economic Theory, Sultan Chand and Co., New Delhi.
3. Agarwal A.N. (2019), Indian Economy, New Age International Pvt. Ltd., New Delhi.
4. Jain and Narang (2011), Accounting Part-I, Kalyani Publishers, New Delhi.
5. Arora, M.N. (2012), Cost Accounting: Principles and Practice (12e), Vikas Publication, New Delhi.

Reference Books

1. Henry Malcom Steiner (1996), Engineering Economics Principles (2e), McGraw Hill Education.
2. Leland Blank and Anthony Tarquin (2012), Engineering Economy (7e), McGraw Hill, New York.



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B. Tech. (Civil Engineering)
Semester IV (Second Year)

Code		Category	Course Title	Hours/Week			Total	Credits	Marks		
Department	University			L	T	P			CIE	SEE	Total
CE2401C	7-1-4-01R25	MA-BS	Numerical Methods, Probability & Statistics	3	0	0	3	3	40	60	100
CE2402C	7-2-4-02R25	CE-PC	Structural Analysis	3	0	0	3	3	40	60	100
CE2403C	7-2-4-03R25	CE-PC	Water Quality and Treatment	3	0	0	3	3	40	60	100
CE2404C	7-2-4-04R25	CE-PC	Hydraulic Engineering	3	0	0	3	3	40	60	100
CE2405C	7-2-4-05R25	CE-PC	Soil Mechanics	3	0	0	3	3	40	60	100
CE2406L	7-2-4-R25P1	CE-PC	Soil Mechanics Laboratory	0	0	2	2	1	40	60	100
CE2407L	7-2-4-R25P2	CE-PC	Water Quality Analysis Laboratory	0	0	2	2	1	40	60	100
CE2408S	7-2-4-R25S1	CE-SC	Soft Skills	1	0	2	3	2	40	60	100
CE2409M	7-2-4-R25M1	CE-MC	Civil Engineering- Societal& Global Impact	2	0	0	2	0	100	0	100
CE2410M	7-0-4-R25M1	CE-MC	Environmental Science	2	0	0	2	0	100	0	100
CE2411N		CE-NG	NSS/NCC/NSO	0	0	0	0	0	0	0	0
TOTAL				20	0	6	26	19	520	480	1000
All students shall mandatorily register for NCC/NSO/NSS and complete 60 hours of activities beginning from the 1 st semester but to be completed before 4 th semester in one of these three options to earn Non-graded (NG) Credits as core requirement. Grade shall be awarded as Satisfactory or Unsatisfactory by the concerned HoD on the basis of participation, attendance, performance and behaviour. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.											
All interested students shall register for Minors degree or Honors degree just before or at the time of commencement of this semester by submitting filled in registration form available from the Head of the Department /Chair person, Board of Studies (UG) of the parent department.											
Students shall undergo Community Service Project (CSP) for a duration of six to eight (6-8) weeks during the summer vacation by completing 45 – 60 hours of work with at least 75% attendance, to be evaluated and reflected in 5 th semester.											


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NUMERICAL METHODS, PROBABILITY & STATISTICS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
IV	3-0-0	7-1-4-01R25	CH, CE & ME

Course Objectives:

1. This course aims at providing the student with the knowledge on Various numerical methods for
Solving transcendental equations,
2. To acquaint the students with different types of numerical methods to interpolate the polynomials, numerical derivatives and integrals.
3. To provide suitable and effective methods called Numerical Methods, for differential equations.
4. To provide knowledge of discrete and continuous distributions and problems on Binomial, Poisson, Normal Distributions. Interpret the association of characteristics and through correlation and regression tools.
5. To acquaint the students with different types of large and small sample tests

Unit I : Error analysis, Curve fitting by the method of least squares, Fitting of (i) Straight line (ii) Second degree parabola (iii) Exponential curves, Solutions of Algebraic & Transcendental Equations: Determination of roots of non - linear equations by iterative methods - Falsi position method - bisection method - Newton Raphson method .

Unit-II : Numerical Interpolation, Integration & Differentiation - Newton's forward & backward interpolation formula - Lagrange's interpolation formula. Numerical differentiation with forward and backward differences, Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule.

UNIT - III: Solution of Ordinary Differential Equations - Taylor series method - Euler's method - Euler's modified method - Runge Kutta second & fourth order methods - Milne's predictor and corrector methods for first order equations.

UNIT - IV: Random variables, Discrete and Continuous distributions, expectation, variance. Distributions: Binomial, Poisson, Normal and Exponential Properties and applications. Correlation – Rank Correlation - Regression analysis.

UNIT - V: Testing of Hypothesis –Large & Small samples-Null and alternate hypothesis, level of significance and critical region-Z-test for single mean and difference of means, single proportion and difference of proportions - t-test for single mean and difference of means - F-test for comparison of variances, Chi-square test for goodness of fit.



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TEXT BOOK: 1. Higher Engineering Mathematics – B.S.Grewal.

1. Numerical methods by E. Balagurusamy, Tata McGraw-Hill Publishing Co.
2. Numerical Methods for Scientific and Engineering Computation 3rd edition by Jain, New Age International.
3. S P Gupta, Statistical Methods, 38th Edition, Sultan Chand & Sons Educational Publishers, 2009.
4. T. K. V Iyengar et al, Probability and Statistics 2nd Edition, S. Chand & Company Ltd, 2010.
5. S. C. Gupta and V K Kapur, Fundamentals of Applied Statistics, 3rd Edition, Sultan Chand & Sons Educational Publishers.

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

1. To apply numerical methods to solve the Solution of Linear and Non-Linear Algebraic Equations and curve fitting problems iterative methods.
2. Derive interpolating polynomials using interpolation formulae Test and evaluate the accuracy of Differentiation and integrals numerically.
3. Using numerical methods, find solution of Ordinary differential equations.
4. Evaluate discrete and continuous probability distributions and able to solve problems on Binomial, Poisson, Normal Distributions. Interpret the association of characteristics and through correlation and regression tools.
5. Design the components of a classical hypothesis test. Infer the statistical inferential methods based on small and large sampling tests.

Mapping of Course Outcomes with Program Outcomes:														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	1	1	1	1	2	1	3	1	3
CO2	3	3	3	3	2	2	2	1	1	2	1	3	1	3
CO3	3	2	2	3	2	1	2	1	1	2	1	3	1	3
CO4	3	2	2	3	1	1	1	1	1	2	1	3	1	3
CO5	3	3	3	3	2	1	1	1	1	2	1	3	1	3

1 - Slightly; 2 - Moderately; 3 – Substantially



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STRUCTURAL ANALYSIS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
IV	3-0-0	7-2-4-02R25	CE

Course Objectives

- 1) To impart the principles of elastic structural analysis and deflection behavior of structures.
- 2) To impart knowledge about various methods involved in the analysis of determinate structures and indeterminate structures
- 3) To study the torsional effect and power transmission and to analyze various types of springs
- 4) To make the student familiar with moving loads on bridges

UNIT- I

DEFLECTIONS: Relationship between curvature, slope and deflection - Differential equation for the elastic line of a beam - Slope and deflection of cantilevers and simply supported beams under point loads, Uniform distributed load, uniformly varying load by integration method (Macaulay's method), moment area method (Mohr's theorem) and conjugate beam method.

UNIT-II

TORSION OF CIRCULAR SHAFTS: Theory of pure torsion in solid and hollow circular shafts - Transmission of power - Combined bending, torsion and end thrust.

SPRINGS: Types of springs - Close and open coiled helical springs under axial loads and axial couple - springs in series and parallel - Carriage or leaf springs.

UNIT- III

ENERGY THEOREMS: Virtual work and energy principles - Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear force – Maxwell's theorem– Betti's theorems–Castigliano's first theorem and unit load method – Deflection of simple pin jointed trusses.

UNIT- IV

INDETERMINATE STRUCTURES: Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies – Analysis of plane trusses with one degree of internal and external indeterminacy – Castigliano's theorem–II – Lack of fit–Analysis of propped cantilever beams under UDL and point loads.

UNIT- V**INFLUENCE LINES AND MOVING LOADS:**

Influence lines for reactions, BM and SF; Curves of maximum BM and SF for single, two and multiple loads, UDL longer and shorter than span, enveloping parabolic and EUDL – forces in truss members.



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Text Books:

- 1) Theory of Structures - Vol.I by S.P.Gupta, G.S.Pandit&R.Gupta.
- 2) Strength of Materials-U.C.Jindal,Pearson Publishers
- 3) Mechanics of Structures Vol.II by S.B.Junarkar.
- 4) Structural Analysis by L.S.Negi&R.S.Jangid.

References:

1. Intermediate structural Analysis by Wang
2. Fundamentals of Structural analysis by Sujith Kumar Rao & Subrata Chakrabarty

Course Outcomes:

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

1. Distinguish between determinate and indeterminate structures
2. Analyze determinate and indeterminate structures
3. Use influence line diagram as a valid tool for structural analysis
4. Asses the power transmission of shafts and springs
5. Evaluate critical load positions and maximum response values for structures subjected to moving vehicle loads.

PO/CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	2	1	2	2	1				1	1	1	1
CO2	2	2	2	2	1	1	1			1	1	1
CO3	2	2	2	1	1				1	1	2	1
CO4	2	1	2	2	2				1	2	2	1
CO5	3	3	3	2	1	1						2

1 - Slightly; 2 - Moderately; 3 – Substantially



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WATER QUALITY AND TREATMENT

Credits: 3**Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
IV	3-0-0	7-2-4-03R25	CE

Course Educational Objective (CEOs)

1. To know the water quality of different sources and water demand estimation.
2. To study the water collection, conveyance and the distribution network systems
3. To learn about the water quality parameters
4. To know the design concepts of water treatment plant
5. To study the advanced water treatment methods.

UNIT – I

SOURCES AND DEMAND OF WATER: Different sources of water, quantity and quality of different sources of water, Types and variation in water demand, factors affecting water demand, design period, population forecasting – Different methods and their suitability.

UNIT-II

WATER COLLECTION, CONVEYANCE AND DISTRIBUTION: Intake works for collection of surface water, Conduits for conveying water - Types of conduits, hydraulics of flow and design of pressure pipes as Gravity pipes, flow in pipe systems, Forces acting on pressure conduits, various types of materials used for pressure pipes, layout of water supply pipes, pipe appurtenances, Testing of water pipe lines. Distribution networks, Distribution reservoirs, design of simple and complex pipe networks.

UNIT – III

WATER USES AND QUALITY REQUIREMENTS: Sources of water pollution, water borne diseases. Need for protected water supply, water quality – Physical, chemical and biological characteristics, water quality standards for different uses.

WATER TREATMENT: Conventional water treatment processes units and their functions. Theory and design of aeration, coagulation, flocculation and clarification, Determination of optimum dose of alum for coagulation of water.

UNIT – IV

FILTRATION AND DISINFECTION: Theory of Filtration – Different types of filters and their design. Disinfection – Disinfectant's mechanism of disinfection – Different methods of Disinfection. Types of Chlorination - Break point chlorination.



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UNIT – V

ADVANCED TREATMENT METHODS: Treatment methods for removal of fluorides, arsenic, hardness, iron and manganese, salinity and colour.

TEXT BOOKS:

1. Water Treatment Principles and Design by James M. Montgomery, Wiley, 1985
2. Water Supply Engineering, by S.K.Garg, **Khanna Publishers.**
3. Environmental Engineering by H.S. Peavy H.S., Rowe, D.R. and Tchobanoglous, G. (1985), McGraw-Hill Book Company, New York, 696.
4. Water Supply and Sewerage, by E.W. Steel and Mc.Ghee

Course Outcomes (COs)

After completion of the course the student will be able to:

1. Estimate the water demand of any area and understand the water sources and its quality
2. Solve the collection, conveyance and distribution network problems
3. Explain about the water quality parameters
4. Plan and design water treatment plant
5. Apply the advanced water treatment technologies

PO&PSO/ CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO(1)	PSO(2)
CO1	3	3	3			2	2	2	2	2	1		3	2
CO2	3	3	3			2	2	2	2	2	1		3	2
CO3	3	3	3			2	2	2	2	2	1		3	2
CO4	3	3	3			2	2	2	2	2	1		3	2
CO5	3	3	3			2	2	2	2	2	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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HYDRAULIC ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
IV	3-0-0	7-2-4-04R25	CE

DESCRIPTION OF THE COURSE:

Fluid Mechanics and Hydraulic Machines is the pre-requisite for this course. This course consists of basics of dimensional analysis, flow through pipes, boundary layer theory and open channel flows.

Course Educational Objectives (CEOs):

1. To understand the importance of dimensional analysis and solve the problems related to flow through pipes.
2. To understand the concepts of boundary layer and flow around submerged objects.
3. To understand the basic concepts of open channel flows and to learn uniform flow characteristic in channels.
4. To understand the concepts of specific energy and specific force.
5. To understand the principles of gradually varied flows and rapidly varied flows.

UNIT I

DIMENSIONAL ANALYSIS AND SIMILITUDE - Dimensional homogeneity, Rayleigh's method, Buckingham's Pi method. Dimensionless groups, Similitude, Types of models, model studies.

FLOW THROUGH PIPES- Losses- Major loss, Darcy-Weisbach equation, minor losses, total energy line, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, siphon, branching of pipes – Pipe networks – Hardy- cross method.

UNIT II

BOUNDARY LAYER THEORY- Boundary layer concepts- Thickness of Boundary Layer – Boundary Layer Along a Long Thin flat Plate and its Characteristics –Laminar Boundary Layer – Turbulent Boundary Layer – Laminar Sublayer – Separation of Boundary Layer – Methods of Controlling the Boundary Layer

FLOW AROUND SUBMERGED BODIES-Types of Drag –Drag on a Sphere, Cylinder and Airfoil – Development of Lift on Immersed Bodies.



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UNIT III

INTRODUCTION TO OPEN CHANNEL FLOW- Section between open channel flow and pipe flow, geometric parameters of a channel, classification of open channels, classification of open channel flow, Velocity and pressure distribution of a channel section.

UNIFORM FLOW- Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient. Most economical section of a channel. Computation of Uniform flow, Normal depth.

UNIT IV

SPECIFIC ENERGY AND SPECIFIC FORCE CONCEPTS- Specific energy, Specific energy curve, critical flow, discharge curve Specific force, Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats.

UNIT V

GRADUALLY VARIED FLOWS- Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profiles, Characteristics of surface profiles. Computation of water surface profile by graphical, Direct and standard step methods.

RAPIDLY VARIED FLOWS- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.

Text/Reference Books:

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, VenTe Chow, Tata McGraw Hill.
5. Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers, 1971.

Course Outcomes (COs):

1. Able to explain the concepts of dimensional analysis and analyse the problems related to flow through pipes.
2. Able to apply the knowledge of boundary layer concepts and flow around submerged objects.
3. Able to apply the concepts of open channel flows and determine the most economical section of a channel.
4. Able to compute specific energy and specific force concepts.
5. Able to analyse the GVF profiles, RVF profiles and their characteristics.



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PO&PSO/CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO (1)	PSO(2)
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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SOIL MECHANICS

Credits: 3**Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
IV	3-0-0	7-2-4-05R25	CE

Prerequisites: Engineering Geology course and Fluid Mechanics course.

Course Educational Objectives (CEOs):

1. Introduce soil and soils formation, phase composition and 3- phase system of soil.
2. Impart procedures for finding index properties of the soils for identification and classification.
3. Introduce the modes of soil water existence, effective stresses, permeability and seepage in soils.
4. Impart the principle of Consolidation and computation of settlements in soils.
5. Impart the methods and procedures for determining Shear Strength of soils.

UNIT- I

Soil Composition and Phase Relationships:

Types of soils - formation and deposition - Phase composition and Soil as 3–Phase system- Weight-Volume parameters: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity - Relationship between various soil parameters - Determination of Moisture content, Specific gravity and Unit weights using various methods.

UNIT -II

Identification and Classification of Soils:

Index properties- Determination of particle size-Dry Sieve Analysis and Sedimentation Analysis- Determination of Consistency Limits-Liquid Limit, Plastic Limit, Shrinkage Limit - Indices from Index properties-Density Index, Plasticity, Liquidity and Consistency Indices, Flow & Toughness Indices - Soil classification based on Particle Size , Texture - Unified and Indian Standard Soil Classification Systems – Engineering significance of classification and classification parameters- Tests for field identification of soils

UNIT -III

Soil Water and Effective Stress Principle:

Mode, Occurrence and types of soil water – Geostatic stresses in soils - capillarity – Total Stress- Pore water pressure- Effective Stress Principle- nature of effective stress, effect of ground level, surcharge and water table on effective stress.



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Permeability and Seepage Analysis:

Darcy's law- coefficient of permeability: determination by constant-head and falling-head methods-Permeability of stratified soils - factors affecting Permeability -Movement of water through soils- stream and potential functions - flow nets, graphical method to plot flow nets-seepage pressure - quick sand condition.

UNIT- IV**Consolidation of Soils:**

Comparison between compaction and consolidation, initial, primary & secondary consolidation - Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

UNIT – V**Shear Strength of Soils:**

Shear strength of soils - Mohr'-Coulomb Failure Criteria - Measurement of shear strength - Direct shear, Unconfined compression and Tri-axial compression tests - Shear strength parameters - Shear strength of cohesive and cohesion less soils - Test conditions

TEXT BOOKS:

1. C. Venkataramiah, Geotechnical Engineering, New age International Pvt. Ltd, (2002).
2. GopalRanjan& A. S. R. Rao, Basic and Applied Soil Mechanics, New age International Pvt . Ltd., New Delhi.

REFERENCES:

1. V.N.S. Murthy, Soil Mechanics and Foundation Engineering, CBS Publishers and Distributors Pvt Ltd., (2018).
2. Braja M. Das, Principles of Geotechnical Engineering, Cengage Learning
3. Donald P. Coduto, Geotechnical Engineering Principles and Practice, Prentice Hall/1st Edition Book ISBN:0135763800

Course Outcomes (COs):

1. Develop interphase relationships using soil as 3-phase system and determine basic properties of soils.
2. Identify and classify soils based on their characteristics.
3. Compute effective stresses in soils under different conditions, permeability and seepage in soils
4. Determine the consolidation characteristics and compute settlement of soils.
5. Determine Shear strength characteristics of soils under different test conditions.



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PO& PSO/CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1	2	2	1	1	1	1					1	1	2	3
CO2	2	2	1	1	1	1		1			1	1	2	3
CO3	2	2	2	2	1	2	1		1		1	1	2	3
CO4	2	2	2	2	2	2	1		1	1	1	1	2	3
CO5	2	3	1	3	3	1					1	1	3	3

1- Slightly 2-Moderately 3-Substantially



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SOIL MECHANICS LABORATORY**Credits: 1****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
IV	0-0-2	7-2-4-R25P1	CE

Course Educational Objective (CEOs):

1. Acquainted with the procedure to determine Gradation of soils in the laboratory.
2. Acquainted with the procedure to determine Specific Gravity of soils in the laboratory
3. Acquainted with the procedure to determine Atterberg limits of soils in the laboratory.
4. Acquainted with the procedure for Classification of soils in the laboratory.
5. Acquainted with the procedure to determine in-situ density of soils in the laboratory.

List of Experiments

1. Grain Size Distribution of soil by Dry Sieve Analysis.
2. Grain Size Distribution of soil by Hydrometer Analysis
3. Specific Gravity of soil
4. Liquid Limit of soil
5. Plastic limit of soil and Free Swell Index of Soil
6. Shrinkage Limit of given soil
7. Shrinkage Limit of given soil pat
8. In-situ Density of soil by Core Cutter method
9. In-situ Density by Sand Replacement method.

Course Outcomes (COs):

1. Conduct Gradation analysis of soils.
2. Conduct Atterberg Limits Test for a given soil.
3. Classify the soils for engineering purpose.
4. Conduct Specific Gravity Test and Free Swell Index of soils.
5. Conduct in-situ Density Tests for soils.

PO & PSO/CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO (1)	PSO (2)
CO1	2	2		2					2	3	3	1	3	3
CO2	2	2		2					2	3	3	1	3	3
CO3	2	1							2	3	3	1	3	2
CO4	2	2		2					2	3	3	1	3	3
CO5	2	2		2					2	3	3	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially


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WATER QUALITY ANALYSIS LABORATORY**Credits: 1****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
IV	0-0-2	7-2-4-R25P2	CE

Course Educational Objective (CEOs):

- 1 To be aware of water quality analysis
- 2 To be aware of how to interpret the results

Water quality Analysis

1. (a) Determination of Colour.
(b) Determination of Taste and Temperature
2. Determination of
(a) Total Suspended and Dissolved Solids.
(b) Total Organic and Inorganic Solids.
3. (a) Determination of pH and Electrical Conductivity.
(b) Determination of Turbidity.
4. (a) Determination of Total Acidity.
(b) Determination of Total Alkalinity.
5. Determination of Total Hardness
6. (a) Determination of Total Chlorides.
(b) Determination of Total Sulphates.
7. (a) Determination of Dissolved Oxygen.
(b) Determination of Residual Chlorine.
8. (a) Determination of Optimum Dose of Coagulant.
(b) Determination of MPN Index of water.

Course Outcomes (COs):

1. After completion of the course the student will be:
2. Able to Perform common environmental experiments relating to water quality Analyses.
3. Able to Statistically analyze and interpret laboratory results.
4. Demonstrate good written and oral communication skills.

PO&P SO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PS O (1)	PSO (2)
CO1	3	3	3			3	2	2	2	2	1		3	2
CO2	3	3	3			3	2	2	2	2	1		3	2
CO3	3	3	3			3	2	2	2	2	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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SOFT SKILLS**Credits: 2****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
IV	1-0-2	7-2-4-R25S1	CE

Course Educational Objective (CEOs):

The objectives of this course are to:

1. Develop effective communication skills (verbal, non-verbal, and written) for academic and professional success.
2. Enhance critical thinking and analytical abilities for better understanding and problem analysis.
3. Build problem-solving and decision-making skills required in individual and team situations.
4. To help students cultivate emotional intelligence and applying effective strategies to control stress for personal well-being and constructive interpersonal relationships.
5. To enable students to understand and practice professional etiquette by exploring its concepts, significance, and modern applications

UNIT I**Soft Skills & Communication Skills**

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.

UNIT II**Critical Thinking**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open mindedness – Creative Thinking - Positive thinking – Reflection.

UNIT III**Problem Solving & Decision Making**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

UNIT IV**Emotional Intelligence & Stress Management**

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips.



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UNIT V**Corporate Etiquette**

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette - Corporate grooming tips -Overcoming challenges.

Course Outcomes (COs):

On successful completion of the course, students will be able to:

1. Demonstrate effective communication skills in personal, academic, and professional contexts.
2. Apply critical and creative thinking skills to analyze situations and make logical judgments.
3. Use appropriate problem-solving techniques and decision-making methods individually and in teams.

PO& PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO (1)	PSO(2)
CO1								2	1	1		3	2	1
CO2									1	3		2	3	2
CO3									3	2	1	2	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially



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CIVIL ENGINEERING - SOCIETAL & GLOBAL IMPACT**Credits: 0****Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
IV	2-0-0	7-2-4-R25M1	CE

Course Objectives:

1. To Provide a Historical and Future Perspective
2. To Analyze Infrastructure Systems and Their Impact:
3. To Instill Principles of Sustainability and Environmental Stewardship:
4. To Develop Professional and Economic Awareness:
5. To Introduce Modern Project Management and Innovation:

Unit I

Introduction to Course and Overview; Understanding the past to look into the future: Preindustrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis; Understanding the importance of Civil Engineering in shaping and impacting the world.

Unit II

Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability

Unit III

Environment-Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability



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Unit IV

Built environment–Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability

Unit V

Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development;

Text Books:

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds)
2. Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
3. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economic and Working Environment, 120th ASCE Annual Conference and Exposition
4. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.

Course Outcomes:

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

CO1: Recall aspects of the built environment and factors impacting the quality of life

CO2: Understand the impact that Civil Engineering projects have on the society at large and on the global arena; and use resources efficiently and effectively.

CP3: Apply professional and responsible judgment and take a leadership role

CO4: Examine the potential of Civil Engineering for employment creation and its contribution to the GDP

CO5: Value the sustainability of the environment, including its aesthetics



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CO/ PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	1	2	1	1	3	2	2	2	2	1	1	2	2
CO2	-	1	2	1	-	3	1	1	-	-	-	-	1	-
CO3	-	-	1	1	-	1	1	2	3	2	3	2	1	1
CO4	-	1	1	2	-	3	1	1	-	1	1	1	1	1
CO5	-	1	-	2	-	2	1	1	-	1	1	1	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially



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ENVIRONMENTAL SCIENCE**Credits: 0****Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
IV	2-0-0	7-0-4-R25M1	CE

Course Educational Objectives (CEOs):

1. Introduce the scope and importance of environmental resources and their sources.
2. Impart knowledge on Ecosystem and Biodiversity.
3. Impart knowledge on causes and consequences of Environmental pollution its Global effects.
4. Familiarize with environmental issues and their management.
5. Outline different social issues and the guidelines formulated for protection of environment.

UNIT I**Environmental Studies and Natural Resources**

Definition, Scope and importance of Environment, Environmental studies, Need for public awareness

Components of Environment- Atmosphere, Hydrosphere, Lithosphere.

Renewable and Non-Renewable Resources and associated problems

Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams benefit and problems.

Forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Land resources: Land as a resource, land degradation, Man induced landslides, soil erosion and desertification.

Mineral resources: Use and overexploitation, Environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity, Case studies.

Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

Role of an individual in conservation of natural resources.

UNIT II**Ecosystem and Biodiversity**

Ecosystem - Concept of an ecosystem.

Structure and functions of an ecosystem.

Producers, consumers and decomposers.

Energy flow in the ecosystem.



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Ecological succession.

Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystem.

(a) Forest ecosystem. (b) Grassland ecosystem

(c) Desert ecosystem. (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation:

Definition, genetic species and ecosystem diversity.

Biogeographically classification of India.

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

Biodiversity at global, National and local levels.

India as a mega-diversity nation.

Hot-spots of biodiversity.

Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts.

Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT – III

Environmental pollution and Global Effects

Definition, Causes, Effects, and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies.

Disaster management: Floods, earthquakes, cyclone, landslides, Tsunami.

Climate change-Global warming, Acid rain, Ozone depletion.

UNIT – IV

Environment Issues and Management

Environment and Human health – Epidemic diseases, HIV/AIDS, Aviation Flue, Water Borne Diseases.

Environmental Impact Assessment, Sustainable Development, Clean Production and Clean Development Mechanisms

Environment Legislation: Environmental Protection Act, Water Act, Air Act, Wild Life Protection Act, Forest Conservation Act, Public Liability & Insurance Act, Issues involved in Enforcement of Environmental legislation.



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UNIT – V**Social Issues and the Environment**

Population growth, Population Explosion, Population Control, Women and Child welfare.

Urbanization, Industrialization, Development projects, Resettlement and Rehabilitation of people – Problems concerned, Case studies.

Consumerism and Waste Products Conservation, Public Awareness, Water Conservation, Rain water harvesting, watershed management, Wasteland reclamation, Human Rights, Value education, Environmental ethics- Issues and possible solution.

Role of information Technology in Environment and Human Health.

Text Books / Reference Books:

1. AnubhaKaushik& C P Kaushik, Environmental studies, New age International Publishers, 2008
2. Benny Joseph, Environmental studies, Tata McGraw-Hill Publishers, 2005
3. M Chandra Sekhar, Environmental Science, Hi-Tech Publishers, 2004
4. Keerthinarayana and Daniel Yesudian, Principles of Environmental Sciences and Engineering, Hi-Tech Publishers, 2005
5. AmalK.Datta, Introduction to Environmental Science and Engineering, Oxford & IBH Publishing Co.Pvt.Ltd, 2000
6. SanthoshkumarGarg,RajeshawriGarg and RajniGarg, Ecological and Environmental studies, Khanna publishers, 2006
7. Gilbert M, Introduction to Environmental Engineering and Science, Masters Publication by Prentice –Hall of India Private Ltd., 1991
8. William P Cunningham and Mary Ann Cunningham, Principles of Environmental Science, Tata McGraw Hill Publishing Co.Ltd, 2002

Course Outcomes(Cos):

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

1. Acquire knowledge in diverse components of environment and natural resources.
2. Understand ecosystem and biodiversity and its conservation methods.
3. Identify and resolve the issues related to sources of different types of pollution and its global effects
4. Provide solutions to individuals, industries and government for sustainable development of natural resources
5. Apply environmental ethics in resolving social issues for protection of diversified ecosystems.



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PO& PSO /CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO (1)	PSO(2)
CO1						3		3	2	1	2	3	3	2
CO2								3	2	1	2	3	3	2
CO3								3	2				3	2
CO4								3	2				3	1
CO5								3	2				3	1

1 - Slightly; 2 - Moderately; 3 – Substantially



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B. Tech. (Civil Engineering)
Semester V (Third Year)

Code		Category	Course Title	Hours/Week			Total	Credits	Marks		
Department	University			L	T	P			CIE	SEE	Total
CE2501C	7-2-5-01R25	CE-PC	Transportation Engineering	3	0	0	3	3	40	60	100
CE2502C	7-2-5-02R25	CE-PC	Design of Reinforced Concrete Structures	3	0	0	3	3	40	60	100
CE2503C	7-2-5-03R25	CE-PC	Hydrology & Water Resources Engineering	3	0	0	3	3	40	60	100
CE2504C	7-2-5-04R25	CE-PC	Foundation Engineering	3	0	0	3	3	40	60	100
CE2505C	7-2-5-05R25	CE-PC	Concrete Technology	3	0	0	3	3	40	60	100
CE2506C	7-2-5-R25PE1	CE-PE	Professional Elective – I	3	0	0	3	3	40	60	100
CE2507L	7-2-5-R25P1	CE-PC	Geotechnical Engineering Laboratory	0	0	3	3	1.5	40	60	100
CE2508L	7-2-5-R25P2	CE-PC	Concrete Technology Laboratory	0	0	3	3	1.5	40	60	100
CE2509S	7-2-5-R25S1	CE-SC	Remote Sensing & GIS	1	0	2	3	2	100	0	100
CE2510K	7-2-5-R25KS	CE-IK	IKS – MOOCS	0	0	0	0	2	0	100	100
CE2511I	7-0-5-R25CS	CE-SI	Community Service Project (CSP)	0	0	0	0	2	100	0	100
TOTAL				19	0	8	27	27	520	580	1100

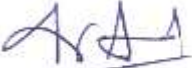
Students shall ensure that IKS MOOCS and IKS Mandatory courses are not same either in title and/or in syllabi.



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CIVIL ENGINEERING**PROFESSIONAL ELECTIVE COURSES**

Professional Elective - I (V Sem)	7-2-5-R25E11	Municipal Solid Waste Management (EE)
	7-2-5-R25E12	Foundations on Expansive Soils (GTE)
	7-2-5-R25E13	Water Power Engineering (H&WRE)
	7-2-5-R25E14	Advanced Structural Analysis (SE)
	7-2-5-R25E15	Traffic Analysis (TE)
	7-2-5-R25E16	Building Construction Practice (Gen)
Professional Elective - II (VI Sem)	7-2-6-R25E11	Air Pollution and its Control (EE)
	7-2-6-R25E12	Geo environmental Engineering (GTE)
	7-2-6-R25E13	Water Resources System Analysis (H&WRE)
	7-2-6-R25E14	Advanced Reinforced Concrete Design (SE)
	7-2-6-R25E15	Traffic Engineering and Management (TE)
	7-2-6-R25E16	Construction Planning and Project Management (Gen)
Professional Elective -III (VI Sem)	7-2-6-R25E21	Environmental Impact Assessment and Audit (EE)
	7-2-6-R25E22	Advanced Geotechnical Engineering (GTE)
	7-2-6-R25E23	Hydraulic Structures (H&WRE)
	7-2-6-R25E24	Structural Dynamics (SE)
	7-2-6-R25E25	Urban Planning and Development (TE)
	7-2-6-R25E26	Organizational Behavior (Gen)
	7-0-6-R25CE1	Introduction to Semiconductor Manufacturing
Professional Elective -IV (VII Sem)	7-2-7-E11R25	Industrial Wastewater Treatment (EE)
	7-2-7-E12R25	Applied Soil Mechanics (GTE)
	7-2-7-E13R25	Watershed Management (H&WRE)
	7-2-7-E14R25	Bridge Engineering (SE)
	7-2-7-E15R25	Railway Engineering (TE)
	7-2-7-E16R25	Sustainable Engineering (Gen)
Professional Elective -V (VII Sem)	7-2-7-R25E21	Climate Change Impact Mitigation and Adaptation (EE)
	7-2-7-R25E22	Offshore Geotechnical Engineering (GTE)
	7-2-7-R25E23	Sustainable Water Resources Development (H&WRE)
	7-2-7-R25E24	Design of Earthquake Resistant Structures (SE)
	7-2-7-R25E25	Docks and Harbour Engineering (TE)
	7-2-7-R25E26	Optimization Techniques in Civil Engineering (Gen)
Professional Elective- VI (VII Sem)	7-2-7-R25E31	Environmental Sanitation (EE)
	7-2-7-R25E32	Geotechniques for Design of Underground Structures (GTE)
	7-2-7-R25E33	Urban Hydrology (H&WRE)
	7-2-7-R25E34	Design of Prestressed Concrete Structures (SE)
	7-2-7-R25E35	Airport Engineering (TE)
	7-2-7-R25E66	Entrepreneurship and Incubation (Gen)



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TRANSPORTATION ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-01R25	CE

DESCRIPTION OF COURSE:

Transportation engineering or transport engineering is the application of technology and scientific principles to the planning, functional design, operation and management of facilities for any mode of transportation in order to provide for the safe, efficient, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods transport.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. Identify the requirements of highways and apply the knowledge for planning highway alignment.
2. Estimate the geometrics for highways
3. Select appropriate highway materials and design the various highway pavements.
4. Estimate the traffic requirements from traffic studies.
5. Understand the various components of Railways, Airports and Docks and Harbors.

UNIT I**HIGHWAY DEVELOPMENT AND PLANNING:**

Highway Development in India – Necessity for Highway Planning- Different Road Development Plans- Classification of Roads- Road Network Patterns – Highway Alignment- Factors affecting Alignment- Engineering Surveys

UNIT – II**HIGHWAY GEOMETRIC DESIGN:**

Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements- Stopping sight Distance, Overtaking Sight Distance and intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.

UNIT – III

PAVEMENT DESIGN: Aggregates and bitumen - desirable properties, tests - Aggregate bitumen mixes - Design by Marshall method., Pavement Types, components and their functions, design factors, flexible pavement design - IRC methods based on CBR only. Rigid pavement design - Calculation of stresses, design of joints, dowel bars, tie bars, thickness of pavement by IRC procedure.



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UNIT – IV**TRAFFIC ENGINEERING:**

Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies- Parking Studies and Parking characteristics- Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams--Road Traffic Signs – Types and Specifications – Road markings- -Types of Road Markings- Design of Traffic Signals –Webster Method –IRC Method-Types of Intersections – Conflicts at Intersections- Types of At-Grade Intersections and Grade Separated Intersections - Channelization: Objectives –Traffic Islands and Design criteria- Rotary Intersection – Concept of Rotary and Design Criteria- Advantages and Disadvantages of Rotary Intersection.

UNIT – V**INTRODUCTION TO RAILWAY, AIRPORT AND HARBOUR ENGINEERING:**

Site selection – Engineering Surveys- Permanent way components – Cross Section of Permanent Way - Points & Crossings -Turn outs- Stations and Yards.

Factors affecting selection of site for Airport – Airport layout and terminal area -Aircraft Characteristics- Geometric Design of Runway- Computation of Runway length – Correction for runway length – Orientation of Runway – Wind Rose Diagram – Runway Lighting system.

Harbours - Types of harbours, site selection- ports, classification of ports – docks - break water, types of breakwaters, quays, jetties, wharves, dolphins, fender systems, aprons, transit sheds and ware houses, dredging.

Course Outcomes (COs):

After Completion of the course the Student is able to:

1. Analyze highway requirements & apply Engineering Principles in highway planning and alignment.
2. Design highway geometric elements, horizontal alignments and vertical alignments.
3. Select appropriate highway materials and highway pavements are designed.
4. Plan and design the traffic requirements from traffic studies.
5. Apprehend different components of Railways, Airports and Harbours.

Text Books:

1. Highway Engineering – S.K.Khanna & C.E.G.Justo, Nemchand & Bros., 7th edition (2000).
2. Railway Engineering – A text book of Transportation Engineering – S.P.Chandola – S.Chand & Co. Ltd. – (2001).
4. Airport Planning and Design- S.K.Khanna and Arora,Nemchand Bros.
5. Docks and Harbour Engineering - S.P.Bindra.



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References:

1. Highway Engineering – S.P.Bindra , Dhanpat Rai & Sons. – 4th Edition (1981)
2. Traffic Engineering & Transportation Planning – Dr.L.R.Kadyali, Khanna publications – 6th Edition – 1997.
3. Railway Engineering – August – Prabha & Co., 15th Edition – 1994.
4. Docks and Harbour Engineering - R.Srinivasan.

PO& PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO (1)	PSO (2)
CO1	3	3	2	1		2	2	1			1	1	3	1
CO2	3	3	3	2		2	1					1	3	2
CO3	3	3	3	2	1	1	1				1	1	3	1
CO4	3	3	3	3	1	3	1	1				1	3	2
CO5	2	1	2			1	1					1	2	

1 - Slightly; 2 - Moderately; 3 – Substantially



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DESIGN OF REINFORCED CONCRETE STRUCTURES**Credits: 3****Assessment: 40 +60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-02R25	CE

DESCRIPTION OF THE COURSE:

This course provides a comprehensive introduction to the philosophy, analysis, and design of reinforced concrete structures in accordance with the IS 456:2000 code of practice. The curriculum bridges the gap between historical design approaches and modern safety standards by transitioning from the Working Stress Method (WSM) to the Limit State Method (LSM). Students will gain an in-depth understanding of material behavior, structural safety, and serviceability requirements.

The core focus lies in developing the technical competency to design and detail fundamental structural elements, including beams (flexure, shear, torsion), slabs (one-way, two-way), staircases, columns, and footings.

Course Educational Objectives (CEOs):

1. To explain the difference between the traditional Working Stress Method (WSM) and the modern Limit State Method (LSM).
2. To teach how to calculate the strength of concrete beams so they can resist bending and shearing forces.
3. To explain how to ensure structures remain usable by controlling deflection (bending) and cracking.
4. To provide step-by-step methods for designing common building parts like floor slabs and staircases.
5. To demonstrate how to design columns and foundations that safely transfer building loads to the ground.

UNIT – I

INTRODUCTION: Design Philosophies – working stress method, ultimate load method and limit state method.

DESIGN FOR FLEXURE – WORKING STRESS METHOD: Assumptions, permissible stresses in concrete and steel, balanced design, transformed area method, analysis and design for flexure of singly and doubly reinforced and flanged sections.



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LIMIT STATE METHOD**UNIT – II**

DESIGN PRINCIPLES: Basic Design Principles - Stress strain curves for concrete and steel - Characteristic strengths and loads - Partial safety factors - Stress block - Various limit states.

DESIGN FOR FLEXURE: Limit state of collapse in flexure - Ultimate flexural strength - Balanced, under-reinforced and over-reinforced sections - Design of singly and doubly reinforced rectangular beams - Design of flanged beams.

UNIT - III

DESIGN FOR SHEAR, TORSION AND BOND: Shear-Truss analogy - Design of beams for shear and torsion - Anchorage and development length.

LIMIT STATES OF SERVICEABILITY: Deflection (short and long term) - Cracking.

UNIT – IV

DESIGN OF SLABS, STAIR CASES AND BEAMS: Design of one way and two way slabs - Design of stair cases - Design of continuous beams and slabs.

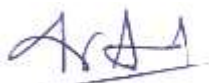
UNIT – V

DESIGN OF COMPRESSION MEMBERS: Columns - Reduction factors - Axially loaded - Eccentrically loaded columns - Uniaxial moment - Biaxial moment (for practice only and not for University Examination).

DESIGN OF FOUNDATIONS: Types of footings - Design of wall footings and isolated, pad stepped and sloped footings - Square, rectangular subjected to axial load.

TEXT BOOKS:

- 1) Reinforced Concrete by Limit State Design by AK Jain.
- 2) Reinforced Concrete Design by SN Sinha.
- 3) Limit State Design of Reinforced Concrete by B.C. Punmia, A.K. Jain.
- 4) Reinforced Concrete Design by Unni Krishna Pillai and Devdas Menon.
- 5) Reinforced Concrete Design by P.C. Varghese.



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Course Outcomes (COs):

1. Able to determine if a concrete beam is safe using both Working Stress and Limit State methods.
2. Able to calculate exactly how much steel reinforcement is needed for beams to resist bending and shear.
3. Able to design one-way and two-way slabs and staircases for residential or commercial buildings.
4. Able to perform checks to ensure a structure won't sag too much or develop wide cracks over time.
5. Able to dimension and reinforce columns and footings to support axial and eccentric loads.

PO& PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO(1)	PSO(2)
CO1	3	3	1					1				1	2	1
CO2	3	3	3			1		1				1	3	1
CO3	3	3	3	1		1		1				1	3	1
CO4	3	2	3			1		1				1	3	2
CO5	3	2	3			1		1				1	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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HYDROLOGY AND WATER RESOURCES ENGINEERING

Credits: 3**Assessment: 40 +60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-03R25	CE

DESCRIPTION OF COURSE:

Fluid Mechanics and Hydraulic Machines and Hydraulic Engineering courses are the pre-requisite courses for this course. Students will learn various hydrological aspects, estimation and their applications. They also learn various aspects of irrigation, canals and related structures.

Course Educational Objective (CEOs):

1. To understand the phases of hydrologic cycle and estimation of precipitation.
2. To learn the concepts and measurement of different abstractions from precipitation.
3. To analyze runoff, flood frequency and flood routing.
4. To understand the concepts of ground water and different methods of irrigation.
5. To design canals and select suitable irrigation structures and cross drainage works.

UNIT I

INTRODUCTION: Hydrologic cycle, Forms and types of precipitation, measurement of precipitation, rain gauge network, mean precipitation, estimation of missing rainfall, consistency of rainfall data, Depth-Area-Duration (DAD) relationship, Intensity- Duration-Frequency (IDF) relationship, Probable Maximum Precipitation (PMP).

UNIT II

ABSTRACTIONS FROM PRECIPITATION: Initial abstractions, Evaporation, process, factors affecting evaporation, measurement, its control, Evapotranspiration, process, types, factors affecting, measurement, Infiltration, process, factors affecting, measurement, infiltration indices.

UNIT III

RUNOFF: Process, factors affecting, estimation, Hydrographs, base flow separation, Unit Hydrograph – derivation of Unit Hydrograph of different durations, distribution graph

FLOODS: Estimation, flood control measures.

FLOOD ROUTING: Basic equations, Reservoir routing.



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UNIT IV

GROUND WATER: Types of formations, Darcy's law, equilibrium equations for confined and unconfined aquifers, recuperation test.

IRRIGATION- Necessity, advantages and ill effects, water requirement of crops, methods of irrigation, duty and delta, soil-water relationships, irrigation requirement, frequency of irrigation.

UNIT V

CANALS: Classification, alignment, Kennedy's silt theory and Lacey's regime theory, Design of lined canals.

CANAL STRUCTURES: Falls, necessity, location, classification; Regulators, necessity, location, classification; Outlets, necessity, location, classification.

Course outcomes (Cos):

After completing the course, the student will be

1. Able to explain the different phases of hydrologic cycle and estimate precipitation.
2. Able to analyze the concepts of abstractions and estimate the abstractions.
3. Able to analyze runoff and the flood frequency analysis.
4. Able to explain the concepts of groundwater and select suitable type of irrigation system.
5. Able to design canals and select suitable irrigation structures and cross drainage works.

Text/Reference Books:

1. P N Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House
2. S K Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers.
3. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
4. P. Jaya Rami Reddy, A text book of Hydrology, University Science Press, Laxmi Publications.
5. L W Mays, Water Resources Engineering, Wiley.

PO&P SO/ CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1	3	3	3	2	2	-	-	-	-	-	-	-	3	1
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	1
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially



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FOUNDATION ENGINEERING**Credits: 3****Assessment: 40 +60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-04R25	CE

PREREQUISTE:

Basic Soil Mechanics, Fluid Mechanics

Course Educational Objectives (CEOs):

Impart geotechnical site investigation methods and compaction methods

Impart the concept and methods of stress distribution in soils due. applied loads and analysing stability of slopes.

Impart earth pressure theories and analysis of earth pressure in retaining structures.

Impart methods of Bearing capacity and the design concepts of shallow foundations.

Impart pile foundations and pile groups.

UNIT - I**SOIL EXPLORATION:** Methods of soil exploration – Boring and Sampling methods – Penetration Tests – Pressure meter – Programme planning and preparation of soil investigation report.**SOIL COMPACTION:** Compaction of cohesive and cohesionless soils - Standard Proctor's test and Modified Proctor's test - Field compaction - Compaction control - C.B.R. test and its use.**UNIT - II****STRESS DISTRIBUTION IN SOILS:** Boussinesq's equation - Vertical stress due to line load, strip load, and uniformly loaded circular area - Newmark's chart - Westergaard's approach - Pressure bulb concept - Approximate methods.**STABILITY OF SLOPES:** Stability analysis of infinite slopes - Stability analysis of finite slopes - Swedish circle method - Friction circle method - Taylor's stability number and use of charts - Improving stability of slopes.**UNIT – III EARTH PRESSURE THEORIES:** Types of Earth Pressures – Earth Pressure at Rest-Active and passive earth pressures in cohesion less and cohesive soils (with and without surcharge) - Rankine's and coulomb's earth pressure theories - Graphical methods due to Rebhann and Culmann.

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UNIT – IV

BEARING CAPACITY AND SHALLOW FOUNDATIONS: Classification and purpose of foundations-general requirements, location and deep foundation of shallow foundations - factors influencing bearing capacity- analytical methods to determine bearing capacity- Terzaghi's, Meyerhof's and Skempton bearing capacity theories- IS code recommendations- Settlement of shallow foundations resting on cohesive and Cohesionless soils-contact pressure under footing.

UNIT-V

PILE FOUNDATIONS: Types of piles - Load carrying capacity based on static formula, dynamic formula, Pile load tests -Pile groups in sands and clays - negative skin friction in single pile and pile groups – causes and remedies.

TEXT/REFERENCE BOOKS:

1. Geotechnical Engineering - C.Venkatramaiah.
2. Numerical Problems, Examples and Objective Questions in Geotechnical Engineering - Prof.A.V.Narasimha Rao and Prof.C.Venkatramaiah.
3. Basic and Applied Soil Mechanics - Gopal Ranjan &A.S.R.Rao.

REFERENCE BOOKS:

1. Analysis and design of foundations and retaining structures - Shamsheer Prakash, Gopal Ranjan &Swamisaran
2. Soil Mechanics & Foundation Engineering – P.Purushothama.Raj
3. Foundation Engineering – Teng

Course Outcomes (COs):

1. Conduct field and laboratory soil exploration and determine compaction characteristics of soils.
2. Determine stresses induced in soils due to external applied loads and analyze stability of finite and infinite slopes.
3. Calculate earth pressure in soil retaining structures.
4. Determine bearing capacity of shallow foundations resting on cohesion and cohesionless soils.
5. Determine load carrying capacity and settlement of piles and pile groups.

PO& PSO / CO	PO (1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO(1)	PSO(2)
CO1	3	3	3	2	2						2	2	3	3
CO2	3	3	3	3	2	2	2	3	2	3	3	2	3	2
CO3	3	2	3	3	3	2	3	2	2	2	3	2	3	2
CO4	3	3	3	3	3	2	2	3	2	2	3	2	3	2
CO5	3	3	3	2	2						2	2	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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CONCRETE TECHNOLOGY

Credits: 3**Assessment: 40 +60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-05R25	CE

Course objectives:

- 1) Explain the role of ingredients of concrete and apply this knowledge to mix design philosophy
- 2) Develop fundamental knowledge in the fresh and hardened properties of concrete
- 3) Produce the testing methodology to evaluate the properties of concrete during fresh and hardened stage
- 4) Knowledge on concrete behavior with response to stresses developed.
- 5) Knowledge on the special concretes and Concreting methods.

UNIT-I**CEMENTS AND AGGREGATES:**

General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, hydration of cement, heat liberation from a setting cement, hardening of cement, structure of hydrated cement, water requirements for hydration.

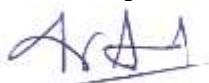
TYPES OF CEMENTS: Ordinary Portland cement, Rapid hardening cement, Sulphate resisting cement, Portland Slag cement, Quick setting cement, Super sulphated cement, Portland pozzolana cement, air entraining cement, coloured cement, expansive cement, High alumina cement.

AGGREGATES: Classification, source, size and shape texture and influence of texture on strength, specific gravity of aggregates, moisture in aggregates, bulking of fine aggregate, methods used for determination of moisture content of aggregates, grading of aggregates, sieve analysis, standard grading curve, grading limits of fine aggregates as per IS ; gap grading.

UNIT-II

WATER & ADMIXTURES: Quality of water for mixing concrete, Tolerable concentrations of some impurities in mixing water, permissible limit for solids as per IS456-2000, use of sea water for mixing concrete.

ADMIXTURES AND CONSTRUCTION CHEMICALS: General, plasticizers and super plasticizers – Dosage, mixing procedure, effect of super plasticizers on the properties of fresh and hardened concrete, Retardors, accelerators. Air-entraining admixtures, effect of air-entrainment on the properties of concrete, fly ash, effect of fly ash on fresh and hardened concrete, high volume fly ash concrete, silica fume, available forms, effect of silica fume on compressive strength of concrete, construction chemicals for curing, construction chemicals for water proofing.



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UNIT-III**FRESH CONCRETE:**

Workability, factors affecting workability, slump test, V-B test, compaction factor test, segregation, bleeding, volume batching and weigh batching, hand mixing, machine mixing, mixing time, compaction of concrete, hand compaction, compaction by vibration, internal vibrator, form work vibrator, table vibrator, platform vibrator, surface vibrator.

UNIT-IV

HARDENED CONCRETE: General, water-cement ratio; gel/space ratio; gain of strength with age; maturity concept of concrete

TEST ON HARDENED CONCRETE: Compression test; moulds and compacting; curing; failure of specimen under compression; effect of height/diameter ratio on strength; flexural strength of concrete; split tensile strength of concrete

ELASTICITY, CREEP AND SHRINKAGE: Elastic properties of concrete, modulus of elasticity of concrete. Factor's affecting modulus of elasticity, Poisson's ratio, creep and factors affecting creep, shrinkage and factors affecting shrinkage.

DURABILITY OF CONCRETE: Factors contributing to cracks in concrete, sulphate attack and methods of controlling sulphate attack, chloride attack, corrosion of steel and its control.

UNIT-V

SPECIAL CONCRETES AND CONCRETING METHODS: Fibre reinforced concrete; Fibres used, factors effecting properties, aspect ratio of fibres, orientation of fibres, workability, mixing, applications, current development in FRC.

NO-FINES CONCRETE: mix proportion, drying shrinkage, Thermal conductivity, applications.

Ferrocement: Casting techniques, hand plastering, semi-mechanized process, Centrifuging, guniting, applications.

LIGHT-WEIGHT CONCRETE: Natural and artificial light-weight aggregates, properties of common light-weight concretes.

READY MIXED CONCRETE: Batching of aggregates, cement, water, mixing of RMC, Time of transit, use of admixtures, Pumping of concrete

Text Book

1. Concrete Technology by M.S.Shetty, S.Chand& Company Pvt. Ltd., New Delhi



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Reference Books

1. Properties of concrete by A.M.Neville, Longman Publishers
2. Concrete technology by M.L.Gambhir, Tata McGraw-Hill Publishing company Ltd., New Delhi.

Course Outcomes:

At the end of the course student is able to:

1. Understand various ingredients of concrete and their role.
2. Examine knowledge on the fresh and hardened properties of concrete.
3. Design concrete mixes using various methods.
4. Perceive special concretes for accomplishing performance levels.
5. Perceive special concretes for accomplishing performance levels.

PO&PS O/ CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1	1	2						1						
CO2		2	1	2			2	1		1	1			
CO3	2	2	1	1			1	1		1	1	1		
CO4		2	1	1		1		1		1	1	1		
CO5		2	1	1		1		1		1	1	1		

1 - Slightly; 2 - Moderately; 3 – Substantially



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GEOTECHNICAL ENGINEERING LABORATORY**Credits: 1.5****Assessment: 40 +60**

Semester	L-T-P	Course Code	Branches
V	0-0-3	7-2-5-R25P1	CE

Pre-requisite: Soil Mechanics Laboratory Experiments**Course Educational Objectives (CEOs):**

1. Acquire skill and practical knowledge on determination of permeability of soils.
2. Acquire gain skill and practical knowledge on determination of Relative Density of cohesionless soils
3. Acquire gain skill and practical knowledge on determination of strength characteristics of soils.
4. Acquire gain skill and practical knowledge on determination of compaction characteristics of soils using heavy compaction energy.
5. Acquire gain skill and practical knowledge on determination of consolidation characteristics of fine soils.

List of Experiments:

1. Permeability test using Constant-head test method
2. Permeability test using Falling-head test method
3. Relative Density
4. Unconfined Compression Strength Test.
5. Direct Shear Test
6. North Dakota Cone Test
7. I.S. Heavy Compaction test
8. California Bearing Ratio test
9. Triaxial Test UU (Demo)
10. Consolidation Test (Demo)
11. Vane Shear Test (Demo)



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Course Outcomes(CO s):

1. Determine permeability and evaluate seepage characteristics of soils.
2. Determine relative Density of cohesionless soils.
3. Determine Strength Characteristics of various soils and assess their behaviour.
4. Determine Heavy Compaction Characteristics for various applications.
5. Determine Consolidation Characteristics and evaluate settlement in fine soils.

PO&PS O/ CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1			3	1		1		2	3	2	1	3	3	2
CO2			3	1		1		2	3	2	1	3	3	2
CO3			3	1		1		2	3	2	1	3	3	2
CO4			3	1		1		2	3	2	1	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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CONCRETE TECHNOLOGY LABORATORY**Credits: 1.5****Assessment: 40 +60**

Semester	L-T-P	Course Code	Branches
V	0-0-3	7-2-5-R25P2	CE

Course Educational Objectives (CEOs):

The objectives of the course is to gain the practical knowledge of properties of concrete materials, behaviour of concrete properties of fresh and hardened concrete.

List of Experiments:

1. To find the properties of ingredients or concrete
2. To know the properties of fresh & hardened concrete under different loading conditions.
3. Sieve Analysis of coarse and fine aggregates
4. Bulking of Sand by Volume and Weight methods
5. Normal consistency, Initial and Final Setting Times of Cement
6. Tests on concrete:
 - a) Slump Test b) Compressive Strength of Concrete Cubes c) Compaction Factor Test d) Compressive Strength of Concrete Cylinders
7. (a) Specific gravity & Water absorption of Coarse aggregate
(b) Specific gravity of Cement
8. Water absorption and Compressive Strength of Bricks

Course Outcomes (COs):

1. Able to find the quality of materials used in concrete and the properties of hardened concrete.

TEXT BOOKS:

1. Concrete Technology by M.S. Shetty – S. Chand & Co
2. Concrete Manual by M.L. Gambhir, Dhanpat Rai & Son

PO&PSO/ CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11))	PO (12)	PSO (1)	PSO (2)
CO1	3	3		2	2				1	2	2	1	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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REMOTE SENSING AND GIS**Credits: 2****Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
V	1-0-2	7-2-5-R25S1	CE

DESCRIPTION OF THE COURSE:

In this Course students learn about basic concepts of Remote sensing and GIS, preparing various thematic map using GIS, Open source software in application of Civil Engineering.

Course Educational Objectives (CEOs):

1. To learn and perform the Map projections.
2. To learn about to prepare the Land use/Land cover Map using toposheet.
3. To learn about the prepare the Land use/Land cover Map using satellite Map.
4. To learn about prepare Surface water mapping.
5. To understand the concepts of preparation of water quality map.

LIST OF EXPERIMENTS:

1. **GEOREFERENCING THE TOPOSHEET:** Basic concepts and foundation of remote sensing, resolution, sensors and satellite, visual interpretation techniques. Understanding the concepts of Map Projections, Introduction to open source software QGIS/GRASS.
2. **LAND USE/LAND COVER MAP USING TOPOSHEET:** Basic concepts of Digitizing, types of digitizing, preparing thematic maps of contours, water bodies, streams, rivers and villages.
3. **LAND USE/LAND COVER MAP USING SATELLITE MAP:** Introduction, Overview, Pre-processing, Radiometric correction, Geometric correction, Rectification. Enhancement Techniques, Contrast stretch, Edge enhancement, Filtering Techniques, Classification Techniques - Supervised and unsupervised classification.
4. **APPLICATION OF GIS IN SURFACE WATER MAPPING:** Delineating Watershed, preparing Stream order map, Stream length map and Drainage density map.
5. **APPLICATION OF GIS IN WATER QUALITY AND MANAGEMENT:** Converting GPS data into Map, preparing spatial map using Inverse Distance Weightage Method.



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REFERENCE BOOKS:

1. M. Anji Reddy Remote sensing and GIS, B. S. Publications, New Delhi.
2. L. R. A. Narayana, Remote Sensing and its applications, University Press 1999.
3. Basudeb Bhatta, Remote Sensing and GIS, Second Edition, Oxford University Press 2011.

Course Outcomes (COs):

1. Able to perform map projections using GIS software.
2. Able to generate Land use/Land cover map using toposheet.
3. Able to generate Land use/Land cover map using Satellite data.
4. Able to prepare surface water mapping using GIS.
5. Able to generate water quality mapping using GIS.

PO&PS O/ CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1	2	2	-	3	3	-	-	-	-	-	-	-	2	3
CO2	2	2	-	3	3	-	-	-	-	-	-	-	2	3
CO3	2	2	-	3	3	-	-	-	-	-	-	-	2	3
CO4	2	2	-	3	3	-	-	-	-	-	-	-	2	3
CO5	2	2	-	3	3	-	-	-	-	-	-	-	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-I-1. MUNICIPAL SOLID WASTE MANAGEMENT**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-R25E11	CE

COURSE OBJECTIVES:

1. To know the different types of solid waste
2. To know the onsite handling, storage and processing of municipal solidwaste
3. To learn about the frequency of collection and location of transfer station
4. To know about the different processing techniques of solidwaste
5. To design the sanitary landfill

UNIT I**INTRODUCTION:**

Objectives of solid waste management; Impacts of solid waste generation on a technological society.

GENERATION OF SOLID WASTES:

Solid waste generation sources; classification of solid waste; data on Indian city wastes; factors influencing generation of solid wastes; characterization and analyses of solid wastes. Elements of solid waste management.

UNIT II**ONSITE HANDLING, STORAGE AND PROCESSING:**

Onsite handling methods used at residential and commercial sources; onsite storage, and onsite processing of solid wastes.

UNIT III**COLLECTION, TRANSFER AND TRANSPORT:**

Collection services-Residential collection services and commercial industrial services. Collection systems, equipment and labour requirements-Types of collection systems, collection routes, Need for transfer station, transport means and methods, Location of transfer stations.



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UNIT IV**PROCESSING TECHNIQUES AND EQUIPMENT:**

Purpose of processing; Mechanical volume reduction, Chemical volume reduction, Mechanical size reduction.

RECOVERY OF RESOURCES, CONVERSION PRODUCTS, AND ENERGY:

Material processing and recovery systems, recovery of chemical conversion products, recovery of biological conversion products, recovery of energy from conversion products.

UNIT V**DISPOSAL OF SOLID WASTES:**

Factors to be considered in landfill site selection, land filling methods and operations, reactions occurring in completed landfills, gas and leachate movement and control, design of landfills.

REFERENCE BOOKS:

1. Bhide, A.D. and Sundaresan, B.B. (1983), Solid Waste Management in Developing Countries, INSDOC, New Delhi.
2. Techobanglous, G.Theisen, H. and Ehasin, R.(1996). Solid waste engineering principles and Management Issues – McGraw Hill, Tokyo.

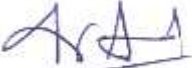
COURSE OUTCOMES:

After completion of course, the student can able to

- 1.Classify the different types of solidwaste
2. Apply the onsite handling, storage and processing methods for municipal solidwaste
3. Explain the frequency of collection and location of transfer station
4. Carry out the different processing techniques of solidwaste and recover materials.
- 5.Describe different landfill methods and design the sanitary landfill.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	1	2	2			2	2	2	2	2	1	1		3	2
CO2	3	3	3			2	2	2	2	2	1	1		3	2
CO3	3	3	3			2	2	2	2	2	1	1		3	2
CO4	3	3	3			2	2	2	2	2	1	1		3	2
CO5	3	3	3			2	2	2	2	2	1	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-I-2 FOUNDATIONS ON EXPANSIVE SOILS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-R25E12	CE

PREREQUISITE: Basic Soil Mechanics, Foundation Engineering

Course Educational Objectives (CEOs):

1. Impart nature of soils and soil Structure.
2. Impart concepts of Swelling and methods of determination of Swelling Characteristics.
3. Impart foundation practices in expansive soils.
4. Introduce different materials and techniques for stabilization of expansive soils.
5. Impart strength and suction concept of expansive soils using different concepts

UNIT-I

Clay Mineralogy: Nature of Soils-Clay mineral structure- Cation exchange -Soil water- Soil Structure-Soil-water interaction

UNIT-II

Swelling Characteristics- Swelling- Factors effecting Swelling- Swelling Potential- Swell Pressure- Methods of Determination-Factors effecting Swelling potential and swell pressure-Heave- Factors effecting Heave- Methods of determination of heave.

UNIT-III

Foundation Practices in Expansive Clays: Sand Cushion-Belled Piers-CNS layer technique- Under reamed Pile Foundation-Construction Techniques- Design Specifications-Load-carrying capacity in compressive and uplift of single and multi under reamed piles in clays and sands- Granular pile Anchors.

UNIT-IV

Lime Soil columns and Lime Slurry pressure injection- Stabilization with admixtures-Propounding- Vertical and Horizontal Moisture barriers.

UNIT: V

Shear strength of expansive soils-Katti's concept of bilinear envelope- Stress-state variables in partly saturated soils- Frelend's strength parameters- Determination of matrix suction by axis translation technique-field suction measurement.


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TEXTBOOKS:

1. F.C. Chen, Foundation on Expansive Soils, Elsevier Scientific Publishing Company, Newyork
2. J.D.Nelson and D. I. Miller, Expansive soils- Problems and Practice in Foundation and pavement Engineering, John Wiley & Sons Inc.

REFERENCES:

1. D.G.Fredlund and H.Rhardjo, Soil Mechanics for Unsaturated Soils, WILEY Inter Science Publication, John Wiley & Sons, Inc.
2. D.R.Katti, A.R.Katti, Behavior of Saturated Expansive Soils and Control

Methods Taylor and Francis.

Codes:

IS:2720(Part XV)-1977 "Measurement of Swelling Pressure of Soils"

Course Outcomes (COs):

1. Analyze the mineralogy of expansive soils.
2. Determine swelling characteristics of expansive soils.
3. Design foundations on expansive soils.
4. Adopt appropriate method of stabilization for expansive soils.
5. Determine Shear Strength and Suction using different concepts.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	3	2	2	3	2		2			2				2	1
CO2	3	2	2	3	2		2			2				2	1
CO3		3	3	3	2		2			2				3	2
CO4		3	3	3	2					1				3	2
CO5	3	3	3	3	2					1				2	2

1 - Slightly; 2 - Moderately; 3 - Substantially



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PE-I-3 WATER POWER ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-R25E13	CE

DESCRIPTION OF THE COURSE:

Fluid Mechanics and Hydraulic Machines are considered as pre-requisite for this course. The students will be learning about design of Hydro power plant and water conveyance system.

Course Educational Objectives (CEOs)

1. To know about different sources of energy
2. To understanding about low and high head plants
3. To know about design of pumped storage power plant
4. To learn about water conveyance losses
5. To know about planning of power house

UNIT I**INTRODUCTION**

Introduction - Sources of Energy - Hydro-power - Estimation of Water power potential.

ELECTRICAL LOAD ON HYDRO-TURBINES

General - Load curve - Load factor - Capacity factor - Utilization factor - Diversity factor - Load duration curve - Firm power - Secondary power - Prediction of load.

UNIT II**HYDRO-POWER PLANTS**

Low and High Head Plants: Classification of Hydel Plants - Run-of-River Plants - General Arrangement of Run-of-River Plants - Valley dam plants - Diversion canal plants. High Head diversion plants - Storage and pondage.

UNIT III

PUMPED STORAGE POWER PLANTS: Basic features - Advantages of pumped storage plants - Types of pumped storage plants - Relative merits of two-unit and three-unit arrangement - Reversible pump-turbines - Problems of operation - Topography, Reservoirs and water conveyance - Power house - Efficiency.



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UNIT IV**WATER CONVEYANCE**

Classification of penstocks - Design criteria - Economical diameter - Anchor blocks - Conduit valves - Bends and Manifolds. Water Hammer - Resonance in Penstocks - Channel surges - Surge tanks. Intakes - Types - Losses - Air Entrainment - Inlet Aeration - Canals - Forebay – Tunnels – Selection of Turbines.

UNIT V**POWER HOUSE PLANNING**

Surface Power Station: Power House Structure - Power house dimensions - Lighting and ventilation. Underground Power Station: Location - Types - Advantages - Components - Types of Layout - Structural Design of Power Houses

Reference Books:

1. Water Power Engineering by M.M.Dandekar and K.N.Sharma.
2. A Text Book of Water Power Engineering by R.K.Sharma and T.K.Sharma.
3. Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N. Modi and S.M. Seth – twenty third edition 2022, Standard Book House, New Delhi.
4. Fluid Mechanics and Hydraulic Machines by R.K.Rajput – Sixth edition 2016, Publication, S.Chand & Company Ltd., New Delhi.

Course Outcomes (Cos)

1. Able to differentiate the different sources of energy and design of electric loads
2. Able to design the low and high head plants
3. Able to design pumped storage power plant
4. Able to design the water conveyance systems in turbines
5. Able to design the power house structures in dams.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)		PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	3	3	3	3	3	-	-	-		-	-	-	-		3	1
CO2	3	3	3	3	3	-	-	-		-	-	-	-		3	1
CO3	3	3	3	3	3	-	-	-		-	-	-	-		3	1
CO4	3	3	3	3	3	-	-	-		-	-	-	-		3	1
CO5	3	3	3	3	3	-	-	-		-	-	-	-		3	1

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-I-4 ADVANCED STRUCTURAL ANALYSIS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-R25E14	CE

COURSE EDUCATIONAL OBJECTIVES (CEOs)

After successful completion of this course, the graduate will be able to:

CEO1:

Understand the behavior and analysis of statically indeterminate beams and frames subjected to various types of loading.

CEO2:

Apply classical structural analysis methods such as slope deflection, moment distribution, and Kani's method to continuous beams and rigid frames.

CEO3:

Incorporate practical considerations such as support settlement, sinking, and sway in the analysis of indeterminate structures.

CEO4:

Formulate and solve structural problems using matrix methods based on flexibility and stiffness approaches.

CEO5:

Analyze structures at collapse using plastic analysis concepts to determine ultimate load capacity and failure mechanisms.

UNIT – I

STATICALLY INDETERMINATE BEAMS: Analysis of propped cantilevers - Shear force and bending moment diagrams - Deflections. Analysis of fixed beams with udl, point loads, uniformly varying load, couple - shear force and bending moment diagrams - Deflections - Effect of sinking of support.

UNIT – II

STATICALLY INDETERMINATE FRAMES: (i) Slope deflection method, continuous beams with degree of indeterminacy not exceeding three, effect of sinking. (ii) Moment distribution method, continuous beams and frames with sway limited to single bay single storey, effect of sinking.



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UNIT – III

KANI'S METHOD: Continuous beams, settlement of supports, single bay portal frames with side sway. Analysis of multistoried frames using substitute frame method, portal and cantilever methods.

UNIT – IV

INTRODUCTION TO MATRIX METHODS: Flexibility and stiffness Coefficients – Force and Displacement methods – Application to beams.

UNIT – V

PLASTIC ANALYSIS: Theory of plastic bending – Idealized stress – strain diagram – Shape factor – Moment- curvature relationships – Plastic hinges – Collapse Mechanisms – Analysis of fixed and continuous beams and portal frames – Statical method and mechanism method of analysis

COURSE OUTCOMES (COs)

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

CO1: Analyze statically indeterminate beams including propped cantilevers and fixed beams, and construct shear force and bending moment diagrams.

CO2: Determine slopes, deflections, and internal forces in continuous beams and frames using slope deflection and moment distribution methods.

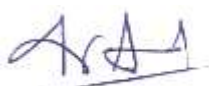
CO3: Apply Kani's method and approximate methods (portal, cantilever, and substitute frame methods) to analyze frames with and without sway.

CO4: Formulate and solve beam and frame problems using flexibility and stiffness matrix methods.

CO5: Evaluate plastic hinge formation, collapse mechanisms, and ultimate loads of beams and portal frames using plastic analysis.

TEXT BOOKS:

1. R.S.Khurmi, Theory of Structures, Dhanpat Rai Publishing Company (p) Ltd, 2009
2. L. S. Negi, Basic Structural Analysis, Tata McGraw Hill

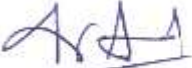


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REFERENCES Course Outcomes:

1. Timoshenko & Young, Theory of Structures, Tata McGraw Hill
2. Junarkar S. B., Structural Mechanics Vol I & II, Charotar Publishers
3. S. K. Roy & S. Chakraborty, Fundamentals of Structural Analysis.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	-	3	1
CO2	3	3	2	2	1	-	-	-	-	-	-	-	3	1
CO3	3	3	2	2	1	-	-	-	-	-	-		3	2
CO4	3	3	2	2	3	-	-	-	-	-	-	2	3	3
CO5	3	3	3	2	1	-	2	-	-	-	-		3	1


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PE-I-5 TRAFFIC ANALYSIS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-R25E15	CE

Course Educational Objectives (CEOs)

After successful completion of this course, the students will be able to:

1. Understand traffic flow characteristics using statistical and probabilistic distributions for vehicle arrivals and headways.
2. Apply queuing theory principles to analyze congestion, delays, and capacity at traffic facilities such as toll plazas, parking garages, and signalized intersections.
3. Analyze pedestrian movement characteristics and assess pedestrian delays and crossing requirements.
4. Evaluate traffic congestion phenomena using shockwave theory and time–space diagrams.
5. Develop simulation models to analyze and improve the performance of traffic systems and transit operations.

UNIT-I:

Traffic Flow Description: Types of Statistical Distributions; Discrete And Continuous Distributions; Counting And Interval Distributions used In Traffic Analysis; Poisson's Distribution for Vehicle Arrivals; Headway Distributions – Exponential Distribution; Shifted Exponential Distribution; Erlang Distribution; Composite Distribution.

UNIT-II:

Queuing Theory: Introduction to Queuing Theory; Notation Used For Describing A Queue System; Analysis of M/M/1 System; Assumptions and Derivation of System State Equations; Application of M/M/1 Analysis for Parking Garages and Toll Plazas - Queuing Theory - D/D/1 System: Traffic Interruptions Like Accidents Or Bottlenecks; Traffic Signal Analysis As D/D/1 System; Computation of Delays and Queue Dissipation Time.

UNIT-III:

Pedestrian Delays and Gaps: Pedestrian Gap Acceptance and Delays; Concept of Blocks, Anti-Blocks, Gaps and Non-Gaps; Underwood's Analysis for Pedestrian Delays; Warrants for Pedestrian Crossing Facilities –Minimum Vehicular Volume Warrant, Minimum Pedestrian Volume Warrant, Maximum Pedestrian Volume Warrant;



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UNIT-IV:

Shockwave Theory: Concept of Shockwave; Causes for Traffic Interruptions and Shockwaves; Flow-Density Diagram use in Shockwave Analysis; Use of Time-Space Diagram For Shockwave Description; Bottleneck Situations and Shockwaves; Traffic Signal and Shockwave Theory; Numerical Examples For Application of Shockwave Theory;

UNIT-V:

Traffic Simulation: Introduction To Simulation; Need For Simulation Modelling; Steps In Simulation; Interval Oriented And Event Oriented Simulation; Use of Random Numbers In Simulation; Random Number Generation Methods; Computing Headways And Arrival Times Based on Random Numbers; Basic Concepts Of Simulation Modelling Application for Signalised Intersections, Pedestrian Crossings and Transit Scheduling.

Course Outcomes (COs):

On successful completion of the course, students will be able to:

1. Apply statistical distributions such as Poisson, exponential, Erlang, and composite distributions to model traffic flow and headway behavior.
2. Analyze queuing systems using M/M/1 and D/D/1 models to estimate delays, queue lengths, and dissipation times.
3. Evaluate pedestrian gap acceptance and delays and justify pedestrian crossing facilities using standard warrants.
4. Analyze traffic interruptions and bottleneck conditions using shockwave theory, flow–density relationships, and time–space diagrams.
5. Apply traffic simulation techniques using random number generation to model signalized intersections, pedestrian crossings, and transit scheduling.

TEXT BOOKS:

1. C. S. Papacostas, Fundamentals of Transportation Engineering –Prentice Hall India Publication

REFERENCE: BOOKS

1. F. L. Mannering & W. P. Kilareski, Highway Engineering and Traffic Analysis –JohnWiley Publishers.
2. A. D. May, Traffic Flow Fundamentals, Prentice Hall India Publication
3. Mcshane& Rogers, Fundamentals of Traffic Engineering

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	–	–	–	–	–	–	–	1	3	1
CO2	3	3	2	3	1	1	–	–	–	–	1	1	3	2
CO3	2	3	2	2	–	3	1	–	–	–	–	1	3	1
CO4	3	3	2	3	1	1	–	–	–	–	–	1	3	2
CO5	3	2	2	2	3	–	–	–	–	–	1	2	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-I-6 BUILDING CONSTRUCTION PRACTICE**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
V	3-0-0	7-2-5-R25E16	CE

Course Educational Objectives (CEOs)

The objectives of this course are to:

CEO-1: Provide fundamental knowledge of building planning principles and building regulations as per National Building Code.

CEO-2: Develop understanding of construction techniques for foundations, masonry, floors, roofs, and staircases.

CEO-3: Familiarize students with building components such as doors, windows, finishes, and fixtures.

CEO-4: Introduce basic building services including water supply, sanitation, electrical services, and fire safety.

CEO-5: Create awareness about modern construction practices, prefabrication, and sustainable building concepts.

UNIT – I:**Building Planning & Building Regulations**

Principles of building planning-Factors affecting building planning-Orientation of buildings-Building bye-laws and development control regulations-Floor area ratio (FAR), setbacks, coverage-National Building Code (NBC) provisions-Site selection and site layout planning

UNIT – II:**Foundations and Masonry Construction**

Soil exploration for buildings-Shallow and deep foundations-Construction of isolated, combined and raft foundations-Brick masonry: bonds, tools and construction techniques-Stone masonry: types and construction-Cavity walls and partition walls

UNIT – III: Floors, Roofs and Staircases

Types of floors: ground and upper floors-RCC, timber and composite floors-Types of roofs: pitched roofs, flat roofs-Roof coverings and waterproofing methods-Staircases: types, design considerations, and construction-Ramps and lifts (basic concepts)

UNIT – IV: Doors, Windows and Finishes

Types of doors and windows-Fixtures and fastenings-Ventilators and sunshades-Plastering: types and defects-Painting, pointing and polishing-Flooring finishes and wall finishes


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UNIT – V: Building Services and Modern Construction

Water supply systems in buildings-Sanitary fittings and drainage systems-Rainwater Harvesting-Electrical services in buildings-Fire safety requirements in buildings-Introduction to prefabricated construction-Green buildings and sustainable construction practices

Course Outcomes (COs):

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

CO-1: Apply principles of building planning, orientation, and building bye-laws in real-life construction projects.

CO-2: Explain construction methods of foundations, brick and stone masonry used in buildings.

CO-3: Describe construction practices of floors, roofs, staircases, and related building components.

CO-4: Identify and explain various doors, windows, finishes, and building services used in residential and commercial buildings.

CO-5: Understand modern construction techniques, prefabricated systems, and sustainable building practices.

Textbooks

1. Arora & Bindra – *Building Construction*
2. Rangwala – *Building Construction*
3. K.B. Sushil Kumar – *Building Construction*

Reference Books:

1. National Building Code (NBC) – Latest edition
2. Barry – *Building Construction*
3. Mckay – *Building Construction*

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	2	1	–	–	–	1	1	3	2
CO2	3	2	2	1	1	–	–	–	–	–	1	1	3	2
CO3	3	2	2	1	1	–	–	–	–	–	1	1	3	2
CO4	3	2	2	1	1	2	1	–	–	–	1	1	3	2
CO5	3	2	2	1	1	2	2	–	–	–	1	2	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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B. Tech. (Civil Engineering)
Semester VI (Third Year)

Code		Category	Course Title	Hours/Week			Total	Credits	Marks		
Department	University			L	T	P			CIE	SEE	Total
CE 2601C	7-0-6-R25M1	CE-BS	Elements of Quantum Computing	2	0	0	2	2	100	0	100
CE 2602C	7-2-6-02R25	CE-PC	Design of Steel Structures	3	0	0	3	3	40	60	100
CE 2603C	7-2-6-03R25	CE-PC	Wastewater Treatment	3	0	0	3	3	40	60	100
CE 2604C	7-2-6-04R25	CE-PC	Estimation & Costing	3	0	0	3	3	40	60	100
CE 2605E	7-2-6-R25PE1	CE-PE	Professional Elective – II	3	0	0	3	3	40	60	100
CE 2606E	7-2-6-R25PE2	CE-PE	Professional Elective – III	3	0	0	3	3	40	60	100
CE2607L	7-2-6-R25P1	CE-PC	Transportation Engineering Laboratory	0	0	3	3	1.5	40	60	100
CE 2608L	7-2-6-R25P2	CE-PC	Wastewater Analysis Laboratory	0	0	2	2	1	40	60	100
CE 2609O	7-2-6-R25OE1	OD-OE	Open Elective – I (MOOCS)	0	0	0	0	3	0	100	100
CE 2610S	7-2-6-R25S1	CE-SC	Computer Applications in Civil Engineering	1	0	2	3	2	100	0	100
CE 2611M	7-1-5-09R25	CE-MC	Professional Ethics in Engineering	2	0	0	2	0	100	0	100
				20	0	7	27	24.5	580	520	1100

Students shall undergo summer Industrial Internships for a duration of **six to eight (6-8) weeks** during the summer vacation by completing **45 – 60** hours of work with at least **75%** attendance, to be evaluated and reflected in 7th semester.

The students have to choose **open electives** (OE-I, OE-II, OE-III, etc..) from other disciplines or departments. **The student cannot opt for an open elective course offered by his own (parent) department/discipline.**

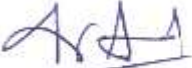


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 DEAN
 FACULTY OF ENGINEERING
 S. V. U. COLLEGE OF ENGINEERING
 TIRUPATI-517 502

CIVIL ENGINEERING**PROFESSIONAL ELECTIVE COURSES**

Professional Elective - I (V Sem)	7-2-5-R25E11	Municipal Solid Waste Management (EE)
	7-2-5-R25E12	Foundations on Expansive Soils (GTE)
	7-2-5-R25E13	Water Power Engineering (H&WRE)
	7-2-5-R25E14	Advanced Structural Analysis (SE)
	7-2-5-R25E15	Traffic Analysis (TE)
	7-2-5-R25E16	Building Construction Practice (Gen)
Professional Elective - II (VI Sem)	7-2-6-R25E11	Air Pollution and its Control (EE)
	7-2-6-R25E12	Geo environmental Engineering (GTE)
	7-2-6-R25E13	Water Resources System Analysis (H&WRE)
	7-2-6-R25E14	Advanced Reinforced Concrete Design (SE)
	7-2-6-R25E15	Traffic Engineering and Management (TE)
	7-2-6-R25E16	Construction Planning and Project Management (Gen)
Professional Elective -III (VI Sem)	7-2-6-R25E21	Environmental Impact Assessment and Audit (EE)
	7-2-6-R25E22	Advanced Geotechnical Engineering (GTE)
	7-2-6-R25E23	Hydraulic Structures (H&WRE)
	7-2-6-R25E24	Structural Dynamics (SE)
	7-2-6-R25E25	Urban Planning and Development (TE)
	7-2-6-R25E26	Organizational Behavior (Gen)
	7-0-6-R25CE1	Introduction to Semiconductor Manufacturing
Professional Elective -IV (VII Sem)	7-2-7-E11R25	Industrial Wastewater Treatment (EE)
	7-2-7-E12R25	Applied Soil Mechanics (GTE)
	7-2-7-E13R25	Watershed Management (H&WRE)
	7-2-7-E14R25	Bridge Engineering (SE)
	7-2-7-E15R25	Railway Engineering (TE)
	7-2-7-E16R25	Sustainable Engineering (Gen)
Professional Elective -V (VII Sem)	7-2-7-R25E21	Climate Change Impact Mitigation and Adaptation (EE)
	7-2-7-R25E22	Offshore Geotechnical Engineering (GTE)
	7-2-7-R25E23	Sustainable Water Resources Development (H&WRE)
	7-2-7-R25E24	Design of Earthquake Resistant Structures (SE)
	7-2-7-R25E25	Docks and Harbour Engineering (TE)
	7-2-7-R25E26	Optimization Techniques in Civil Engineering (Gen)
Professional Elective- VI (VII Sem)	7-2-7-R25E31	Environmental Sanitation (EE)
	7-2-7-R25E32	Geotechniques for Design of Underground Structures (GTE)
	7-2-7-R25E33	Urban Hydrology (H&WRE)
	7-2-7-R25E34	Design of Prestressed Concrete Structures (SE)
	7-2-7-R25E35	Airport Engineering (TE)
	7-2-7-R25E66	Entrepreneurship and Incubation (Gen)



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ELEMENTS OF QUANTUM COMPUTING**Credits: 2****Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
VI	2-0-0	7-0-6-R25M1	CS

Prerequisites: Physics**Course Objectives**

1. To introduce the basic principles of quantum mechanics relevant to computing.
2. To differentiate between classical and quantum computation models.
3. To understand qubits, superposition, entanglement, and quantum gates.
4. To study basic quantum algorithms and their real-world applications.

UNIT – I:

Evolution of computation: classical to quantum paradigm, Limitations of classical computation, Basic principles of quantum mechanics relevant to computation.

Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT - II

Quantum states and qubits, Superposition principle and quantum measurement. Quantum entanglement and its importance.

Quantum gates: Pauli, Hadamard, Phase, CNOT, Toffoli. Bloch sphere representation of qubit states.

UNIT - III

Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT - IV

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.



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UNIT - V

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge

REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci.
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information,
3. Vol. I: Basic Concepts, Vol II
4. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

Course Outcomes

1. Understand basic principles of quantum mechanics relevant to computation.
2. Understand basics of quantum states, qubit and gates.
3. Understand physical implementation of Qubit
4. Understand Quantum algorithms and their implementation
5. Understand the Impact of Quantum Computing on Cryptography

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			1	2	1	1		1	1	1	2
CO2	1	2	2	1	1	1	2		1	1	1	2		
CO3	2	1	3	3	1	1	1				1	3	1	3
CO4	1	2	3	3	1	1	1	1		1	1	3	1	3
CO5	2	2	2	2	2	1	1	1	1		1	3	1	3

1 – Slightly; 2 - Moderately; 3 – Substantially



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DESIGN OF STEEL STRUCTURES

Credits: 3**Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-02R25	CE

Pre-Requisites: Strength of Materials, Structural Analysis.

Course Educational Objective (CEOs):

1. Familiarize students with various design stresses and different types of connections
2. Understand design concepts of tension and compression members
3. Equip student with the concepts of designing flexural members
4. Familiarize students with the design of different types column bases

UNIT – I

Introduction - Properties of Sections - Types of Loads - Design stresses in Tension, Compression, and Shear as per IS code.

Types of Connections- Riveted, Bolted and Welded Connections - Strength of a Bolt - Lap and Butt Joints - Modes of failure and Efficiency of a Bolted Joint - Design of Lap and Bolted joints and Bracket connections.

UNIT – II

Welded joints - Types of Welded Joints - Strength of Fillet and Butt Weld- Design of Welded joints - Design of a Bracket connection.

Design of Tension Members - Lug angles - Tension splice.

UNIT – III

Design of compression members - Single and Built-up Columns - Design of the Laced and Battened Columns - Design of Eccentrically Loaded Columns

UNIT – IV

Laterally Supported and Laterally Unsupported beams - Design of Simple Beam - Design of Built-up Beams - Curtailment of Flange Plates.

UNIT – V

Design of Column Bases - Slab Base - Gusseted Base -- Grillage Foundation.



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TEXT BOOKS

1. Design of Steel Structures – (Limit State Method as per IS 800-2007) by Bhavakatti S.S.
2. Design of Steel Structures - (Limit State Method as per IS 800-2007) by N.Subramanian.
3. Design of Steel Structures - (Limit State Method as per IS 800-2007) by S.K.Duggal.

Course Outcomes (COs):

After completion of the course the student will be able to:

1. Analyze and design different types of bolted connections with relevant IS codes
2. Analyze and design of welded connections and Tension members with and without Lug angles
3. Design of built-up compression members subjected to axial loads
4. Carryout analysis and design of flexural members
5. Design of design of different types of foundations for steel columns.

PO&PS O/CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1	3										2		1	2
CO2	3			2	3				2	1			1	1
CO3	3	3	2			2	1	1		2		2	2	2
CO4			2		3			2					2	2
CO5	3		2		2				3		2		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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WASTEWATER TREATMENT

Credits: 3

Assessment: 40 + 60

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-03R25	CE

Course Educational Objectives (CEOs):

1. To know how to estimate quantity of wastewater generation.
2. To study the physical, chemical and biological characteristics of the wastewater.
3. To learn the design concepts involved in the wastewater treatment plant.
4. To know the advanced technologies involved in the wastewater treatment plant.
5. To know about the various effluent disposal methods

UNIT I

WASTEWATER COLLECTION: Sanitation - systems of sanitation, Dry conservancy system, water carriage system, sewerage, systems of sewerage. sources of wastewater, Estimation of quantity of municipal wastewater, Estimation of quantity of storm water, Different types of sewers, design flows through sanitary sewers, storm sewers and combined sewers, Hydraulic design of sewers, Sewer appurtenances, House drainage and Plumbing systems.

UNIT II

CHARACTERISTICS OF DOMESTIC WASTEWATER: Characteristics and composition of sewage - Physical, chemical and biological. BOD equation and factors affecting the BOD rate of reaction, population equivalent.

PRELIMINARY AND PRIMARY SEWAGE TREATMENT: Concept of wastewater treatment, Preliminary, primary, secondary and tertiary treatment, Conventional treatment process flow diagrams of municipal wastewater treatment plants - Functions of each unit, design of screens, grit chamber, and primary settling tanks.

UNIT III

SECONDARY TREATMENT OF SEWAGE: Principles of biological treatment, nutritional requirement of biological treatment system, factors affecting biological treatment systems. Design, construction, operation and maintenance of activated sludge process, oxidation ditch, trickling filters and waste stabilization ponds. .

UNIT IV

SLUDGE MANAGEMENT: Types of sludges, Quantity and characteristics of sludges, sludge treatment and disposal. Tertiary treatment - Removal of nitrogen, phosphorus, refractory organics, heavy metals, suspended solids and pathogenic bacteria.



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UNIT V

EFFLUENT DISPOSAL: Standards for disposal, disposal into surface water bodies - Self-purification, zones of pollution - Dissolved oxygen sag curve- Streeter - Phelp's equation, Marine disposal. On land disposal and treatment systems - overflow, flooding and irrigation.

Onsite Disposal System: Septic tank and effluent disposal system.

TEXTBOOKS:

1. Sewage Disposal and Air Pollution Engineering, by S.K.Garg, Khanna publishers.
2. Environmental Engineering by H.S. Peavy H.S., Rowe, D.R. and Tchobanoglous, G. (1985), McGraw-Hill Book Company, New York.
3. Water Supply and Sewerage, by E.W. Steel and Mc.Ghee.

REFERENCE BOOKS:

1. Wastewater Engineering, Treatment, Disposal, and Reuse by Metcalf and Eddy, 5th edition, Mc-Graw-hill education, New York.

Course Outcomes (COs):

1. Able to estimate the quantity of wastewater generation and design sanitary sewers
2. Able to analyze the characteristics of waste water.
3. Able to design the wastewater treatment plants.
4. Able to apply technologies to treat sludge and remove other contaminants
5. Able to apply suitable effluent disposal methods.

PO & PSO /CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO(2)
CO1	3	3	3			2	2	2	2	2	1		3	2
CO2	3	3	3			2	2	2	2	2	1		3	2
CO3	3	3	3			2	2	2	2	2	1		3	2
CO4	3	3	3			2	2	2	2	2	1		3	2
CO5	3	3	3			2	2	2	2	2	1		3	2

1 - Slightly; 2 - Moderately; 3 - Substantially



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ESTIMATION & COSTING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-04R25	CE

DESCRIPTION:

Provides cost estimates/comparison costs for the value of goods that are provided by the supply chain. Overall Purpose of the Role: To collect and analyse data and information in order to estimate costs associated with manufacturing a product.

Course Educational Objective (CEOs):

1. To know about the building estimation
2. To understand different types of floorings, roof, wood work of building construction
3. To learn about the rate analysis.
4. To comprehend valuation.
5. To gain knowledge in contracts and Construction Management

UNIT - I

General items of work in building - Standard units - Principles of working out quantities for detailed and abstract estimates, approximate and detailed estimates of simple buildings

UNIT - II

Standard specifications for different items of building construction - Earth work for foundations, mortars, foundation concrete - Reinforced concrete, Brick work, Stone masonry, sand, cement, kankar, lime, mosaic flooring, terrozoic flooring, RCC roof and AC roof and GI sheets, plastering, painting, pointing and wood works.

UNIT - III

Rate analysis for the following items:

Earth work for foundations and basement of buildings

Mortars: Cement mortar (1:4)

Foundation Concrete: Cement Concrete (1:5:10)

Reinforced Concrete: Lintels, slabs, beams, columns (1:2:4)

Brick work: Constructed with first class bricks with L.M. (1:1.5) and C.M (1:6)

Stone masonry: C.R. S - Ist sort constructed with C.M. (1:2) and R.R.Masonry C.M (1:2).

Flooring: (a) with Cuddapah or Shahbad slabs.

(b) Ellis pattern flooring with 10 cm.

Concrete and 20mm cement concrete surface - Mosaic flooring.



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Roofing: (a) R.C.C roof 10cm thick, 2 courses of flat tiles to top.

(b) A.C. corrugated sheet roofing on steel purlins.

Plastering: a) C.M. (1:4) 12 mm thick.

Pointing: a) with C.M (1:3) flush pointing to R.R.masonry.

b) C.M (1:3) for brick masonry.

c) Pointing to Cuddapah slab flooring.

Painting: a) White washing and colour washing of walls: 2 coats.

b) Painting iron and wood work: 3 coats.

Wood work: Panelled doors and windows.

UNIT - IV

Valuation:

Introduction, technique of valuation, elements of valuation and factors affecting valuation, methods of valuation of land property and building property, rate of interest for sale, purchase, mortgage, Fixation of rent.

Valuation – Gross income, Net income, Outgoings, Scrap value, Salvage value, Obsolescence, Annuity, Capitalized value, Year's purchase, Sinking fund, Depreciation; Determination of depreciation.

UNIT – V

Contracts and Construction Management

Contracts - Difference between Tender/Bid & Contract and Agreement and Contract, Documents part of Contract document and its relevance, General Conditions of Contracts mapping Indian law governing it and Bidding Process. Salient features of FIDIC form of Contract. Definitions to Alternative Dispute Methods.

Construction Management – Introduction, Phases of Construction Project, Basic Introduction to - management of Resources (3M – Men, Material and Money), Quality Management, Safety Management. Project Scheduling– Introduction to PERT and CPM, Simple Analysis on Critical Path Identification, Work Break Down Structure. Project Control – Earned Value Analysis and S curve.

TEXT BOOKS:

1. Text book of estimating and costing - B.N.Dutta.
2. Estimating Costing by G.S.Biride.
3. Valuation by Rangwala.
4. A.P.D.S.S. Standard data book Vol.II.
5. A.P.Department standard specifications.
6. Professional practice - by Roshan Namvati
7. Construction Project Management Theory and Practice (3rd Edition) by Kumar Neeraj Jha
8. Building and Engineering Contracts: Law and Practice" by Dr. P.C. Markanda (6th Ed., LexisNexis)



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Course Outcomes (COs) :

After completion of the course the student will have:

1. To know about the approximate or detailed estimation of simple buildings.
2. To be thorough in standard specifications in building construction.
3. To work on rate analysis of different items of work of buildings.
4. To be able to proficient in valuation of buildings.
5. To be able to understand contracts, tenders, specification and construction management.

PO & PSO /CO	P O (1)	PO (2)	PO (3)	P O (4)	PO (5)	P O (6)	P O (7)	PO (8)	PO (9)	PO (10)	PO (11)	P O (1 2)	PS O (1)	PSO(2)
CO1	3	2	1	2	1	-	-	-	-	-	-	-	3	2
CO2	2	2	1	2	1	-	-	-	-	-	-	-	3	2
CO3	2	2	2	2	1	-	-	-	-	-	-	-	3	2
CO4	2	2	2	2	1	-	-	-	-	-	-	-	3	2
CO5	2	2	2	2	1	-	-	-	-	-	-	-	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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TRANSPORTATION ENGINEERING LABORATORY**Credits: 1.5****Assessment: 40 +60**

Semester	L-T-P	Course Code	Branches
VI	0-0-3	7-2-6-R25P1	CE

Course Educational Objectives (CEOs):

1. To provide hands-on training in determining the physical and mechanical properties of coarse aggregates, such as strength, toughness, and shape, to understand their behaviour under traffic loads.
2. To demonstrate the standard testing procedures for evaluating the quality, consistency, and safety aspects of bituminous binders used in flexible pavement construction.
3. To develop the ability to assess the suitability of highway materials by comparing experimental results with standard specifications (IS codes) for efficient pavement design.

LIST OF EXPERIMENTS:**CYCLE – I**

1. Specific Gravity and Water Absorption Test.
2. Aggregate Impact Test
3. Elongation Index Test
4. Flakiness Index Test
5. Angularity Test
6. Los Angeles Abrasion Test
7. Aggregate Crushing Test
8. Stripping Value of Aggregate

CYCLE – II

1. Flash & Fire Point Test
2. Softening point Test
3. Specific Gravity of Bitumen
4. Penetration Test on Bitumen

Course Outcomes (COs):

After completion of the course the student will be:

1. To determine the physical and mechanical properties of road aggregates to assess their suitability for pavement construction.
2. To evaluate the grade, consistency, and thermal properties of bituminous materials to ensure quality and safety in road works.
3. To analyze experimental data against standard specifications (such as IS codes) to recommend appropriate materials for highway engineering projects.



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PO&PS O/ CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1	3	2	3	3	1	1		1	3	2		1	3	1
CO2	3	2	3	3	1	1		1	3	2		1	3	1
CO3	3	3	2	3	1	2	1	2	3	2		2	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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WASTEWATER ANALYSIS LABORATORY**Credits: 1****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	0-0-2	7-2-6-R25P2	CE

Course Educational Objectives (CEOs):

1. To be aware of wastewater analyses.
2. To be aware of how to interpret the results.

List of Experiments on Wastewater Analyses

1. (a) Determination of Colour.
(b) Determination of Odor and Temperature.
2. Determination of Total Dissolved Solids and Suspended solids.
3. (a) Determination of Settleable Solids.
(b) Determination of pH.
4. Determination of Total Nitrogen.
5. Determination of Total Phosphorous.
6. Determination of Total Sulphates.
7. Determination of BOD of wastewater.
8. Determination of COD of wastewater.

Course Outcomes (COs):

After completion of the course the student will be:

1. Able to Perform common environmental experiments relating to wastewater characteristics.
2. Able to Statistically analyze and interpret laboratory results.
3. Able to Demonstrate good written and oral communication skills.

PO & PSO /CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO(2)
CO1	3	3				3	2	2	2	2	1		3	2
CO2	3	3				3	2	2	2	2	1		3	2
CO3	3	3				3	2	2	2	2	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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COMPUTER APPLICATIONS IN CIVIL ENGINEERING**Credits: 2****Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
VI	1-0-2	7-2-6-R25S1	CE

Course Educational Objectives (CEOs):

1. To learn modelling, analyse and design of individual structural elements like beams.
2. To learn modelling, analyse and design of Portal frames and mutli-storied frames.
3. To learn modelling, analyse and design of building structures.

Exercise 1:

Modelling, Analysis and Design of a Cantilever Beams with different loadings.

Exercise 2:

Modelling, Analysis and Design of a Simply supported Beams with different loadings.

Exercise 3:

Modelling, Analysis and Design of Fixed beams with different loadings.

Exercise 4:

Modelling, Analysis and Design Continuous beams with different loadings.

Exercise 5:

Modelling, Analysis and Design of Portal frames with different loadings.

Exercise 6:

Modelling, Analysis and Design of Multi Level Frames with different loadings.

Exercise 7:

Modelling, Analysis and Design of Roof Truss.

Exercise 8:

Modelling, Analysis and Design of a 3D Stucture.

It may be advisable to conduct Lab demonstrations along with Lab practices.**Software: STAAD.Pro**


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Course Outcomes(Cos):

At the end of this Course the student will be able to

1. learn modelling, analyse and design of individual structural elements like beams.
2. learn modelling, analyse and design of Portal frames and multi-storied frames.
3. learn modelling, analyse and design of building structures.

PO&PSO /CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)	PSO (1)	PSO (2)
CO1		3	3		3				1	2		3	3	3
CO2		3	3		3				1	2		3	3	3
CO3		2	2		2				1	3		1	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PROFESSIONAL ETHICS IN ENGINEERING

Credits: 0**Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
VI	2-0-0	7-1-5-09R25	CE

COURSE OBJECTIVES:

1. To understand the core values that shape a professional character, such as integrity, work ethic, and civic virtue.
2. To create awareness about engineering ethics and theories of moral development (Kohlberg & Gilligan).
3. To instil a sense of responsibility regarding safety, risk assessment, and the experimental nature of engineering projects.
4. To educate students on their rights and responsibilities in a workplace, including Intellectual Property Rights (IPR) and confidentiality.
5. To broaden the perspective on global issues, such as environmental ethics, computer ethics, and the role of engineers as managers and consultants.

UNIT I

HUMAN VALUES

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self Confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II

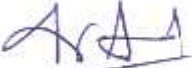
ENGINEERING ETHICS

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.



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UNIT IV**SAFETY, RESPONSIBILITIES AND RIGHTS**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V**GLOBAL ISSUES**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

COURSE OUTCOMES:

1. Apply holistic human values, such as integrity, honesty, and empathy, to their personal and professional lives to maintain harmony.
2. Apply ethical theories (like Utilitarianism or Duty ethics) to resolve moral dilemmas and distinguish between ethical and unethical professional behavior.
3. Analyze engineering projects as social experiments, demonstrating an understanding of codes of ethics and the need for responsible experimentation.
4. Assess safety and risk in engineering practices and defend professional rights and responsibilities, including intellectual property and whistleblowing.
5. Evaluate global challenges—such as environmental degradation, computer ethics, and weapons development—and apply ethical principles to multinational corporate scenarios.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, —Engineering Ethics, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, —Engineering Ethics – Concepts and Cases, Cengage Learning, 2009.
3. John R Boatright, —Ethics and the Conduct of Business, Pearson Education, New Delhi, 2003



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4. Edmund G Seebauer and Robert L Barry, —Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, —Business Ethics: Decision Making for Personal Integrity and Social Responsibility Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, Value Education', Vethathiri publications, Erode, 2011.

PO&PS CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1						2		3	3			3		1	2
CO2						2		3	2			2		1	1
CO3						3	1	3	2			2		2	1
CO4						3		3	2	1		2		2	2
CO5						2	3	3	1			2		1	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-II-1 AIR POLLUTION AND ITS CONTROL**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E11	CE

Course Educational Objectives (CEOs):

1. To know the global effects of air pollution, air pollutants characteristics and sampling methods for measurement of air pollutants.
2. To know the effects caused by different air pollutants on human beings, animals, plants and materials.
3. To understand the meteorological aspects of air pollutants dispersion.
4. To learn about the technologies used to reduce air pollution.
5. To understand the concepts of automobile pollution and its control.

UNIT – I

POLLUTION SOURCES: Natural and Anthropogenic sources of Air pollutants. Types of Air pollutants. Properties of Air pollutants –Particulates, Carbon Monoxide, Ozone, Oxides of Sulphur, Oxides of Nitrogen, Hydrocarbons.

GLOBAL EFFECTS: Acid Rains, Greenhouse effect and Ozone layer depletion

AIR POLLUTION SAMPLING AND MEASUREMENT –Devices for sampling, Different sampling methods, Sampling of Particulate Matter and Sampling of Stack gas. Analyses of air pollutants - Sulphur Dioxide, Nitrogen Oxides, Carbon Monoxide, Oxidants and Ozone, Hydrocarbons, Particulate Matter.

UNIT – II

EFFECTS OF AIR POLLUTANTS:

Effects of Carbon Monoxide, Particulate Matter, Sulphur Dioxide, Oxides of Nitrogen, Hydrocarbons and photochemical oxidants on human health. Effects on vegetation - Necrosis, Epinasty, Abscission and Chlorosis. Effects of Arsenic, Fluorine and Lead on animals. Effects of Air pollutants on metals, building materials, paints, textiles, paper, leather, rubber and economy.



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UNIT – III**METEOROLOGICAL ASPECTS OF AIR POLLUTANT DISPERSION:**

Wind direction and speed, Temperature, Atmospheric stability, Mixing height, Precipitation, Humidity, Solar radiation, Visibility, Inversions and plume behaviour. The Gaussian Dispersion Model, Diffusion coefficients and Box model.

UNIT - IV**AIR POLLUTION CONTROL METHODS:**

CONTROL OF PARTICULATE MATTER—General methods of control - Zoning - Town planning. Control of particulate matter –Gravity settling chambers, Cyclones, Inertial separators, scrubbers, bag- filter and Electrostatic Precipitators.

REMOVAL OF GASEOUS MATTER—Control of Sulphur Dioxide by Reinluft process and Westvaco process, Control of NO_x by combustion modification process, VOCs control by adsorption and condensation.

UNIT - V**AIR QUALITY AND EMISSION STANDARDS – Ambient Air Quality Standards****AUTOMOBILE POLLUTION:**

Sources, emissions from diesel and petrol engines, Bharat VI standards, catalytic convertors, Management of automobile pollution.

AIR POLLUTION LEGISLATION: Salient features of Air Pollution Control Act, 1981, and Environment (Protection) Act, 1986.

TEXT BOOKS:

1. M. N. Rao and H. V. N. Rao, Air Pollution, Tata McGraw Hill Company.
2. K. V. S. G. Murali Krishna, Air Pollution and Control, Laxmi Publications, New Delhi, 2015.
3. C. S. Rao, “Environmental Pollution Control Engineering,” Wiley Eastern Limited, New Delhi.
- 4.

REFERENCE BOOKS:

1. Crawford, M (1976). Air Pollution Control Theory, McGraw-Hill, New York.
2. H.C.Perkins (1974). Air Pollution, Mc-Graw Hill, Tokyo.
3. Wark, Kenneth and Cecil F. Warner (1976). Air Pollution : Its Origin and Control, Dun-Dunneley, New York.



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Course Outcomes (COs):

After completion of course student can able to:

1. Describe the global effects of air pollution, air pollutants characteristics and sampling methods of air pollutants.
2. Explain the effects caused by different air pollutants on human beings, animals, plants and materials.
3. Apply the meteorological aspects of air pollutants dispersion concepts in the different dispersion modelling.
4. Capable of applying suitable technologies to reduce air pollution.
5. To manage automobile pollution.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O(2)
CO1	3	3	3			2	2	2	2	2	1			3	2
CO2	2	1	1			1	3	2	2	2	1			3	2
CO3	3	3	3			2	2	2	2	2	1			3	2
CO4	3	3	3			2	2	2	2	2	1			3	2
CO5	3	2	2			2	2	2	2	2	1			3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-II-2 GEOENVIRONMENTAL ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E12	CE

PREREQUISTE: Basic Soil Mechanics, Environmental Engineering

Course Educational Objectives (CEOs):

1. Impart mineralogical composition and fabric/ structure in engineering behavior of soil.
2. Introduce sources of subsurface contamination sources and their effects.
3. Introduce waste contaminant system and selection criteria for impounding containment.
4. Introduce the construction and design concepts of contaminant systems.
5. Impart utilization of of waste material in geotechnical constructions for waste reduction.

UNIT I

SOIL COMPOSITION & STRUCTURE

Phase Composition of Soil – Mineralogical Composition of solid phase – Role of Composition in Engineering behaviour of soils – Fabric and Structure – Types of soil structure – Diffused double layer – Role of soil structure in the Engineering behaviour of soils.

UNIT II

SUBSURFACE CONTAMINATION

Industrialization and Urbanization – Pollution – Control & Remediation – Subsurface Contamination – Mechanisms of contaminant transport – Effects of subsurface contamination – Detection of polluted zones – Monitoring effectiveness of designed facilities.

UNIT III

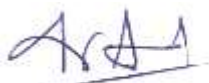
WASTE CONTAINMENT SYSTEM

Essentials of waste containment – Factors influencing contaminant mobility in the subsurface – Containment site selection techniques – Types of containment systems – Configuration of land fills, slurry wells and surface impoundments for containment.

UNIT IV

CONSTRUCTION AND DESIGN OF CONTAINMENT SYSTEMS

Leachate generation – Leachate collection and Removal systems – Stability of land fills – Land fill construction and operation – Construction of Impoundments – Design of Impoundments – Construction of Slurry trench walls.



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UNIT V

GEOTECHNICAL REUSE OF WASTE MATERIAL

Waste Reduction – use of waste in Geotechnical Constructions – Engineering properties of waste – Waste material in embankments and fills.

TEXT BOOKS

1. Geoenvironmental Engg. by L.N. Reddi and H.J. Inyang

REFERENCE BOOK

1. Geotechnical Engineering by S.K. Gulhathi & Manoj Datta.

Course Outcomes (COs):

1. Analyze the engineering behavior of soils based on soil composition and structure.
2. Assess of surface contamination and its effects in soil properties.
3. Analyze waste contaminant and select the site for impoundment.
4. Analyze waste contaminant and design for construction of containment systems.
5. Reuse of waste material in geotechnical constructions for waste deduction.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	3	3	2	2	1					2	1			3	2
CO2	3	2	2	2	1					2	1			2	2
CO3	2	2	2	2	1					2	1			3	2
CO4	2	2	2	2	1					2	1			3	2
CO5	3	2	2	2	1					2	1			3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-II-3 WATER RESOURCES SYSTEM ANALYSIS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E13	CE

DESCRIPTION OF THE COURSE:

Hydrology and Water Resources Engineering is considered as pre-requisite for this course. The students will be learning about concepts of system analysis, economics of water resources and linear and dynamic programming in water resources systems.

Course Educational Objectives (CEOs):

1. To learn the concepts of system analysis.
2. To understand the concepts of Economics of water resources projects.
3. To know about the systems approach to reservoirs.
4. To apply the linear programming concepts to water resources systems.
5. To apply the dynamic programming concepts to water resources systems.

UNIT I

Concept of System and System Analysis - Definition and Types of Systems- Basic Principles of Systems Approach and Analysis. Systems Techniques in Water Resources.

UNIT II

Introduction to Optimization, Linear and Dynamic Programming - Simulation - Economics of Water Resources Projects - Cost Benefit Analysis - Cost Allocation among various projects in a Multi-purpose Project.

UNIT III

Systems Approach to Reservoir - Deterministic Flows - Reservoir Sizing and Reservoir Operations. Basic Concepts of Random Flows- Reliability.

UNIT IV

Application of Linear Programming to Water Resources Systems - Irrigation Water Allocation for Single and Multiple Crops - Reservoir Operation for Irrigation.



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UNIT V

Applications of Dynamic Programming to Water Resources Systems - Optimal Crop Water Application - Steady State Reservoir Operating Policy for Irrigation.

TEXTBOOKS:

1. Loucks, D.P. and Eelco Van Beek, Water Resources systems planning and management: An Introduction to methods, models and applications. (2005), UNESCO.
2. Vedula, S. and Mujumdar, P. Water resources Systems: Modeling techniques and analysis, (2005), Tata McGraw Hill, New Delhi.

REFERENCES:

- 1) Mays, L.W. and Tung, Y. K., Hydro-systems Engineering and Management, (1992). McGraw Hill, USA.
- 2) Simonovic, S.P., Managing water resources: Methods and tools for a systems approach, (2009). UNESCO Publishing, France.
- 3) R. K. Sharma & T. K. Sharma, A Textbook of Irrigation Engineering, S. Chand and Company Limited, New Delhi

Course Outcomes (COs):

1. Able to explain the concepts of system analysis.
2. Able to apply the concepts of Economics of water resources projects.
3. Able to understand about the systems approach to reservoirs.
4. Able to apply the linear programming concepts to water resources systems.
5. Able to apply the dynamic programming concepts to water resources systems.

PO&PSO CO \	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	3	3	3	2	2									3	2
CO2	3	3	3	2	2									3	2
CO3	3	3	3	2	2									3	2
CO4	3	3	3	2	2									3	2
CO5	3	3	3	2	2									3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-II-4 ADVANCED REINFORCED CONCRETE DESIGN**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E14	CE

Course Educational Objectives (CEOs)

After successful completion of this course, the students will be able to:

CEO1: Understand the fundamental principles of reinforced concrete design as per relevant Indian Standard codes.

CEO2: Analyze and design different types of footings and retaining walls considering soil–structure interaction.

CEO3: Design flat slabs, water tanks, and domes by applying structural analysis, strength, and serviceability criteria.

CEO4: Interpret design requirements and prepare detailed reinforcement drawings for RCC structures.

CEO5: Develop the ability to apply engineering judgment to solve practical foundation and special structure design problems.

UNIT-I: Footings

Design of isolated, rectangular, Combined, Trapezoidal and raft footings

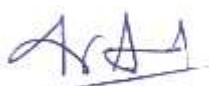
UNIT-II: Retaining walls

Active and passive earth pressure Co-efficient -

Design and detailing of cantilever and counter fort retaining walls with horizontal and inclined backfill

UNIT-III: Flat slabs

Design and detailing of flat slabs, Column head-column capital-,interior, edge and corner panels-IS code method



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UNIT-IV: Water Tanks

Design and detailing of circular and rectangular water tank resting on the ground, partly and fully submerged

UNIT-V: Domes

Meridial thrust-Hoop Stress-Design principle

Design and detailing of domes

Course Outcomes (COs)

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

CO1: Analyze and design isolated, combined, trapezoidal, and raft footings based on soil conditions and loading requirements.

CO2: Compute active and passive earth pressure coefficients and design cantilever and counterfort retaining walls for different backfill conditions.

CO3: Design and detail flat slab systems including interior, edge, and corner panels using IS code methods.

CO4: Design and detail circular and rectangular water tanks resting on ground and in submerged conditions as per IS 3370.

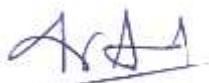
CO5: Analyze meridional thrust and hoop stresses and design RCC domes based on thin shell theory.

Text Books

1. B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain
Reinforced Concrete Structures, Laxmi Publications, New Delhi
2. Pillai & Menon *Reinforced Concrete Design*
Tata McGraw-Hill Education
3. Varghese P.C. *Advanced Reinforced Concrete Design*

Reference Books

1. S. Unnikrishna Pillai & Devdas Menon *Reinforced Concrete Design*
Tata McGraw-Hill

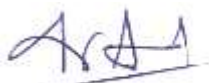


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2. C.S. Reddy
Design of Reinforced Concrete Structures Tata McGraw-Hill
3. Shah & Karve
Illustrated Design of Reinforced Concrete Buildings
Structures Publications
4. H.J. Shah
Reinforced Concrete Structures – Volume II
Charotar Publishing House
5. Krishna Raju N.
Advanced Reinforced Concrete Design
CBS Publishers

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	–	1	–	–	–	–	1	3	2
CO2	3	3	3	2	1	1	1	–	–	–	–	1	3	2
CO3	3	3	3	2	2	–	–	–	–	–	–	1	3	2
CO4	3	3	3	2	1	2	2	–	–	–	–	1	3	3
CO5	3	3	3	2	1	–	–	–	–	–	–	1	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-II-5 TRAFFIC ENGINEERING AND MANAGEMENT**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E15	CE

Course Educational Objectives (CEOs)

After completing this course, students will be able to:

1. Understand traffic characteristics related to roads, users, vehicles, and traffic flow with reference to Indian urban conditions.
2. Conduct and interpret traffic surveys for effective traffic planning, analysis, and forecasting.
3. Design and evaluate traffic control measures including intersections, signals, signs, and road markings.
4. Analyze traffic safety and environmental issues and propose suitable preventive and mitigation measures.
5. Apply traffic management strategies and ITS concepts to improve efficiency, safety, and sustainability of transportation systems.

UNIT – I**TRAFFIC CHARACTERISTICS:**

Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India

UNIT – II**TRAFFIC SURVEYS:**

Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.

UNIT – III**TRAFFIC ENGINEERING REGULATION AND CONTROL:**

Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelization – Grade separation – Traffic signs and road markings.



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UNIT – IV**TRAFFIC SAFETY AND ENVIRONMENT:**

Road accidents – Causes, effect, prevention, and cost – street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, health effects and abatement measures.

UNIT – V**TRAFFIC MANAGEMENT:**

Area Traffic Management System – One-way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – Non road pricing options – Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM)-

- Introduction to Intelligent Transportation Systems (ITS)- ITS Applications in Traffic Management.

Course Outcomes (COs)

On successful completion of the course, students will be able to:

1. Explain traffic characteristics such as road classification, road user behavior, vehicle performance, and traffic flow fundamentals.
2. Conduct and analyze traffic surveys including speed, volume, O-D, parking studies, and determine level of service.
3. Design traffic engineering control systems such as rotary intersections, signalized intersections, traffic signs, and road markings.
4. Evaluate road safety and environmental impacts of traffic and recommend appropriate accident prevention and pollution control measures.
5. Apply traffic management and ITS concepts such as TSM, TDM, road pricing, and intelligent transportation systems in urban traffic management.

TEXT BOOKS:

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2008.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, NemChandBros., Roorkee, Revised 10th Edition, 2014.



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3. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan PressLtd.1996.

4. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-SecondEdition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

REFERENCES:

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHILearningPvt. Ltd., 2005
2. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall,1998
4. Hobbs. F.D. Traffic Planning and Engineering, University of Brimingham, PeragamonPress Ltd, 1994.
5. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions,Hargreen Publishing Company , 1998.
6. Jason C.Yu Transportation Engineering, Introduction to Planning, Design and Operations, Elseevier, 1992.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	–	–	–	1	–	–	–	–	–	1	2	–
CO2	3	3	2	2	1	–	–	–	–	–	–	1	3	2
CO3	3	3	3	2	1	1	–	–	–	–	–	1	3	2
CO4	2	2	1	2	–	3	3	1	–	–	–	1	2	1
CO5	3	2	2	2	3	2	2	–	–	–	1	2	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-II-6 CONSTRUCTION PLANNING AND PROJECT MANAGEMENT**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E16	CE

Course Educational Objectives (CEOs)

1. Able to plan construction projects, schedule the activities determine and control the cost of the project, by creating cash flows and budgeting.
2. Understand the operation of construction equipment.
3. To know the labour and safety laws, quality control and ethical audit in construction industry.

UNIT I

INTRODUCTION:

Significance of construction management, Objectives and functions, Construction types, Resources, Stages in construction, personnel involved in construction planning and their roles, Engineering drawings, specifications and tender documents and their importance in planning. Scheduling and control, Advantages, Classification of scheduling, Methods of planning and scheduling, Bar charts (Gnat charts), and Mile stone charts.

UNIT II

CPM and PERT, Comparison between CPM and PERT, Network techniques terminology, Event and activity, Network representation, AON and AOA system, Development of network, errors and dummies in net-work logic, calculation of network (CPM) times, floats and slacks, project scheduling and critical path, superficial path, Up-dating, Resources smoothening and levelling.

Cost-time analysis in Net-work planning, Importance of time-cost analysis, Direct costs and Indirect costs, Operation time-cost Trade off graphs, Normal and crash points, Project

Time-cost Trade, off curves, optimizing project costs, Recompression of multiple critical paths, Crash limit and free float limit, optimization of costs.



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UNIT III

CONSTRUCTION EQUIPMENT:

Engineering Fundamentals, classification, rolling resistance, Rim pull, Coefficient of friction, Conditions of Management factor, Coefficient of traction swelling and shrinkage of soils, Selection of construction equipment, Depreciation, Methods of cost reduction in construction, Earth Moving Equipment, excavating plants and equipment, Transporting equipment, earth compaction equipment, Earth spreading Equipment, Equipment for concrete construction.

UNIT IV

Progress control, purpose, Methods of recording progress, Recording and analysis of progress, corrective action, productivity and methods to increase productivity, work study, Time-study, operation analysis, process charts.

Organizing construction: Types of organization, Details, Principles of organization, Details, Organizational relationship, organization charts, Functions of different personnel involved in organizing construction, Types of contracting firms, Temporary services, Job Layout.

Inspection and Quality Control: Importance of Inspection and quality control, principles of Inspection, Enforcement of specifications, stages of Inspection and quality control, Testing services and Inspection Team, Testing of structures, Different types of tests, Assessment of quality of construction work.

UNIT V

Construction Labor: Status of construction worker, Types of labor, Wages, Trade unions, Trade union Act 1936, Labour welfare fund Act 1965, payment of wages Act, Minimum wages act, Contract labor Act, Industrial dispute Act, Factories Act.

Safety in construction Industry: Importance of safety, Accidents, causes and safety measures in construction Industry, Safety campaign.

ETHICAL AUDIT

Introduction, Aspects of project realization, Ethical audit procedures, The decision makers, Variety of interests, Formulation of briefs, The environment, The audit statement, The audit reviews.



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TEXT BOOKS

1. Construction Planning and Management by P.S.Gohlot and B.M.Dhir, Wiley Eastern Limited, New Delhi (1992).
2. Construction Equipment and its Management by S.C.Sarma, Khanna Publishers, Delhi (1995).
3. Engineering Ethics by M.GovindaRajan, S.Natarajan and V.S.Senthilkumar, Prentice-Hall of India Pvt. Ltd. (2004), New Delhi (Chapters 4 and 7).
4. Construction Management and Accounts by J.L.Sharma, SatyaPrakashan Publications, New Delhi.
5. Construction Engineering and Management by S.Seetharaman, Umesh Publications, Delhi (1997).
6. Construction Management and Accounts by Harpal Singh, Tata McGraw-Hill Publishing Limited, New Delhi.
7. PERT and CPM: Principles and Application.3rd edn.-L.S.SrinathAffiliated East-West press pvt.Ltd. New Delhi.
8. Planning and control with PERT and CPM -Richard,Levin and Charles A.Kirkpatrick Tata McGraw-Hill publishing Co.Ltd,New Delhi.

Course Outcomes (COs)

On successful completion of the course, the student will be able to:

CO 1: Explain the significance, objectives, functions, and stages of construction management, including the role of personnel, drawings, specifications, and tender documents.

CO 2: Develop and analyze project schedules using bar charts, milestone charts, CPM, and PERT techniques, and identify critical paths and floats.

CO 3: Perform time–cost trade-off analysis and optimize project duration and cost through crashing and resource leveling techniques.

CO 4: Select suitable construction equipment and apply productivity improvement, work study, progress control, inspection, and quality control methods.

CO 5: Interpret labour laws, apply construction safety measures, and evaluate ethical issues in project realization through ethical audit procedures.



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COs ↓ / POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	–	–	–	–	–	–	2	–	3	1
CO2	3	3	2	2	3	–	–	–	–	–	2	–	2	3
CO3	2	3	2	2	3	–	–	–	–	–	3	–	2	3
CO4	3	2	2	1	2	–	1	–	–	–	2	–	3	2
CO5	1	–	–	–	–	2	2	3	2	1	1	2	1	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



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PE-III-1 ENVIRONMENTAL IMPACT ASSESSMENT AND AUDIT**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E21	CE

Course Educational Objectives (CEOs):

1. To know importance of EIA, EIS and steps involved in EIA.
2. To study the various types of EIA methodologies.
3. To study the prediction and assessment of impacts on different environments.
4. To learn EMP for mitigation of impact.
5. To understand the various types of environmental audit.

UNIT-I**INTRODUCTION:**

Impact of Development on Environment, Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS), EIA Types, steps involved in EIA, Advantages and disadvantages of EIA.

UNIT-II**METHODOLOGIES:**

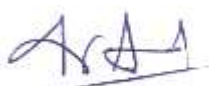
Criteria for selection of EIA methodology, objectives of EIA methodologies, Methodologies of EIA - Ad hoc, checklists, matrices, networks, overlays method and cost benefit analysis method.

UNIT-III**PREDICTION AND ASSESSMENT:**

Prediction and Assessment of Impacts on land, water, air environment, Prediction and assessment of impact of noise on the environment, Prediction and Assessment of Impacts on biological Environment. Prediction and Assessment of Impacts on Socio-Economic environment.

UNIT-IV**ENVIRONMENTAL MANAGEMENT PLAN:**

Plan for mitigation of adverse impact on environment - options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People – Environment management Plan.



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UNIT-V**ENVIRONMENTAL AUDIT:**

Objectives of Environmental Audit, Types of environmental Audit, evaluation of Audit data and preparation of Audit report.

TEXT BOOKS

1. Anjaneyulu, Y. Environmental Impact Assessment methodologies ,B.S. Publications, Hyderabad, 2002.
2. Canter, R.L. Environmental Impact Assessment, McGraw Hill Inc., New Delhi, 1996.
3. S.K. Shukla and P.R. Srivastava, Concepts in Environmental Impact Analysis, Common Wealth Publishers, New Delhi, 1992.
4. Environmental science and Engineering by j. Glynn and Gary W. Hein Ke-Prentice Hall Publishers.

REFERENCE BOOKS

1. John G.Rau and David C Hooten (Ed), Environmental Impact Analysis Hand book, McGraw Hill Book Company, 1990.
2. Environmental Assessment Source book, Vol. II and III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, Handbook of Environmental Impact Assessment Vol.I and II. Blackwell Science, New York, 1999.
4. Environmental science and Engineering, by Suresh K.Dhaneja-S.K., Katania and sons Publication., New Delhi.
5. Environmental pollution and control, by Dr. H. S. Bhatia - Galgotia Publication (P) Ltd, Delhi.

Course Outcomes (COs):

After completion of course, student can able to:

1. Explain the importance of EIA, EIS and steps involved in EIA.
2. Differentiate the various types of EIA methodologies.
3. Understand the concepts of prediction and assessment of impacts on different environments.
4. Apply EMP for mitigation of impact.
5. Explain the various types of environmental audit.



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PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	1	1	1			2	2	2	2	2	1	1		3	2
CO2	3	3	3			2	2	2	2	2	1	1		3	2
CO3	3	3	3			2	2	2	2	2	1	1		3	2
CO4	3	3	3			2	2	2	2	2	1	1		3	2
CO5	2	2	2			3	3	2	2	2	1	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-III- 2 ADVANCED GEOTECHNICAL ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E22	CE

PREREQUISITE: Basic Soil Mechanics, Foundation Engineering

Course Educational Objectives (CEOs):

The course will enable students to:

- 1) Introduce different types of retaining structures and their stability considerations
- 2) Introduce mechanically stabilized earth and its applications.
- 3) Impart proportioning of isolated and combined footings.
- 4) Introduce laterally loaded piles and proportioning of piles.
- 5) Impart concept of foundations on expansive soils.

UNIT I

EARTH RETAINING STRUCTURES : Types of Retaining Structures - Stability Considerations of Gravity and Cantilever Retaining Walls.

UNIT II

MECHANICALLY STABILIZED EARTH: Reinforced Earth, Basic Mechanism, Types of Reinforcements, Selection/Improvement of ground using Geotextiles, Geogrid, Geomembranes, Geocells, Geonets, and Applications.

UNIT III

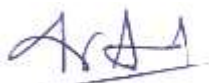
PROPORTIONING OF SHALLOW FOUNDATIONS– Classification and purpose, contact pressure under footings, proportioning of isolated footings, Need of Strap & Combined Footings-Types of Combined Footings-Proportioning of Rectangular & Trapezoidal Combined Footings -Strap Footing

UNIT IV

LATERALLY LOADED PILES: Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behavior of Piles, Proportioning Of Pile Foundations, Lateral And Uplift Capacity Of Piles.

UNIT V

FOUNDATIONS ON EXPANSIVE SOILS- Expansive soils, parameters of expansive soils, classification of expansive soils, preventive measures for expansive soil, design of foundations in swelling soils-drilled piers, belled drilled pier, under reamed piles, construction of under reamed piles.



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TEXT BOOKS:

1. V.N.S.Murthy, “Advanced Foundation Engineering”, CBS Publishers.
2. GopalRanjan&A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age Publishers.

REFERENCES:

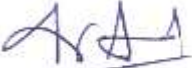
- 1.Braja M. Das, “Principles of Geotechnical Engineering”, Cengage Learning.
- 2.Purushtoma Raj, “ Ground Improvement Techniques “.Pearson Publications
3. Bowles, J.E., Foundation Analysis and Design (1988) – 4th Edition, McGraw-Hill Publishing Company, Newyork.

Course Outcomes (COs) :

1. Analyse the stability of earth retaining structures
2. Apply mechanically stabilized earth works using geotextiles for different applications.
3. Design isolated, strap and combined footings.
4. Design laterally loaded piles and estimate pile load capacity
5. Design foundation on expansive soils using different types of drilled piers.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PS O (1)	PS O(2)
CO1	3		3	3	2		1			2	2	1	3	2
CO2	3		3	3	2	1	1			2	2	1	3	3
CO3	3		3	3	2	1	1			2	2	1	3	3
CO4	3		3	3	2	1	1			2	2	1	3	3
CO5	3		3	3	2	1	1			2	2	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-III- 3 HYDRAULIC STRUCTURES**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E23	CE

DESCRIPTION OF THE COURSE:

Hydrology and Water Resources Engineering are considered as pre-requisite for this course. The students will be learning about design of hydraulic structures, design of gravity dams and spillways.

Course Educational Objectives (CEOs):

1. To learn about Canal structures of falls, cross drainage works, regulators and outlets
2. To understand the concepts of design of diversion head works.
3. To know about different types of dams and reservoirs.
4. To learn design concepts of Gravity dam
5. To understand the concepts of spillways

UNIT 1**CANAL STRUCTURES**

Falls – classification - selection of suitable site; Cross Drainage (C-D) works - classification- selection of suitable site; Regulators - classification- selection of suitable site; Outlets- classification- selection of suitable type - Sensitivity and flexibility.

UNIT II**DIVERSION HEAD WORKS**

Weirs – location - classification - causes of failure – Design of weirs using Bligh's theory and Khosla's theory- Design of vertical drop weir.

UNIT III**DAMS AND RESERVOIRS**

Dams – Classification – selection of suitable site - selection of suitable type – Reservoir – classification - Zones- Determination of reservoir capacity – life of reservoir.



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UNIT IV

GRAVITY DAMS

Introduction – Forces acting – Stresses – causes of failure - Stability analysis – Elementary profile – limiting height of a gravity dam – Foundation treatment – Joints.

UNIT V

SPILLWAYS

Spillways – functional requirements – classification – Energy dissipation below the spillway for different positions of JHC and TWC – Stilling basins – Gates

TEXT BOOKS :

1. Irrigation Engineering and Hydraulic Structures - P.N.Modi.
2. Irrigation Engineering and Hydraulic Structures - S.K.Garg.
3. A text book of Irrigation Engineering and Hydraulic Structures - R.K.Sharma.
4. Irrigation and Water Power Engineering – B.C.Punmia and Dr.Pande.
5. Irrigation and Water Resources and Water Power Engineering – Dr. P.N.Modi.

Reference Books:

1. Irrigation and water resources engineering by G.L. Asawa, New Age International Publishers
2. Irrigation, Waterpower and Water Resources Engineering by K R Arora; Standard Publication, New Delhi 2010
3. Water resources engineering by Satyanarayana Murthy. Challa, New Age International Publishers 2020

Online Learning Resources:

<https://nptel.ac.in/courses/105105110>

Course Outcomes (COs):

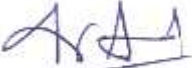
1. Able to explain Canal structures of falls, cross drainage works, regulators and outlets
2. Able to design of diversion head works.
3. Able to classify different types of dams and reservoirs.
4. Able to design gravity dam.
5. Able to compute energy dissipations in spillways.



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PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O(2)
CO1	3	3	3	3	3	-	-	-	-	-	-	-		3	1
CO2	3	3	3	3	3	-	-	-	-	-	-	-		3	1
CO3	3	3	3	3	3	-	-	-	-	-	-	-		3	1
CO4	3	3	3	3	3	-	-	-	-	-	-	-		3	1
CO5	3	3	3	3	3	-	-	-	-	-	-	-		3	1

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-III-4 STRUCTURAL DYNAMICS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E24	CE

The objectives of the course are

1. To model, analyze, and interpret the dynamic behaviour of structural systems
2. To predict how structures, behave when subjected to external, time-dependent forces.
3. To model, analyze, and solve complex structural dynamics problems.
4. To analyze complex structural systems where exact analytical solutions are difficult or impossible to obtain.
5. To derive and solve partial differential equations of motion, determine natural frequencies and mode shapes under various boundary conditions.

UNIT I**THEORY OF VIBRATIONS**

Introduction - Elements of a vibratory system - - Free and Forced Vibrations - Undamped and Damped Vibrations

SINGLE DEGREE OF FREEDOM SYSTEM

Degrees of Freedom – Idealization of Structures as SDOF System - Formulation and solution of the equation of motion SDOF System - Response of Free vibration system - Determination of natural frequency - Determination of Damping in Structures - Critical damping - Logarithmic decrement.

UNIT II**RESPONSE OF SINGLE DEGREE FREEDOM SYSTEM – FORCED VIBRATIONS**

Forced vibration systems - Response to harmonic excitation - Dynamic Magnification Factor (DMF) – Duhamel's Integral – Response to Support Motion – Transmissibility.

UNIT III**MULTI-DEGREE OF FREEDOM SYSTEM**

Formulation of equations of motion of MDOF - Evaluation of structural property matrices- Undamped free vibrations - Evaluation of natural frequencies and mode shapes – Orthogonal Principle.

UNIT IV**APPROXIMATE METHODS OF COMPUTING NATURAL FREQUENCIES**

Rayleigh's Method – Dunkerley's Method – Method of Iterations – Stodola- Vainelo Method- Rayleigh-Ritz method.



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UNIT V**DYNAMIC ANALYSIS OF CONTINUOUS SYSTEMS**

Flexural vibrations of Beams – Equation of motion – Free vibration of uniform beams – Natural frequencies and Mode Shapes of beams with different support conditions – Orthogonal condition between normal modes.

TEXT BOOKS

1. Mario Paz - Structural Dynamics Theory and Computations, CBS Publishers
2. Anil Kumar Chopra, Dynamics of Structures, Prentice Hall India Pvt. Ltd.

REFERENCES:

1. R.W. Clough & J. Penzien, Dynamics of Structures, Mc. Graw Hill Publications,
2. J.J. Humar, Dynamics of Structures, Prentice Hall India Pvt. Ltd.

Course Outcomes (COs) :

After completion of the course the student will be able to

1. Model, analyze and determine response of the single-degree-of-freedom (SDOF) structural systems
2. Analyze and predict the dynamic behavior of structures systems subjected to external loads
3. Analyze the dynamic behavior of complex, multi-degree-of-freedom structures
4. Efficiently estimate the fundamental natural frequencies of complex, multi-degree-of-freedom (MDOF) systems.
5. Mathematically model and solve for the dynamic behavior of structures with distributed mass

PO \ CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	3		2			1	2				2			2	
CO2		3		2	3			3	3	2		2			3
CO3	3	2		2											
CO4		3	2					2				2			1
CO5	3	2				2			3					1	

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-III- 5 URBAN PLANNING AND DEVELOPMENT**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E25	CE

Course Educational Objectives (CEOs)

After completing this course, the students will be able to:

1. Understand fundamental concepts of urbanization and the structure, classification, and growth trends of urban areas at different spatial levels.
2. Learn the planning process including principles, types of plans, and methods of data collection for urban and regional planning.
3. Develop competence in plan formulation and evaluation for regional plans, master plans, and detailed development plans.
4. Apply planning standards and project formulation techniques for the planning and design of urban development projects.
5. Understand planning legislation and governance mechanisms and the role of stakeholders in urban development and management.

UNIT I**BASIC ISSUES**

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

UNIT II**PLANNING PROCESS**

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT III**DEVELOPMENT PLANS, PLAN FORMULATION & EVALUATION**

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights, Special Economic Zones- Development of small town and smart cities-case studies



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UNIT IV

PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V

LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN

SYSTEM

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

Course Outcomes (COs):

On successful completion of the course, students will be able to:

1. Explain basic urban planning concepts such as human settlements, urbanization trends, and classification of urban areas.
2. Describe the planning process including goal setting, surveys, data collection, and questionnaire design.
3. Prepare and evaluate development plans such as regional plans, master plans, and detailed development plans using planning regulations.
4. Apply planning standards for site analysis, layout design, project formulation, and financing of urban development projects.
5. Interpret planning legislation and assess the role of public, private, and community stakeholders in urban development and management.

TEXTBOOKS:

1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
4. Edwin S.Mills and Charles Becker, Studies in Urban development, A World Bank publication, 1986

REFERENCES:

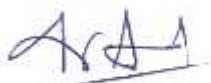
1. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai
2. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi, 2002
3. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
4. 4CMDA, Second Master Plan for Chennai, Chennai 2008



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CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	–	–	–	2	2	–	–	–	–	1	2	–
CO2	3	2	1	2	–	1	–	–	–	–	–	1	2	1
CO3	3	3	3	2	1	2	1	–	–	–	1	1	3	2
CO4	3	3	3	2	1	1	1	–	–	–	2	1	3	3
CO5	2	2	1	–	–	3	2	2	–	–	1	1	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-III- 6 ORGANIZATIONAL BEHAVIOUR**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VI	3-0-0	7-2-6-R25E26	CE

DESCRIPTION OF THE COURSE:

This course gives an opportunity for the students to know the various management techniques in organizational behavior such as Role of management, planning process, organization structure and design, perception and learning, group dynamics and Leadership and Organizational Culture and Climate.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. To understand the concepts of role of management, planning, policies and strategies
2. To know the concept of organizational structure and design
3. To understand the concept of perception and learning
4. To know about group dynamics
5. To understand the concept of Comparative Management Styles and approaches

UNIT I

Nature of Management - Social Responsibility ties of Business - Manager and Environment Levels in Management - Managerial Skills - Planning - Steps in Planning Process - Scope and Limitations - Short Range and Long-Range Planning - Flexibility in Planning - Characteristics of a sound Plan - Management by Objectives (MBO) - Policies and Strategies - Scope and Formulation - Decision Making - Techniques and Processes.

UNIT II

Organizing - Organization Structure and Design - Authority and Responsibility Relationships - Delegation of Authority and Decentralization - Interdepartmental Coordination - Emerging Trends in Corporate Structure, Strategy and Culture - Impact of Technology on Organizational design - Mechanistic vs Adoptive Structures - Formal and Informal Organization.

UNIT III

Perception and Learning - Personality and Individual Differences - Motivation and Job Performance - Values, Attitudes and Beliefs - Stress Management - Communication Types- Process - Barriers - Making Communication Effective.



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UNIT IV

Group Dynamics - Leadership - Styles - Approaches - Power and Politics - Organizational Structure - Organizational Climate and Culture - Organizational Change and Development.

UNIT V

Comparative Management Styles and approaches - Japanese Management Practices Organizational Creativity and Innovation - Management of Innovation - Entrepreneurial Management - Benchmarking - Best Management Practices across the world - Select cases of Domestic & International Corporations - Management of Diversity.

Reference Books:

1. Organizational Behavior, Stephen P. Robbins, Pearson Education.
2. Organizational Behaviour, S.S.Khanka, S.Chand
3. Organizational Behavior , Mishra .M.N ,Vikas
4. Management and Organizational behavior, Pierce Gardner, Cengage.
5. Principles of Management, Koonz, Weihrich and Aryasri, Tata McGraw Hill.
6. Management and Organizational Behaviour, Subbarao P, Himalaya Publishing House.
7. Organizational Behaviour, Sarma, Jaico Publications.
8. Principles of Management, Murugesan, Laxmi Publications.

Course Outcomes (COs):

After completion of the course the student will be able to:

1. Able to explain the concepts of role of management, planning, policies and strategies
2. Able to explain the organizational structure and design
3. Able to explain the concept of perception and learning
4. Able to explain about group dynamics
5. Able to explain the concept of Comparative Management Styles and approaches

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO (1)	PSO (2)
CO1	-	-	-	-	-	2	-	2	-	2	2	-	-	1
CO2	-	-	-	-	-	2	-	2	-	2	2	-	-	1
CO3	-	-	-	-	-	2	-	2	-	2	2	-	-	1
CO4	-	-	-	-	-	2	-	2	-	2	2	-	-	1
CO5	-	-	-	-	-	2	-	2	-	2	2	-	-	1

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-III- 7 INTRODUCTION TO SEMICONDUCTOR MANUFACTURING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code (7-0-1-01R25)	Branches
VI	3-0-0	7-0-6-R25CE1	CH,CE,EE,EC,ME,CS (All Branches)

Course Overview:

This course deals with semiconductor materials, semiconductor wafer manufacturing and characterization, semiconductor device manufacturing techniques, characterization and advanced processing tools, semiconductor ecosystem and applications.

This course prepares the students to apply their knowledge for designing the processes and manufacturing the equipment and tools for semiconductor device manufacturing in India under the National Semiconductor Mission Programme.

Course Objective(s):

- To explain the physics of semiconductor materials and devices.
- To discuss the processes involved in semiconductor manufacturing.
- To understand the ecosystem of semiconductor manufacturing.
- To get knowledge of safety aspects in the semiconductor industry.
- To design systems and equipment for semiconductor manufacturing.

UNIT – 1:**Semiconductor materials (Si, Ge, GaAs, GaN, SiC):**

Electrical classification of solids (metals, semiconductors and insulators), intrinsic and extrinsic semiconductors, crystal structure and defects, band gap and Fermi level, doping effects on electrical conduction in semiconductors, direct and indirect bandgap semiconductors.

UNIT – 2:**Semiconductor wafer manufacturing and characterization:**

Thermal and chemical processes involved in converting pure sand into electronic grade polycrystalline silicon, pure silicon crystal growth from polysilicon, silicon wafer fabrication and polishing.



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UNIT – 3:**Thin film fabrication and characterization:**

Vacuum-based thin film deposition techniques for metals, semiconductors and dielectrics; Physical Vapour Deposition (PVD); Chemical Vapour Deposition (CVD); analytical characterization techniques (XRD, SEM, TEM, XPS etc.); plasma, lasers and ion beams for semiconductor manufacturing.

UNIT – 4:**Semiconductor Device Manufacturing Techniques:**

Introduction to IC-chip manufacturing, oxidation, lithography, etching, doping, diffusion, ion-implantation and metallization, realization of on-chip resistor, diode, capacitor and inductor, bonding and packaging.

UNIT – 5:**Semiconductor ecosystem, safety and applications:**

Clean room aspects, gas handling systems in semiconductor manufacturing, safety aspects in device fabrication (electrical, chemical and vacuum), clean water and pure chemical requirements, CMOS-based IC chips for computers and mobiles, semiconductor-based solar cells and displays, lab-grown diamonds for semiconductor applications.

Textbooks:

1. Sze SM and Lee MK, *Semiconductor Devices: Physics and Technology*, 3rd Edition, Wiley India (2016).
2. Swami Nathan P, *Semiconductor Materials, Devices and Fabrication*, Wiley (2019)

References:

1. Neaman D, *Semiconductor Physics and Devices*, 4th Edition, McGraw Hill (2017).
2. MKS Handbook: *Semiconductor Devices and Process Technology*, 2nd Edition (2017).
3. Gandhi S.K, *VLSI Fabrication Principles: Silicon and Ga-As*, 2nd Edition, Wiley (2008).



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

1. Understand the basic properties and behavior of semiconductor materials used in electronic devices.
2. Learn how semiconductor wafers are manufactured from raw materials to finished silicon wafers.
3. Gain knowledge of thin-film deposition methods and basic material characterization techniques.
4. Understand the main steps involved in semiconductor device and IC fabrication processes.
5. Become familiar with the semiconductor manufacturing ecosystem, safety practices, and major applications of semiconductor devices.

PO/ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	3	2
CO2	3	2	-	2	-	-	-	-	-	-	-	1	3	1
CO3	2	2	-	3	3	-	-	-	-	-	-	1	2	2
CO4	2	2	3	2	2	-	-	-	-	-	-	1	1	1
CO5	1	-	-	-	-	3	2	2	2	1	-	2	2	2



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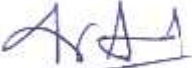
**B. Tech. (Civil Engineering)
Semester VII (Fourth Year)**

Code		Category	Course Title	Hours/Week			Total	Credits	Marks		
Department	University			L	T	P			CIE	SEE	Total
CE 2701E	7-2-7-R25PE1	CE-PE	Professional Elective–IV	3	0	0	3	3	40	60	100
CE 2702E	7-2-7-R25PE2	CE-PE	Professional Elective – V	3	0	0	3	3	40	60	100
CE 2703E	7-2-7-R25PE3	CE-PE	Professional Elective – VI	3	0	0	3	3	40	60	100
CE2704O	7-2-7-R25OE1	OD-OE	Open Elective -II (MOOCS)	0	0	0	0	3	0	100	100
CE 2705O	7-2-7-R25OE2	OD-OE	Open Elective – III (MOOCS)	0	0	0	0	3	0	100	100
CE 2706S	7-2-7-R25S1	CE-SC	Architectural CAD	1	0	2	3	2	100	0	100
CE 2707M	7-2-7-R25M1	CE-MC	Disaster Preparedness & Planning	2	0	0	2	0	100	0	100
CE2708M	7-0-3-R25M2	CE-MC	Constitution of India	2	0	0	2	0	100	0	100
CE 2709K	7-2-7-R25MK	CE-IK	Introduction to Indian Knowledge systems (IKS – Mandatory)	2	0	0	2	0	100	0	100
CE 2710I	7-0-7R25CS	CE-SI	Summer Industrial Internship	0	0	0	0	2	100	0	100
				16	0	2	18	19	620	380	1000
Students shall ensure that IKS MOOKS and IKS Mandatory courses are not same either in title and/or in syllabi.											


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CIVIL ENGINEERING**PROFESSIONAL ELECTIVE COURSES**

Professional Elective - I (V Sem)	7-2-5-R25E11	Municipal Solid Waste Management (EE)
	7-2-5-R25E12	Foundations on Expansive Soils (GTE)
	7-2-5-R25E13	Water Power Engineering (H&WRE)
	7-2-5-R25E14	Advanced Structural Analysis (SE)
	7-2-5-R25E15	Traffic Analysis (TE)
	7-2-5-R25E16	Building Construction Practice (Gen)
Professional Elective - II (VI Sem)	7-2-6-R25E11	Air Pollution and its Control (EE)
	7-2-6-R25E12	Geo environmental Engineering (GTE)
	7-2-6-R25E13	Water Resources System Analysis (H&WRE)
	7-2-6-R25E14	Advanced Reinforced Concrete Design (SE)
	7-2-6-R25E15	Traffic Engineering and Management (TE)
	7-2-6-R25E16	Construction Planning and Project Management (Gen)
Professional Elective -III (VI Sem)	7-2-6-R25E21	Environmental Impact Assessment and Audit (EE)
	7-2-6-R25E22	Advanced Geotechnical Engineering (GTE)
	7-2-6-R25E23	Hydraulic Structures (H&WRE)
	7-2-6-R25E24	Structural Dynamics (SE)
	7-2-6-R25E25	Urban Planning and Development (TE)
	7-2-6-R25E26	Organizational Behavior (Gen)
	7-0-6-R25CE1	Introduction to Semiconductor Manufacturing
Professional Elective -IV (VII Sem)	7-2-7-E11R25	Industrial Wastewater Treatment (EE)
	7-2-7-E12R25	Applied Soil Mechanics (GTE)
	7-2-7-E13R25	Watershed Management (H&WRE)
	7-2-7-E14R25	Bridge Engineering (SE)
	7-2-7-E15R25	Railway Engineering (TE)
	7-2-7-E16R25	Sustainable Engineering (Gen)
Professional Elective -V (VII Sem)	7-2-7-R25E21	Climate Change Impact Mitigation and Adaptation (EE)
	7-2-7-R25E22	Offshore Geotechnical Engineering (GTE)
	7-2-7-R25E23	Sustainable Water Resources Development (H&WRE)
	7-2-7-R25E24	Design of Earthquake Resistant Structures (SE)
	7-2-7-R25E25	Docks and Harbour Engineering (TE)
	7-2-7-R25E26	Optimization Techniques in Civil Engineering (Gen)
Professional Elective- VI (VII Sem)	7-2-7-R25E31	Environmental Sanitation (EE)
	7-2-7-R25E32	Geotechniques for Design of Underground Structures (GTE)
	7-2-7-R25E33	Urban Hydrology (H&WRE)
	7-2-7-R25E34	Design of Prestressed Concrete Structures (SE)
	7-2-7-R25E35	Airport Engineering (TE)
	7-2-7-R25E66	Entrepreneurship and Incubation (Gen)



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PE-IV-1 INDUSTRIAL WASTE WATER TREATMENT**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E11	CE

Course Educational Objectives (CEOs):

The course educational objectives are:

1. To teach impact of industrial wastes on environment.
2. To impart knowledge on selection of treatment methods for industrial wastewater
3. To teach characteristics of wastewater and treatment process involved in different industries
4. To provide knowledge on waste reduction practices and sludge management
5. To know the concepts of clean technologies

UNIT – I**INDUSTRIAL WASTE REGULATIONS**

Industrial activity in India, Guidelines for siting of industries and industrial estates. Characteristics of industrial Wastewater. Differences between industrial wastewater and domestic sewage.

IMPACT OF INDUSTRIAL WASTES ON ENVIRONMENT: Impact of Acids and Alkalis, suspended matter, organic matter (BOD), refractory organics, colored matter, inorganic solids, heavy metals, foaming agents (detergents), nutrients, oil and greases, biological (pathogenic) wastes, thermal waters and nuclear wastes on the environment.

UNIT – II**TREATMENT METHODOLOGY**

Neutralization, Equalization, Proportioning, Sedimentation, Flotation, Screening, coagulation, Evaporation, Ion Exchange, Reverse Osmosis, Lagooning, Trickling filter, Rotating biological contactors, Anaerobic digestion system.

UNIT-III

OUTLINES OF MANUFACTURING PROCESSES, SOURCES, VOLUMES, CHARACTERISTICS, AND TREATMENT PROCESSES OF MAJOR INDUSTRIES: Sugarcane, tannery, pulp and paper mills, textile mill industry and fruit processing industry.



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UNIT – IV

INDUSTRIAL WASTE MINIMIZATION PRACTICES: Volume reduction, strength reduction, process changes, equipment modifications, chemical substitution, segregation of wastes, equalization of wastes, by-product recovery, proportioning wastes.

MANAGEMENT OF INDUSTRIAL SLUDGES: Sources of production of industrial sludges, anaerobic and aerobic digestion, vacuum filtration, elutriation, drying beds, Sludge Lagooning, wet combustion process, drying and incineration, sanitary landfill.

UNIT – V

CLEAN MANUFACTURE PROCESS-Basic concepts of clean technologies, Zero pollution industrial complexes, Introduction to ISO 14000, Life Cycle Analysis, Common effluent treatment plants.

TEXT BOOKS

1. M. N. Rao and A. K. Dutta, Wastewater Treatment, Oxford & IBH, New Delhi.
2. K.V. S. G. Murali Krishna, Industrial Water and Wastewater Management

REFERENCE BOOKS :

1. Nemerow, N.L. (1977). Liquid waste of Industry, Theories, Practices and Treatment, Addison-Wesley Publishing Company, London.
2. Mahajan, S.P. (1990). Pollution Control Processing Industries. Tata Mc-Graw – Hill Publishing Company Limited, New Delhi.
3. Rao, M.N.and A.K.Datta. (1979). Wastewater Treatment. Rational Methods of Design and Industrial Practices. Oxford and IBH Publishing Co., New Delhi.

Course Outcomes (COs):

At the end of the course student can able to:

1. To describe the impacts of industrial wastewater on environment.
2. Capable of applying suitable treatment technology for industrial waste water treatment
3. To characterize the different industrial wastewater and apply suitable treatment methods
4. Capable of minimizing the industrial waste and manage industrial sludge
5. To apply concepts of clean manufacturing process.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	2	1	1			3	2	2	2	2	1	1		3	2
CO2	3	3	3			2	2	2	2	2	1	1		3	2
CO3	3	3	3			2	2	2	2	2	1	1		3	2
CO4	3	3	3			2	2	2	2	2	1	1		3	2
CO5	3	3	3			2	2	2	2	2	1	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE PE-IV-2 APPLIED SOIL MECHANICS**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E12	CE

PREREQUISTE: Basic Soil Mechanics, Foundation Engineering

Course Educational Objectives (CEOs):

1. Impart different soil improvement techniques for shallow soil layers.
2. Impart different soil improvement techniques for deep soil layers.
3. Introduce of Arching in soils and Tunnels in soils.
4. Introduce braced cut and its component design.
5. Introduce conduits and the design load on conduits.

UNIT I SOIL IMPROVEMENT TECHNIQUES FOR SHALLOW LAYERS

Soil improvement - Mechanical treatment - Lime stabilization - Cement Stabilization - Bituminous stabilization - Chemical Stabilization - Freezing and heating - Geotextiles.

UNIT II SOIL IMPROVEMENT FOR DEEP LAYERS

Dynamic compaction and consolidation - Preloading - Sand drains - Electro-osmosis - Lime columns - Stone columns -

Grouting.

UNIT III ARCHING & OPEN CUTS

Arching in soils-Theories of Arching-Cain's Theory-Tunnels through Sand

UNIT IV BRACED EXCAVATIONS

Braced cut - Apparent pressure diagrams for cuts in both sands and clays - Types of bracing systems - Design of various components of bracing - Bottom heave of cuts in soft clays - Piping failure of cuts in sands

UNIT V CONDUITS

Classes of Under Ground Conduits-Uses of Conduits-Load on Ditch Conduit-Load on Positive & Negative Projecting Conduits-Load on Conduits due to Live Loads.

TEXT BOOKS :

1. Alam Singh "Modern Geotechnical Engineering"
2. Gopal Ranjan & A.S.R.Rao, "Basic and Applied Soil Mechanics."
3. C.Venkatramaiah - Geotechnical Engineering.



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REFERENCE BOOKS:

1. Analysis and design of foundations and retaining structures - ShamsheerPrakash, GopalRanjan&Swamisaran
2. Soil Mechanics & Foundation Engineering – P.Purushothama.Raj
3. Foundation Engineering – Teng

Course Outcomes (CO's):

1. Choose ground improvement techniques to be adopted for shallow soil layers.
2. Choose ground improvement techniques to be adopted for deep soil layer.s
3. Analyze and design of Arching in soils and Tunnels in sands.
4. Design different components of braced excavations.
5. Design conduits to withstand different loading conditions.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	3	2	2	3	2		2			2				2	1
CO2	3	2	2	3	2		2			2				2	1
CO3	3	3	3	3	2		2			2				3	2
CO4	3	3	3	3	2					1				3	2
CO5	3	3	3	3	2					1				2	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE PE-IV-3 WATERSHED MANAGEMENT**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-6-R25E13	CE

DESCRIPTION OF THE COURSE:

Hydrology and Water Resources Engineering are considered as pre-requisite for this course. The students will be learning about hydrology, watershed and soil conservation concepts and applying this knowledge in management of different watersheds.

Course Educational Objectives (CEOs):

1. To learn about Rainfall-Runoff analysis and estimation and design of storm
2. To know about various types of soil erosions and their equations
3. To understand various concepts of watershed and their impacts on human
4. To understand various concepts of watershed management.
5. To know the concepts of soil conservation and water harvesting techniques.

UNIT I**WATERSHED HYDROLOGY:**

Precipitation - Analysis –Runoff – Factors affecting- Estimation of runoff by different methods- Floods- estimation of floods.

UNIT II**SOIL EROSION:**

Soil erosion – Erosion due to water and wind – Gully erosion – stream bank erosion- Factors affecting soil erosion-- Erosivity and Erodability- Universal soil loss equation.

UNIT III**WATERSHED CONCEPT**

Definition- watershed characteristics- Classification of watersheds- watershed delineation and prioritizing- Coding of watershed - Human impacts on watershed – Flood control measures.

UNIT IV**WATERSHED MANAGEMENT**

Watershed management principles and objectives- Factors affecting watershed management- Watershed inventory – Consultation process–Evaluation of constraints and criteria – Simple assessment methods - Participatory watershed management – Adaptive watershed management- Community watershed management- Integrated watershed management.



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UNIT V

SOIL CONSERVATION AND WATER HARVESTING TECHNIQUES

Farm ponds – Percolation tanks – Drop spillway – Pipe spillway – Erosion control structures - Artificial recharge – Different Methods – Rainwater harvesting.

REFERENCE BOOKS:

1. Prof. R. Suresh, “Watershed Hydrology “Standard Publishers.
2. Isobel W. Heathiote. “Integrated Watershed Management – Principles and Practices”.
3. Schwab, G.O. & others, “Soil and water Conservation Engineering”.
4. Prof. R. Suresh, “Soil and water Conservation Engineering”. (Standard Publishers).
5. Wayne A. Pettyjohu, “Introduction to Artificial Ground Water Recharge” Scientific Publishers, Jodhpur.

Course Outcomes (COs):

1. Able to explain about Rainfall-Runoff analysis and estimation and design of storm
2. Able to determine soil erosion and their classification
3. Able to classify different types of watersheds and their impacts
4. Able to compute watershed constraints and integrated watershed management.
5. Able to design soil and water harvesting structures.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PS O (1)	PS O (2)
CO1	3	2	1	2	1	-	-	-	-	-	-	-	3	2
CO2	2	2	1	2	1	-	-	-	-	-	-	-	3	2
CO3	2	2	2	2	1	-	-	-	-	-	-	-	3	2
CO4	2	2	2	2	1	-	-	-	-	-	-	-	3	2
CO5	2	2	2	2	1	-	-	-	-	-	-	-	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE PE-IV-4 BRIDGE ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E14	CE

Course Educational Objectives (CEOs)

1. Understand the fundamentals, classification, and planning aspects of bridges in accordance with IRC specifications.
2. Analyze and design short span bridges such as slab culverts, slab bridges, and T-beam bridges.
3. Apply design principles for long span bridges including continuous, box girder, and balanced cantilever bridges.
4. Comprehend construction techniques such as handling, hoisting, and launching of prestressed concrete girders.
5. Identify and design appropriate bearings, substructures, and foundations based on site and soil conditions.

UNIT-I**Introduction**

Classification-Investigations and Planning-Choice of type.I.R.C. specifications for road bridges-Standard live loads, other forces acting on bridges -General design considerations.

UNIT-II**Short Span Bridges**

Load distribution theories-Analysis and design of slab culverts-Tee beam and slab bridges.

UNIT-III**Long span girder bridges**

Design principles of continuous bridges-Box girder bridges balanced cantilever bridges.

UNIT-IV

Handling-Hoisting&Other Launching techniques of pre-stressed Girders.

UNIT-V

Bearings-Sub structures and Foundation for bridges.

Course Outcomes (COs)

On successful completion of the course, students will be able to:

CO1: Classify bridges and interpret IRC provisions, live loads, and forces acting on bridge structures.

CO2: Analyze load distribution and design short span bridge components such as slab culverts and T-beam bridges.



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CO3: Design and evaluate long span girder bridges including continuous, box girder, and balanced cantilever systems.

CO4: Explain construction, handling, and launching methods for prestressed concrete girders with safety considerations.

CO5: Select and design bearings, substructures, and foundations suitable for different bridge and soil conditions.

Text Books

1. Victor, D.J. Essential of Bridge Engineering, Oxford IBH.
2. Ponnuswamy, S, Bridge Engineering. Tata McGraw Hill.

Reference Books

1. Rowe, R.E., Concrete Bridges Design C.R. Books & Co.
2. Derrick Beckett, An Introduction to Structural Design of Concrete Bridges, Surry University Press, Oxford.
3. Taylor, F.N, Thomson, S.E. & Smulshi, E. Reinforced Concrete Bridges John Wiley Sons.
4. Balcht, B & Jaegar, L.G., Bridge Analysis simplified McGraw Hill.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	2	1	–	–	1	1	–	–	–	–	1		2	–
CO2	3	3	3	2	1	–	–	–	–	–	–	1		3	1
CO3	3	3	3	3	2	–	–	–	–	–	–	1		3	2
CO4	2	1	2	–	2	1	–	–	–	–	1	1		2	3
CO5	3	3	3	2	1	1	1	–	–	–	–	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE PE-IV-5 RAILWAY ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-6-R25E15	CE

Course Educational Objectives (CEOs)

After completing this course, students will be able to:

1. Understand the fundamentals of railway engineering, including history, development, and importance of railways in national transport.
2. Learn the components of the permanent way and track, including rails, sleepers, ballast, fastenings, and geometric design of track alignment.
3. Analyze and design railway track elements such as points, crossings, and turnouts, and understand signaling and interlocking principles.
4. Understand railway operations and maintenance practices, including track laying, drainage, station layout, and yard engineering.
5. Explore modern railway systems and technologies, including high-speed rail, urban rail transit, electrification, and safety management.

UNIT – I**Introduction to Railway Engineering**

Importance and role of railways in national transport- History and development of Indian Railways- Surveys for route location and alignment- Permanent way: components and functions- Types of gauges and gauge selection- Rails: types, functions, requirements- Rail fastenings and fittings

UNIT – II**Track Components & Geometric Design**

Sleepers: types, functions, density- Ballast: types and requirements- Coning of wheels, creep of rails- Track resistances and tractive effort concepts- Horizontal curves: super-elevation, transition curves- Vertical alignment: gradients, grade compensation

UNIT – III**Points, Crossings & Signalling**

Points and crossings: terminology, types, design basics- Turnouts and crossovers- Station yards and sidings- Introduction to signaling and interlocking principles- Train control systems, block systems

UNIT – IV**Track Maintenance & Operations**

Track laying methods- Track maintenance: objectives, procedures- Drainage of track formation- Maintenance equipment basics- Station layout and yard engineering



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UNIT – V**Modern Railway Systems & Emerging Topics**

High-speed rail concepts and requirements- Urban and suburban railways (e.g., LRT, MRTS)-
Electrification basics and traction systems (conceptual)- Safety norms and disaster management in railways

Course Outcomes (COs)

On successful completion of the course, students will be able to:

CO1: Explain the growth and characteristics of railways in India, types of gauges, and the role of permanent way components.

CO2: Analyze track geometry and design including horizontal and vertical alignment, super-elevation, transition curves, and gradients.

CO3: Design points, crossings, turnouts, and understand signaling systems for safe and efficient railway operation.

CO4: Plan and evaluate track maintenance, station layout, and operational practices to ensure sustainable railway functioning.

CO5: Apply knowledge of modern railway systems such as high-speed rail, urban rail transit, and railway electrification in planning and design.

Textbooks

1. S.C. Saxena & S.P. Arora, A Textbook of Railway Engineering, Dhanpat Rai & Co.
2. Satish Chandra & M. Agarwal, Railway Engineering, Oxford & IBH Publishing.
3. K. K. Khanna & M. G. Arora, Railway Engineering, Nem Chand & Bros., Roorkee.
4. J.S. Mundrey, Railway Track Engineering, Tata McGraw Hill, New Delhi.
5. S. P. Bindra, Track Engineering, Dhanpat Rai & Sons.

Reference Books

1. J.S. Mundrey, *Railway Track Engineering*, McGraw Hill, 2nd Edition, 2014.
2. R. Srinivasan, *Railway Engineering*, Universities Press.
3. S. P. Chand & Co., *Railway Engineering*, Revised Edition.
4. C. A. O'Reilly, *Railway Track Design and Maintenance*, CRC Press.
5. Indian Railways Institute of Civil Engineering (IRICEN) Manuals & Publications – For modern practices and standards.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	–	2	1	–	–	–	–	1	2	–
CO2	3	3	3	2	1	1	1	–	–	–	1	1	3	2
CO3	3	3	3	2	2	1	1	–	–	–	1	1	3	3
CO4	3	2	2	2	1	2	2	–	–	–	2	1	3	2
CO5	3	2	2	2	2	2	2	–	–	–	2	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE PE-IV-6 SUSTAINABLE ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-6-R25E16	CE

Course Educational Objectives (CEOs)

The objectives of this course are to:

CEO-1: Introduce the principles of sustainable development and their relevance to civil engineering practice.

CEO-2: Provide knowledge of sustainable construction materials and eco-friendly construction techniques.

CEO-3: Develop understanding of energy-efficient and green building concepts.

CEO-4: Impart knowledge of sustainable water, waste management, and environmental protection methods.

CEO-5: Enable students to assess environmental impacts of civil engineering projects using LCA and EIA tools.

UNIT – I: Introduction to Sustainable Engineering

Concept and principles of sustainability-Sustainable development goals (SDGs)-Need for sustainable engineering in civil engineering-Triple bottom line: environmental, economic, and social sustainability-Role of engineers in sustainable development

UNIT – II: Sustainable Materials and Construction Practices

Green building materials-Use of industrial by-products in construction (fly ash, GGBS, silica fume)-Recycled and renewable materials-Low-energy and low-carbon construction techniques-Sustainable construction practices

UNIT – III: Energy Efficiency and Green Buildings

Energy consumption in buildings-Energy-efficient building design-Passive solar design concepts-Green building rating systems (LEED, GRIHA, BEE)-Net-zero energy buildings

UNIT – IV: Water and Waste Management

Sustainable water resources management-Rainwater harvesting-Water-efficient plumbing systems-Waste management in construction and demolition-Solid waste management and recycling

UNIT – V: Environmental Impact and Life Cycle Assessment

Environmental impact assessment (EIA)-Life cycle assessment (LCA) of civil engineering projects-Carbon footprint of construction activities-Climate change and adaptation strategies-Sustainable urban development



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Course Outcomes (COs)

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

CO-1: Explain concepts and principles of sustainable engineering and sustainable development goals.

CO-2: Identify and select sustainable materials and construction practices for civil engineering projects.

CO-3: Apply energy-efficient design concepts and green building rating systems.

CO-4: Propose sustainable solutions for water resource management and waste management in construction.

CO-5: Evaluate environmental impacts of projects using life cycle assessment and environmental impact assessment methods.

Text Books

1. Kibert, C.J. – *Sustainable Construction: Green Building Design and Delivery*
2. Charles J. Kibert – *Sustainable Construction: Green Building Design and Delivery*
3. Keoleian & Menerey – *Life Cycle Design Framework*

Reference Books

1. UN Reports on Sustainable Development Goals (SDGs)
2. GRIHA & LEED Manuals
3. ISO 14040 & 14044 – Life Cycle Assessment standards

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	1	1		2	2	1				1	2	2
CO-2	3	2	2	1	1	1	2	1			1	1	3	2
CO-3	3	2	3	1	1	1	3	1			1	1	3	2
CO-4	3	2	2	1	1	2	3	1			1	1	3	3
CO-5	3	3	2	2	1	2	3	1			1	2	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-V-1 CLIMATE CHANGE IMPACT MITIGATION AND ADAPTATION**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-6-R25E21	CE

Course Educational Objectives (CEOs):

The course educational objectives are:

- 1.To teach the various aspects of atmospheric temperatures and concepts of global warming.
2. To explain the effects of climate change on various environments.
- 3.To teach about the impacts of climate change and mitigating measures of climate change.
4. To impart knowledge on climate change adaptation measures.
- 5.To know the concepts of clean technologies

UNIT-I**INTRODUCTION:**

Atmospheric temperatures, water vapor and precipitation, clouds and temperature ranges, ocean circulation pattern, El Nino and its effects.

GLOBAL WARMING: Emission sources of greenhouse gases, effects of Greenhouse gases, control measures of global warming.

UNIT-II

IMPACTS OF CLIMATE CHANGE: Effects of Climate changes on fresh water systems, terrestrial ecosystems, agriculture, marine environment, human health and human settlements.

UNIT-III**ASSESSMENT OF IMPACTS:**

Qualitative description, indicators of change, compliance to standards, costs and benefits, geographical analysis, case studies.

MITIGATING CLIMATE CHANGE:

Concept of carbon sequestration, Carbon sequestration modalities and procedures, Carbon capture and storage, Carbon trading, Montreal protocol, Kyoto protocol, Role and functions of IPCC, National and International action plan on climate change.

UNIT-IV**CLIMATE CHANGE ADAPTATION MEASURES:**

Adaptation Strategy in various sectors – Building climate resilient infrastructure measures, Agriculture and water management, Disaster and risk management, Ecosystem and conservation.



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UNIT-V

ALTERNATE ENERGY SOURCES:

Energy source -wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Clean Development Mechanism - Energy Audit.

Text Books

1. Climate Change: Causes, Effects and Solutions, John T. Hardy. Willy Publication, USA.
2. Principles and Practices of Air Pollution Control and Analysis, J.R. Mudakavi, I.K., international Publishing House Pvt. Ltd., New Delhi.
3. Carbon Capture: Sequestration and Storage (Issues in Environmental Science and Technology), RE Hester and RM Harrison, 2009, published by Royal society of chemistry.

Reference Books

1. Global Warming and Climate Change. Vol I and II. By Velma. I. Grover, Science Publishers, 2005.
2. Climate Change – An Indian Perspective, by Dash Sushil Kumar, Cambridge University Press India Pvt. Ltd, 2007
3. IPCC Fifth Assessment Report, Cambridge University Press, Cambridge, UK,
4. Impacts of Climate Change and Climate Variability on Hydrological Regimes, by Jan C. van Dam, Cambridge University Press, 2003.

COURSE EDUCATIONAL OUTCOMES:

After completion of the course, the student can able to

1. Explain the various aspects of atmospheric temperatures and concepts of global warming.
2. Explain the effects of climate change on environment and human beings.
3. Apply mitigating measures of climate change.
4. Apply adaptation measures on climate change.
5. Understand the concepts of clean technologies

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	2	3	2		2	3	2	2	2	2	1	1		3	2
CO2	2	3	2		2	3	2	2	2	2	1	1		3	2
CO3	2	3	2		2	3	2	2	2	2	1	1		3	2
CO4	2	3	2		2	3	2	2	2	2	1	1		3	2
CO5	2	3	2		2	3	2	2	2	2	1	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-V-2 OFFSHORE GEOTECHNICAL ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-6-R25E22	CE

PREREQUISTE: Basic Soil Mechanics, Foundation Engineering

Course Educational Objectives (CEOs):

1. Introduce offshore environment, structures, properties of marine soils and problems.
2. Impart effect of wave loading and repeated loading.
3. Understand the geotechnical challenges, investigation and sampling techniques for marine soil deposits.
4. Impart different foundations in marine soil deposits
5. Introduce deep foundations adopted for marine soil deposits under repetitive loading conditions.

UNIT I

MARINE SOIL DEPOSITS: Offshore environment, Offshore structures and foundations, Specific problems related to marine soil deposits, Physical and engineering properties of marine soils

UNIT II

BEHAVIOR OF SOILS SUBJECTED TO REPEATED LOADING: Effect of wave loading on offshore foundations, Behavior of sands and clays under cyclic loading, Laboratory experiments including repeated loading, Cyclic behavior of soils based on fundamental theory of mechanics, Approximate engineering methods which can be used for practical cases

UNIT III

SITE INVESTIGATION IN THE CASE OF MARINE SOIL DEPOSITS: Challenges of site investigation in marine environment, Different site investigation techniques, sampling techniques, Geophysical methods, Recent advancements in site investigation and sampling used for marine soil deposits

UNIT IV

FOUNDATIONS IN MARINE SOIL DEPOSITS: Different offshore and near shore foundations, Gravity platforms, Jack-up rigs.

UNIT V

DEEP FOUNDATIONS AND ANCHORS: Pile foundation – Axial capacity – Lateral capacity – Deflections – Construction – Anchored foundations.

References



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1. H. G. Poulos. "Marine Geotechnics", Unwin Hyman Ltd, London, UK, 1988
2. D. V. Reddy and M. Arockiasamy, "Offshore Structures ", *Volume: 1*, R.E. Kreiger Pub and Co., 1991
3. D. Thomson and D. J. Beasley, "Handbook of Marine Geotechnical Engineering", US Navy, 2012

Course Outcomes

1. Analyze the properties of marine soils and problems specific to marine soil deposits.
2. Analyze behavior of marine soils subjected to repeated loading
3. Plan for investigation in marine environment including Geophysical methods.
4. Assess the factors governing the choice of the most suitable type of foundation for a given marine Structure.
5. Select the type of foundation for a given marine Structure.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PS O (1)	PS O(2)
CO1	3	2	2	3	2		2			2			2	1
CO2	3	2	2	3	2		2			2			2	1
CO3	3	3	3	3	2		2			2			3	2
CO4	3	3	3	3	2					1			3	2
CO5	3	3	3	3	2					1			2	2

*1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-V-3 SUSTAINABLE WATER RESOURCES DEVELOPMENT**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E23	CE

DESCRIPTION OF THE COURSE:

Hydrology and Water Resources Engineering is considered as pre-requisite for this course. The students will be learning about concepts of water resources planning, evaluation and monitoring water quality in water distribution network.

Course Educational Objectives (CEOs):

1. To learn the concepts of Role of water resources in National Development
2. To learn about the water resources planning and project formulation.
3. To learn the Impact on Evaluation and monitoring of water quality and management of water distribution networks
4. To learn the management strategies for excess and deficit water balance.
5. To learn the concepts of Riparian Rights and Inter Basin Linking of Rivers

UNIT I

INTRODUCTION: Water Resources Potential, Demand and Development -Role of water in National Development - Assessment of Water Resources of the country - River Basins - Hydro-meteorological and Hydrological Data. Assessment of Utilizable flows - Conventional and non-conventional methods - Estimation of Water need- National Water Policy. Conjunctive use of surface and ground water. Future Water Requirements - Scope of development.

UNIT II

WATER RESOURCES PLANNING AND PROJECT FORMULATION: Water Resources Planning - Single and Multipurpose Projects - Project Formulation, Comparison of Alternatives - Cost Benefit Analysis. Cost Allocation among various purposes. Water Resources Systems Analysis - Optimization Approaches.

UNIT III

ENVIRONMENTAL ASPECTS OF INTEGRATED WATER RESOURCES DEVELOPMENT: Evaluation and monitoring of water quality and management of water distribution networks for Irrigation, Flood control and Power generation - Catchment Treatment and Watershed Management. Command Area Development - Resettlement and Rehabilitation.



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UNIT IV

MANAGEMENT STRATEGIES FOR EXCESS AND DEFICIT WATER BALANCES: Flood Control & Management - Various methods of Control - Administrative Planning - Management Programmes and Flood Cushioning -Structural Methods. Non-structural Methods - Flood forecasting & Warning, Flood plain zoning and Flood proofing. Drought Prone Area Development - Soil Conservation Methods.

UNIT V

RIPARIAN RIGHTS AND INTER BASIN LINKING OF RIVERS: Indian Scenario - Various Proposals and their Status - Dr. K. L. Rao's Proposal, Capt. Dastur's Garland Canal, National Perspective Plan, NWDA Link and Peninsular Rivers Development Component - Overall Benefits and Major constraints. Water Laws of India - Regulating Authorities - Interstate Water Dispute Acts - River Water Tributes - Cauvery, Krishna Godavari and Vamsadahra Tribunals.

TEXT BOOKS:

1. A Textbook of Irrigation Engineering and Hydraulic Structures, S K Sharma, S. Chand and Company Limited, New Delhi
2. Water Resource Engineering: R. L. Linsley & J. B. Fragini, McGraw-Hill

REFERENCES:

1. P. N. Modi, Irrigation and Water Resources & Water Power, Standard Book House.
2. A.S. Gordan, Principles of Water Resource engineering:
3. S. K. Garg, Irrigation engineering and Hydraulic structures, Standard Book House. Punmia & Lal, Irrigation and water power engineering, Laxmi Publications pvt. Ltd., New Delhi.

Course Outcomes:

1. Able to understand the concepts of Role of water resources in National Development
2. Able to design the water resources planning and project formulation.
3. Able to Impart on Evaluation and monitoring of water quality and management of water distribution networks
4. Able to apply the management strategies for excess and deficit water balance.
5. Apply to apply the concepts of Riparian Rights and Inter Basin Linking of Rivers

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	3	3	3	3	3	-	-	-	-	-	-	-		3	1
CO2	3	3	3	3	3	-	-	-	-	-	-	-		3	1
CO3	3	3	3	3	3	-	-	-	-	-	-	-		3	1
CO4	3	3	3	3	3	-	-	-	-	-	-	-		3	1
CO5	3	3	3	3	3	-	-	-	-	-	-	-		3	1

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-V-4 DESIGN OF EARTHQUAKE RESISTANT STRUCTURES (SE)**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-6-R25E24	CE

Pre-Requisites: Structural Analysis, Structural Dynamics**Course Educational Objective (CEOs):**

1. To quantify seismic hazard by understanding the relationship between geological forces and ground motion
2. To establish a robust seismic load path by integrating structural symmetry, simplicity, and material ductility at the earliest stages of planning.
3. To quantify and distribute seismic forces throughout a structure in strict compliance with the IS: 1893 (Part I) - 2016 code.
4. To engineer "Box Action" in brittle structures to ensure they behave as a cohesive, earthquake-resistant unit.
5. To ensure structural survivability by designing reinforcement layouts and allow members to undergo large inelastic deformations without sudden collapse.

UNIT I**ENGINEERING SEISMOLOGY**

Earthquake phenomenon – Cause of earthquakes – -Faults- Theory of Plate Tectonics- Seismic waves – Terms associated with Earthquakes – Magnitude and Intensity of an Earthquake – Earthquake Scales – Energy Released – Earthquake Measuring Instrument –Seismic zones of India.

UNIT II

Conceptual Design: Introduction-Functional Planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical Members-Twisting of buildings- Ductility-definition-ductility relationships-flexible buildings-framing systems-choice of construction materials-reinforcing steel.

UNIT III**INTRODUCTION TO EARTHQUAKE RESISTANT DESIGN**

Earthquake resistant design – Regular and irregular configurations – Design Earthquake loads – Basic load combinations – Lateral load resisting systems – Determination of design lateral forces – Equivalent lateral force procedure – Lateral distribution of base shear – provisions of IS: 1893 (Part I)- 2016

UNIT IV

Masonry Buildings: Introduction- Elastic properties of masonry assemblage- Categories of masonry



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buildings- Behaviour of unreinforced and reinforced masonry walls- Behaviour of Infill walls- Box action and bands - Improving seismic behaviour of masonry buildings

UNIT V

DUCTILE DETAILING

Ductility – Definition –Types –Factors affecting Ductility – Ductile detailing Provisions as per IS: 13920-2016 – Ductile detailing of beams, columns and beam-column joint.

TEXT BOOKS:

1. O Pankaj Agarwal & Manish Shrikhonde - Earthquake Resistant Design of Structures, Prentice Hall India Pvt. Ltd.
2. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press.

REFERENCES:

1. Jaikrishna & Chandra Sekar Elements of Earthquake Engineering, South Asian Publications, N.D.
2. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons.
3. Earthquake Resistant Design of Building structures by Vinod Hosur, Wiley India Pvt. Ltd.

Course Outcomes (COs) :

After completion of the course the student will be able to:

1. Understand the fundamental causes, characteristics, and measurement of earthquakes
2. Apply fundamental principles of structural behavior and design to create safe and efficient structures
3. Equip students with the knowledge and skills necessary to analyze, plan, and design earthquake resistant structures
4. Evaluate the structural safety of unreinforced, reinforced, and confined masonry under gravity and seismic loads.
5. Apply specialized reinforcement techniques to RC Structures, ensuring they can undergo extensive inelastic deformations without structural collapse.

PO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO(1)	PSO(2)
CO1	3		2			1	2				2		2	1
CO2		3		2	3			3	3	2		2	2	2
CO3	2		3				2						2	2
CO4				3		2		2		1			2	2
CO5		2					3		2				2	3

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-V-5 DOCKS AND HARBOUR ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E25	CE

Course Educational Objectives (CEOs)

After completing this course, students will be able to:

1. Understand the scope and importance of water transportation and the development of ports and harbors in India.
2. Study natural marine phenomena such as waves, tides, winds, and sediment movement affecting port and harbor planning.
3. Gain knowledge of harbor infrastructure components and their functional requirements.
4. Understand port facilities and navigational aids required for efficient and safe port operations.
5. Apply planning and economic evaluation principles for sustainable development of ports and harbor projects.

UNIT – I

Water Transportation:

Scope, Merits, Developments of Water Transportation in India, Inland waterways, River, canal, Inland water Transportation, Development of Port & Harbours, Harbour Classification, Site Selection, Harbour Dimensioning

UNIT – II

Natural Phenomena:

Wind, Tides, Water waves, Wave decay & Ports, Wave Diffraction Breaking, Reflection, Littoral drift, Sediment

UNIT – III

Harbour Infrastructure: Types of Break Waters, Jetty, Dock Fenders, Wharves, Dolphin Mooring accessories, Repair facilities, Wet Docks, Lift Docks, Dry Docks, Gates for Graving docks, Floating Docks, Slipways, Locks and Gates

UNIT – IV

Port Facility: Transit Shed, Warehouses, Cargo handling, Container Handling, Inland port facility, Navigational Aids, Types, Requirements of Signals, Lighthouses, Beacon lights, Buoys, Dredging & Coastal protection, Types of Dredges, Choices, usage of dredge material, Sea wall protection, Sea wall revetments, bulkhead.



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UNIT – V

Planning of Ports: Regional and intercontinental transportation development, forecasting cargo & Passenger demand, regional connectivity, Cargo handling, Capacity of Port, Economic Evaluation of Port projects, Impact of Port activities.

Course Outcomes (COs)

On successful completion of the course, students will be able to:

1. Explain the scope, merits, and development of water transportation systems including inland waterways, ports, and harbors.
2. Analyze the effects of natural phenomena such as waves, tides, wind, and sediment transport on harbor design.
3. Describe the design and function of harbor infrastructure such as breakwaters, docks, wharves, and mooring facilities.
4. Explain port facilities, navigational aids, dredging, and coastal protection measures used in port operations.
5. Apply port planning principles to forecast traffic demand, evaluate port capacity, and assess economic and environmental impacts.

TEXT BOOKS

1. Bindra, S.P, A Course in Docks and Harbor Engineering, Dhanpat Rai and Sons, New Delhi, India, 1992.
2. R. Srinivasa Kumar, Transportation Engineering: Railways, Airports, Docks and Harbors, Universities Press Pvt Ltd, Hyderabad. 2014.

REFERENCES

1. Alozo Def. Quinn, Design and Construction of Ports and Marine Structures, McGraw-Hill Book Company, New York
2. Srinivasan R., Docks & Tunnel Engineering, Charotar Publishing House, Anand.
3. Seetharaman, S., Dock and Harbour Engineering, Umesh Publications, New Delhi, India, 1999.
4. V.N. Vazirani and S.P. Chandola, Docks and Harbour Engineering – Text book of Transport Engineering Vol. II, Khanna Publishers, New Delhi.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	–	2	1	–	–	–	–	1	2	–
CO2	3	3	2	3	2	1	2	–	–	–	–	1	3	2
CO3	3	3	3	2	2	1	2	–	–	–	1	1	3	3
CO4	3	2	2	2	3	1	2	–	–	–	1	1	2	3
CO5	3	3	3	2	2	2	3	–	–	–	2	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-V-6 OPTIMIZATION TECHNIQUES IN CIVIL ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E26	CE

DESCRIPTION OF THE COURSE:

This course gives an opportunity for the students to know the various optimization techniques which can be adopted in design, construction and maintenance of any engineering system. Linear Programming, Non-Linear Programming, Dynamic Programming techniques are explained in detail. Advanced optimization techniques such as Genetic algorithm, Evolutionary search algorithm, Simulated Annealing and Ant Colony Optimization are briefly introduced.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. To understand the basic concepts of mathematical models and constraints in optimization method.
2. To know and solve basic concept of linear programming
3. To understand and analyse the basic concept of non-linear programming
4. To understand and compute Dynamic programming and network analysis.
5. To understand and analyze the concepts of non-traditional methods of optimization techniques.

UNIT I

INTRODUCTION: Activity- Design methodology - Mathematical models -Design Variables, Objective Function, Unconstrained functions – Single variable – Several variables – Equality Constraints – In-equality constraints - Problem Formulation – Generalized Newton Raphson method

UNIT II

LINEAR PROGRAMMING (LP): Introduction to LP and formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Algorithm, Minimization – Simplex Algorithm using Big-M method, Two phase method, Duality in linear programming, Transportation & Assignment Problems, Integer linear programming.

UNIT III

NON-LINEAR PROGRAMMING Optimality criteria – unconstrained function of single variables –several variables- Uni-directional search - Direct search methods – pattern search method - constrained function of single variable – several variables – Gradient Based Methods.

UNIT IV

DYNAMIC PROGRAMMING AND NETWORK ANALYSIS: Pipeline network problem –solution of network – optimality – allocation process -probability in PERT analysis, project time cost trade off, introduction to resource smoothing and allocation – optimization by dynamic programming – simulation methods.



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UNIT V

NON-TRADITIONAL METHODS: Simulated Annealing – Algorithm- Boltzmann's equation – stability – Genetic Algorithm and Evolutionary Strategy –Choice of population – genetic operators- survival of the fittest – two bar pendulum – generation – Ant Colony Optimization –probability – finding the short path – pheromone trail.

COURSE OUTCOMES (COs):

1. Able to formulate the basic mathematical model in optimization technique.
2. Able to analyze the concepts in linear programming.
3. Able to analyze the concepts in Non-linear programming
4. Able to solve the problems in dynamic programming and network analysis.
5. Able to analyze the non-traditional methods in optimization method.

TEXT BOOKS:

1. Rao, S.S: "Engineering Optimization: Theory and Practice", John Wiley & Sons, Inc, 2009.
2. Taha, H.A, "Operations Research: An Introduction, Pearson, 2013.
3. N D Vohra, Quantitative Techniques in management, Tata McGraw Hill, 2006.

REFERENCES:

1. Goldberg, D.E, "Genetic Algorithms in search, Optimization and Machine Learning", Addison and Wesley, 1989.
2. Dorigo, M and Stutzle, T, "Ant Colony Optimization", MIT Press, Cambridge, 2004.
3. Deb, K, Optimization for Engineering Design, Prentice Hall of India, 2012.
4. Ravindran, A, Ragsdell, K.M, Reklaitis, G.V, "Engineering Optimization: Methods and Applications", Wiley, New York, 2006.
5. Hadley, G, "Linear programming", Narosa Publishing House, New Delhi, 1992.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO2	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO3	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO5	3	3	2	3	2	-	-	-	-	-	-	-		2	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-VI-1 ENVIRONMENTAL SANITATION**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E31	CE

Course Educational Objectives (CEOs):

The course educational objectives are:

1. To teach the various aspects of environmental and rural sanitation.
2. To explain about the rural water supply, insect control and rodent control.
3. To teach about the various aspects of milk and restaurant sanitation.
4. To impart knowledge on swimming pool sanitation and epidemiology
5. To know the natural environmental and occupational hazards.

UNIT I**INTRODUCTION**

Define Environment and Environmental Sanitation, Status of environmental Sanitation in Indian Villages, Towns and cities, Concepts of Holistic cleanliness.

RURAL SANITATION

Conservancy, Public latrine, Night soil collection and disposal – Trenching – Composting – Bore hole latrine, Aqua privy, W.C, Septic tank, Soak pit, Imhoff tank.

ANIMAL WASTE DISPOSAL

Sanitary way of dung storage. Bio-gas plants – Classification, operation and maintenance problems.

UNIT II**RURAL WATER SUPPLY**

Water borne diseases, protection of well water, protected water, pumps, pump house, over head tank, disinfection, public taps, low-cost water treatment methods.

INSECT CONTROL

Fly & Mosquito Life cycles, diseases transmission, control measures.

RODENT CONTROL

Diseases transmitted, common rodents – R.Rattus, R.Norvegicus and R.Musculus, Habits, Physical features, control measure – Trapping – Baiting – Fumigation, Rat – Proof construction.

UNIT III**MILK SANITATION**

Diseases transmitted, planning a cow shed, pasteurization, quality control.

RESTAURANT SANITATION

Water supply, food and drink, storage, handling, utensils, equipment, washing, employees, toilet facilities, disposal facilities – Garbage, refuses, drainage. Food preservation.



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UNIT IV

SWIMMING POOL SANITATION

Classification of pools – planning of pools, quality of water, recirculation, treatment, pool regulations.

EPIDEMIOLOGY

Introduction and definitions, causative agents, symptoms, preventive measures of important communicable diseases like measles, mumps, T.B and Water borne diseases like Cholera, dysentery, typhoid, jaundice and arthropod borne diseases like malaria, dengue fever, filariasis.

UNIT V

NATURAL ENVIRONMENTAL HAZARDS

Classification of natural hazards. Impact of hazards on mankind.

OCCUPATIONAL HAZARDS AND PREVENTION

Definition, significant occupational hazards, prevention of occupational hazards.

REFERENCE BOOKS :

1. Salvato J.A. Jr. (1958). Environmental sanitation, John Wiley and Sons, New York.
2. Chanlett, E.T. (1979). Environmental Protection, Mc-Graw- Hill, Kogakusha Ltd.
3. Krishnan, N.V. (1993). Safety Management in Industry, Jaico Publishing House, Delhi.

Course Educational Objectives (CEOs):

1. After completion of course, the students can able to :
2. Explain the various aspects of environmental and rural sanitation.
3. Apply measures to the rural water supply, insect control and rodent control.
4. Describe the various aspects of milk and restaurant sanitation.
5. Maintain swimming pool sanitation and control diseases.
6. Apply control measures to natural environmental and occupational hazards.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PS O (1)	PS O (2)
CO1	2	2	2		2	2	2	2	2	2	1	1		3	2
CO2	3	3	3		2	2	2	2	2	2	1	1		3	2
CO3	3	2	2		2	3	3	2	2	2	1	1		3	2
CO4	3	3	3		1	2	2	2	2	2	1	1		3	2
CO5	2	2	2		2	2	3	2	2	2	1	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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PE-VI-2 GEOTECHNIQUES FOR DESIGN OF UNDERGROUNDS TRUCTURES**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E32	CE

PREREQUISTE: Basic Soil Mechanics, Foundation Engineering, Engineering Geology

Course Educational Objectives (CEOs):

- 1) Introduce excavation methods and design of supporting systems
- 2) Impart analysis of deep excavations
- 3) Impart design procedure for excavation supporting systems.
- 4) Impart excavation and protection procedure to be adopted for adjacent buildings during construction carrying out below the ground level.
- 5) Introduce the elements and construction process of tunnel

UNIT-I**Excavation Methods and Lateral Supporting System**

Introduction - excavation methods and lateral supporting systems -retaining walls-strutting systems-factors influencing on the selection of the retaining struts stem-case history. Lateral earth pressure for design of supporting systems-Rankine's and Coulomb's earth pressure theory-earth pressure for design of excavation.

UNIT-II**Analysis of Deep Excavation**

Introduction - free and fixed earth support method -shear failure of strutted walls-push in- basal heave-upheaval-sand boiling-Stress and deformation analysis of excavation: simplified method-beam on elastic foundation method-finite element method.

UNIT-III**Design of Excavation Supporting Systems**

Introduction -design methods and factor of safety -retaining wall -structural components in braced excavations -strut systems-anchor systems-tests of anchors.

UNIT-IV**Excavation and Protection of Adjacent Buildings**

Introduction -protection of building using the behaviour of excavation induced deformation _ building protection by auxiliary methods -construction defects and remedial measures _ building rectification methods.



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UNIT-V

Design of Tunnel

Introduction-longitudinal and transverse profile of tunnel structure – tunnel protection against fire - advanced systems of anti-water insulation of underground structures - loading types of shallow and deep tunnels, rock mass classification - mining technologies of deep excavation- shield technology, execution technology of shallow underground structures, sewerage objects - trenchless technologies.

TEXTBOOKS:

1. Chang-YuOu, Deep Excavation Theory and Practice, Taylor & Francis Group, /London, UK, 2006.
2. Terzaghi, K. and Peck, R.B, John, Soil Mechanics in Engineering Practice, Wiley & Sons, New York, 1967.

REFERENCES:

1. Holtz, R.D. and Kovacs, W.D, An Introduction to Geotechnical Engineering., Prentice -Hall, Inc., Englewood Cliffs, NJ, 1981.
2. Hausman, M.R., Engineering Principles of Ground Modification, McGraw-Hill Publishing Company, New York, 1990.
3. Hoek, E., Brown, E.T., Underground excavations in rock, The Institution of Mining and Metallurgy, London, SW7 2BP, England, 1980.
4. Megaw T.M., and Bartlett, J.V., Tunnels: planning, design, construction by Ellis Horwood, 1983

Course Outcomes(COs):

1. Analyze the lateral supporting systems of excavation for underground structures.
2. Analyze deep excavations for underground structures.
3. Analyze and design various supporting systems for underground construction.
4. Plan for protection of adjacent buildings due to underground construction.
5. Planning of different components for safety in tunnel construction.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PSO(1)	PSO(2)
CO1	3	3	2	2	1		1			2			3	2
CO2	3	3	3	2	1		1			2			3	2
CO3	3	3	2	2	1		1			2			3	2
CO4	3	3	2	2			1			2			3	2
CO5	3	3	2	2			1			2			2	1

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-VI-3 URBAN HYDROLOGY**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E33	CE

DESCRIPTION OF THE COURSE:

Hydrology and Water Resources Engineering is considered as pre-requisite for this course. The students will be learning about concepts of methods of urban drainage, analysis and management of drainage system.

Course Educational Objectives (CEOs):

- 1) To learn about impact of urbanization on catchment hydrology by precipitation analysis
- 2) To learn about methods of urban drainage.
- 3) To learn about storm water drainage structures and best management practices.
- 4) To learn about design of master drainage plan.
- 5) To learn about the concepts of Hydrological models.

UNIT I**INTRODUCTION**

Urbanization and its effect on water cycle – urban hydrologic cycle – Effect of urbanization on hydrology. Precipitation Analysis: Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration and design of urban drainage systems, Intensity-Duration - Frequency (IDF) curves, design storms for urban drainage systems.

UNIT II**METHODS OF URBAN DRAINAGE**

Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse , major and minor systems. Drainage systems: Open channel, underground drains, appurtenances, pumping, source control.

UNIT III**ANALYSIS AND MANAGEMENT**

Storm water drainage structures, design of storm water network- Best Management Practices– detention and retention facilities, swales, constructed wetlands, models available for storm water management.

UNIT IV**MASTER DRAINAGE PLANS**

Issues – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning, use of models in planning.



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UNITV

HYDROLOGICAL MODELS:

General principles of hydrological modelling - The Rational Method - The time-area method - The unit hydrograph method - Physically based distributed models - Physically based partially distributed models - Hydraulic modelling - Model calibration and validation - Probabilistic models - Expert systems

TEXT BOOKS:

1. Akan A.O and R.L. Houghtalen, Urban Hydrology, Hydraulics and Stormwater Quality: Engineering Applications and Computer Modelling (2006), Wiley International.
2. Hall M. J., Urban Hydrology (1984), Elsevier Applied Science Publisher.

REFERENCES BOOKS:

1. Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, Manual on Drainage in Urbanised area' (1987 – 2 volumes), UNESCO,
2. Wanielista M. P. and Eaglin, Hydrology – Quantity and Quality Analysis (1997), Wiley and Sons.
3. Stahre P. and Urbonas B., Stormwater Detention for Drainage (1990), Water Quality and CSO Management, Prentice Hall.
4. Maksimovic C. and J. A. Tejada-Guibert, Frontiers in Urban Water Management – Deadlock or Hope (2001), IWA Publishing.

Course Outcomes

- 1) Able to understand the concept of impact of urbanization on catchment hydrology by precipitation analysis
- 2) Able to understand about methods of urban drainage.
- 3) Able to design the storm water drainage structures and best management practices.
- 4) Able to design of master drainage plan.
- 5) Able to understand the concepts of Hydrological models.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)	PS O (1)	PS O (2)
CO1	3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3


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1 - Slightly; 2 - Moderately; 3 – Substantially

PE-VI-4 DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Credits: 3

Assessment: 40 + 60

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E34	CE

DESCRIPTION:

Prestressed concrete is a system devised to provide sufficient precompression in the concrete beam by tensioned steel wires, cables, or rods that under working conditions the concrete has no tensile stresses or the tensile stresses are so low that no visible cracking occurs.

Course Educational Objectives (CEOs):

1. To learn the principles, materials, methods and systems of prestressing.
2. To know the different types of losses and analysis of prestressed members.
3. To learn the design of prestressed concrete beams for flexural, shear and tension and to calculate ultimate flexural strength of beam.
4. To learn the design of anchorage zones in post-tensioned and transmission length of pre-tensioned beams.
5. To learn the calculation of short- & long-term deflection of PSC beams.

UNIT – I

INTRODUCTION: Historic development – General principles of pre-stressing – pre-tensioning and post tensioning – Advantages and limitations of pre-stressed concrete – Materials – High strength concrete and high tensile steel their characteristics. I.S.Code provisions, Methods and Systems of Pre-stressing; Pre-tensioning and post tensioning methods – Analysis of post tensioning - Different systems of pre-stressing like Hoyer System, Magnel System Freyssinet system and Gifford – Udall System.

UNIT – II

ANALYSIS OF SECTIONS FOR FLEXURE: Elastic analysis of concrete beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons.

LOSSES OF PRESTRESS: Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage bending of member and frictional losses.

UNIT – III

DESIGN OF SECTIONS FOR FLEXURE AND SHEAR: Allowable stress, Design criteria as per I.S.Code – Elastic design of simple rectangular and I-section for flexure, shear, and principal stresses – design for shear in beams – Kern – lines, cable profile.



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UNIT – IV

ANALYSIS OF END BLOCKS: by Guyon's method, Fressinet and Magnelblotten method, Anchorage zone stresses – Approximate method of design – Anchorage zone reinforcement – Transmission length - Transfer of prestress in pre-tensioned members.

UNIT – V

DEFLECTIONS OF PRESTRESSED CONCRETE BEAMS: Importance of control of deflections – factors influencing deflections – short term deflections of uncracked members - prediction of long-term deflections.

Course Outcomes (COs):

On completion of the course, the students will be able to:

1. Know the general principle of prestressed concrete and materials & methods.
2. Analysis of a prestressed concrete beam accounting for losses
3. Design the anchorage zone for post tensioned members
4. Design of PSC beams under flexure & shear
5. To get an idea over Estimation of deflection of PSC beams

TEXT BOOKS:

1. Pre-stressed Concrete by Krishna Raju; - Tata Mc.Graw Hill Publications.
2. Pre-stressed Concrete by N.Rajasekharan; - Narosa publications.

REFERENCES:

1. Pre-stressed Concrete by Ramamrutham; Dhanpatrai Publications.
2. Design of Pre-stressed concrete structures (Third Edition) by T.Y. Lin & Ned H.Burns, John Wiley & Sons Inc..Codes: BIS code on pre-stressed concrete, IS 1343.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	–	1	–	–	–	–	–	1	2	2
CO2	3	3	2	2	1	1	–	–	–	–	–	1	3	3
CO3	3	3	3	2	1	1	–	–	–	–	1	1	3	3
CO4	3	2	3	2	1	1	–	–	–	–	1	1	3	3
CO5	3	2	2	2	–	1	–	–	–	–	–	1	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-VI-5 AIRPORT ENGINEERING**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E35	CE

Course Educational Objectives (CEOs)

After completing this course, the students will be able to:

1. Understand the growth and characteristics of airports and aircraft, including airfield components, traffic zones, and approach areas.
2. Learn airport engineering principles such as site selection, runway orientation, and terminal area layout concepts.
3. Analyze airport capacity and delays and apply airport planning techniques for effective design of runways, taxiways, and aprons.
4. Understand grading, drainage, and terminal area planning along with air traffic control systems and navigational aids.
5. Apply geometric design principles for runways and taxiways, including lighting, markings, and compliance with standards and specifications.

UNIT – I

Growth and Characteristics of Airport and Aircraft: Growth of air transport, airport organization and associations, Classifications of airports airfield components, airport traffic zones and approach areas. Aircraft Components, size turning radius, speed, airport characteristics.

UNIT – II

Airport Engineering: Airport site selection – factors affecting site selection and surveys- runway orientation – wind rose diagram – basic runway length – correction for runway length – terminal area – layout and functions – concepts of terminal building – simple building, linear concept, pier concept and satellite concept – typical layouts

UNIT – III

Capacity and Delay, Airport planning, surveys and Design: Factors affecting capacity, Determination of runway capacity related to delay, gate capacity, and Taxiway capacity Airport Site Selection, Runway length and width, sight distances, longitudinal and transverse grades, runway intersections, taxiways, clearances, aprons, numbering, holding apron, noise control, Problems.

UNIT – IV

Airport Grading, Planning and Design of the Terminal area: Operational concepts, space relationships and area requirements, vehicular traffic and parking at airports. Grading of airport area, hydrology, Airport Drainage, Air Traffic Control and Aids: design of drainage systems, construction methods, layout of surface drainage and subsurface drainage system, Problems. Runways and taxiways markings, day and night landing aids, airport lighting, ILS and other associated aids.



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UNIT –V

Geometric design of runways and taxiways Aircraft characteristics – influence of characteristics on airport planning and design – geometric design elements of runway – standards and specifications as per - functions of taxiways – taxiway geometric design – geometric elements and standard specifications – runway and taxiway lighting.

Course Outcomes (COs):

On successful completion of the course, students will be able to:

1. Explain airport and aircraft characteristics, classifications of airports, airfield components, and airport traffic zones.
2. Evaluate airport site selection and runway orientation using wind rose diagrams, and design terminal layouts (linear, pier, satellite concepts).
3. Analyze capacity, delays, and operational efficiency of runways, taxiways, gates, and aprons in airport planning.
4. Design airport grading, drainage, and terminal areas and understand air traffic control, lighting, and landing aids.
5. Apply geometric design standards for runways and taxiways considering aircraft characteristics, operational requirements, and lighting systems.

TEXT BOOKS:

1. Khanna, Arora and Jain, Airport Planning and Design, Nem Chand and Bros., Roorkee
2. Rangwala, Airport Engineering – Charotar Publisher

REFERENCES:

1. R. Srinivasa Kumar, Transportation Engineering: Railways, Airports, Docks and Harbors, Universities Press Pvt Ltd, Hyderabad. 2014.
2. Virender Kumar and Satish Chandra, Airport Planning and Design, Galgotia Publication press.
3. Robert Horenjeff, Planning and Design of Airports, 2nd edition, McGraw Hill Book Co.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	–	1	–	–	–	–	–	1	2	–
CO2	3	3	3	2	1	1	1	–	–	–	1	1	3	2
CO3	3	3	3	3	2	1	1	–	–	–	1	1	3	3
CO4	3	2	3	2	2	2	2	–	–	–	2	1	3	3
CO5	3	3	3	2	3	1	1	–	–	–	2	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially


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PE-VI-6 ENTREPRENEURSHIP AND INCUBATION**Credits: 3****Assessment: 40 + 60**

Semester	L-T-P	Course Code	Branches
VII	3-0-0	7-2-7-R25E36	CE

Course Educational Objectives (CEOs):

The objectives of this course are to:

CEO-1: Introduce the fundamentals of entrepreneurship and its role in economic and infrastructural development.

CEO-2: Develop skills for identifying business opportunities and generating innovative ideas.

CEO-3: Enable students to prepare business plans and understand financial and managerial aspects of startups.

CEO-4: Familiarize students with incubation processes, startup ecosystems, and government support mechanisms.

CEO-5: Impart knowledge of legal, ethical, and sustainable practices in entrepreneurship.

UNIT – I: Introduction to Entrepreneurship

Concept and nature of entrepreneurship-Entrepreneur vs. manager-Characteristics of successful entrepreneurs-Types of entrepreneurship (small, social, techno, rural)-Role of entrepreneurship in economic development-Entrepreneurial opportunities in civil engineering

UNIT – II: Innovation and Business Idea Generation

Creativity and innovation in business-Opportunity identification and idea generation techniques-Design thinking for entrepreneurs-Feasibility analysis (technical, market, financial)-Business model concepts (Business Model Canvas)

UNIT – III: Business Plan and Financial Management

Business plan preparation and components-Sources of finance (banks, venture capital, angel investors, government schemes)-Basics of accounting and financial statements-Cost estimation and pricing strategies-Break-even analysis

UNIT – IV: Incubation and Start-up Ecosystem

Concept and importance of incubation-Business incubators and accelerators-Startup ecosystem in India-Government initiatives: Startup India, MSME schemes-Intellectual Property Rights (IPR) – patents, trademarks, copyrights

UNIT – V: Legal, Ethical and Sustainability Aspects

Legal requirements for starting a business-Company registration and licenses-Ethical issues in entrepreneurship-Risk management and failure handling-Sustainable and social entrepreneurship



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Course Outcomes (COs)

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

CO-1: Understand and explain key concepts of entrepreneurship and entrepreneurial characteristics.

CO-2: Identify opportunities, generate innovative business ideas, and perform feasibility analysis.

CO-3: Develop business plans, analyze financial requirements, and understand funding sources.

CO-4: Explain incubation processes, startup ecosystems, and government schemes for startups.

CO-5: Apply legal, ethical, and sustainable principles in entrepreneurial ventures.

Text Books

1. Vasant Desai – *Dynamics of Entrepreneurial Development and Management*
2. Poornima M. Charantimath – *Entrepreneurship Development and Small Business Enterprises*
3. Robert D. Hisrich & Michael Peters – *Entrepreneurship*
- 4.

Reference Books

1. Barringer & Ireland – *Entrepreneurship: Successfully Launching New Ventures*
2. Startup India Portal – Government of India
3. WIPO Manuals on Intellectual Property Rights

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	2	2	1	2	2	1	1	3	2
CO2	3	3	2	2	1	2	2	1	2	2	2	2	3	3
CO3	3	2	3	2	2	2	2	1	2	2	3	2	3	3
CO4	3	2	2	1	1	2	3	1	2	2	2	2	3	3
CO5	3	2	2	1	1	3	3	3	2	2	2	2	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially



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ARCHITECTURAL CAD**Credits: 2****Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
VII	1-0-2	7-2-7-R25S1	CE

Course Educational Objectives (CEOs):

1. Develop a foundational understanding of Building Information Modelling (BIM) principles and gain proficiency in navigating the software interface, managing project properties, and organizing project browsers.
2. Demonstrate the ability to model a complete building shell by accurately placing architectural elements and structural components within a unified 3D environment.
3. Utilize the data-driven nature of BIM to create, manage, and format automated schedules for rooms, doors, and equipment, ensuring high levels of accuracy in project quantities and layouts.
4. Develop the skills to generate and customize 2D and 3D views, including floor plans, elevations, sections, and callout details, while applying proper annotation and CAD-integration techniques for construction documentation.
5. Analyze and implement vertical circulation systems and master the final output phase by exporting projects into industry-standard formats (DWG, PDF, DWFx) for multi-disciplinary collaboration.

Exercise 1:

INTRODUCTION: Building Information Modeling (BMI) – User Interface – Creating a new Project – Floor Plans - Properties

Exercise 2:

BASIC ARCHITECTURAL MODELING: Adding of Walls – Doors – Windows – Floors – Roofs – Modify Elements

Exercise 3:

BASIC STRUCTURAL MODELING: Grids – Columns – Floors - Slabs – Slab Edges – Foundations

Exercise 4:

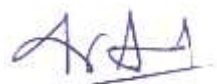
DEVELOP A PROJECT: Interior Layout – Rooms- Room Schedule – Door Schedule – Furniture – Equipment – Custom Wall Types – Curtain Walls

Exercise5:

VIEW CREATION AND PROPERTIES: Creating Plans – Elevations – Sections – View Properties – Perspective Camera Views

Exercise 6:

DETAILING: Annotating Detail Views – Importing CAD Details – Detail Lines / Components



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Exercise 7:

Vertical Circulation & Penetrations: Stairs – Ramps – Elevators – Railings – Multi Level vs Single Storey – Sketch Stairs – Component Stairs - Shaft Openings.

Exercise 8:

OUTPUT: Printing – PDF – Settings – Export to DWG / DWFx – Export Images

Course Outcomes (Cos):

Upon successful completion of this course, the student shall be able to:

1. Ability to utilize the User Interface, establish project levels, and manage project properties to initiate a Building Information Model.
2. Develop a comprehensive 3D model by integrating architectural elements with structural components while maintaining spatial accuracy.
3. Create and manage intelligent schedules for rooms and building components, ensuring that data extraction reflects real-time model changes for furniture and equipment.
4. Produce a standard set of construction documents, including plans, sections, and 3D perspectives, enhanced with detailed 2D annotations and imported CAD components.
5. Design functional vertical circulation systems and execute multi-format exports (DWG, PDF) to facilitate professional interdisciplinary collaboration.

PO&PSO CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1					3							2		1	3
CO2	3	2	3		3							1		3	3
CO3			2		3				2		3			2	3
CO4	1		2		3					3				3	2
CO5	2		2		3					2		2		2	3

1 - Slightly; 2 - Moderately; 3 – Substantially


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DISASTER PREPAREDNESS & PLANNING**Credits: 0****Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
VII	2-0-0	7-2-7-R25M1	CE

Course Objectives:

The objectives of the course are

1. To Understand basic concepts in Disaster Management.
2. To Understand Definitions and Terminologies used in Disaster Management.
3. To Understand Types and Categories of Disasters.
4. To Understand the Challenges posed by Disasters.
5. To understand Impacts of Disasters Key Skills.

UNIT I

Introduction on Disasters: Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation, disaster phenomena, events - global National & Regional.

UNIT II

Types, Trends, Causes and Consequences of Disasters: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

UNIT III

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management - Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro-zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters– Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation Restoration of Critical Infrastructure.

UNIT IV

Disaster Management in India:

Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies, DRR programmes in India and the activities of National Disaster Management Authority.



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UNIT V

Applications of Science and Technology for Disaster Management:

Geo-informatics in Disaster Management, Disaster Communication System (Early Warning and Its Dissemination), Land Use, Planning and Development, Regulations. Community Engagement, Recovery, and Reconstruction, Importance of community involvement in disaster management, Stakeholder analysis and engagement strategies, Building partnerships with government agencies, NGOs, and local communities.

Course Outcomes:

The student will develop competencies in

1. The application of Disaster Concepts to Management.
2. Analyzing Relationship between Development and Disasters.
3. Ability to understand Categories of Disasters.
4. Ability to analyze early warning systems and its dissemination in Disasters.
5. Realization of the responsibilities to society.

Text Books:

1. Pandey, M., "Disaster Management", Wiley India Pvt. Ltd., 2014
 2. J. P. Singhal, "Disaster Management", Laxmi Publications., 2019
 3. M. C. Gupta, "Manual on natural disaster management in India", NIDM, New Delhi. Latest edition
- Supplementary Readings

References:

1. H. N. Srivastava & G.D. Gupta, "Management of Natural Disasters in developing countries", Daya Publishers.2006
2. Singh, J., "Disaster Management: Future Challenges and Opportunities", K W Publishers Pvt. Ltd., 2013
3. Bhattacharya, T., "Disaster Science and Management" McGraw Hill Education (India) Pvt. Ltd., 2017
4. Coppola D. P., "Introduction to International Disaster Management", Elsevier Science (B/H).2020

CO-PO Mapping

PO&PSO/ CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)
CO1	3	2	2	1	1	-	-	-	-	-	1	1
CO2	2	3	2	2	-	2	2	-	-	-	-	1
CO3	3	2	-	-	-	1	-	-	-	-	-	-
CO4	2	3	2	3	2	1	-	-	-	1	-	2
CO5	-	-	-	-	-	3	3	3	2	2	-	2

1 - Slightly; 2 - Moderately; 3 – Substantially



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CONSTITUTION OF INDIA**Credits: 0****Assessment: 100 + 00**

Semester	L-T-P	Course Code	Branches
VII	2-0-0	7-0-3-R25M2	CE

Course Educational Objectives (CEOs):

Students will learn:

1. To Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit-I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble Salient Features

Unit-II

Contours of Constitutional Rights & Duties:

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit-III

Organs of Governance:

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions



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Unit-IV**Local Administration:**

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: Zila Pachayat.
- Elected officials and their roles, CEO Zila Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

Unit-V**Election Commission:**

- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT BOOKS/REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes (COs):**Students will be able to:**

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.
5. Discuss the role of Election Commission

CO-PO Mapping

PO&PSO/ CO	PO (1)	PO (2)	PO (3)	PO (4)	PO (5)	PO (6)	PO (7)	PO (8)	PO (9)	PO (10)	PO (11)	PO (12)
CO1	2	2	-	-	2	1	2	-	-	2	1	1
CO2	2	1	1	-	1	1	-	-	-	1	1	1
CO3	2	2	-	-	2	1	2	-	-	2	1	1
CO4	-	-	-	-	2	1	2	-	-	2	1	1
CO5	1	2	-	-	2	1	2	-	-	2	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially



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INTRODUCTION TO INDIAN KNOWLEDGE SYSTEMS**Credits: 0****Assessment: 100 + 0**

Semester	L-T-P	Course Code	Branches
VII	2-0-0	7-2-7-R25MK	CE

UNIT-I

Astronomy and mathematics - Introduction to various fields in traditional Indian Knowledge system. Methods and Sources. - Ancient Indian Observational Astronomy - Foundation concepts - nakṣatra, graha, time units, phenomena like meteors, eclipses. - Mathematical thinking - numerical and spatial thinking, śulbasūtra, zero, sundials, water clock, time measurement.

UNIT-II

Language, literature and Art - Formation of words in saṃskṛta and some ideas from Pāṇini and Patañjali. Technical words and examples of their usage. – Music, Vedic chants, sāma, some concepts in ancient treatises like nārādīyaśikṣānātyaśāstra.

UNIT-III

Earth and Atmosphere - Anomalous phenomena, Earthquakes, clouds, rainfall, soil, agriculture and food science

UNIT-VI

Architecture and Civil Engineering - Sindhu-Sarasvatī cities, Description in purāṇa, arthaśāstra. A glance at select texts like nāradaśilpa, mayamata, mānasāra.

UNIT-V

Material science - Knowledge and use of various materials in āyurveda, rasaśāstra and vāstuvidyā.

References:

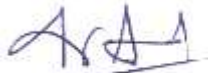
1. Dikshit, S. B. (1969, 1981). BharatiyaJyotish Sastra (in Marathi) Poona (1896). (Transl. RV Vaidya, Vol.1). New Delhi: Government of India Press.
2. Iyengar, R. N. (2016) Astronomy in Vedic texts, History of Indian Astronomy, A Handbook - Volume brought out on the occasion of IX International Conference on Oriental Astronomy November 14–18.
3. Iyengar, R. N. (2013). Parāśara Tantra (Ed. Text, Trans. & Notes), Bangalore: Jain University Press.
5. Sastry T.S. K (Ed.). (1984). VedāṅgaJyotiṣa of Lagadha, Indian Journal of History of Science, 4) Supplement, 1–74.
6. Sen, S. N., and Shukla, K. S. (Ed.) (2000). History of Astronomy in India, 2nd Revised Edition. New Delhi: Indian National Science Academy.
7. Thompson R.L. (2007) The Cosmology of the BhāgavataPurāṇa (First Indian Edition) MLBD Publ. Delhi.
8. Iyengar, R.N; Kannan K.S; Wakankar S. Y. (2018) NāradaŚilpaśāstra - Sanskrit Text on Architectural Civil Engineering, Jain University Press.
9. B. Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana (2022) Introduction to Indian Knowledge System: Concepts and Applications.



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B. Tech. (Civil Engineering)
Semester VIII (Fourth Year)

Code		Category	Course Title	Hours/Week			Total	Credits	Marks		
Department	University			L	T	P			CIE	SEE	Total
CE2801PI	7-0-8-R25PS	CE-PWSI	Project Work & Full Semester Internship	0	0	24	24	12	50	50	100
TOTAL				0	0	24	24	12	50	50	100
In the final semester, the student should mandatorily undergo full semester internship and parallelly he/she should <i>work on a project with well-defined objectives</i>. At the end of the semester the candidate shall submit an internship report and its completion certificate in the department. Student is permitted to submit report on the work carried out during the internship as project report provided the internship work is in the discipline of his B.Tech. Program. Internship programs offered by AICTE/APSSDC/NSDC/SWAYAM PLUS /Any State or Central Government organizations involving Industry experts and approved by the concerned BoS/Head/Head of the Institution are also considered equivalent to full semester Internship provided it involves 90 – 120 hours of work. The Internship work area can be in his own discipline or inter-disciplinary (One discipline being his own) or other discipline also. The project work shall be either in the discipline of his own or inter-disciplinary.											


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 DEAN
 FACULTY OF ENGINEERING
 S.V.U. COLLEGE OF ENGINEERING
 TIRUPATI-517 502

BRIDGE COURSES FOR EXIT FOR B.Tech. CIVIL ENGINEERING

Two months internship in industry or bridge courses mentioned below of 6 to 8 credits on NPTEL – SWAYAM Platform

Semester	Exit Option	Credits	Additional Credits for Exit students	List of Bridge courses
Sem I & II	U.G Certificate	40.5	6-8	1. Strength of Materials 2. Fluid Mechanics 3. Engineering Geology 4. Structural Analysis 5. Soil Mechanics 6. Water Quality and Treatment 7. Transportation Engineering
Sem III & IV	U.G Diploma	42.0	6-8	1. Concrete Technology 2. Design of Reinforced Concrete Structures 3. Design of Steel Structures 4. Foundation Engineering 5. Waste Water Treatment 6. Estimation & Costing 7. Remote Sensing & GIS
Sem V & VI	B.E Vocational	51.5	---	N.A.
Sem VII & VIII	B.E Vocational	31.0	---	N.A.


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