Course Title	Solid Mechanics - 2					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801501	PCC	02	01	00	03	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. Study of the subject provides the understanding of principal stress, strains and theories of failure.
2. Understand the difference between thin and thick cylinders.
3. Ability to identify the different types of columns and struts.
4. Can determine the direct and bending stresses.
5. To estimate the stresses due to unsymmetrical bending

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

CO 1	Understand the concept of stress, principal stresses, strains.
CO 2	Determine the hoop and longitudinal stresses in thin and thick cylinders.
CO 3	Identify the behavior of columns and apply the Euler equation.
CO 4	Understand the concept of direct stress and bending stresses
CO 5	Identify the centroidal principal axes of different sections

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	3											3		
CO 2	1														
CO 3	2												3		
CO 4		3													
CO 5	2														

Unit - 1 Principal Stresses and Strains

Introduction – Stresses on an inclined section of a bar under axial loading – Compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical solutions.

Theories of Failures: Various Theories of failures like Maximum Principal stress theory – Maximum Principal Strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

Unit - 2 Thin Cylinders

Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – Hoop, longitudinal and volumetric strains – Changes in diameter, and volume of thin cylinders– Thin spherical shells.

Thick Cylinders: Introduction Lame's theory for thick cylinders – Derivation of lame's formulae – Distribution of hoop and radial stresses across thickness – Design of thick cylinders – Compound cylinders – Thick spherical shells.

Unit - 3 Columns and Struts

Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns – Assumptions – derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column –

Slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

Unit - 4 Direct and Bending Stresses

Stresses under the combined action of direct loading and B.M - Core of a section - Circular, rectangular and triangular (solid and hollow) - Stresses due to direct loading and B.M about both axis.

Unit - 5 Unsymmetrical Bending

Introduction – Centroidal principal axes of section – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid - Location of neutral axis.

Textbooks:

1. R. K. Rajput, "A Textbook of Strength of Materials", S. Chand Publishing, New Delhi.
2. R. K. Bansal, "A Textbook of Strength of Materials", Laxmi Publications, New Delhi.

Reference Books:

1. S. S. Bhavikatti, "Strength of Materials", Vikas Publishing, Noida.
2. S. P. Timoshenko and D. H. Young, "Elements of Strength of Materials", Eastern Wiley Publications, Noida.
3. D. S. Prakash Rao, "Strength of Materials – A Practical Approach", Universities Press (India) Private Ltd., Hyderabad.
4. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Mechanics of Materials", Laxmi Publications, New Delhi.

Course Title	Hydraulic Machinery					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801502	PCC	02	00	00	02	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. To understand the application of momentum principle of impact of jets on plain and curved surfaces
2. To study the types of centrifugal pumps, work done and efficiency of the different types centrifugal pumps and also study about performance of pumps and characteristic curves
3. To study about specific speed and performance characteristics of different types of turbines
4. To study about hydroelectric power plant and estimation of hydropower potential
5. To explain the concept of positive displacement

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

CO 1	Calculate force and work done by a jet on fixed or moving plate and curved plates
CO 2	Apply the working principles of impulse and reaction turbines
CO 3	Select the type of turbine required with reference to available head of water and discharge
CO 4	Determine the characteristics of centrifugal pump
CO 5	Apply the working principles of the reciprocating pump

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	3											3		
CO 2		2													
CO 3		2													
CO 4		1											3		
CO 5		2											3		

Unit – 1

Momentum Equations and Force of Jet on Vanes Linear momentum equation and its application to find the force of jet on vanes – Vanes: stationary and moving, flat and curved, jet striking at centre and edge, series of flat and curved vanes – Velocity triangles: at inlet and outlet of vanes, calculation of work-done and efficiency; Moment of momentum equation, theory of turbo-machinery

Unit – 2

Pelton, Francis and Kaplan Turbines Hydraulic Turbines: general layout of hydro-electric power plants, classification of turbines; Pelton, Francis and Kaplan turbines: working principle, parts, work done, efficiency, setting, working proportions and design; Degree of reaction; Draft tube: principle, types, efficiency

Unit – 3

Performance and Unit Quantities of Turbines Performance of Turbines: efficiencies of turbines, operation under constant head and speed, main characteristic curves, operating characteristic curves, constant efficiency curves; Unit quantities: working under varying condition, unit speed, unit discharge, unit power, use of unit quantities; Specific speed: concept of homologous units, specific speed, selection of turbines – Cavitation

Unit – 4

Centrifugal Pumps Centrifugal Pumps: working principle, types, parts, setting, work done – Performance: heads and efficiencies, main characteristic curves, operating characteristic curves, constant efficiency curves – Priming – Minimum starting speed – Multistage pumps – Specific speed – NPSH and cavitation

Unit – 5

Reciprocating Pump and Miscellaneous Hydraulic Machines Reciprocating pump: working principle, types, parts, setting, discharge, work done – Slip – Indicator diagram – Air vessels; Miscellaneous hydraulic machines: hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic ram

Textbooks:

1. P. N. Modi and S. M. Seth, "Hydraulics and Fluid Mechanics Including Hydraulics Machines", Standard Book House U-O Rajsons Publications Pvt. Ltd., New Delhi.
2. R. K. Bansal, A textbook of Fluid Mechanics and Hydraulic machinery, Laxmi Publications (P)Ltd., New Delhi.

Reference Books:

1. Jagadish Lal, "Hydraulic Machines", Metropolitan Book Co. Pvt., .Ltd. New Delhi.
2. Miroslav Nechleba, "Hydraulic Turbines", Constable & Co. Ltd., London.

Course Title	Structural Analysis – 1					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801503	PCC	02	01	00	03	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. Students understand the principles and analysis of structures like fixed & Continuous Beams, Energy theorems by various methods.

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

CO 1	Analyze fixed & Continuous beams for shear, bending moment and deflections
CO 2	Analyze second and third degree statically indeterminate beams using MD & SD Methods
CO 3	Determine deflection of beam and trusses using energy methods.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		3											3		
CO 2		3											3		
CO 3		3											3		

Unit - 1 Fixed Beams

Introduction to statically indeterminate Beams with UDL, central point load, eccentric load, number of point loads, uniformly varying loads, couple and combination of loads- shear and bending moment diagrams- deflection of fixed Beams, effect of sinking of support, effect of rotation of support.

Unit - 2 Continuous Beams

Introduction-Clapeyrons theorem of three moments- analysis of continuous Beams with constant moment of inertia with one or both ends fixed-continuous beams with over hanging.

Unit - 3 Slope Deflection Method

Introduction, derivation of slope deflection equations, application to continuous beams with and without sinking of supports.

Unit - 4 Moment Distribution Method

Introduction, application of continuous beams with and without sinking of supports.

Unit - 5 Energy Theorems

Introduction, strain energy in linear elastic system, expression of strain energy due to axial load, Bending moment and shear forces- castiglianos first theorem-deflection of simple Beams.

Textbooks:

1. CS Reddy, "Basic Structural Analysis" Disaster Risk Reduction in South Asia", Tata McGraw-Hill Companies, Inc. New York.
2. S. S. Bhavikatti, "Structural Analysis – Vol.1 & Vol.2", Vikas Publishing, Noida.

Reference Books:

1. S. Ramamrutham and R. Narayan, "Theory of Structures", Dhanpat Rai Publishing Company, New Delhi.

Course Title	Geotechnical Engineering					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801504	PCC	02	01	00	03	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives: The course is designed to students,

1. To create an ability to apply knowledge of geotechnical engineering.
2. To accentuate the understanding of the basic principles of soil mechanics and its application to solve problems related to geotechnical engineering.
3. To improve the basic understanding of the index and engineering properties of soils
4. To improve the concepts to understand the hydraulic behavior of the soils

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

CO 1	Identify and tabulate different types of soils and their properties.
CO 2	Calculate and illustrate the permeability characteristics of soils, seepage quantities and pore water pressures below the ground.
CO 3	Analytically compute the vertical stress in a semi-infinite soil mass due to various loading conditions.
CO 4	Understand and interpret the compaction curve with compaction effort, soil type and the basic mechanism of consolidation of soils.
CO 5	Determine the shear strength parameters by analytically and graphically for various geotechnical problems.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2												3		
CO 2		3											2		
CO 3						2							2		
CO 4				2									3		
CO 5		3											3		

Unit – 1 Soil and its Index Properties

Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship – Relative density - Moisture Content, Specific Gravity, In-situ Density, Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Tests for field identification and classification of soils - I.S. Classification of soils

Unit – 2 Permeability and Seepage through Soils

Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting – laboratory determination of coefficient of permeability – Field determination of permeability - Permeability of layered systems

Seepage through Soils: Total, neutral and effective stresses – quick sand condition – Seepage through soils – Flownets: Characteristics and Uses.

Unit – 3 Stress Distribution in Soils

Boussinesq's equation - Vertical stress due to line load, strip load, and uniformly loaded circular area and Wester Gaard's theories for point loads and areas of different shapes – Pressure bulb concept - Newmark's influence chart – Approximate methods

Unit – 4 Compaction and Consolidation

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties – Field compaction Equipment - compaction quality control

Consolidation: Pressure – void ratio curve – Compression index – Coefficient of Compressibility – Modulus of volume change – Consolidation process – Consolidation settlement - Terzaghi's theory of one dimensional consolidation – coefficient of consolidation – Pre-consolidation pressure – Normally consolidated and over consolidated soils.

Unit – 5 Shear Strength of Soils

Mohr – Coulomb Failure theories – Types of laboratory strength tests – strength tests based on drainage conditions – Shear strength of sands – Critical Void Ratio – Liquefaction- shear strength of clays.

Textbooks:

1. Dr. K R Arora "Soil Mechanics & Foundation Engineering", Standard Publishers Distributers, New Delhi.
2. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain "Soil Mechanics & Foundation Engineering", Lakshmi Publications, New Delhi.

Reference Books:

1. C Venkatramaiah "Geotechnical Engineering", New Age International (P) Limited, Publishers, New Delhi.
2. JA Knappett and RF Craig "Craig's Soil Mechanics", Spons Press, New York.

Course Title	Environmental Engineering					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801505	PCC	02	00	00	02	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. This subject provides the knowledge of water sources, standards, treatment of water for distribution to the domestic purpose. Basics of plumbing are also included.

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

CO 1	Get an idea of water supply and its development, need, objectives to the public.
CO 2	Know the sources, Quality and Standards of water.
CO 3	An acquaintance with different treatments for protected water supply.
CO 4	Advanced water treatments in removal of harmful constituents and water management.
CO 5	Different water distribution system, its working and the basics of plumbing.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1			2												
CO 2			2											2	
CO 3						2									
CO 4							3								
CO 5						2								3	

Unit - 1 Introduction

Environmental Engineering - Role of Environmental Engineer - Water supply - Development of public water supply - Need for protected water supplies - Objectives of water supply systems - Water supply scheme - Quantity of water - Estimating requirements - Design period – Per Capita Consumption - Fluctuations in demand pattern -population forecast – Arithmetic, Incremental, Geometric methods.

Unit - 2 Sources, Quality and Standards of Water Sources of water

Surface and ground water sources – Quality of water - Physical, chemical and biological aspects - Analysis of water - Water quality standards - Impurities in water - Waterborne diseases – Drinking water quality standards.

Unit - 3 Treatment of Water

Flowchart of water treatment plant - Treatment methods (Theory and Design) – Sedimentation - Coagulation - Sedimentation with Coagulation – Filtration - Chlorination and other Disinfection methods - Softening of Water – Defluoridation - Removal of Odors.

Unit - 4 Advanced Water Treatments

Principles and functions of Aeration - Iron and manganese removal, Defluoridation and demineralization -Water softening - Desalination - Membrane Systems - Recent advances.

Water Management: Sustainable Development - Rain Water harvesting methods - Water Pollution - Causes and effects

Unit - 5 Water Distributions

Distribution systems – Requirements, Layout of Water distribution systems - Design procedures-Hardy Cross and equivalent pipe methods service reservoirs – Joints, valves such as sluice valves, air valves, scour valves and check valves water meters – Laying and testing of pipe lines – Pump house, waste detection and prevention, Principles of design of water supply in buildings - House service connection.

Textbooks:

1. S K Garg, "Environmental Engineering Vol.1", Khanna Publishers, New Delhi.
2. B C Punmia, Ashok Kumar Jain and Arun Kumar Jain "Water Supply Engineering", Laxmi Publications, New Delhi.

Reference Books:

1. H S Peavy, D R Rowe and G Tehobanoglous "Environmental Engineering", Tata McGraw-Hill Companies, Inc. New York.
2. S K Hussain "Water Supply and Sanitary Engineering", Oxford & IBH, New Delhi.

Course Title	Transportation Engineering					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801506	PCC	02	00	00	02	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. This course is taught to impart the knowledge in highway planning, alignment, geometric design of different elements of highway, different traffic surveys, traffic regulation and management and pavement design

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

CO 1	Conduct different engineering surveys and take up different highway alignment projects.
CO 2	Design highway pavement geometrics.
CO 3	Collect traffic data, analyze the data and design suitable traffic management systems
CO 4	Do structural design of flexible and rigid pavements.
CO 5	Conduct laboratory tests on pavement materials to evaluate their suitability and adaptability for different pavement construction.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		2											3		
CO 2		3											3		
CO 3		3											3		
CO 4		3											3		
CO 5		2													

Unit – 1 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 – 2 Highway Geometric Design

Importance of Geometric Design - 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-Design of Transition Curves -Design of Vertical alignment – Gradients – Vertical curves.

Unit – 3 Traffic Engineering

Basic Parameters of Traffic -Volume, Speed and Density– Highway capacity-Traffic Volume Studies - Speed studies - Road Accidents – Condition Diagram and Collision Diagrams.

Traffic Regulation and Management: Road Traffic Signs – Road markings -Types of Road Markings- Design of Traffic Signals – Webster Method –Saturation flow – Phasing and timing diagrams – Numerical problems.

Unit – 4 Pavement Design

Types of pavements – Difference between flexible and rigid pavements – Pavement Components – Functions of pavement components – Design Factors – Design methods – IRC methods only (as per IRC 37-2002) – Design of Rigid pavements – Critical load positions – Westergaard's stress equations – Stresses in rigid pavements

Unit - 5Highway Materials and construction practice

Desirable Properties and Testing of Highway Materials-Aggregate-Crushing, Abrasion, Impact Tests, Water absorption, Flakiness and Elongation indices-Tests on Bitumen-Penetration, Ductility, Viscosity and Softening point Tests-Construction Practice-Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORT&H specifications]-Highway Drainage.

Textbooks:

1. S K Khanna, C E G Justo and A. Veeraragavan "Highway Engineering", Nemchand Publications, New Delhi.

Reference Books:

1. G V Rao "Principles of Transportation and Highway Engineering", Tata McGraw-Hill Companies, Inc. New York.
2. L R Kadiyali "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi.
3. Partha Chakroborthy, Animesh Das, "Principles of Transportation Engineering", Prentice Hall of India, New Delhi.
4. S P Bindra "Highway Engineering", Dhanpath Rai& Sons, New Delhi.

Course Title	Advanced Structural Analysis by Matrix Methods					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801507	PEC 1	02	00	00	02	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives: The course is designed to students,

1. To introduce stiffness method and flexibility method for analysis of statically indeterminate structures.
2. To understand the basics of finite element method and application to structural analysis.
3. Use and/or develop structural analysis software to analyze complicated structural systems.
4. Interpret the output from computer-based analyses for the purpose of structural design

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

CO 1	Analyze statically indeterminate beams, rigid jointed and pin jointed frames and trusses using Flexibility method
CO 2	Analyze statically indeterminate beams, rigid jointed and pin jointed frames and trusses using Stiffness method

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		3											3		
CO 2		3											3		

Unit – 1 Introduction to Matrix methods

Introduction, coordinate systems, displacement and force transformation matrices, element and structure stiffness matrices, Element and structure flexibility matrices, equivalent joint loads, stiffness and flexibility approaches.

Unit – 2 Matrix methods for beams

Analysis of beams, fixed and continuous beams by flexibility method. Analysis of beams, fixed and continuous beams by stiffness method.

Unit – 3 Matrix methods for Plane truss problems

Analysis of 2-D trusses by flexibility method, Analysis of 2-D trusses by stiffness method

Unit – 4 Matrix methods for Plane Frames

Analysis of 2-D frames by Flexibility matrix methods.

Unit – 5 Matrix methods for Plane Frames

Analysis of 2-D frames by Stiffness matrix methods.

Textbooks:

1. G. S. Pandit and S. P. Gupta, "Matrix Methods of Structural Analysis", Tata McGraw-Hill Companies, Inc. New York.
2. M W Weaver and Gere, "Matrix Analysis of framed Structures", Van Nostrand Reinhold.

Reference Books:

1. Devdas Menon, "C.K Wang Advanced Structural Analysis", Narosa Publishing House.
2. Asslam Kassimali, "Matrix Analysis of Structures", Brooks/Cole Publishing Co., USA.
3. C.K Wang, "Analysis of Indeterminate Structures", Tata McGraw-Hill Companies, Inc. New York.

Course Title	Pre-Stressed Concrete					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801508	PEC 1	02	00	00	02	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. To give idea on methods available on pre-stressed concrete and analysis of pre-stressed members and design of members.

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

CO 1	Calculate the effect of prestressing on statically determinate structures and statically indeterminate structures.
CO 2	Design, analysis, detailing and construction of prestressed concrete structural.
CO 3	Distinguish between pre-tensioning technology and post-tensioning technology.
CO 4	List the differences between pre- and post-tensioned systems for structural
CO 5	Design and analyze prestressed concrete and concrete composite structures.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		2													
CO 2		3											3		
CO 3		2													
CO 4		2													
CO 5		3											3		

Unit - 1 Introduction and Systems of Pre-Stressing

Introduction: General Principles of Pre-Stressed Concrete Members – Advantages and Limitations of Pre-Stressed Concrete – Comparison of Pre-Stressed Concrete Beams with Reinforced Concrete Beams.

Systems of Pre-Stressing: Classification of Pre-Stressed Concrete Members, System of Pre-Stressing, Pre-Tensioned System, Stability of the System. Hoyer System, Magnel Blaton System, Freyssinet System, Gifford Udall System, P.S.C Mono Wire System, C.C.L Standard System, LEE-MCCALL System.

Unit - 2 Losses of Pre-Stresses

Loss of Pre-Stress in Pre-Tensioned and Post-Tensioned Due to Various Causes Like Elastic Shortening of Concrete, Shrinkage of Concrete, Creep of Concrete, Relaxation of Stress in Steel, Slip in Anchorage Bending of Member and Wobble Frictional Losses.

Unit - 3 Analysis and design of sections for flexure

Assumptions, Analysis by Stress Concept – Elastic Analysis of Concrete Beams Pre-Stressed with Straight, Concentric, Eccentric, Bent and Parabolic Tendons – Design of Pre-Stressed Concrete Beams – I.S Recommendations as per IS 1343 Code Book – Design of Rectangular and an I-Section of a Beam – Lever Arm Concept – Kern Distance.

Unit - 4 Shear Design of PSC Beam

Design of Shear based on IS 1343 Code Book – Design of Beam.

Unit - 5 Deflections of Pre-Stressed Concrete Beams

Importance of Control of Deflections – Factors Influencing Deflections – Short Term Deflections of Un-cracked Members Prediction of Long Term Deflections.

Textbooks:

1. S Ramamrutham "Pre-Stressed Concrete", Dhanpat Rai Publishing Company (P) Limited, New Delhi.
2. N Krishna Raju "Pre-Stressed Concrete", Tata McGraw-Hill Companies, Inc. New York.
3. N Rajagopalan "Pre-Stressed Concrete", Narosa Publishing House, New Delhi.

Reference Books / IS Codes:

1. IS 1343-2012 "Indian Standard Code of Practice for Prestressed Concrete", Bureau of Indian Standards, New Delhi.

Course Title	Ground Improvement Techniques					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801509	PEC 1	02	00	00	02	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives: The course is designed to students,

1. To learn and understand various ground improvement technique.
2. To learn various method of compaction for ground improvement in its strength.
3. To learn various physical and chemical modification for ground improvement
4. To learn the method to choose the foundation and or treatment method based on the site condition

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

CO 1	Select the ground improvement technique which is suitable and economical for soil strengthening.
CO 2	Select different techniques based on the various types of soils in-situ.
CO 3	Design reinforced earth structures**.**
CO 4	Exposed to the knowledge on use of geosynthetic material

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		2											3		
CO 2		2											3		
CO 3		2											3		
CO 4		2													

Unit – 1

In-situ densification methods in granular soils, Vibration at the ground surface, Impact at the Ground surface, Vibration at depth, Impact at depth. In-situ densification methods in cohesive soils, Preloading, Dewatering, Drain wells, Sand drains, Sandwich geodrains, Stone columns, Lime columns, Thermal methods.

Unit – 2

Reinforced earth principles, Components of reinforced earth walls, Factors governing design of reinforced earth walls, Design principles of reinforced earth walls.

Unit – 3

Geotextiles: Introduction, Type of geotextiles, Function and their application, tests for geotextile materials, Geogrids, Functions of geogrids. Expansive soils, Problems in Expansive soils, Mechanism of swelling, swell pressure, swell potential, Heave, Tests for identification, I. S. Test Methods of determination of swell pressure, Foundation techniques in Expansive soils.

Unit – 4

Mechanical stabilization: Soil aggregate mixtures, Properties and proportioning techniques, soft aggregate stabilization, compaction, Field compaction control. Cement stabilization: Mechanism-Factors affecting and properties, Uses of additives, Design of soil-cement mixtures, Construction techniques.

Unit – 5

Lime and Bituminous stabilization: Types of admixtures, Mechanism, Factors affecting, Design of mixtures, Construction methods.

Textbooks:

1. Dr. P. Purushothama Raj., "Ground Improvement Techniques", Lakshmi Publications Pvt. Ltd.
2. Jones, J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1985.
3. Koerner, R.M. and Welsh, J.P., Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.
4. Koerner, R.M., Designing with Geosynthetics (Third Edition), Prentice Hall, 1997.

Reference Books:

1. Moseley, M.D., Ground Treatment, Blackie Academic and Professional, 1998.
2. Hehn, R.W., Practical Guide to Grouting of Underground Structures, ASCE, 1996.
3. Das, B.M., Principles of Foundation Engineering, (Fourth Edition). PWS Publishing, 1999

Course Title	Remote Sensing and GIS					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801510	PEC 1	02	00	00	02	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. The purpose of this course is to provide an understanding of physical concepts and underlying various engineering and technological applications in remote sensing. In addition, the course is expected to understand the basic principles of remote sensing and its applications.

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

CO 1	Perceive the basics of remote sensing.
CO 2	Pick out the characteristics of the instruments used for remote sensing.
CO 3	Analyze the need and standard techniques used for image processing
CO 4	Perceive the basics of GIS.
CO 5	Study the areas of application using Remote Sensing and GIS.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															
CO 2															
CO 3				2											
CO 4					2										3
CO 5															3

Unit - 1 Remote Sensing Basics

Introduction to Basic Concepts: Definition – Physics of Remote Sensing – Electro Magnetic Radiation (EMR) – Interaction of EMR with atmosphere, Earth surface features – Vegetation, soils, water – Spectral reflectance curves – Atmospheric windows

Unit - 2 Platforms and Sensors

Remote Sensing Systems: Platforms: Introduction – Types – Satellites and orbits, - Spectral, radiometric and spatial resolutions, temporal resolution of satellites - Some remote sensing satellites and their features.

Unit - 3 Image Processing Techniques

Digital Image Processing: Image enhancement – Contrast stretch, Spatial filtering and edge enhancement; Classification – Supervised unsupervised classification – Visual image interpretation techniques.

Unit - 4 G I S

Geographical Information Systems: Basic Principles – Definition – Components – Data Structures – Raster and Vector formats – Functioning of GIS – Data Input – Data Manipulation – Data Retrieval – Spatial Data Analysis – Computational Analysis Methods (CAM) – Visual Analysis Methods (VAM) - Data Display – Data Base Management Systems.

Unit - 5 Remote Sensing Applications

Remote Sensing Applications: Water shed management - Irrigation Management - Drought Assessment - Environmental Monitoring - other applications.

Textbooks:

1. Thomas Lillesand, Ralph W Kiefer and Jonathan Chipman "Remote Sensing and Image Interpretation", John Wiley & Sons, India.
2. M Anji Reddy "Remote Sensing & GIS", B.S Publications, Hyderabad.
3. C P Lo and Albert K W Yeung "Concepts and Techniques in Geographical Information Systems", Prentice Hall of India, New Delhi.

Reference Books:

1. Floyd F Sabins Jr. "Remote Sensing Principles and Interpretation", Freeman and Co., San Francisco.
2. J R Jensen "Remote Sensing of the Environment: An Earth Resource Perspective", Prentice Hall of India, New Delhi.

Course Title	Surface Hydrology					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801513	PEC 1	02	00	00	02	30	70	100
Mid Exam Duration: 02.00 Hrs						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. The students acquire knowledge about hydrologic cycle, precipitation its measurement and analysis along with its abstractions
2. Students understand infiltration, constitution of stream flow and hydrographs
3. The students understand floods, analysis, routing along with its mitigation and management
4. It creates awareness regarding surface water pollution, causes, prevention and remedial measures
5. The students are made to understand different disasters and its management. In addition, they study about climate change, drought and water harvesting

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

CO 1	Learn about precipitation and its measurement, analysis and interpretation.
CO 2	Know about abstractions to rainfall, infiltration, evaporation and transpiration along with their estimation and derivation of unit hydrograph from hydrograph.
CO 3	Gain Knowledge about floods, its estimation, combat floods and flood routing.
CO 4	Familiarize with surface water pollution, causes, effects and remedial measures.
CO 5	Acquire knowledge about disasters and its management, conservation of water and climate change and its impact on water resources.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		2											2		
CO 2		2											2		
CO 3							2								
CO 4							2								
CO 5							2								

Unit – 1 Components of Hydrologic Cycle

Hydrologic Cycle, Precipitation, Cloud Seeding, Rain Gauge Net Work, Estimation of Missing Rainfall Data, Mean Precipitation Over an Area by Arithmetic Mean, Thiessen Polygon and Isohyetal Methods, Checks of Rainfall Data, Double Mass Curve, Evaporation, Transpiration, Methods of Estimation of Evapotranspiration.

Unit – 2 Initial Abstractions & Hydrograph Analysis

Infiltration, Factors affecting Infiltration, Measurement of Infiltration, Infiltration Curve and Infiltration Indices. Runoff: Stream flow Hydrograph, Hydrograph Separation, Unit Hydrograph.

Unit – 3 Hydrology of Floods

Definition: Hydrology of Floods: Causes of Floods, Flood Discharge Formulae and Envelope Curves, Flood Frequency Analysis, Flood Control- Flood Control Dams, Detention Basins, Levees, Diversion Channels, Flood Channel Improvement Schemes. Flood Routing: Routing Through a Reservoir by I.S.D. Method, Channel Routing by Muskingum Method.

Unit – 4 Surface Water pollution

Introduction, Causes of Water Pollution, their Effects, Remedial Measures, Pattern of Pollution, Self-Purification Processes in Streams. Raw and Treated Water Quality Monitoring and Surveillance Including Various Standards.

Unit – 5 Disaster Management

Types of Natural Disasters and Manmade Disasters, Effects of Drought, Combating Drought, Reducing Runoff Losses, Reducing Evaporation and Deep Percolation, Efficient use of Stored Soil Water, Early Warning Systems, Evacuation Plans and Post Disaster Management and Administration, Climate change and its impact on Water Resources, Overview of rain water harvesting.

Textbooks:

1. Larry W. Mays., "Water Resources Engineering", John Wiley, 2010.
2. P. Jayarami Reddy., "A Text Book on Hydrology", Laxmi Publications, New Delhi.
3. H .M. Raghunadh., "A Text Book on Hydrology", New Age International (P) Limited, Publishers, New Delhi.

Reference Books:

1. U. Aswathanarayana., "Water and Environment", A.A. Balkema Publishers, 2001.
2. K. C. Parti., "Hydrology and Water Resources Engineering", Narosa Publishing House, New Delhi.
3. A. K. Biswas., "Water Resources-Environment Planning& Development", Tata McGraw-Hill Companies, Inc. New York.
4. Wanisliste & Elenlin., "Hydrology Quantity & Quality", John Wiley, 2010.
5. Ven Te Chow, Maidenment & Mays., "Applied Hydrology", Tata McGraw-Hill Companies, Inc. New York.

Course Title	Geotechnical Engineering Laboratory					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801514	PCC	00	00	02	01	50	50	100
Mid Exam Duration: --						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. To introduce traditional program consisting mostly of practical courses related to geotechnical engineering.
2. To apply the knowledge of science, mathematics and engineering with the context of applications in geotechnical engineering.
3. To design and conduct experiments, analyze and interpret data related to the various laboratory tests studied in geotechnical engineering.
4. To classify the soils based on the index and engineering properties

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

CO 1	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
CO 2	An opportunity to work in groups
CO 3	An ability to identify, formulate and practice the various soil identification and classification tests.
CO 4	An ability to select, formulate or enhance the testing facilitates to cater the requirement of selection of proper soil type as per the requirement.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		3											2		
CO 2		3											2		
CO 3				3									2		
CO 4				3									2		

LIST OF EXPERIMENTS

1. Determination of Water Content
   - Oven drying Method
   - Pycnometer Method
2. Determination of Specific Gravity
   - Pycnometer Method
   - Density Bottle Method
3. Particle Size Analysis
   - Dry Sieve Analysis
   - Hydrometer Analysis (Demo)
4. Consistency Limits
5. Free Swell Index
6. Determination of In-Situ Densities
   - Core Cutter Method
   - Sand Replacement Method

Textbooks:

1. S Mittal and J P Shukla "Soil Testing for Engineers", Khanna Publishers, New Delhi.
2. T G Sitharam and T N Ramamurthy "Geotechnical Engineering", S Chand Publishing, New Delhi.

Reference Books:

1. Compendium of Indian Standards on Soil Engineering: Part – 1 & 2, Laboratory and Field Testing of Soils for Civil Engineering Purposes.
2. Dr. K R Arora "Soil Mechanics & Foundation Engineering", Standard Publishers Distributers, New Delhi.

Course Title	Transportation Engineering Laboratory					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801515	PCC	00	00	02	01	50	50	100
Mid Exam Duration: --						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. Aggregate and its engineering behavior
2. Bitumen and its engineering behavior

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

CO 1	Characterize the pavement materials.
CO 2	Perform quality control tests on pavement & pavement materials
CO 3	Identify suitability of different aggregates for various paving jobs
CO 4	Identify the grade of given bituminous sample.
CO 5	Able to perform marshall mix design of various bituminous mixes for different paving jobs.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		2											2		
CO 2		2											2		
CO 3		2											2		
CO 4		2											2		
CO 5		2											2		

LIST OF EXPERIMENTS

I. ROADAGGREGATES:

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUSMATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.

Textbooks:

1. G Venkatappa Rao, K Ramachandra Rao, Kausik Pahari and D V Bhavanna Rao "Highway Material Testing and Quality Control", I K International Publishing House Pvt. Limited, New Delhi.

Reference Books:

1. Ajay K Duggal and Vijay P Puri "Laboratory Manual in Highway Engineering", New Age International (P) Limited, Publishers, New Delhi.
2. S K Khanna, C E G Justo and A Veeraraghavan "Highway Engineering", Nem Chand & Bros Publishers, Roorkee, Uttarakhand.

Course Title	Environmental Engineering Laboratory					B. Tech, CE 5th Semester		
Course Code	Category	L	T	P	Credits	Maximum Marks		
						Continuous Internal Assessment	End Exam	Total
1801516	PCC	00	00	02	01	50	50	100
Mid Exam Duration: --						End Exam Duration: 03.00 Hrs		

Course Objectives:

1. To get exposure about water and sewage analysis.
2. The laboratory provides knowledge of estimating various parameters like P^H, Chlorides, and different solids in water.
3. For effective water treatment, the determinations of optimum dosage of coagulant and chloride demand are also included.
4. The estimation status of Industrial effluents will also be taught in the laboratory by estimating BOD and COD of effluent.

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

CO 1	Identify the BIS and WHO standards of water for domestic consumption and also for various industrial and agricultural purposes.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1							2							2	

LIST OF EXPERIMENTS

1. Determination of pH and Turbidity
2. Determination of Conductivity and Total dissolved solids.
3. Determination of Alkalinity/Acidity.
4. Determination of Chlorides.
5. Determination and Estimation of total solids, organic solids and inorganic solids.
6. Determination of Dissolved Oxygen.
7. Determination of B.O.D
8. Determination of C.O.D
9. Determination of Optimum coagulant dose.
10. Determination of Chlorine demand.

Textbooks:

1. Dr. G Kotaiah and Dr. N Kumara Swamy "Environmental Engineering Lab Manual", Charotar Publishing House, Anand, Gujrat.

Reference Books:

1. Clair N Sawyer, Perry L Mccarty and Gene F Parkin "Chemistry for Environmental Engineering and Science", Tata McGraw-Hill Edition, New Delhi.