

**Punjab Technical University, Jalandhar**

**CIVIL ENGINEERING**

**Scheme of Syllabi**

**For 2004 & Onward Batches**

**TEACHING SCHEME OF B.TECH (CIVIL) THIRD SEMESTER**

Course	Name of Course	L	T	P	Contact Hrs.	Ext.	Int.	Marks
Theory								
CE-201	SURVEY-1	3	1	-	4	60	40	100
CE-203	FLUID MECHANICS-I	3	1	-	4	60	40	100
CE-205	BUILDING MATERIAL	3	-	2	5	60	40	100
CE-207	SOLID MECHANICS	3	2	-	5	60	40	100
HM-253	PRINCIPALS OF ECONOMICS & MANAGEMENT	3	1	-	4	60	40	100
CE-209	LAB-I (FLUID MECHANICS-I)	-	-	2	2	20	30	50
CE-211	LAB-II (SOLID MECHANICS)	-	-	2	2	20	30	50
CE-213	WORKSHOP TRAINING OF 4 WEEKS DURATION AFTER 2ND SEMESTER	-	-			40	60	100
TOTAL		15	5	6	26	380	320	700

**Scheme of B.Tech (Civil ) Fourth Semester**

Course	Name of Course	L	T	P/D	Contact Hrs.	Ext.	Int	Marks
<b>Theory</b>								
CE-202	Survey-II	3	1		4	60	40	100
CE-204	Fluid Mechanics-II	3	1		4	60	40	100
CE-206	Building Construction	3	1		4	60	40	100
CE-208	Structural Analysis-I	3	2		5	60	40	100
CE-210	Rock Mech. & Engg Geology	3	1		4	60	40	100
CE-216	Envoinalmental Science	3	1		4	60	40	100
<b>Practicals</b>								
CE-212	SurveyLab			4	4	20	30	50
CE-214	StructuralAnalysisLab			2	2	20	30	50
	General Fitness						100	100
	<b>Total</b>	<b>18</b>	<b>7</b>	<b>6</b>	<b>31</b>	<b>400</b>	<b>400</b>	<b>800</b>

Survey Camp of 6 weeks duration at the end of 4th semester.

<i>Scheme of B.Tech (Civil ) Fifth Semester</i>								
Course	Name of Course	L	T	P/D	Contact Hrs.	Ext.	Int.	Marks
CE-301	<u>Construction Machinery &amp; Works Mgt.</u>	3	1	-	4	60	40	100
CE-303	<u>Design of Steel Structures-I</u>	3	2	-	5	60	40	100
CE-305	<u>Structural Analysis-II</u>	3	2	-	5	60	40	100
CE-307	<u>Design of Concrete Structures-I</u>	3	2	-	5	60	40	100
CE-309	<u>Environmental Engg-I</u>	3	1	-	4	60	40	100
CE-311	<u>Transportation Engg-I</u>	3	1	-	4	60	40	100
<b>Practicals</b>								
CE-313	<u>Concrete Lab</u>			2	2	20	30	50
CE-315	<u>Environmental Engg Lab</u>			2	2	20	30	50
CE-317	<u>Survey Camp</u>					40	60	100
	<b>Total</b>	<b>18</b>	<b>9</b>	<b>4</b>	<b>31</b>	<b>440</b>	<b>360</b>	<b>800</b>

<i>Scheme of B.Tech (Civil ) Sixth Semester</i>								
Course	Name of Course	L	T	P/D	Contact Hrs.	Ext.	Int.	Marks
<b>Theory</b>								
CE-302	<u>Transportation Engg-II</u>	3	1		4	60	40	100
CE-304	<u>Geotechnical Engg.</u>	3	1		4	60	40	100
CE-306	<u>Irrigation Engineering-I</u>	3	1		4	60	40	100
CE-308	<u>Professional Practice</u>	3	1		4	60	40	100
CE-310	<u>Design of Concrete Structures-II</u>	3	2		5	60	40	100
CE-312	<u>Structural Analysis-III</u>	3	1		4	60	40	100
<b>Practicals</b>								
CE-314	<u>Transportation Engg. Lab</u>			2	2	20	30	50
CE-316	<u>Geotechnical Engg. Lab.</u>			2	2	20	30	50
CE-318	<u>Concrete Drawing (Computer Aided)</u>			2	2	20	30	50
	<u>General Fitness</u>						100	100
	<b>Total</b>	<b>18</b>	<b>7</b>	<b>6</b>	<b>31</b>	<b>420</b>	<b>430</b>	<b>850</b>

<i>Scheme of B.Tech (Civil ) Seventh/Eighth Semester</i>								
Course	Name of Course	L	T	P/D	Contact Hrs.	Ext.	Int.	Marks
CE-	Industrial Training					500	500	1000
<i>Scheme of B.Tech (Civil ) Seventh/ Eighth Semester</i>								
Course	Name of Course	L	T	P/D	Contact Hrs.	Ext.	Int.	Marks
<b>Theory</b>								
CE-402	<u>Hydrology &amp; Dams</u>	3	1		4	60	40	100
CE-404	<u>Earthquake Resistant Structures</u>	3	1		4	60	40	100
CE-406	<u>Environmental Engg-II</u>	3	1		4	60	40	100
CE-408	<u>Design of Steel Structures-II</u>	3	1	3	7	60	40	100
CE-410	<u>Irrigation Engg-II</u>	3	1	3	7	60	40	100
CE-412	<u>Foundation Engg.</u>	3	1		4	60	40	100
<b>Practicals</b>								
CE-414	<u>Project</u>			4	4	80	120	200
<b>(Any one of the following specialisation)</b>								
Environment Engg.								
GeoTech. Engg.								
Transportation Engg								
Hydraulic Structures								
Structural Engg.								
General Fitness							100	100
	<b>Total</b>	<b>18</b>	<b>6</b>	<b>10</b>	<b>34</b>	<b>440</b>	<b>460</b>	<b>900</b>

## CE-201 Survey-I

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

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**3 1 0**

**1. Introduction :** Different types of surveys.

**2. Chain Surveying:** Principal of chain surveying, description of different equipment, Methods of chaining & booking, selection of base line and stations, obstacles in chaining. Location of inaccessible points by chain, tape & ranging rods.

**3. Prismatic compass survey:** Description of Prismatic & surveyors compass methods of traversing, local attraction and its elimination adjustment of closing error by graphical method.

**4. Plane Table Survey:** Description of different equipment, different methods of plane tabling, Strength of Fix, Two point and three point problems and their solutions.

**5. Leveling:** Description of Dumpy and Tilting levels & leveling staves, methods of leveling sensitivity of bubble tube, setting out grade lines permanent adjustment of above mentioned leveling instruments.

**6. Contouring:** Setting out contour gradient, different methods of contouring. Simple earth work calculations of areas and volumes.

**7. Minor Instruments:** Box sextant, hand level, Abney level, Planimeter, ghat tracer, tangent clinometer etc.

**Books Recommended:**

1. Surveying and Leveling: T.P. Kanetkar
2. Surveying and Leveling : Dr. N. Singh
3. Surveying : Dr. P.B. Sahiwny

## CE-203 FLUID MECHANICS-I (THEORY)

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

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**3 1 0**

**PURPOSE**

This is a core subject, basic knowledge of which is required by all engineers. This course aims at developing an understanding of the behavior of fluids in motion or at rest and the subsequent effects of the fluid on the boundaries. The study of this subject will develop analytical abilities related to fluid flow.

**INSTRUCTIONAL OBJECTIVES**

The students should be able to have Conceptual understanding of fluids and their properties. Understanding of fluid statistics, fluid kinematics and fluid dynamics. Basic knowledge of dimensional analysis and similitude. Understanding of laminar and turbulent flows and flow measurement.

**CONTENTS**

**A. THEORY**

**1. Fluid and their properties :** Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; Continuum concept of fluid: density, specific weight and relative density; viscosity and its dependance on temperature; surface tension and capillarity, vapour pressure and cavitation: compressibility and bulk modulus; Newtonian and non-Newtonian fluids.

**2. Fluid Statics :** Concept of pressure, Pascal's law and its engineering hydrostatic paradox. Action of fluid pressure on plane (horizontal, vertical and inclined) submerged surface, resultant force and center of pressure, force on a curved surface due to hydrostatic pressure.

Buoyancy and floatation, stability of floating and submerged bodies, Metacentric height and its determination, rotation of liquid in a cylindrical container.

**3. Fluid Kinematics:** Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal & tangential acceleration streamline, pathline and streakline, flow rate and discharge mean velocity continuity equation in Cartesian co-ordinates.

Rotational flows- Rotational velocity and circulation, stream & velocity potential functions.

4. **Fluid Dynamics** :- Euler's equation, Bernoulli's equation and steady flow energy equation; representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.

5. **Dimensional Analysis and Similitude**: Fundamental and derived units and dimensions, dimensional homogeneity, Rayleigh's and Buckingham's Pi method for dimensional analysis, dimension less number and their significance, geometric, kinematic and dynamic similarity, model studies.

6. **Laminar and turbulent Flows**: Flow regimes and Reynolds number, critical velocity and critical Reynolds number, laminar flow in circular cross section pipes. Turbulent flows and flow losses in pipes, Darcy equation minor head losses in pipe fittings, hydraulic and energy gradient lines.

7. **Flow Measurement**:- Manometers, Pitot tubes, venturimeter and orifice meters, orifices, mouth pieces, notches and weirs.

#### **INSTRUCTIONAL APPROACH**

The laws, concepts and principles will be taught through lecture-cum-discussion.

The elaboration of the laws, concepts and principles will be done through numerical examples.

The numerical problems will be solved in the classroom lectures and tutorials for practice.

The application of laws, concepts and principles will be taught through lecture-cum- discussion.

The theory taught will be reinforced through conduct of practicals in the laboratory.

Distribution of these marks for the various components of assessment will be as follows:

- |   |          |
|---|----------|
| i) Two class tests                      | 25 marks |
| ii) Home assignments (Minimum three)    | 25 marks |
| iii) Practical Exercises (Minimum five) | 25 marks |

End of semester examination will comprise of a three hours written test of 75 marks. The written test will follow the table of specifications and guidelines framed by University.

#### **Books Recommended:**

1. Fluid Mechanics & Hydraulic Machines : Dr. R.K. Bansal
2. Mechanics of fluid by Massey BS; Van Nostrand Reinhold Co.
3. Fluid Mechanics by Douglas JF, Gasiorek JM, Swaffield JP; Pitman
4. Fluid Mechanics : Streetes VL & Wylie EB; Mcgraw Hill book company.
5. Unit operations by Mc Cabe and Smith, mcgraw Hill.
6. Principles of Unit Operations by Foust et al.
7. Fluid Mechanics by White
8. Fluid Mechanics by Dr. R.J. Garde.

## CE-205 Building Materials

Internal Marks: 40  
 External Marks: 60  
 Total Marks: 100

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 3 0 2

- 1. Building Stones:** General, Qualities of a good building stone-Deterioration of stones-Preservation of stones, Common building stone of India & their Uses-Artificial stones. '
- 2. Bricks:** General, Constituents of bricks, desirable and harmful ingredients in brick earth, qualities of good bricks, testing of bricks, strength, Absorption, weathering of bricks. Varieties of fire bricks, sand lime bricks, building tiles- roofing; flooring and wall tiles.
- 3. Lime:** Cementing material, Characteristics of good quality lime, classifications & testing of Lime, Hydraulic test, acid test, setting & slaking of lime, uses of different varieties of lime
- 4. Concrete:** Constituents of concrete, different types of cements used in concrete, brief introduction to ingredients and manufacture of cements. Hydration and compounds of hydration. Properties and testing of cement.
- 5. Concrete Mixes:** Design of concrete mixes by ISI method and ACI method. Design of high strength concrete mixes. Design of concrete mix for flexural strength.
- 6. Production of Concrete:** Introduction, Batching of materials, mixing of concrete materials, transportation and placing of concrete, compaction of concrete, curing of concrete.
- 7. Properties of fresh and hardened concrete:** Introduction, workability, factors effecting workability, methods of determination of workability, strength of concrete, factors effecting strength of concrete, durability and permeability of concrete, factors effecting permeability of concrete, creep and shrinkage of concrete.
- 8. Timber:** Advantages of timber construction, timber trees- exogenous and endogenous trees; soft and hard woods, structure of tree, felling of trees, defects in timber, characteristics of good timber, uses and testing of timber.
- 9. Miscellaneous Materials :** Paints and varnishes; Distempering; white and color washing; glass and glass products; Asphalt and Bitumen.

**Recommended Book**

1. Building Materials : Rangwala

CE-207

SOLID MECHANICS

Internal Marks: 40

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External Marks: 60

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Total Marks: 100

**1 Simple Stresses and Strains:** Introduction, stress-strain curves for elastic materials, different types of stresses and strains, elastic limit, Hookes' Law, Young's modulus of elasticity, Bulk modulus, modulus of rigidity, Lateral strain, Elongation due to self weight bars of tapering sections, bars of varying sections, equivalent area of composite sections, temperature stresses, relation between elastic constants. Volumetric strain.

**2. Complex Stress:** Introduction, rectangular block subjected to normal stresses along and across two planes, combination of normal and tangential stresses, pure shear, principal stresses and Principal planes, Mohrs Circle, Principal strains, Computation of Principal stresses from Principal strains.

**3. Bending moment & shear force diagrams:** Introduction, Types of beams, supports and loading, sign conventions for bending moments and shear forces, Shear force and Bending moment diagrams for simply supported, cantilever and overhanging beams for different types of loading. Relationship between Bending moment, Shear Force and loading Graphical method of plotting Bending Moment & Shear Force Diagrams.

**4. Bending and Shear Stresses:** Introduction, Assumption made in theory of simple bending, derivation of basic equation, determination of stresses in simple sections, built up sections and composite sections. (flitched Beams), Introduction to theory of unsymmetrical bending beams of uniform strength, variation of shear stress across depth of various beam sections.

**5. Torsion:** Introduction, torsion of shafts and springs, derivation of basic torsion equation, Power transmitted, sections subjected to combined bending and torsion, Principal stresses, equivalent Bending Moment & Torque, Helical spring, analysis of closed Coil helical spring.

**6. Deflection of Beams:** Derivation of basic equation of elastic curve, deflection in beams with different end conditions and different loadings by double integration method, Macaulay's method, moment area theorem, conjugate beam method, unit method and strain energy method. Maxwel's reciprocal theorem.

**7. Columns and Struts:** Introduction, Euler's buckling loads for columns with different end conditions, limitations of Euler's formula, column carrying eccentric loads, laterally loaded columns, empirical formula.

**8. Strain Energy:** Introduction, Strain Energy due to axial Loads, Bending shear and Torsional stress, Impact load, strain energy due to Principal stress & strains, theories of failure. (5 lectures)

**Books Recommended:**

1. Strength of Materials : Sadhu Singh
2. Strength of Materials ; E. Popov.
3. Strength of Materials : S.M.A. Kazimi

**HM-253 Principles of Economics & Management**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

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**3 1 0**

**PART-I ECONOMICS**

**Economics** : Definition, nature and scope.

**Economy** : Types, problems and functions.

**Basic Terms & Concepts** : Good, Utility, value, capital & margin

Human wants, consumption and standard of living

Consumers' Behaviour , Consumers' surplus

Demand & law of demand, determinants of demand & elasticity of demand.

Scale of Production: Law of returns

Costs & Costs Curves, Supply & Supply curves

Market – Definition and types, equilibrium of firms & industry

**Pricing** : Commodity pricing under perfect competition, monopoly, monopolistic competition and oligopoly

Theories of Distribution, Rent, Interest and Profits

**PART-II PRINCIPLES OF MANAGEMENT**

Functions of Management, Management- Science or Art

Universality of Management, Scientific Management

Principles of Management by Henry Fayol

Authority, Responsibility, Accountability and Power

Delegation of Authority

Motivation- Concept and theories

**Books Recommended:**

Economics : Sloman

Managerial Economics : P.L. Mehta

Modern Micro Economics : Koutsoyannisa

Principles & practices of Management : L.M. Prasad

Essentials of Management : Koontz & Weihrich

**CE-209**

**Laboratory-I (Fluid Mechanics- I)**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

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**0 0 2**

- To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
- To study the flow through a variable area duct and verify Bernoulli's energy equation.
- To determine the coefficient of discharge for an obstruction flow meter (venturimeter/orifice meter)
- To determine the discharge coefficient for a Vee notch or rectangular notch.
- To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
- To determine the hydraulic coefficients for flow through an orifice.
- To determine the friction coefficient for pipes of different diameter.
- To determine the head loss in a pipe line due to sudden expansion / sudden contraction/ bend.
- To determine the velocity distribution for pipe line flow with a pitot static probe.

**CE-211 Laboratory-II SOLID MECHANICS**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

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1. Draw Stress Strain curve for Ductile and Brittle material.
2. Draw shear stress shear strain curve for ductile and brittle material in torsion strength test machine.
3. Draw load deflection curve for spring in loading and unloading conditions.
4. To determine the hardness strength of the given material.
5. To determine the fatigue strength of the material.
6. To determine the impact strength in Izod and Charpy test.
7. To determine the load carrying capacity of the leaf spring.

**Syllabus for B.Tech (Civil ) Fourth Semester****CE-202 Survey – II**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

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- 1. Theodolite :** Different types of Theodolites, temporary & permanent adjustment, traversing with a Theodolite, adjustment of closing error by Bowditch & transit rules.
- 2. Curves:** Different types of curves, their degree and calculation of ordinates, and angles, their layout obstacles in curves.
- 3. Tachometric Survey :** Different types of tachometer, calculation of vertical and horizontal distances, substance bar. Tachometric leveling with both angle of depression and elevation, errors due to curvature & refraction.
- 4. Triangulation :** Measurement of baseline, corrections for the baseline, selection of stations.
- 5. Trigonometric Levelling:** Height & distance of inaccessible objects.
- 6. GIS :** Introduction, concepts and terminology, Utility of GIS, Essential components of a GIS, Data acquisition through scanners and digitizers, Data storage, Data manipulation and analysis Applications of GIS.
- 7. GPS :** Introduction, working principle, Various application of GPS related to Civil Engg., components of GPS – Point positioning and differential positioning.
- 8. Remote Sensing :** Introduction, interaction of EMR with Earth Surface Working Principles and Instrumentation.

**Books Recommended:**

1. Surveying, By C.L. Kochher – Danpat Rai & Sons
2. Surveying by Kanetkar
3. Kaplan, E.D., Understanding GPS : Principles and applications
4. Campbell, J.B. Taylor and Francis, "Introduction to Remote Sensing".

## CE-204 Fluid Mechanics-II

Internal Marks: 40  
 External Marks: 60  
 Total Marks: 100

L T P  
 3 1 0

**1. Laminar Flow:** Navier-stokes equations in Cartesian coordinates (no derivation), meaning of terms, flow between parallel plates, stokes law. Flow through porous media., Transition from laminar to turbulent flow.

**2. Boundary Layer Analysis:** Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

**3. Turbulent Flow:** Definition of turbulence, scale and intensity, Effects of turbulent flow in pipes. Equation for velocity distribution in smooth and rough pipes (no derivation). Resistance diagram.

**4. Flow Past immersed bodies:** Drag and lift deformation Drag and pressure drag. Drag on a sphere, cylinder and Airfoil: lift-Magnus Effect and circulation, lift on a circular cylinder.

**5. Uniform flow in open Channels:** Flow classifications, basic resistance Equation for open channel flow. Chezy, Manning, Bazin and Kutter formulae. Variation of roughness coefficient, conveyance and normal depth. Velocity Distribution. Most efficient flow sections; rectangular, trapezoidal and circular.

**6. Energy and Momentum principles and critical flow:** Energy and specific Energy in an open channel; critical depth for rectangular and trapezoidal channels. Alternate depths, applications of specific energy to transitions and Broads crested weirs. Momentum and specific force in open channel flow, sequent depths.

**7. Gradually varied Flow:** Different Equation of water surface profile; limitation, properties and classification of water and surface profiles with examples, computation of water surface profile by graphical, numerical and analytical approaches.

**8. Hydraulic Jump and Surges:** Theory of Jump, Elements of jump in a rectangular Channel, length and height of jump, location of jump, Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges

**Books Recommended:**

1. Fluid Mechanics : Dr. R.K. Bansal
2. Fluid Mechanics : Dr. Modi & Dr. Seth.
3. Fluid Mechanics : Dr. Jagdish Lal

	<b>CE-206</b>	<b>Building Construction</b>	
<b>Internal Marks:</b>	<b>40</b>		<b>L T P</b>
<b>External Marks:</b>	<b>60</b>		<b>3 1 0</b>
<b>Total Marks:</b>	<b>100</b>		

Brick & Stone Masonry: Terms used; types of bonds; their merits and demerits; Rubble and ashlar joints in stone masonry, introduction to cement concrete hollow blocks, advantages and disadvantages of concrete block masonry over brick masonry.

Walls and Foundation: Load bearing and non-load bearing walls, estimation of load on walls and footings, Thickness considerations, partition and cavity walls design of masonry walls, pillars and footings.

Damp Proofing: Sources, Causes of dampness in buildings, bad effects of dampness, methods of damp proofing.

Arches and Lintels: Introduction to terms used in Arches; different types of arches; brick and stone arches, types and functions of lintels.

Roofs: Introduction, terms used, types of roof trusses and roof coverings, details of rain proofing, rain water pipes.

Doors and Windows: Introduction, terms used, location of doors and windows, types of doors and windows, methods of fixing doors and window frames in walls. Ventilators.

Plastering, Pointing and Painting: Introduction, objects and types, special materials for plastered surfaces, distempering, white washing and color washing of plastered surfaces.

Floors: Introduction, various types of floors commonly used and their suitability for different buildings, constructional details of concrete and Terrazzo floorings, marble flooring, anti-termite treatment.

Miscellaneous Topics:

- (a) Site selection; and orientation of building.
- (b) Principles of acoustical design of Building.
- (c) Fire proof construction methods.
- (d) Non Engineered Earth quake resistant design of building.
- (e) Construction and expansion joints.
- (f) Building bylaws

Recommended Books

- 1. Building Construction : S.K. Sharma
- 2. Building Construction : Sushil Kumar
- 3. Building Construction : B.C. Punmia

	CE-208	STRUCTURAL ANALYSIS-I	
<b>Internal Marks:</b>	<b>40</b>		<b>L T P</b>
<b>External Marks:</b>	<b>60</b>		<b>3 2 0</b>
<b>Total Marks:</b>	<b>100</b>		

**1. Deflection of Beams**

Review of Double Integration Method and Macaulay's Method, moment area theorem, conjugate beam method, unit method and strain energy method. Maxwell's reciprocal theorem.

**2. Thin Cylinders and Spheres**

Introduction, stresses and strains in thin cylinders and spherical shell, volumetric change, wire wound thin cylinders, thin vessels subjected to internal pressure.

**3. Analysis of determinate Trusses**

Introduction, determination of forces in member of trusses by method of joints, method of sections, Deflection of Joints of plane frames by castigliano's first theorem and unit load method.

**4. Analysis of Dams, chimneys and Retaining Walls**

Introduction, limit of eccentricity for no tension in the section, core of the section, middle third rule, wind pressure on chimneys.

**4. Rolling Loads**

Introduction to rolling loads and influence lines, Determination of shear force, bending moment at a section and absolute shear force and bending moment due to single point load, uniformly distributed load, several point loads etc.

**5. Influence Lines**

Construction of Influence lines for reaction, shear forces and bending moment for simply supported, overhauling and compound beams, influence lines for girders with floor beams, Influence lines for forces in members of frames. Influence lines for deflection.

**6. Arches**

Introduction, Analysis of three hinged, two hinged and fixed arches, spandrel braced arches, Influence lines for horizontal thrust, shear force and bending moment for three hinged and two hinged arches.

**7. Cables and suspension Bridges**

Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, suspension bridge with two hinged and three hinged stiffening girders, influence lines.

**Book Recommended**

- 1 Basic structural Analysis C.S.Reddy.
- 2 Analysis of Structures Vol- I and Vol.-II Vazirani & Ratwani
- 3 Intermediate structural Analysis C.K.Wang

**CE-210 ROCK MECHANICS & ENGG. GEOLOGY**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

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1. General Geology : Importance of Engg. Geology applied to Civil Engg. Practices. Weathering, definition, types and effect. Geological works of rivers, wind, glaciers as agents of erosion, transportation and deposition.
2. Rocks & Minerals : Minerals, their identification igneous, sedimentary & metamorphic rocks. classification of rocks for engineering purposes. Rock quality designation (ROD)
3. Structural Geology : Brief idea about stratification, apparent dip, true dip, strike and in conformities. Folds, faults & joints : definition, classification relation to engg. Operations.
4. Engineering Geology : Geological considerations in the Engg. Projects like tunnels, highways, foundation, dams, reservoirs. Earthquake : Definition, terminology, earthquake waves, intensity, recording of earthquake.
5. Engineering properties of rocks and laboratory measurement : Uniaxial compression test, tensile tests, permeability test, shear tests, size and shape of specimen rate of testing. Confining pressure, stress strain curves of typical rocks. Strength of intact and fissured rocks, effect of anisotropy, influence of effect of pore fluid type unsaturated and temperature.
6. In-situ determination of Engg. Properties of Rock masses : Necessity of in-situ tests, uniaxial load tests in tunnels and open excavations, cable tests, flat jack test, shear test, pressure tunnel test. Simple methods of determining in situ stresses bore hole inercoring technique-bore hold deformation gauges.
7. Improvement in properties of Rock masses : Pressure grouting for dams and tunnels, rock reinforcement rock bolting.

**Books Recommended :-**

- |                                   |   |                     |
|-----------------------------------|---|---------------------|
| 1. Introduction to Rock Mechanics | : | Richard E. Goodman. |
| 2. Engg. Behaviour of rocks       | : | Farmar, I.W.        |
| 3. Rock Mechanics and Engg.       | : | Jaager C.           |
| 4. Fundamentals of Rock Mechanics | : | Jaager and Cook     |
| 5. Engineering Geology            | : | D.S.Arora           |
| 6. Engineering Geology            | : | Parbin Singh        |
| 7. Rock Mechanics for Engineering | : | B.P. Vsma.          |

**CE-216 ENVIRONMENTAL SCIENCE**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**Unit 1 : The Multidisciplinary nature of environmental studies**

Definition, scope and importance

(2 Lectures)

Need for public awareness.

**Unit 2 : Natural Resources :**

**Renewable and non-renewable resources :**

Natural resources and associated problems.

- a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- b) Water resources : Use and over-Utilization of surface and ground water, floods, drought, conflicts and water, dams-benefits and problems.
- c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

**Unit 3 : Ecosystems**

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- 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 ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

**Unit 4 : Biodiversity and its conservation**

Introduction – Definition : genetic, species and ecosystem diversity.  
 Biogeographical 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.

Endangered and endemic species of India

Conservation of biodiversity : In-situ conservation of biodiversity.

### **Unit 5 : Environmental Pollution**

#### **Definition**

Causes, effects and control measures of :-

Air pollution

Water pollution

Soil pollution

Marine pollution

Noise pollution

Thermal pollution

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, earthquake, cyclone and landslides.

8 lectures)

### **Unit 6 : Social Issues and the Environment**

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people ; its problems and concerns. Case studies.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

(7 lectures)

### **Unit 7 : Human Population and the Environment**

- Population growth, variation among nations.
- Population explosion – Family Welfare Programme.
- Environment and human health.
- Human Rights.
- Value Education.
- HIV / AIDS
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

### **Unit 8 : Field work**

- Visit to a local area to document environmental and river forest grassland hill mountain.
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

**CE-212 Survey Lab**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 4**

1. Measurement of distance, ranging a line, plotting of details in chain survey.
2. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
3. Different methods of leveling, height of instrument, rise & fall methods.
4. Plane table survey, different methods of plotting two point & three point problem.
5. Setting up temporary and permanent adjustment of a theodolite. Measurement of horizontal angles by repetition and reiteration methods using a theodolite. Measurement of vertical angle by theodolite.
6. Determination of tocheometric constants. Determination of reduced levels by techeometric observations.
7. Determination of height of an inaccessible object with instrument axis in the same plane as the object and in different planes.
8. Setting out a transition curve. Setting out of circular curves in the field using different methods.

**CE-214 Structural Analysis Lab**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

1. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.
2. To determine the Flexural Rigidity of a given beam.
3. To verify the Moment- area theorem for slope and deflection of a given beam.
4. Deflection of a fixed beam and influence line for reactions.
5. Deflection studies for a continuous beam and influence line for reactions.
6. Study of behavior of columns and struts with different end conditions.
7. Experiment on three-hinged arch.
8. Experiment on two-hinged arch.
9. Deflection of a statically determinate pin jointed truss.
10. Forces in members of Redundant frames.
11. Experiment on curved beams.
12. Unsymmetrical bending of a cantilever beam.

**CE-301 CONSTRUCTION MACHINERY & WORKS MANAGEMENT**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**1. INTRODUCTION :**

Need for project planning & management, value engineering , time value of money, activity & event, bar chart, Milestone chart, uses & draw backs.

**2. PERT :**

Construction of PERT network, time estimates, network analysis, forward pass & backward pass, slack, critical path, data reduction, suitability of PERT for research project, numerical problems.

**3. CPM :**

Definitions, network construction, critical path, fundamental rules, determination of project schedule, activity time estimates, float types, their significance in project control, numerical problems.

**4. COST ANALYSIS AND CONTRACT :**

Type of costs, cost time relationships, cost slopes, conducting a crash programme, determining the minimum total cost of project, flexible budgets, cost & quality control, profit planning control & decision making, cost accounting systems, numerical problems.

Updating a project, when to update, time grid diagram, resource scheduling.

planning of different components of civil engineering projects such as a house, workshop, dam, tunnel.

**5. EARTH MOVING MACHINERY :**

Tractors, bull dozers, rippers, scrappers power shovels, dragline, hoes. Line diagram of each, sizes, output, uses, factors affecting selection of each equipment, economic life of equipment maintenance and repair cost.

Hoisting & Transporting Equipments: Hosts, Winches, Cranes, Belt conveyors, Ropeways, trucks & Wagons.

**6. CONSTRUCTION EQUIPMENT :**

Plants for grading, batching, mixing, types of mixers, concrete pumps, bitumen plants.

**BOOKS RECOMMENDED:**

Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi

PERT and CPM - L.S.Srinath, East West Press

Management Guide to PERT & CPM - Wiest & levy

Construction Equipment & Planning and Application. - Mahesh Verma

Hand book of Heavy Construction - W Stubbes Jr.

**CE-303 DESIGN OF STEEL STRUCTURES - I**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 2 0**

Note : Use of relevant Indian Standards is allowed.

1. Allowable stresses in direct tension, compression, bearing and shear in structural steel.
2. Riveted, Bolted and Welded connection for axial loads.
3. Design of Tension and Compression Members
4. Design of steel Beams, Purlins and Encased Beams
5. Design of Built up Columns under Axial Loading using Lacing and Battening Systems.
  1. Design of Column Bases under direct and eccentric Loads ( Slab Base, Gusseted Base and Grillage foundation)
6. Design of Steel Roof Truss : design of members for the given loads, design of riveted and welded connections, detailed working drawings.
7. Design of Plate Girder for static loads ( UDL or Concentrated Loads at fixed points)

**BOOKS RECOMMENDED:**

1. Design of Steel Structures Vol.-III By Vazirani & Ratwani
2. Design of Steel Structures By Arya & Azmani
3. Steel Structures By S.K.Duggal
4. Design of Steel Structures Vol.-I By Ram Chandra

**CE - 305 STRUCTURAL ANALYSIS – II****Internal Marks: 40****L T P****External Marks: 60****3 2 0****Total Marks: 100**

1. ANALYSIS OF STATICALLY INDETERMINATE STRUCTURES: Degree of static and kinematic indeterminacies, analysis of indeterminate beams, rigid frames and trusses by method of consistent deformation, law of reciprocal deflections, method of least work, induced reactions on statically indeterminate beams, rigid frames and trusses due to yielding of supports.
2. FIXED AND CONTINUOUS BEAMS: Analysis of fixed beams, continuous beams and propped cantilevers by moment-area theorem and strain energy method, fixed end moments due to different types of loadings, sinking and rotation of supports, bending moment and shear force diagrams for fixed beams and propped cantilevers, slope and deflection of fixed beams, analysis of continuous beams by the Three moment equation (Clapeyron's theorem) due to different types of loadings, effect of sinking of supports.
3. SLOPE-DEFLECTION METHOD: Introduction, slope-deflection equations, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements.
4. MOMENT-DISTRIBUTION METHOD: Introduction, absolute and relative stiffness of members, stiffness and carry-over factors, distribution factors, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements, symmetrical beams and frames with symmetrical, skew-symmetrical and general loading.
5. ROTATION CONTRIBUTION METHOD: Introduction, basic concept, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loadings and yielding of supports, symmetrical beams and frames, general case- storey columns unequal in height and bases fixed or hinged.
6. APPROXIMATE METHODS OF STRUCTURAL ANALYSIS: Vertical and lateral load analysis of multistory frames, portal, cantilever and substitute-frame methods and their comparison.
7. SPACE FRAMES: Introduction, simple space truss, types of supports, equilibrium and stability conditions, analysis of determinate and indeterminate space frames using tension coefficient method.
8. INFLUENCE LINES FOR STATICALLY INDETERMINATE STRUCTURES: Muller- Breslau principle for statically determinate and indeterminate beams, trusses and rigid frames, influence lines for reactions, shear force and bending moment for statically indeterminate beams, trusses and rigid frames.

**RECOMMENDED BOOKS :**

1. Basic structural analysis - C.S. Reddy
2. Intermediate structural analysis - C . K. Wang.
3. Indeterminate structural analysis - J. Sterling Kinney
4. Theory of structures - B.C. Punima,

**CE-307 DESIGN OF CONCRETE STRUCTURE – I**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 2 0**

Note : Use of relevant Indian Standards is allowed.

1. Strength and behaviour of concrete and steel, Assumptions made in theory of RCC. Principle of design of flexural members by working stress and Limit State Methods.

Note: All design and analysis using Limit State Method for following topics.

2. Analysis of beams:

Moment of Resistance of singly, doubly and flanged beams, Design of continuous beams.

3. Analysis of shear, bond and torsion.
4. Analysis of one and two way slabs, Design of flat slabs, Design of continuous slabs
5. Calculation of cracking and deflection for Limit State of Serviceability.
6. Design of axially and eccentrically loaded columns.
7. Design of Stair case.

**Books Recommended:**

1. Design of Reinforced Concrete Structures P. Dayaratnam
2. Reinforced Concrete Fundamentals Ferguson
3. Design of Concrete Structures Nilson and Winter
4. Reinforced Concrete Structural Elements Purshothaman  
Behavior, Analysis and Design
5. Reinforced Concrete Design Pillai & Menon
6. Limit State Design Ramachandra
7. Limit State Design A.K. Jain
8. Limit State Design of Reinforced Concrete P.C. Vergese

**CE-309 ENVIRONMENTAL ENGINEERING-I**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

1. **PUBLIC WATER SUPPLY:** Beneficial uses of water, water demand, per capita demand, variation in demand; causes, detection and prevention of wastage of water, population forecasting.
2. **SOURCES OF WATER SUPPLY:** Surface and underground sources, relation and development of source in r/o quality and quantity of water, Development of wells, Storage reservoir-balancing and service storage, capacity determination by mass curve method. Intake and transmission system distribution systems: network design.
3. **QUALITY AND EXAMINATION OF WATER:** Necessity for examination of water impurities in water, sampling of water, physical, chemical and bacteriological quality for domestic water supply. Drinking water quality standards and criteria.
4. **WATER SUPPLY AND DRAINAGE OF BUILDINGS:** System of water supply houses connections, metering, internal distribution, and sanitary fittings pipe joints, Different types of pipes and pipes materials.
5. **WATER TREATMENT:** Unit operations in water treatment screening, sedimentation, and its theory sedimentation aided with coagulation, flocculation, sand filtration-slow, rapid, gravity and pressure filters, Disinfecting, Necessary: requirements of disinfectant, methods, of disinfecting different practices of chlorinating.
6. **MISCELLANEOUS METHODS OF WATER TREATMENT:** Aeration, taste and odour control iron and manganese removal water softening processes Base exchange process, Swimming pool water Treatment

**Books:-**

1. Water Supply Engineering Environmental Engg. I by B.C. Punmia, Ashok Jain, Arun Jain.
2. Environmental Engineering - A Design Approach by ARCADIO P. SINCERO, GREGORIA A. SINCERO
3. Environmental Engineering and Technology, by PEAVY, ROWE.

## CE-311 TRANSPORTATION ENGINEERING – I

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

1. **Introduction:** Importance of Transportation, Different Modes of Transportation, Characteristics of Road Transport.
2. **Highway Development & Planning:** Principles of Highway Planning, Road Development in India, Classification of Roads, Road Patterns, Planning Surveys.
3. **Highway Alignment:** Requirements, Alignment of Hill Roads, Engineering Surveys.
4. **Highway Geometric Design:** Cross Section Elements, Carriageway, Camber, Sight Distances, Horizontal Curves, Extra-widening, Super-elevation, Vertical Curves.
5. **Highway Materials:** Properties of Sub-grade and Pavement Component Materials, Tests on Sub-grade Soil, Aggregates and Bituminous Materials.
6. **Highway Construction:** Earthen/Gravel Road, Water Bound Macadam, Wet Mix Macadam, Bituminous Pavements, Cement Concrete Pavements.
7. **Highway Drainage:** Importance, Surface Drainage and Subsoil Drainage, Construction in Water-logged areas.
8. **Highway Maintenance:** Pavement Failures, Pavement Evaluation, Maintenance and Strengthening Measures.
9. **Highway Economics & Financing :** Total Transportation Cost, Economic Analysis, Sources of Highway Financing.
10. **Traffic Characteristics :** Road User Characteristics, Driver Characteristics, Vehicular Characteristics
11. **Traffic Studies:** Volume and Speed Studies, O-D Survey, Parking Study
12. **Traffic Safety:** Cause and Type of Accidents, Use of Intelligent Transport System
13. **Traffic Control Measures:** Signs, Markings, Islands, Signals
14. **Traffic Environment Interaction:** Noise Pollution, Vehicular Emission, Pollution Mitigation Measures

**Books Recommended:**

1. Khanna S.K., and Justo, C.E.G. "Highway Engineering", Nem Chand and Brothers, Roorkee, 1998.
2. Kadiyali, L.R. "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi, 1997.
3. Flaherty, C.A.O. "Highway Engineering", Volume 2, Edward Arnold, London, 1986.
4. Sharma, S.K. "Principles, Practice & Design of Highway Engineering", S. Chand & Company Ltd., New Delhi, 1985.
5. Khanna S.K., and Justo, C.E.G. "Highway Material Testing Laboratory Manual", Nem Chand and Brothers, Roorkee, 1997.

**CE-313 CONCRETE LAB**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

The following experiments are to be performed in the Concrete Lab.

1. To Determine the Specific Gravity of cement.
2. To Determine the Standard Consistency, Initial and Final Setting Times of Cement.
3. To Determine Soundness of Cement.
4. To Determine the Compressive Strength of Cement.
5. To Determine the Compressive Strength of Bricks/Tiles.
6. To Determine the Fineness Modulus of Fine and Coarse Aggregates.
7. To Determine the Bulk Density, Water Absorption and Sp. Gr. of Fine and Coarse Aggregates.
8. To Determine the Slump, Compaction Factor and Vee-Bee Time of Concrete.
9. Mix Design of Concrete.
10. To Determine the Compressive Strength of Concrete by Cube and Cylinder.
11. To carry out the Tensile and Flexural tests of Concrete.
12. To determine the Compressive Strength of hardened Concrete by Non-Destructive Test

**Books/Manuals :-**

1. Concrete Manual By Dr. M.L. Gambhir, Dhanpat Rai & Sons Delhi.
2. Concrete Lab Manual by TTTI Chandigarh

**CE - 315 ENVIRONMENTAL ENGINEERING Lab**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

1. To measure the PH value of a sample
2. To find the turbidity of a given sample
3. To find B.O.D. of a given sample
4. To measure D.O. of a given sample
5. Determination of Hardness of a given sample
6. Determination of total solids, dissolved solids, suspended solids of a given sample
7. To determine the concentration of sulphates in water/wastewater sample.
8. To find chlorides in a given sample
9. To find acidity/alkalinity of a given sample
10. To determine the COD of a wastewater sample.

Books Recommended:-

1. Environment Engg. Chemistry by Sawyer & Macarty.
2. Standard Methods of examination of water & wastewater APHA, AWWA, WEF

**CE - 317 SURVEY CAMP**

**Internal Marks: 60**  
**External Marks: 40**  
**Total Marks: 100**

The students will be required to make a topographic map of an undulating hilly terrain measuring about 250 acres. The work will be as under:

Reconnaissance, selection of main stations, measurement of horizontal and vertical angles, measurement of base line, determination of R.L. of main station by double levelling from B.M., measurement of bearing of any one line, computation of coordinates of station points, plotting of details, interpolation of contours.

**The duration of survey camp is of 4 weeks.**

## CE-302 TRANSPORTATION ENGINEERING – II

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

1. **Introduction to Railway Engineering:** History of Railways, Development of Indian Railway, Organisation of Indian Railway, Important Statistics of Indian Railways.
2. **Railway Gauges:** Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge.
3. **Railway Track:** Requirements of a Good Track, Track Specifications on Indian Railways, Detailed Cross-Section of Single/Double Track on Indian Railways.
4. **Components of Railway Track:** Rails, Sleepers, Ballast, Subgrade and Formation, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails.
5. **Geometric Design of Railway Track:** Alignment, Gradients, Horizontal Curve, Super-elevation, Equilibrium Cant, Cant Deficiency, Transition Curves.
6. **Points and Crossings:** Functions, Working and Design of Turnout, Various types of Track Junctions and their layouts, Level-crossing.
7. **Railway Stations & Yards:** Site Selection, Classification & Layout of Stations, Marshalling Yard, Locomotive Yard, Equipment at Railway Stations.
8. **Signalling and Interlocking:** Objectives, Classification of Signals, Types of Signals in Stations and Yards, Automatic Signalling, Principal of Interlocking.
9. **Modernization of Railway Tracks:** High Speed Tracks, Improvement in existing track for high speed, Ballastless Track, MAGLEV Track.
10. **Introduction to Airport Engineering:** Air Transport Scenario in India and Stages of Development, National and International Organisations.
11. **Airport Planning:** Aircraft Characteristics, Factors for Site Selection, Airport Classification, General Layout of an Airport.
12. **Obstructions and Zoning Laws:** Imaginary Surfaces, Approach Zones and Turning Zones.
13. **Runway Orientation and Design:** Wind Rose Diagram, Basic Runway Length, Corrections, Geometric Design Elements, Runway Configuration, Aircraft Parking System.
14. **Taxiway Design:** Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons.
15. **Visual Aids:** Marking and Lighting of Runway, Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR.

**Books Recommended:**

- Aggarwal, M.M. "Railway Engineering", Prabha and Company, New Delhi, 1997.  
 Saxena, S.C., and Arora, S.P. "A Text Book of Railway Engineering", Dhanpat Rai and Sons, Delhi, 1997.  
 Khanna, S.K., Arora, M.G., and Jain, S.S. "Airport Planning and Design", Nem Chand & Bros. Roorkee, 1999.  
 Horenjeff, R. and McKelvey, F. "Planning and Design of Airports", McGraw Hill Company, New York, 1994.

**CE – 304 GEOTECHNICAL ENGINEERING**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

1. Basic Concepts: Definition of soil and soil mechanics common soil problems in Civil Engineering field. Principal types of soils. Important properties of very fine soil i.e. adsorbed water, Base Exchange and soil structure. Characteristics of main Clay mineral groups i.e. montmorillonite, illite and kaolinite, Basic definitions in soil mechanics. Weight volume relationship theory and determination of specific gravity from picnometer test. Field density from sand replacement method and other methods.
2. Index Properties: Grain size analysis. Stock's law and Hydrometer analysis. Consistency and sensitivity Clay as per I.S. Code Atterberge Limits Flow Index and Toughness Index. Underlying theory of shrinkage limit determination. Classification of coarse grained soils. Classification of fine-grained soils as per Indian standard classification system (IS-1498-1970).
3. Compaction: Definition and object of compaction and concept of O.M.C. and zero Air Void Line. Modified proctor Test. Factors affecting compaction Effect of compaction on soil properties and their discussion. Field compaction methods- their comparison of performance and relative suitability. Field compactive effort. Field control of compaction by proctor.
4. Consolidation: Definition and object of consolidation difference between compaction and consolidation. Concept of various consolidation characteristics i.e.  $a_v$ ,  $m_v$  and  $c_v$  primary and secondary consolidation. Terzaghi's Differential equation and its derivation Boundary conditions for Terzaghi's solution for one dimensional consolidation concept of  $c_v$ ,  $t_v$  &  $U$ . consolidation test determination of  $c_v$  from curve fitting methods, consolidation pressure determination. Normally consolidated and over consolidated clays. Causes of over-consolidation. Effect of disturbance on e-Log sigma curves of normally consolidated clays, importance of consolidation settlement in the design of structures.
5. Permeability and Seepage: Concept of effective stress principal, seepage pressure, critical hydraulic gradient and quick sand condition. Capillary phenomenon in soil. Darcy's Law and its validity, seepage velocity, co-efficient of permeability and its determination in the laboratory. Average permeability of stratified soil mass, factors affecting 'K' and brief discussion.
6. Shear Strength: Stress analysis of a two dimensional stress system by Mohr circle. Concept of pole. Coulomb's law of shear strength coulomb - Mohr strength theory. Relation between principal stresses at failure. Direct, triaxial and unconfined shear strength tests. Triaxial shear tests based on drainage conditions typical strength envelopes for clay obtained from these tests. Derivation of skempton's pore pressure parameters. Stress strain and volume change characteristics of sands.
7. Earth Pressure: Terms and symbols used for a retaining wall. Movement of all and the lateral earth pressure. Earth pressure at rest. Rankine states of plastic equilibrium and derivations of expressions for  $K_a$  and  $K_p$  for horizontal backfills. Rankine's theory both for active and passive earth pressure for Cohesionless backfill with surcharge and fully submerged case. Cohesive backfill condition. Rankine's Earth pressure for a cohesionless backfill with sloping surface (with proof) concept of active and passive Earth pressure on the basis of stability of a sliding wedge. Coulomb's method for cohesion less backfill. Merits and demerits of Rankine and Coulomb's theories graphical construction and Rebhan's graphical construction (without surcharge load).

**Books:-**

1. Soil Mech. & Foundation Engg, by K.R.Arora
2. Geotechnical Engineering, by P. Purshotama Raj
3. Soil Mech. & Foundation Engg., by V.N.S.Murthy

**CE – 306 IRRIGATION ENGINEERING –I**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**1. METHOES OF IRRIGATION:**

Advantages and disadvantages of irrigation, water requirements of crops, factors affecting water requirement, consumptive use of water, water depth or delta and crop relation, Duty of water, relation between delta, duty and base period, Soil crop relation-ship and soil fertility, sprinkler irrigation advantages & limitations. Planning and design of sprinkler irrigation, drip irrigation advantages & limitations, suitability.

**2. CANAL IRRIGATION:**

Classifications of canals, canal alignment, Inundation canals, Bandhara irrigation, advantages and disadvantages, Silt theories-Kennedy's theory, Lacey's theory, Drawbacks in Kennedy's & Lacey's theories, comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy & Lacey's theories, suspended and bed loads.

**3. LINED CANALS:**

Types of lining, selection of type of lining, Economics of lining, maintenance of lined canals, silt removal, strengthening of channel banks, measurement of discharge in channels, design of lined canals, methods of providing drainage behind lining.

**4. LOSSES IN CANALS, WATER LOGGING AND DRAINAGE:**

Losses in canals-Evaporation and seepage, water logging, causes and ill effects of water logging-anti water logging measures. Drainage of land, classification of drains - surface and subsurface drains, Design considerations for surface drains, Advantages and maintenance of tile drains.

**5. INVESTIGATION AND PREPRRATION OF IRRIGATION PROJECTS:**

Classification of project, Project preparation-investigations, Design of works and drawings, concept of multi - purpose projects, Major, Medium and miner projects, planing of an irrigation project, Economics & financing of irrigation works. Documentation of project report.

**6. TUBE - WELL IRRIGATION :**

Types of tube - wells - strainer type, cavity type and slotted type. Type of strainers, Aquifer, porosity, uniformity coefficient, specific yield & specific retention, coefficients of permeability, transmissibility and storage. Yield or discharge of a tube well, Assumptions, Theim & Duputi's formulae. Interference of tube wells with canal or adjoining tube-wells, optimum capacity, Duty and delta of a tube well. Rehabilitation of tubewell.

**7. RIVER TRAINING WORKS:**

Objectives, classification of river-training works, Design of Guide Banks. Groynes or spurs - Their design and classification ISI. Recommendations of Approach embankments and afflux embankments, pitched Islands, Alficial cut-off objects and design Considerations River control - objectives and methods.

Books:-

1. Principles & practice of Irrigation Engg. S.K..Sharma
2. Irrigation & Water Power Engg. B.C. Punmia, Pande B.B.Lal
3. Fundamentals of Irrigation Engg. Dr. Bharat Singh
4. Irrigation Engg. & Hydraulic Structure S.R.Sahasrabudhe
5. Irrigation Engg. & Hydraulic Structure Varshney, Gupta & Gupta
6. Irrigation Engg. & Hydraulic Structure Santosh Kumar Garg

**CE-308 PROFESSIONAL PRACTICE**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

1. Estimates-Method of building estimates, types, site plan index plan, layout plan, plinth area, floor area, Technical sanction , administrative approval, estimate of buildings, roads , earthwork, R.C.C. works, sloped roof, roof truss, masonry platform, complete set of estimate
  2. Analysis of rates- For earthwork, concrete work, D.P.C., stone masonry, plastering, pointing, roadwork
  3. Specifications- For different classes of building and Civil engineering works.
  4. Types of contracts- Tenders, tender form, submission and opening of tenders, measurement book, muster roll , piecework agreement and work order
  5. Accounts-Division of accounts, cash, receipt of money, cash book, temporary advance, imprest, accounting procedure, arbitration, arbitration act.
1. Estimating and Costing by B.N.Datta
  2. Estimating and Costing by G.S.Birdie
  3. Estimating and Costing by V.N. Chakravorty

**CE-310 DESIGN OF CONCRETE STRUCTURES-II**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 2 0**

Note:

1. Use of Indian Standards is allowed.
  2. All Designs by Limit State Method.
1. Design of isolated footing, square, circular and rectangular.
  2. Design of Combined Footing: Trapezoidal and Rectangular, Design of strap and Raft Footing.
  3. Beams curved in Plan: Design of Semi Circular Beams Supported on Two Supports and Three Supports, Design of Circular Beams Supported on Symmetrically Placed Columns, Torsion in Circular Beams.
  4. Domes: Introduction of Different types of Domes. Design of Spherical and Conical domes, Design of Cylindrical Shells Supported on Edge Beams.
  5. Water tank: General Design Requirements, Design of Circular and Rectangular Tanks Resting on Ground, Design of Underground Rectangular tanks, Different Types of Over Head Service Reservoirs, Design of Intz Tank.
  6. Retaining walls: Design of Cantilever and Counter fort Retaining Walls.

**Books Recommended:**

1. Design of Reinforced concrete structures P. Dayaratnam
2. Treasure of RCC Design Sushil Kumar
3. Advanced Design of Structures N. Krishna Raju
4. RCC design Syal and Ummat
5. Advanced RCC Design Pillai & Mennon

**CE - 312 STRUCTURAL ANALYSIS III**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

1. **BASIC CONCEPTS OF STRUCTURAL ANALYSIS:** Static and kinematic indeterminacies of beams, rigid-jointed plane and space frames, pin-jointed plane and space frames and hybrid structures, actions and displacements, action and displacement equations, generalized system of coordinates, unit-load method, conjugate-beam method, slope-deflection equations.
2. **FLEXIBILITY MATRIX (PHYSICAL APPROACH):** Basic definitions and types of matrices, matrix operations, matrix inversion, solution of linear simultaneous equations, matrix partitioning, development of flexibility matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using physical approach.
3. **STIFFNESS MATRIX (PHYSICAL APPROACH):** Development of stiffness matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using physical approach, reduced stiffness matrix, total stiffness matrix, translational or lateral stiffness matrix.
4. **STIFFNESS MATRIX (ELEMENT APPROACH):** Transformation of system displacements to element displacements through displacement transformation matrix, transformation of element stiffness matrices to system stiffness matrix, development of stiffness matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using element approach, relation between flexibility and stiffness matrices.
5. **STIFFNESS METHOD OF ANALYSIS:** Analysis of continuous beams, rigid-jointed plane frames and pin-jointed plane frames using the physical and element approaches, effect of support settlements, temperature stresses and lack of fit, comparison of flexibility and stiffness methods of analysis.
6. **FINITE ELEMENT METHOD (FEM):** Basic concept, discretisation, procedure, elementary applications of principles and formulation of problems, steps of FEM.

**BOOKS RECOMMENDED:**

1. Structural analysis- A matrix approach - GS Pandit and SP Gupta
2. Matrix analysis of framed structures - William weaver , Jr. James M. Gere
3. Basic structural analysis - C.S. Reddy
4. Finite element analysis - C.S. Krishnamurthy
5. Finite element methods - O.C. Zeincwicz.

**CE-314 TRANSPORTATION ENGINEERING (LAB)**

**Internal Marks: 30**

**External Marks: 20**

**Total Marks: 50**

**L T P**

**0 0 2**

**1. Tests on Sub-grade Soil**

- i. IS Compaction Test
- ii. California Bearing Ratio Test

**2. Tests on Road Aggregates**

- Gradation Test
- Crushing Value Test
- Abrasion Value Test
- Impact Value Test
- Specific Gravity & Water Absorption Test
- Shape Test
- Marshal Stability Test

**3. Tests on Bituminous Materials**

- Penetration Test
- Ductility Test
- Softening Point Test
- Flash & Fire Point Test
- Bitumen Extraction Test

**4. Field Tests**

- i. Roughness Measurements of Road by Profilograph

**Books/Manuals Recommended :**

1. Khanna S.K., and Justo, C.E.G. "Highway Testing Manual", Nem Chand and Brothers, Roorkee, 1998.

**CE – 316 GEOTECHNICAL ENGINEERING LAB**

**Internal Marks: 30**

**External Marks: 20**

**Total Marks: 50**

**L T P**

**0 0 2**

1. Determination of in-situ density by core cutter method.  
Determination of in-situ density by sand replacement method.  
Determination of Liquid Limit & plastic Limit by Casagrande apparatus and penetrometer method.  
Determination of specific gravity of soil solids by pycnometer method.  
Grain size analysis of a given sample of sand and determination of coefficient of uniformity and coefficient of curvature.  
Direct shear and triaxial test on a given soil sample.  
Unconfined compression test for fine grained soil.  
Determination of permeability by constant Head Methods and variable head method.  
Compaction test (proctor) and modified proctor test.  
Plot of zero air voids line.  
Determination of Relative Density of soil.

Books Recommended:-

Soil Testing Engineering, Manual By Shamsheer Prakash and P.K. Jain.

**CE-318 CONCRETE DRAWING (COMPUTER AIDED)**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

Detailed Working Drawings (Computer Aided):

1. Isolated Footing : Rectangular, Circular and Square footing.
2. Combined Footing : Rectangular, Trapezoidal, Strap and Raft Footing
3. Spherical and Conical Domes
4. Cantilever and Counterfort Retaining Walls
5. Intz Tank

**CE - 402 HYDROLOGY AND DAMS**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

1. Introduction, Precipitation: Importance of hydrological data in water resources planning. The hydrologic cycle. Mechanics of precipitation, types and causes, measurement by rain gauges, Gauge net-works, hyetograph, averaging depth of precipitation over the basin, mass-rainfall curves, intensity duration frequency curves, depth area-duration curves.
2. .
  - a. Interception, Evapo-transpiration and Infiltration: Factors affecting interception, evaporation from free water surfaces and from land surfaces, transpiration, Evapo-transpiration.
  - b. Infiltration Factors affecting infiltration, rate, Infiltration capacity and its determination.
3. Runoff: Factors affecting runoff, run-off hydrograph, unit hydrograph theory, S-curve hydrograph, Snyder's synthetic unit hydrograph.
4. Peak Flows: Estimation of Peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and its hydrograph.
5. Gravity Dams-Non Overflow Section: Forces acting, Stability factors, stresses on the faces of dam, Design of profile by the method of zoning, elementary profile of a dam.
6. Gravity Dams-Spillways: Creagers profiles neglecting velocity of approach, profile taking velocity of approach into account, Upstream lip and approach ramp, Advantages of gated spillways, Discharge characteristics of spillways.
7. Arch and Buttress Dams: Classification of arch dam- constant radius, constant angle and variable radius , Cylinder theory, Expression relating central angle and Cross-Sectional area of arch. Types of buttress dams, Advantages of buttress dams.
8. Earth Dams: Components of earth dams and their functions, Phreatic line determination by analytical and graphical methods.

**REFERENCE**

1. Engineering Hydrology - J.Nemec.
2. Hydrology Chester, Wisler - Brater.
3. Engineering Hydrology - Stanley Buttler.
4. Ground Water Hydrology - TODD.
5. Engineering for Dams Vol. II & III - Creager Justin & Hinds.
6. Design of Small Dams - U.S.B.R.
7. Hydrology by. S.K.Garg
8. Hydrology by. R.K. Sharma
9. Irrigation and Power Engg. By B.C. Pummie

**CE-404 EARTHQUAKE RESISTANT STRUCTURES****Internal Marks: 40****L T P****External Marks: 60****3 1 0****Total Marks: 100**

1. Introduction to Earthquakes, Causes of earthquakes, basic Terminology, Magnitude, Intensity, Peak ground motion parameters.
2. Past earthquakes and Lessons learnt.
3. Introduction to theory of Vibrations, Sources of Vibrations, Types of Vibrations, Degree of Freedom, spring action and damping, Equation of motion of S.D.O.F. systems, Undamped, Damped system subjected to transient forces, general solution, green's function.
4. Lateral Force analysis, Floor Diaphragm action, Moment resisting frames, shear walls.
5. Concepts of seismic design, Lateral Strength, stiffness, ductility and structural configuration.
6. Provision of IS 1893 for buildings.
7. Seismic Design of Masonry Structures, Provision of IS 4326
8. Seismic Design and Detailing of R.C.C. buildings, Provision of IS 13920.

**References:-**

1. Dynamics of Structures by R.W. Clough and Joseph Penzien.
2. Structural Dynamics by Mario & Paz
3. Earthquake Resistant Design by David J. Dowrick
4. Elements of Earthquake Engg By Jai Krishna, A.R. Chandrasekaran, Brijesh Chandra
5. I.S. 1893-2002 Indian Standard Criteria for Earthquake Resistant Design of Structures.
6. I.S. 4326-1993 Indian Standard for Earthquake Resistant Design and Construction of Buildings.
7. I.S. 13920-1993 Ductile detailing of Reinforced Concrete Structures subjected to Seismic Forces.

**CE – 406 ENVIRONMENTAL ENGINEERING –II****Internal Marks: 40****L T P****External Marks: 60****3 1 0****Total Marks: 100**

1. INTRODUCTION: Terms & definitions, systems of sanitation and their merits and demerits, system of sewerage, choice of sewerage system and suitability to Indian conditions.
2. DESIGN OF SEWERS: Quantity of sanitary and storm sewage flow, forms of sewers. Conditions of flow in Sewers, sewers of equivalent section, self cleansing and limiting velocity, hydraulic formulae for flow of sewerage in sewers and their design.
3. CONSTRUCTION & MAINTENANCE OF SEWERS: Sewer apparatuses, Materials for sewers. Laying of sewers, joints in sewers, testing of sewers pipes. Maintenance, operation and precaution before entering a sewer.
4. HOUSE DRAINAGE: rinciples of House drainage, traps, Inspection chamber Indian and European type W.C. Flushing cisterns, soil-waste and anti-syphorage pipes, plumbing system.
5. CHARACTERISTICS & TESTING OF SEWAGE: Composition of sewage, sampling, physical & chemical analysis of sewerage, biological decomposition of sewage, kinetics of organic waste stabilization.
6. TREATMENT OF SEWAGE: Unit processes o waste water treatment, screens, grit-chambers, detritus tank, skimming tank, grease traps, sedimentation, chemical treatment, aerobic biological treatment, trickling filter (LRTF & HRTF), activated sludge processes, anaerobic treatment, units-sludge digesters and biogas plant.
7. LOW COST WASTE WATER TREATMENT UNITS: Oxidation's Ponds, Lagoons, ditches, septic tanks and imhoff tanks, Theory, design, advantages & disadvantages.

**Books:-**

1. Waste Water Engg. (Environmental Engg.-II) by B.C.Punmia, Ashok Jain
2. Environmental Engg. - A design Approach by ARCADIO P. SINCERO GREGORIA P. SINCERO
3. Waste Water Engineering Treatment, Disposal, Reuse by METCALF & EDDY
4. Environmental Pollution Control Engg. By C.S. RAO
5. Environmental Engg. By PEAVY, R OWE, TCHOBANOGALOUS

**CE-408 DESIGN OF STEEL STRUCTURES – II**

**Internal Marks: 40**

**External Marks: 60**

**Total Marks: 100**

**L T P**

**3 1 3**

Note: Use of relevant Indian Standards is allowed.

1. Design of riveted and welded joints, subjected to moment in the plane of joint and perpendicular to the plane of joint, framed connections.
2. Design of steel foot bridge with parallel booms, carrying wooden decking using welded joints.
3. Complete design of industrial buildings
  - i. Gantry girder
  - ii. Column bracket
  - iii. Mill bent with constant moment of inertia
  - iv. Lateral and Longitudinal bracing for column bent
4. Design of single track railway bridge with lattice girders having parallel chords (for B.G.)
  - i. Stringer
  - ii. Cross girder
  - iii. Main girders with welded joints
  - iv. Portal sway bracings
  - v. Bearing rocker and rollers

**BOOKS RECOMMENDED:**

1. Design of Steel Structures Vol.-III By Vazirani & Ratwani
2. Design of Steel Structures By Arya & Azmani
3. Steel Structures By S.K.Duggal
4. Design of Steel Structures Vol.-II By Ram Chandra

**CE – 410 IRRIGATION ENGINEERING-II**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 3**

Theories of Seepage: Seepage force and exit gradient, salient features of Bligh's Creep theory, Lane's weighted Creep theory and Khosla's theory, Determination of uplift. Pressures and floor thickness.

Design of Weirs: Weirs versus barrage, design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir.

energy Dissipation Devices: Use of hydraulic jump in energy dissipation, Factors affecting design, Types of energy dissipators and their hydraulic design.

Diversion Head Works: Functions and investigations: component parts of a diversion head work and their design considerations, silt control devices.

Distributory Regulators: Offtake alignment, cross-regulators – their functions and design, Distributory head regulators, their design, canal escape.

Canal Falls: Necessity and location, types of falls and their description, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls.

Cross-Drainage works : Definitions, choice of type, Hydraulic design consideration, Aqueducts their types and design, siphon aqueducts – their types and design considerations, super passages, canal siphons and level crossing.

Canal Out-lets : Essential requirements, classifications, criteria for outlet behaviours, flexibility, proportionality, sensitivity, sensitiveness, etc. Details and design of non-modular, semi-modular and modular outlets.

**BOOK SUGGESTED**

Design of Irrigation Structures by S.K. Sharma.  
 Irrigation and Water Power Engg. By B.C. Punmia & Pande B.B. Lal.  
 Irrigation Engg. and Hydraulics Structures by S.R. Sahasrabudhe.  
 Irrigation Engg. Vol.I, II & III by K.R. Sharma.  
 Irrigation Practice and Design Vol. I to VII by K.B. Khushlani.  
 The Fundamental Principles of Irrigation and Water Power by B.B. Priyani.  
 Irrigation Engg. Vol. I & II by Ivan E. Houk.  
 Fundamentals of Irrigation Engg. by Dr. Bharat Singh.  
 I.S.I.Codes.

**CE - 412 FOUNDATION ENGINEERING**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

Shallow Foundation-I: Type of shallow foundation Depth and factors affecting it. Definition of ultimate bearing capacity, safe b.c. and allowable b.c. Rankine's analysis and Terzaghi's analysis. Types of failures. Factors affecting bearing capacity. Skempton's equation. B.I.S. recommendations for shape, depth and inclination factors. Plate Load test and standard penetration Test. Their procedure, merits and demerits Factors affecting 'N' value Corrections to be applied to observed value.

Shallow Foundation-II: Boussinesq equation for a point load, uniformly loaded circular and rectangular area, pressure distribution diagrams. Newmark's chart and its construction. Two - to - one method of load distribution. Comparison of Boussinesq and Westergaard analysis for a point load. Limitations of elastic formula. Contact pressure Distribution. Causes of settlement of structures comparison of Immediate and consolidation settlement calculation of settlement by plate load Test and Static Cone penetration test data. Allowable settlement of various structures according to I.S. Code. Situation most suitable for provision of rafts. Proportioning of rafts in sand-s and Clays. Various methods of designing raft. Floating foundation.

Machine Foundations: Basic definition of theory of vibration terms, Analysis of theory of single degree system for :-

Free vibrations.

Damped Free vibration

Forced vibrations with constant Harmonic

Excitation (Frequency response curves) Dynamic soil properties (Equivalent spring constants) Determination of  $C_u$  by cyclic plate load test and Block vibration test. Natural frequency of foundation-soil system by Barkans Method. Co-relation between  $C_u$  and other dynamic properties of soil. Type of machine Foundations - Neat sketches and brief description.

Soil Investigation: Object of soil investigation for new and existing structures. Depth of exploration for different structures. Spacing of bore Holes. Methods of soil exploration and relative merits and demerits. Types of soil sample. Design features of sampler affecting sample disturbance. Essential features and application of the following types of samples.

Open Drive samples

Stationery piston sampler

Rotary sampler

Geophysical exploration by seismic and resistivity methods. Bore Hole log for S.P.T.

Pile Foundations – I: Necessity and uses of piles classification of piles. Merits and demerits of different types based on composition. Types of pile driving hammers & their comparison. Effect of pile driving on adjacent ground. Use of engineering News Formula and Hiley's Formula for determination of allowable load. Limitations of pile driving formulae. Pile load test-object, pre-requisites, test arrangement, procedure and assessment of safe load. Separation of skin friction and point resistance using cyclic pile load test data. Related numerical problems.

Pile Foundation – II: Determination of point resistance and frictional resistance of a single pile by Static formulas. Piles in Clay-Safe load on a Friction and point Bearing pile. Pile in sand Spacing of piles in a group, factors affecting capacity of a pile group by Terzaghi - peck approach. Efficiency of pile group by converse - Labare formula and feds formulas. Bearing capacity of a pile group in clay by block failure and individual action approach. Approximate methods for determination of stress on lower strata in pile groups. Calculation of settlement of friction pile group in clay using the following equation.

$$S = \frac{H \times C_c}{1 + e_0} \log_{10} \left( \frac{\sigma + \Delta \sigma}{\sigma} \right)$$

Related Numerical problems. Settlement of pile groups in sand Negative skin friction.

Caissons and Wells: Major areas of use of caissons advantages and disadvantages of open box and pneumatic caissons. Essential part of a pneumatic caisson. Components of a well foundation. Calculation of allowable bearing pressure. Conditions for stability of a well, Terzaghi's analysis for

lateral stability for a light well-embedded in sand. Modification of the analysis for a heavy well. Forces acting on a well foundation. Computation of scour depth.

Books Recommended:-

Soil Mechanics & Foundation Engineering by B.C.Punmia  
Geotechnical Engineering by Alam Singh  
Soil Mechanics by V.N.S. Murthy

**CE - 414 ENVIRONMENT ENGINEERING (Project)**

**Internal Marks: 120**

**External Marks: 80**

**Total Marks: 200**

**L T P**

**0 0 4**

1. Design of a wastewater treatment plant for a city.
2. Design of a water treatment plant for a city.
3. Design of water distribution system for a colony.
4. Study of Groundwater or surface water quality in areas close to polluting industries. Design of

**CE - 414 GEOTECHNICAL ENGINEERING (Project)**

**Internal Marks: 120**

**External Marks: 80**

**Total Marks: 200**

**L T P**

**0 0 4**

Soil investigations for foundations of a multistoreyed structure-Planning, Field tests(SPT,Plate load test and DCPT),Laboratory tests and preparation of final project reports:-

Study of the area to be investigated for geotechnical design of the foundation.No. and spacing of boreholes required to be excavated.No. of standard penetration and other related tests required to be done along with the depth of exploration. Collection of disturbed and undisturbed samples for laboratory testing. Related laboratory tests like mechanical analysis, Atterbergs' limit test etc. Determination of shear parameters by Triaxial compression test or Direct shear test etc. Preparation of the report and borehole log. Calculation of bearing capacity of the strata at different levels. Proportioning of the footing size and depth. Estimated cost of the project.

or

Ground improvement by improving soil properties using various methods of soil stabilisation, use of materials like cement, lime, bitumen, all types of fibres-natural and synthetic etc.

**Books**

1. Soil Mechanics and Foundation Engineering by Dr. K.R.Arora
2. Analysis of Substructures by Dr. Swami Saran
3. Geotechnical Engg. by Purshotama Raj
4. Analysis and Design of Foundations by Dr. Shamsheer Prakash.

**CE - 414 TRANSPORTATION ENGINEERING (Project)**

**Internal Marks: 120**

**External Marks: 80**

**Total Marks: 200**

**L T P**

**0 0 4**

The students will be acquainted with the following aspects of Transportation Engineering:

1. Design of Flexible Pavement
2. Design of Rigid Pavement
3. Life-Cycle Cost Analysis of Pavements
4. Pavement Management System
5. Transportation Environmental Interaction

**CE - 414 HYDRAULIC STRUCTURES (Project)****Internal Marks: 120****External Marks: 80****Total Marks: 200****L T P****0 0 4**

On the basis of given data, the students will be required to prepare a preliminary project with design and drawings by making suitable assumptions. The report should elucidate the planning, execution and the maintenance stages at any one or more of the follow:-

1. Water requirement of crops.
2. Irrigation channels and canal head works.
3. Any irrigation structure (Hydraulic)
4. Surface irrigation.
5. Tube wells.
6. Drainage Schemes.
7. Dams.
8. Investigation and Planning of reservoirs.
9. Spillways and Energy dissipators.
10. Water resources and development.

**CE - 414 STRUCTURAL ENGINEERING (Project)****Internal Marks: 120****External Marks: 80****Total Marks: 200****L T P****0 0 4**

The Students will be given some Multi-storeyed Building Plans and the related data. The Students are required to prepare

1. Idealisation of the Building
2. Assessment of all Loads
3. Analysis of Structures
4. Structural Design of all Components
5. Preparation of Structural Drawings
6. Estimate of the Building

The final report will be prepared which include planning, analysis, design and drawings.

**CE-414 TRANSPORTATION ENGG PROJECT****Internal Marks: 120****External Marks: 80****Total Marks: 200****L T P****0 0 4**

The students will be acquainted with the following aspects of Transportation Engineering:

1. Design of Flexible Pavement
2. Design of Rigid Pavement
3. Life-Cycle Cost Analysis of Pavements
4. Pavement Management System
5. Transportation Environmental Interaction