

RAJASTHAN TECHNICAL UNIVERSITY
TEACHING SCHEME, B.Tech. [CIVIL ENGINEERING]
SECOND YEAR (3rd SEMESTER)

3CE1A: STRENGTH OF MATERIALS– I (L-3, T-1)

UNIT 1

Simple Stresses and Strains: Concept of stress and strain in three dimensions and generalized Hooke's law; Young's modulus; Tension test of mild steel and other materials: true and apparent stress, ultimate strength, yield stress and permissible stress; Stresses in prismatic & non prismatic members and in composite members; Thermal stresses; Shear stress, Shear strain, Modulus of rigidity, Complementary shear stress; Poisson's ratio, Volumetric strain, Bulk modulus, relation between elastic constants; Stresses in composite members, Compatibility condition

UNIT 2

Compound Stress: Two dimensional stress system: stress resultant, principal planes and principal stresses, state of pure shear maximum shear stress, Mohr's circle & its application.

Moment of Inertia: Polar and product moment of inertia, Principal axes and principal moment of inertia

UNIT 3

Columns: Short and long columns, slenderness ratio, crushing and buckling of column, short column subjected to axial and eccentric loads; Euler's theory and its limitation, concept of effective length of columns; Rankine & Secant formulae.

Membrane Analysis : Stress and strain in thin cylindrical & spherical shells under internal pressures.

UNIT 4

Bending of Beams: Types of supports, support reactions, determinate and indeterminate structures, static stability of plane structures; Bending moment, Shear force and Axial thrust diagrams for statically determinate beams subjected to various types of loads and moments, Point of Contra-flexure, relation between load, SF and BM

UNIT 5

Theory of simple bending: Distribution of bending and shear stresses for simple and composite sections

Suggested Readings:

1. Strength of Material by Singer and Pytel, Harper Collins Publishers.
2. Elements of Strength of Materials by Timoshenko & Young, Mc Graw Hill Book Co.
3. Mechanics of Structures by Timoshenko & Gere, CBS Publishers and Distributors.
4. Mechanics of Structures Vol. I & II by S.B Junarkar, Charotar Publishing House, Anand.
5. Strength of Materials & Mechanics of Structures: Vol. I, II by Dr. B.C. Punmia Laxmi Publications (p) Ltd.

3CE2A: CIVIL ENGINEERING MATERIALS (L-3)

UNIT 1

Stones: Source and types of stones, various standard test on building stones including compressive strength, water absorption, durability, impact value, tensile strength. Identification, Selection criteria and uses of common building stones. Dressing of stones.

UNIT 2

Clay Products : Manufacturing of Bricks. Types and properties of bricks and their determination as per IS code such as water absorption, compressive strength, effloresces, dimension and tolerance test. Types of Tiles, Standard tests for tiles as per IS code such as water absorption, tolerance, impact value, glazing. Fly Ash: Properties, classification, use of fly-ash in manufacturing of bricks & cement.

UNIT 3

Cement & Lime : Raw materials, chemical composition and manufacturing process of cement. Basic compounds (Bouge's compounds) of cement and their role, types of cement. Setting and hardening of cement, physical properties of cement, Various standard tests on Portland cements, as per IS code including consistency, setting time, fineness, soundness and strength.

Lime: Classification as per IS, Manufacturing process, properties, standard tests of lime. Use of lime in construction. Gypsum, properties and use, Plaster of Paris.

UNIT 4

Mortar and Plaster: types of sand, bulking of sand, tests for sand, classification, mortar preparation methods: Functions and tests & their uses in various types pointing & plastering.

Timber & Steel: Definitions of related terms, classifications and properties, defects in wood, conversion of wood, seasoning, preservation, fire proofing, Ply woods, fiber boards,. Steel: properties, types mild steel and HYSD steel and their use, common tests on steel

various types of paints and Varnishes; white wash and distempers and their application.

UNIT 5

Environmental friendly Building material: Concept of embodied energy of materials, energy used in transportation and construction process. Natural material like bamboo, rammed earth, stones, stabilized blocks; supplementary cementitious materials like blast furnace slag, silica fume, rice husk ash,; building materials from agro and industrial wastes.

Miscellaneous: Properties, types and uses of glass, aluminum, Asbestos, G.I., plastics in construction.

Suggested Readings:

1. *Construction Materials: Their nature & Behaviour* by J.M. Illston; E& FN Spon
2. *Building Materials: Products, Properties and Systems* by Ghambir, Tata Mc Graw Hill, Delhi.
3. *Building Materials* by Prabin singh; S.K.Kataria & Sons.
4. *Building Materials* by S. Duggal; New Age International Publishers.
5. *CBRI and BMTPC Publications.*
6. *Materials for Civil and Construction Engineers*, by Michale, S.Mamlouk and Jhon P.Zaniewski, Pearson Noida.

3CE3A: ENGINEERING GEOLOGY (L-3)

UNIT1

General Geology: Branches and Scope of Geology, Internal Structure of the Earth, Types of Weathering & Geological work of natural agencies like River & Wind. Geological Time Scale. Physical Properties of Minerals.

UNIT2

Petrology: Formation, Texture, Structure and Classification of Igneous, Sedimentary and Metamorphic Rocks. Engineering Properties of Rocks for Building & Road Material. Laboratory and Field & in-situ Test for Site Construction.

UNIT3

Structural Geology: Causes, Terminology, Classification, Recognition, Effects and Engineering consideration of Fold, Fault, Joints and Unconformities. Dip & Strike Problems.

UNIT4

Engineering Geology: Geophysical methods as applied to Civil Engineering for Subsurface Analysis (Electrical and Seismic methods). Terminology, Types and Geological consideration for site selection of Dam & Tunnel.

UNIT5

Remote Sensing & GIS: Remote Sensing & GIS System, Nature of Electromagnetic Radiation, Electromagnetic Spectrum, Energy Interactions with Earth's Surface Materials, Remote Sensing Platforms & Sensor's Characteristics. Application, Advantages and Limitations of Remote Sensing and GIS in Various fields of Civil Engineering.

Suggested Readings:

1. Parbin Singh-A Text Book of Engineering & General Geology- S.K.Kataria & sons
2. S.K.Garg- Physical & Engineering Geology- Khanna Publishers
3. N Chenna Kesavulu- A Text book of Engineering Geology- Macmillan India Ltd.
4. M.T.Maruthesha Reddy- A Text book of Applied Engineering Geology- New Age International Publisher
5. Remote Sensing and GIS: B.Bhatta- Oxford Publishers.

3CE4A: CONSTRUCTION TECHNOLOGY (L – 3)

UNIT 1

Building Requirements & Construction System: Building components, their functions and requirements, types of construction, load bearing construction and framed structure construction. Lift slab construction. Prefabricated/precast construction; advantages & disadvantage of prefabrication.

Temporary structures: Types & methods of shoring, underpinning and scaffolding.

Foundation & Site Preparation: Purpose, types of foundation, depth of foundation, Sequence of construction activity and co-ordination, site clearance, marking, foundation plan,

Brick and Stone Masonry : Basic principle of sound masonry work, different types of bonds, relative merits and demerits of English, single Flemish and double Flemish bond. Comparison between stone and brick masonry. General principles, classification of stone masonry

UNIT 2

Damp Proofing: Causes of dampness, effects of dampness methods and material for damp proofing DPC treatment in buildings, methods and materials for anti termite treatment.

Joints : Requirements, types and material used, construction details. Grouting of Joints of Precast reinforced Concrete Structures.

Arches and Lintels : Terms used, types of arches and their construction detail, types of lintels and constructions. thin precast RCC lintels in Brick walls.

Partition Wall : Types, purpose and use of partition wall.

Stairs : Terms used, requirements of good staircase, classification, construction details and suitability of different types of stairs, lifts and ramps.

UNIT 3

Fabrication and Erection Work : Fabrication of Structural steel at slopes and sites, Handling and transportation of units to be erected, Erection of Fabricated steel structures, Prefabricated/precast construction; relative advantages & disadvantage and various precast units & Erection of Precast reinforced Concrete Structures.

Ground & Upper floors : Floor components and their junctions, selection of flooring and floor types, construction details of ground and upper floors, merits and demerits

Roof and Roof Covering : Purposes, classification of roofs, terms used, types of pitched roofs, trussed roofs specially king port, queen port, steel roof trusses, details of steel roof trusses, method of construction, roof covering materials for pitched roofs. Thin R.C. ribbed slab for floors & roofs. Precast R.C. plank flooring/roofing.

UNIT 4: Advance Construction Equipments

Different types of construction equipments viz. Earth moving equipments & their outputs, Dewatering equipments, Pumping equipments, Grouting equipments, Pile Driving equipments, Compaction equipments, Concreting equipments.

UNIT 5: Equipment Management in Construction Projects

Forecasting equipment requirements, Output and capacity of equipments, Selection of equipments, Spare-parts management, Owning Costs-investment costs, depreciation, major repair cost, Operation Cost & Its types. Investment Cost, Cost of Repairs, Overheads Cost accounting, Break-even point theory, Replacement of equipment. Maintenance management-types of maintenance, breakdown maintenance, preventive maintenance & its functions.

Reference Books:

1. *Construction Technology* by Subir K. Sarkar & Subhajit Saraswati, Oxford University Press
2. *Building Construction* by Bindra & Arora; Dahnpat Rai & Sons.
3. *Construction Equipments & Management* by R.L. Purifoy, Tata Mc Graw Hill.
4. *Construction Equipments* by Mahesh Verma, Metropolitan Book Co.
5. *Construction Equipments and its Management* by S.C.Sharma, Prentice Hall of India (PHI).

3CE5A: FLUID MECHANICS (L-3 T-1)

UNIT 1

Fluids: Definition, Ideal fluids, real fluids, Newtonian and non-Newtonian fluids.

Properties of Fluids: Units of measurement, Mass density, Specific weight, Specific volume, Specific Gravity, Viscosity, Surface tension and Capillarity, Compressibility and Elasticity.

UNIT 2

Hydrostatics : Pressure at a point in a static fluid; pressure variation in an incompressible static fluid; atmospheric pressure, Gauge pressure, vacuum pressure, absolute pressure, Manometers Bourdon pressure gauge.

Buoyancy: Forces acting on immersed plane surface. Centre of pressure, forces on curved surfaces. Conditions of equilibrium for floating bodies, meta-centre and met centric height experimental and analytical determination of met centric height.

UNIT 3

Equilibrium of Fluid particles and flow: Fluid mass subjected to horizontal and vertical acceleration and uniform rotation.

Hydro-kinematics : Types of Flows : Steady and unsteady, uniform and non-uniform, stream lines, path lines, stream tubes, principles of conservation of mass, equation of continuity, acceleration of fluid particles local and connective, Rotational and irrotational motions, free and forced vortex, circulation and voracity velocity potential and stream function, elementary treatment of flow net. Euler's equations of motion and integration of Euler's equations, Bernoulli's equation for incompressible Fluids, assumptions in Bernoulli's equation, Energy correction factor.

UNIT 4

Applications of Bernoulli's equation : Pitot tube, Venturimeter, orifice meter, orifices & mouth pieces, time of emptying of tanks by orifices, sharp edged rectangular, triangular and trapezoidal notches, Francis formula. Velocity of approach. End contractions Cippoletti Weir, time of emptying reservoirs by weirs.

Momentum Equation and its Application : Development of momentum equation by control volume concept, Momentum correction factor, applications – Borda's mouth pieces, sudden enlargement of flow, pressure on flat plates, Nozzles.

UNIT 5

Flow Through Pipes : Laminar flow, Reynolds experiment, transition from laminar to turbulent flow. Turbulent Flow : Laws of fluid friction, friction factor Moodys diagram, loss of head due to friction and other causes. Hydraulic gradient, total energy line Chezy's, Darcy's and Manning's formula, flow through parallel pipes and pipes in series, flow through branched pipes. Flow along a by pass. Power transmission through pipe, condition for maximum power. Elementary water hammer concept.

Suggested Readings:

1-Fluid Mechanics by Dr. K.R. Arora, Standard Publishers and Distributers, Delhi.

2- Fluid Mechanics by Dr. R.K. Bansal, Laxmi Publication (P) Ltd.

3- Fluid Mechanics by Modi & Seth, Standard Publishers, Delhi.

4.Fluid Mechanics by H.M.Raghunath, CBS Publishers and Distributers.

5. Fluid Mechanics & Machinery by C.S.P.Ojha, R.Berndtsson and P.N.Chandramauli, Oxford Publishers, Delhi.

3CE6A : ADVANCED ENGINEERING MATHEMATICS (L-3)

UNIT 1

Fourier Series & Z Transform – Expansion of simple functions in fourier series. Half range series, Change of intervals, Harmonic analysis. Introduction, Properties, Inverse Z Transform .

UNIT 2

Laplace Transform - Laplace transform with its simple properties. Unit step function, Dirac delta function their Laplace transforms, Inverse Laplace, transform – convolution theorem, applications to the solution of ordinary and partial differential equations having constant coefficients with special reference to wave and diffusion equations.

UNIT 3

Fourier Transform - Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant co-efficient with special reference to heat equation and wave equation.

UNIT 4

Numerical Analysis: Difference operation Forward backward and central, shift and average operators and relation between them. Newton’s forward and backward differences interpolation formulae. Sterling’s formulae, Lagrange’s interpolation formula. Numerical differentiation and integration. Trapezoidal rule, Simpson's one third and one eighth rule.

UNIT 5

Numerical integration: Numerical integration of ordinary differential equations of first order, Picards method, Euler's method & Modified Euler's Method, Mille's method and Ranga Kutta fourth order method.

Suggested Readings:

- 1.Engineering Maths Vol-I by Chandrika Prasad, Standard Publishers and Distributers.
Vol-II by Chandrika Prasad, Standard Publishers and Distributers.
- 2.Higher Engineering Maths by Gaur & Kaul, Jaipur Publishing House.

Typical list of experiments for III Semester Labs

3CE7A: CIVIL ENGINEERING MATERIAL LAB (P-2)

1. Identification of Materials by Visual Inspection
2. To determine Normal Consistency, Initial & Final setting time, Specific Gravity, fineness & compressive strength of Cement (IS: 269-1967)
3. To Study the Utilization of Fly Ash
4. To Study the Procedure for Testing of Stone
5. To Study the Fiber Reinforced Concrete
6. To Study the Properties and Use Of Different Glasses
7. To Study the Different Aluminum and Steel Sections
8. To Study the Manufacture and Use of Concrete Hollow Blocks
9. To Determine Compressive and Tensile Strength of Timber Parallel and Perpendicular to Grain
10. To Study the Properties and Uses of Kota Stone
11. To determine the Water Absorption and Tolerance Limit of Bricks

3CE8A : ENGINEERING GEOLOGY LAB (P-2)

1. Physical Properties of Minerals
2. Physical Properties of Rocks
3. Identification of Minerals in Hand Specimen
4. Identification of Rocks in Hand Specimen
5. Identification of Geological features through wooden Models
 - a) Structural Geological Diagrams
 - b) Petrological Diagrams
 - c) Engineering Geological Diagrams
6. Interpretation of Geological Map (10 Nos.)
7. Dip & Strike Problems (8 Nos.)

3CE9A: BUILDING DRAWING- I (P-3)

Building Components –

1. Drawing of walls
 - i. Brick and Stone masonry
 - ii. Partition wall, cavity wall and cross section of external wall
2. Pointing, Arches, Lintels and Floors
3. Doors and Windows

4. Stairs, cross section of Dog legged stairs
5. Roofs: Flat and Inclined (Steel)
6. Foundations for Masonry Structures and Framed Structures, Provision of Damp Proof

Course

Building Planning –

1. Development of Front Elevation and Sectional Elevation from a given plan
2. Development of Plan, Front Elevation and Sectional Elevation from line diagram

3CE10A: FLUID MECHANICS LAB. (P-2)

1. To verify the Bernoulli's theorem.
2. To calibrate the Venturimeter.
3. To calibrate the Orificemeter.
4. To determine Metacentric Height.
5. To determine C_c , C_v , C_d of an orifice.
6. To determine C_d of a mouthpiece.
7. To determine C_d of a V-notch.
8. To determine viscosity of a given fluid.
9. Bye Pass.

3CE11A: PROFESSIONAL ETHICS AND DISASTER MANAGEMENT (P-3)

Refer to to syllabus common to all branches.

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SECOND YEAR

4CE1A : STRENGTH OF MATERIALS–II (L-3 T-1)

UNIT 1

Deflection of Beams : Differential relation between load, shear force, bending moment, slope deflection. Slope & deflection in determinate beams using double integration method, Macaulay's method, area moment method and conjugate beam method.

UNIT 2

Analysis of prop cantilever structures, Analysis of Indeterminate Structure using Area moment method, Conjugate beam method Combined direct and bending stress, middle third rule, core of a section, gravity retaining wall

UNIT 3

Fixed Beams & Continuous Beams: Analysis of fixed beams & continuous beams by three moments Theorem and Area moment method.

UNIT 4

Torsion: Elementary concepts of torsion, shear stress in solid and hollow circular shafts, angle of twist, power transmitted by a shaft, combined bending and torsion;

Springs: Stiffness of springs, springs in series and parallel, laminated plate springs, leaf spring, close coiled helical springs, open coiled springs.

UNIT 5

Vibrations: Elementary concepts of structural vibration, Mathematical models, basic elements of vibratory system. Degree of freedom. Equivalent Spring stiffness of springs in parallel and in series.

Simple Harmonic Motion: vector representation, characteristic, addition of harmonic motions, Angular oscillation.

Undamped free vibration of SDOF system: Newton's law of motion, D'Alembert's principle, deriving equation of motions, solution of differential equation of motion, frequency & period of vibration, amplitude of motion; Introduction to damped and forced vibration.

Suggested Readings:

- 1.Strength of Material by Singer and Pytel, Harper Collins Publishers.
- 2.Elements of Strength of Materials by Timoshenko & Young, Mc Graw Hill Book Co.
- 3.Mechanics of Structures by Timoshenko & Gere, CBS Publishers and Distributers.
- 4.Mechanics of Structures Vol. I & II by S.B Junarkar, Charotar Publishing House.
- 5.Strength of Materials & Mechanics of Structures: Vol. I by Dr. B.C. Punmia Laxmi Publications (P) Ltd.

4CE2A: CONCRETE TECHNOLOGY (L-3)

UNIT 1

Ingredients of concrete : Cement: hydration of cement and its basic compounds, structure of hydrated cement, C-S-H gel, heat of hydration, gel-space ratio and its significance. **Aggregates:** types, physical properties and standard methods for their determination.

Concrete : Grade of concrete, proportioning of ingredients, water content and its quality for concrete, water/cement ratio and its role, Properties of fresh concrete including workability, air content, Flow ability, Segregation, Bleeding and Viscosity etc. - Factors affecting, methods of determination.

UNIT 2:

Properties of hardened concrete such as strengths, permeability, creep, shrinkage, factors influencing, Standard tests on fresh and hardened concrete as per IS code. Aggregate- cement interface, maturity concept.

NDT: Introduction and their importance. Application & use of Rebound Hammer, Ultra-sonic pulse velocity meter, Rebar & Cover meter, half cell potential meter, corrosion resistivity meter, core sampling.

UNIT 3

Concrete Handling in Field : Batching, mixing, placing and transportation of concrete, equipments for material handling, various methods their suitability and precautions. Compaction of concrete: methods & equipments. Curing of concrete: various methods their suitability. Durability of concrete.

UNIT 4

Concrete mix design (ACI, IS method), quality control for concrete.

Admixture in concrete : Chemical and mineral admixtures, their types and uses: water reducers, accelerator, retarders, water-proofing plasticizers, super plasticizers, air-entraining agents. Use of fly ash and silica fume in concrete, their properties and effect.

UNIT 5

Form work: Requirements, their types and codal guidelines for the design. Typical formworks and shuttering/centering for Columns, beams, slabs, walls, arches and staircase. Slip and moving formwork.

Special types of concrete: Introduction to high strength concrete, high performance concrete, sulphate resisting concrete, under water concreting, self compacting concrete, pumpable concrete: their salient properties and application.

Suggested Readings:

1. Concrete Technology by Neville & Brooks, Pearson Education.
2. Concrete: Microstructure, Properties & Materials by Mehta P.K, Tata Mc Graw Hill.
3. Concrete Technology by M.S.Shetty, S.Chand & Co.
4. Concrete materials by Popovics, Standard Publishers.
5. Chemistry of Cement and Concrete by Peter C.Hewlett, Elsevier Butterworth Heinemann.

4CE3A: HYDRAULICS AND HYDRAULIC MACHINES (L – 3)

UNIT 1

Dimensional Analysis & Models : Dynamical Similarity and Dimensional Homogeneity Model experiment, geometric, Kinematic and Dynamic similarity. Reynold's, froudes, Weber's, Euler and Mach numbers. Distorted river models and undistorted models, proper choice of scale ratios. Scale effect. Principle of dimensional analysis Rayleigh method, Buckingham theorem, applications of dimensional analysis to pipe Friction problems, resistance to motion of partially and fully submerged bodies and other simple problems. Ship model experiments.

UNIT 2

Laminar Flow : Relation between shear & pressure gradient. Flow between plates & pipes. Equations for velocity distribution, pressure difference.

Turbulent Flow in pipes : Theories of Turbulence, Nikuradse's Experiments. Hydro dynamically smooth & rough boundaries. Laminar, Sub layer, Equations of velocity distribution and friction coefficient. Stanton Diagram, Moody's diagram.

UNIT 3

Flow through channels : Uniform, Non-Uniform and variable flow. Resistance equations of Chezy, Manning and Bazin. Section factor for uniform flow. Most Efficient rectangular, triangular and trapezoidal sections. Equations of gradually varied flow in Prismatic channels. Limitation of its applicability and assumption made in its derivation. Specific energy of flow. Critical depth in prismatic channels. Alternate depths. Rapid, critical and sub critical Flow Mild, steep and Critical Slopes. Classification of surface curves in prismatic channels and elementary computation

UNIT 4

Rapidly varied flow: Hydraulic jump or standing wave in rectangular channels. Conjugate or sequent depths Losses in jump, location of jump. Broad crested weirs for channel flow: Measurement, velocity distribution in open channels, parshall flume.

Impact of free Jets : Impact of a jet on a flat or a curved vane, moving and stationary vane, flow over radial vanes.

UNIT 5

Centrifugal pumps and turbines : Volute and whirlpool chambers, Losses of head due to variation of discharge Manometric and Hydraulic efficiencies, Description of single and multistage pumps. Specific speed, characteristic curves. Model Test. Reaction and Impulse turbines, specific speed,

Mixed flow turbines. Pelton wheel turbine, Francis turbine, propeller turbine and Kaplan turbine Efficiency, Characteristics of turbines. Basic principles of governing of turbines, Draft-tube, Selection of turbines, model tests.

Suggested Readings:

1. Fluid Mechanics & Hydraulics by John F.Douglas & Lynne B. Jack, Prentice Hall Inc.
2. Fluid Mechanics & Hydraulics by Dr. K.R, Arora, Standard Publishers & Distributers, Delhi.
3. Fluid Mechanics & Hydraulics by Dr. R.K. Bansal, Laxmi Publications (P) Ltd.
4. Fluid Mechanics & Hydraulics by Modi & Seth, Standard Publishers & Distributers, Delhi.
5. Fluid Mechanics & Machinery by C.S.P.Ojha, R.Berndtsson and P.N.Chandramauli, Oxford Publishers, Delhi.

4CE4A: SURVEYING – I (L-3)

UNIT 1

Introduction :Importance of surveying to engineers, Plane and geodetic surveying, methods of location of points, principle of surveying from whole to part, conventional signs.

Measurement of Distances : Different types of chains, tapes and their uses. Sources of error and precautions, corrections to tape measurements. Field problems in distance measurement. Advance techniques of distance measurements.

UNIT 2

Measurement of Angles & Direction : Different types of direction measuring instruments and their uses. Reference meridians, Bearing and azimuths, magnetic declination and its variation. Use and adjustment of surveyors and prismatic compass. Vernier and micro-optic theodolite, temporary and permanent adjustment of vernier theodolite. Measurement of horizontal and vertical angle by different methods. Application of theodolite in field problems.

UNIT 3

Traversing : Different methods of traversing; chain traverse, chain & compass traverse, transit-tape traverse. Methods of computations and adjustment of traverse; transit rule, Bowditch rule, graphical method, axis method. Gales traverse table.

UNIT 4

Leveling : Definitions of various terms in leveling. Different types of leveling, sources of errors in leveling curvature and refraction corrections. Temporary and permanent adjustment of dumpy and tilting levels. Computation and adjustment of levels. Profile leveling; L-Section and cross-sections.

UNIT 5

Plane Table Surveying : Elements of plane table survey working operations, methods of plane table survey; intersection, traversing and resection, two point and three point problems.

Contouring : Characteristics of contours, contour interval, contour gradient, Methods of locating contours, uses of contour maps.

Reference Books:

- 1.Plane Surveying by Dr. A.M. Chandra, New Age International.
- 2- Surveying Volume I by Dr. B.C. Punamia Laxmi Publications (P) Ltd.
- 3- Surveying Volume –I & II by Dr. K.R. Arora Standard Book House Delhi
- 4- Surveying & Leveling by Subramanian Oxford University Press.
- 5.Surveying Vol.1 by S.K.Duggal Tata Mc Graw Hill,Delhi.

4CE5A: BUILDING PLANNING (L-3)

UNIT 1

Introduction: Types of buildings, Classification of buildings by occupancy, Multi storey building, criteria for location and site selection, site plan and its detail.

Sun Consideration : Different methods of drawing sun chart, sun shading devices, design of louvers, energy conservation in buildings, passive solar cooling and heating of buildings.

UNIT 2

Climatic and comfort Consideration: Elements of climate, global climate, climatic zones of India, comfort conditions, bi-climatic chart, climate modulating devices.

Orientation: Meaning, factors affecting orientation, orientation criteria for tropical climate.

Building Bye Laws and NBC Regulations: Objective of by-laws, Regulation regarding; means of access, lines of building frontages, covered area, floor area ratio, open spaces around buildings, height & sizes of rooms, plinth regulation and sanitation provisions.

UNIT 3

Principles of Planning: Different factors affecting planning viz-aspect, prospect, furniture requirement, roominess, grouping, circulation, elegance, privacy etc.

Vastu Shastra In Modern Building planning: Factors considered in Vastu, site selection, orientation, planning and design of residential buildings, office buildings.

UNIT 4

Functional design and Accommodation requirements of

(A) **Residential Buildings:** Anthropometry, activities and their spatial requirements; Area planning, living area, sleeping area, service area; Bubble diagram showing sequence of arrangement of area, plan, elevation, sectional elevation.

(B) **Non Residential Buildings:** viz-school buildings, rest house, primary health centers, post office, bank, College library, cinema theatres etc.

UNIT 5

Services in Buildings

(A) Lighting and ventilation, doors and windows, lifts.

(B) Acoustics, sound insulation and noise control.

(C) Fire fighting provisions.

Suggested Readings:

1- Manual of Tropical Housing and Buildings by Koenigs Berger Orient and Longman.

2- Building Drawing by M.G.Shah, C.M. Kala, S.Y.Patki , Tata Mc Graw Hills.

3.SP.41 (S&T)- Handbook on functional Requirements of Buildings Part-I

4. National Building Code, BIS.

5. Architecture Drafting and Design by Donald E. Helper, & Paul I Wallach.

6. Time Saver Standards for Housing and Residential Development by DE Chiara, Tata Mc Graw Hill, Delhi.

4CE6A: QUANTITY SURVEYING & VALUATION (L- 3)

Unit: 1

Introduction: Purpose and importance of estimates, principles of estimating. Methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet; bill of quantities. Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.

Unit: 2

Rate Analysis: Task for average artisan, various factors involved in the rate of an item, material and labor requirement for various trades; preparation for rates of important items of work. Current schedule of rates. (C.S.R.)

Unit: 3

Estimates: Preparing detailed estimates of various types of buildings, R.C.C. works, earth work calculations for roads and estimating of culverts, Services for building such as water supply, drainage and electrification.

Unit: 4

Cost of Works: Factors affecting cost of work, overhead charges, Contingencies and work charge establishment, various percentages for different services in building.

Unit: 5

Valuation: Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate interest, methods of valuation, rent fixation of buildings.

Suggested Readings:

- 1- Estimating & costing by B.N.Dutta, UBS Publishers & Distributers.
- 2- Estimating Costing Specification & Valuation in Civil Engg. M .Chakroborty, Bhakti Vedanta, Book Trust, delhi.
- 3.Quantity Surveying and Valuation by S.C. Rangawala , Charotar Publishing House.

Typical List of Experiments for Labs of IV Semester

4CE7A: CONCRETE TECHNOLOGY LAB. (P-3)

1. To determine the fineness of Cement by sieving through a 90 micron I.S. Sieve.
2. To determine the flexural strength of Concrete.
3. To determine Soundness of cement by Le-chatelier apparatus.
4. To determine the specific gravity of fine aggregate (sand) by Pycnometer.
5. To determine the bulking of fine aggregate and to draw curve between water content and bulking.
6. To determine the fineness modulus of coarse aggregates and fine aggregates by sieve analysis.
7. To determine the workability of given concrete mix by slump test.
8. To determine the workability of given fresh concrete mix by compaction factor test.
9. To determine the optimum dose of super plastisizers by Flow table test.
10. To design concrete mix of M-20 grade without admixture in accordance with I S recommendations.
11. To design concrete mix of M-40 grade with admixture in accordance with I S recommendations.
12. To determine the Elstic Modulus of Concrete.
13. To determine the Permeability of Conerte.
14. NDT

4CE8A: HYDRAULICS LAB. (P-2)

1. To determine the minor losses.
2. To determine the friction factor.
3. To determine C_d of Broad crested wier.
4. To verify the momentum equation.
5. To determine the discharge of venturimeter.
6. To determine Manning's & Chezy's coefficient of roughness for the bed of a given flume.
7. To plot characteristics curve of hydraulic jump.
8. To plot characteristics curve of Pelton Wheel.
9. To plot characteristics curve of Centrifugal Pump.

4CE9A : SURVEYING LAB. I (P-3)

1. Ranging and Fixing of Survey Station.
2. Plotting Building Block by offset with the help of cross staff.
3. To determine the magnetic bearing of a line
 - a. Using surveyor's compass
 - b. Using prismatic compass
4. Measurement and adjustment of included angles of traverse using prismatic compass.

5. To determine the reduced levels using Tilting Level/Automatic Level.
6. To determine the reduce levels in closed circuit using Dumpy Level.
7. To carry out profile leveling and plot longitudinal and cross sections for road.
8. To carryout temporary adjustment of Theodolite & Measurement of horizontal angle.
 - a. By method of repetition.
 - b. By method of Reiteration.
10. To determine the tachometric constant.
11. To determine the horizontal and vertical distance by tachometric survey.
12. To study the various minor instruments.

4CE10A: BUILDING DRAWING- II (P-3)

1- To plan and draw working drawing of a Residential building with following detail.

- (a) Site plan
 - (b) Foundation plan
 - (c) Plan
 - (d) Two sectional elevations
 - (e) Front elevation
 - (f) Furniture plan
 - (g) Water supply and sanitary plan
 - (h) Electric fitting plan
- 2- To design and draw a Primary Health Center
- 3- To design and draw a Primary School
- 4- To design and draw a Rest House
- 5- To design and draw a Post Office
- 6- To design and draw a Bank
- 7- To design and draw a College Library
- 8- To design and draw a Cinema Theatre

4CE11A : MATERIAL TESTING LAB. (P-2)

1. Tensile Strength Test – Mild Steel and HYSD bar
2. Compressive Strength Test – Mild Steel and Cast Iron
3. Compressive Strength Test – Cement Cubes and Concrete Cubes
4. Compressive Strength Test – Bricks
5. Compressive Strength Test – Wooden Blocks
6. Hardness Test – Rockwell Hardness and Brinell Hardness

7. Impact Test – Izod and Charpy
8. Modulus of Rupture of Wooden Beam
9. Fatigue Test
10. Spring Test
11. Torsion Test

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5CE1A THEORY OF STRUCTURES –I (L-3, T-1)

UNIT: 1

Introduction to Indeterminate structures, Degrees of freedom per node, Static and Kinematic indeterminacy (i.e. for beams, frames & portal with & without sway etc.), Releases in structures, Maxwell's reciprocal theorem and Betti's theorem, Analysis of Statically Indeterminate Structures using Slope-deflection method.

UNIT: 2

Analysis of structures using Moment-distribution method applied to continuous beams and portal frames with and without inclined members

UNIT: 3

Unit load method & their applications: deflection of determinate beams and frames, analysis of determinate and redundant frames up to two degree of redundancy, lack of fit in redundant frames.

Introduction to Energy Methods : Strain energy for gradually applied, suddenly applied and impact loads, Strain energy due to axial loads, bending, shear and torsion; Castiglione's theorems & their applications in analysis of determinate and redundant frames up to two degree of redundancy and trussed beams; Stresses due to temperature & lack of fit in redundant frames; deflection of determinate beams, frames using energy methods

UNIT: 4

Column Analogy method for indeterminate structures, determination of carry over factor for non-prismatic section.

Kani's Method: Analysis of beams and frames with & without sway by Kani's method.

UNIT: 5

Approximate methods for lateral loads: Analysis of multistory frames by portal method, cantilever method & factor method.

Analysis of determinate space trusses by tension coefficient method.

Suggested Readings:

1. Advanced Structural Analysis by Dr. A.K. Jain, Nem Cahnd and Brothers, Roorkee.
- 2- Mechanics of Structures by Timoshenko & Young, Mc Graw Hill Book Co.
- 3- Mechanics of Structures Vol.-I by Junarkar & Shah, Charotar Publishing House.
- 4- Theory of Structures by Jangid & Negi, Tata Mc Graw Hill.
- 5- Structural Analysis by Ghali & Neville, E&FN,Spon.
- 6.Strength of Materials & Mechanics of Structures: Vol. I by Dr. B.C. Punmia Laxmi Publications (P) Ltd.
- 7.**Structural Analysis by Hibbler R.C., Pearsons**

5CE2A: ENVIRONMENTAL ENGINEERING-I (L- 3)

UNIT: 1

General: Environment and its components, Importance of water, Role of an Environmental Engineer, Historical overview.

Water Demand: Design flow, design periods, design population, factors affecting water consumption, variation in water demand, design capacities for various water supply components.

UNIT: 2

Source of water and collection works: Alternative sources i.e. rain, surface and ground water, Assessment of yield and development of the source.

Quality of water: The hydrological cycle and water quality, physical, chemical and biological water quality parameters, water quality requirements, Indian Standards.

UNIT: 3

Transmission of water: Hydraulics of conduits, selection of pipe materials, pipe joints, pumps, pumps station.

Preliminary Treatment of Water: Historical overview of water treatment, water treatment processes (theory and application): aeration, solids separation, settling operations, coagulation, softening,

UNIT: 4

Advanced Treatment of Water: filtration, disinfection, other treatment processes, dissolved solids removal, treatment plant design, preparation of hydraulic profiles.

UNIT: 5

Distribution of water: Method of distributing water, distribution reservoirs, distribution system, distribution system components, capacity and pressure requirements, design of distribution systems, hydraulic analysis of distribution systems, pumping required for water supply system.

Plumbing of Building for water supply: Service connections, fixture units, simultaneous flow, design of plumbing system.

Suggested Readings:

- 1- Water Supply by S.K. Garg, Khanna Publishing Co.
2. Environmental Engineering by Peavy, H.S., Rowe D.R. and Techobanoglous, Mc Graw Hill, Book Company.
- 3 Manual of Water Supply and Water Treatment, Ministry of Urban Development, Govt.of India.

5CE3A: GEOTECHNICAL ENGINEERING – I (L-3, T-1)

Unit 1

Soil and soil-mass constituents, water content, specific gravity, void ratio, porosity, degree of saturation, air void and air content, unit weights, density index etc. Inter-relationships of the above. Determination of index properties of soil: water content, specific gravity, particle size distribution, sieve and sedimentation analysis, consistency limits, void ratio and density index. Classification of soil for general engineering purposes: particle size, textural, H.R.B. Unified and I.S. Classification systems.

Unit 2

Clay mineralogy: Soil structure; single grained, honeycombed, flocculent, and dispersed, structure of composite soils, clay structure; basic structure, mineral structures, structures of Illite Montmorillonite and kaolinite and their characteristics. Soil water absorbed, capillary and free water, Darcy's law of permeability of soil and its determination in laboratory. Field pumping out tests, factors affecting permeability, permeability of stratified soil masses.

Unit 3

Stresses in soil mass: total, effective and neutral pressure, calculation of stresses, influence of water table on effective stress, quicksand phenomenon. Seepage and Seepage Pressure, Laplace's equation for seepage. Flow net and its construction. Uplift pressure, piping, principle of drainage by electro Osmosis, phreatic line, Flow net through earth dam.

Unit 4

Mohr's circle of stress, shearing strength of soil, parameters of shear strength, Coulomb's failure envelope, determination of shear parameters by Direct Shear Box. Triaxial and unconfined compression test apparatuses. Typical stress-strain curves for soils. Typical failure envelopes for cohesion less soils and normally consolidated clay soils.

Unit 5

Principles of soil compaction, laboratory compaction tests; Proctor's test Modified Proctor tests, Measurement of field compaction, field methods of compaction and its control, dry and wet of optimum, factors affecting compaction, compaction equipments. Soil stabilization, Mechanical Stabilization. Stabilization with cement, lime and bitumen.

Suggested Readings:

- 1- Basic and applied Civil Mechanics by Rajan & Rao, New Age International Publishers.
- 2- Soil Mechanics & Foundation Engineering by Arora K.R, Standard Publishers and Distributers, Delhi.
- 3- Soil Engineering in Theory & Practice by Alam Singh, CBS Publishers and Distributers, Delhi.
4. Geotechnical Engineering—Principles and Practices, Coduto PHI Publisheres.
5. Principles of Geotechnical Engineering by Braja M. Das, CENAGE Learning New Delhi.

5CE4A : SURVEYING – II (L-3)

UNIT: 1

Trigonometric Leveling: Trigonometric leveling, Objects accessible and non accessible, Determination of levels object- when two instrument positions in same and different vertical planes. Curvature, Refraction and Axis Signal corrections, Determination of difference in elevations of points by trigonometric leveling by single observation method (angle of elevation, angle of depression), reciprocal method.

UNIT: 2

Curve Surveying: Elements of circular (Simple, compound and reverse) curves, transition curves, degrees of curve, Linear and angular Methods of setting out circular and transition curves.

UNIT: 3

Triangulation: Merits and demerits of traversing, triangulation and trilateration. Grades of triangulation, Strength of figure, field procedure of triangulation. Reconnaissance and selection of triangulation stations. Indivisibility of stations and calculation of the heights of towers. Equipment needed for base line measurement, corrections to base line. Satellite station and base line extension.

UNIT: 4

Errors in Surveying: Classification of errors in surveying. The probability curve, its equation and properties, theory of least squares, weight, most probable value, probable errors, standard errors. Normal equation correlates.

Adjustment of Triangulation Figures: Adjustment of levels. Adjustment of triangulations figures, Braced quadrilateral Triangle with central, station. Approximate and method of least squares for figure adjustment, Trilateration.

UNIT: 5

Field Astronomy: Definitions of terminology used in Astronomy, Co-ordinate Systems.

Relationships between different Co-ordinate systems. Astronomical Triangle, Napier's Rule. Different methods of determination of Azimuth. Electronic distance measurement and use of Total station.

Suggested Readings:

- 1-Surveying – Vol. I & II by K.R. Arora Satandard Book House, Delhi.
- 2- Surveying Vol. 2 & 3 by B C Punmia Laxmi Publications, Delhi.
- 3- Advance Surveying by Sathees Kumar, R.Sathis Kumar , N. Madhu, Pearson Education
- 4.Plane and Geodetic Surveying Vol.I &II, BY David Clark, CBS Publishers and Distributers.
5. Surveying Vol.2 by S.K.Duggal, Tata Mc Graw Hill, Delhi.
6. Advance Surveying by A.M.Chandra, New Age Inetrnational, Delhi.

5CE5A : BUILDING DESIGN (L -3)

UNIT 1

Design Loads: Design loads for different types of buildings. (IS-875 part 1 & 2). Load distribution & concept of load flow to different structural components.

Structural Systems: Assumption of integrity aspect ratios & over turning resistance, strength & stiffness of buildings, symmetry and Asymmetry in building forms, Vertical and lateral load resting elements, shear walls, framed tubes and various multistory configurations..

UNIT 2

Lateral loads: Wind loads & calculation of wind load on structures (IS: 875-Part 3).

UNIT 3

Lateral loads: Earthquake loads & calculations of earthquake loads on buildings masonry & framed structures. (IS: 1893 – Part 1).

UNIT 4

Masonry and Framed Buildings: Design of masonry buildings and framed buildings, Earthquake resistant construction of buildings, and various provisions as per IS codes; IS-4326, IS-13827, IS-13828, IS-13920, IS-13935.

UNIT 5

Mass Housing: Prefabricated construction for mass housing.

Special Roofs: Introduction to folded plates, cylindrical shells, north-light shell roofs, grid and ribbed floors.

Suggested Readings:

IS : 875, Part I, II & III

IS : 1893

IS : 4326

IS : 13920

5CE6.1A : GROUND IMPROVEMENT TECHNIQUES (L-3)

Unit 1

Introduction: Formation of soil, major soil types, collapsible soil, expansive soil, reclaimed soil, sanitary land fill, ground improvements; objective, potential.

General principles of compaction: Mechanics, field procedure, quality control in field.

Unit 2

Ground Improvement in Granular soil: In-place densification by (a) Vibro floatation (b) Compaction piles in sand(c) Vibro compaction piles (d)Dynamic compaction (e) Blasting

Unit 3

Ground improvement in cohesive soil: Preloading with or without vertical drains. Compressibility vertical and radial consolidation, Rate of consolidation, Preloading methods. Types of drains, Design of vertical drains, Construction techniques.

Stone column: Function, Design principles, load carrying capacity, construction techniques, settlement of stone column foundation.

Unit 4

Ground Improvement by Grouting & Soil Reinforcement : Grouting in soil: Types of grout, desirable characteristics, Grouting pressure, Grouting methods.

Soil Reinforcement – Mechanism, Types of reinforcing elements, Reinforcement- Soil interaction, Reinforced soil application beneath roads, foundation and retaining walls.

Unit 5

Soil Stabilization:

Lime Stabilization – Base Exchange mechanism, Pozzolonic reaction, lime-soil interaction, lime columns, Design of foundation on lime column.

Cement stabilization-Mechanism, amount, Age and curing.

Fly ash-Lime stabilization

Soil bitumen stabilization

Suggested Readings:

- 1- Ground Improvement Techniques by Purushottam Raj, Tata Mc Graw Hills, Delhi.
- 2-Text book of Geostatic Engineering by Gulhati & Dutta, Tata Mc Graw Hills, Delhi.
- 3- Principles of Foundation Engg by B.M. Das, Thomson, Books/Cole.
- 4- Foundation Design Manual By N.V Nayak, Dhanpat Rai and Sons.
- 5- Soil Engineering in Theory and Practice Vol. III by Alam Singh CBS Publishers

5 CE 6.2A: ADVANCED CONCRETE TECHNOLOGY (L- 3)

UNIT: 1

Concrete Production: Difference in mix proportioning for vibrator compacted concrete, pumpable and roller compacted concrete. Considerations in a plant operations in ready mixed concrete (RMC). Different types of mixers, transportation systems and pumps in RMC.

Rheology of Concrete: Flow ability, Segregation, Bleeding and Viscosity etc. - Factors affecting, related standards including slump flow test, v funnel test, U box test, J Ring test, Stability test, L Box test, rheometer test etc.

UNIT 2

Mineral and Chemical admixtures in Concrete:

Chemical: Applications of accelerators, importance of chloride free admixtures, Typical dosages and applications, Case studies of use in tunnels.

Application of Retarders, particularly in RMC applications.

High range water reducing admixtures: Naphthalene and melamine based, PCE based. Principle of working. Application procedure, Shelf life, Outline of different commercial types available in Indian market (more than 10).

Mineral : Flyash : Basic properties, IS 3812 specifications for use in cement and concrete. Properties of typical flyashes available in the country. Graded flyash, Pozzocrete and its applications.

Ground Granulated Blast Furnace Slag (GGBFS): Basic properties, Indian standards, Applications.

Ultra fine powders: Micro Silica, Metakaolin, Limestone, Calcium carbonate powders etc: Basic properties, role in cement concrete and applications.

UNIT: 3

Strength of Concrete: Strength- porosity relationship, factors affecting compressive strength, behaviour of concrete under uniaxial, biaxial and triaxial stress states, Split Tensile strength and modulus of rupture -test methods and empirical formulae for their estimation as per ACI manual of concrete practice and Indian standards.

Elasticity, Creep and Shrinkage of Concrete: Elastic behaviour, Method of determination of Elastic modulus, factors affecting modulus of elasticity, early volume change in concrete due to plastic shrinkage, autogeneous shrinkage and drying shrinkage- factors affecting them, typical values and their methods of determination.

Creep of concrete- specific creep, typical values, creep recovery, factors affecting creep and its determination with ASTM procedure.

UNIT 4:

Microstructure of Concrete: Interfacial transition zone, hydration kinetics, hydrated cement paste (hcp), ettringite, calcium hydroxide, presence of micro-cracks in concrete mass - their characteristics and significance on performance of concrete,

Penetrability of Concrete: Permeability, sorptivity and diffusion in concrete- test methods and significance.

Durability of Concrete: Physical and chemical processes, recently employed methods of tests for ensuring longer and durable concrete structures like Resistivity, RCPT, etc- case studies involving decision based on rapid chloride permeability test (RCPT), DIN permeability, etc

UNIT 5:

Special Aggregates: Light weight, heavy weight- their characteristics and uses in concrete. Specific purpose concretes and cement based composites: Self Compacting Concrete : Mix proportioning, EFNARC guidelines. Fiber cements and fiber reinforced cement based composites, mass concrete and polymer concrete etc.- materials, production and application areas.

High performance concrete- performance characteristics in fresh and hardened states, production precautions - case studies of use of HPC in India: Delhi Metro construction, Mumbai – Worli Sea link project, atomic power projects, Hydro electric power projects etc.

Nano Technology in Cement and Concrete: Use of nano silica, CNTs and other nano materials.

Reference Books:

- 1.Properties of Concrete by A.M. Neville, Longman Publishers.
- 2- Concrete Technology by M.S. Shetty, Dahnpat Rai & Sons.
- 3- Concrete Technology by Neville & Brooks, Pearson Education.
- 4- Concrete Microstructure P.K. Metha, Tata Mc Graw Hill.
5. Concrete Technology- A. S. Santhakumar, Oxford University Press

5CE6.3A: SOLID WASTE MANAGEMENT (L- 3)

UNIT: 1

General: Problems associated with Solid Waste Disposal.

Generation of Solid Waste: Goals and objectives of solid waste management, Classification of Solid Waste. Solid Waste Generation, Factors Influencing Generation of Solid Waste, Characteristics of Solid Waste, Analysis of Solid Waste.

UNIT: 2

Onsite Handling, Storage and Processing: Public Health and Aesthetics, Onsite Handling, Onsite, Storage, Dust bins, Community Containers, Container Locations, On-site Processing Methods.

UNIT: 3

Solid Waste Collections, Transfer and Transport: Collection Systems, Equipment and Labor requirement, Collection Routes, Options for Transfer and Transport Systems.

UNIT: 4

Processing and Disposal Methods: Processing Techniques and Methods of Disposal, Sanitary land filling, Composting and Incineration, Bioremediation.

UNIT: 5

Recovery of Resources, Conversion, Products and Energy: Material Recovery, Energy Generation and Recovery Operation, Reuse in other industry.

Industrial Solid Waste: Nature, Treatment and Disposal Methods.

Suggested Readings:

- 1-Solid Waste Engineering Principles and Management Issues by G.Technobanogios H.Theisen & R.Blssen, Mc Graw Hill Book Co.
- 2.Solid Waste Management by C.L.Mantell, Mc Graw Hill Book Co.
3. Solid Waste Management in Developing Countries by Bhide& Sunrashen PHI.

Typical list of experiments for V Semester Labs

5CE7A: ENVIRONMENTAL ENGINEERING DESIGN & Lab. -I (P- 2)

1. To determine the pH of the given sample of water.
2. To determine the turbidity of the given sample of water
3. To determine Total Solids of the given water sample.
4. To determine the Total Dissolved Solids of the given water sample.
5. To find out conductivity of the given water sample.
6. To determine hardness of the given water sample.
7. To find out chloride of the given water sample.
8. To determine alkalinity of the given water sample.

9. To find out acidity of the given water sample.
10. To determine hardness of the given water sample.
11. To determine the optimum dose of alum by Jar test.
12. To study various water supply Fittings.

5CE8A: GEOTECHNICAL ENGG.-I LABORATORY (P-2)

1. Grain size distribution by sieving.
2. Determination of water content by Pycnometer.
3. Determination of specific Gravity by Pycnometer.
4. Determination of liquid limit by Casagrande's apparatus.
5. Determination of liquid limit by cone penetrometer.
6. Determination of plastic limit
7. Determination of shrinkage limit
8. Determination of field density by core-cutter
9. Determination of field density by sand replacement method
10. Determination of compaction properties by standard Proctor Test Apparatus
11. Determination of C- ϕ values by Direct Shear Test Apparatus
12. Determination of Unconfined Compressive Strength by unconfined compression Test Apparatus

5CE9A: SURVEY LAB. -II (P-3)

1. To measure the horizontal and vertical angles by Theodolite.
2. To determine the Height of an object by trigonometric leveling (Instruments in same vertical plane).
3. To determine the Height of an object by trigonometric leveling (Instruments in different vertical planes).
4. To shift the R.L. of known point by double leveling.
5. To measure and adjust the angles of a braced quadrilateral.
6. To prepare a contour map by indirect contouring.
7. To prepare the map of given area by plane tabling.
8. To determine the Azimuth of a given line by ex-meridian observations of Sun.
9. Survey Camp (including exercise on triangulation, topographic, or project survey) with maximum duration of 10 days.

5CE 10A : COMPUTERS AIDED BUILDING DESIGN (P- 3)

Design Problems as syllabus of theory

5CE11 : STRUCTURAL ENGINEERING LAB (P-2)

1. Study of friction, screw jacks, winch crabs etc.
2. Deflection of a truss
3. Clark-Maxwell reciprocal theorem with truss
4. Funicular polygon for flexible cable
5. Analysis of redundant frame
6. Deflection of curved members
7. Buckling of columns
8. Clark-Maxwell reciprocal theorem with simply supported beam
9. ILD for deflection in a steel beam using unit load method
10. ILD for support reaction using Muller-Breslau Principle
11. Unsymmetrical bending.
12. Two hinged and three hinged arches.

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6CE1A :THEORY OF STRUCTURES – II (L-3, T-1)

UNIT: 1

Influence line diagram & Rolling load: ILD for beams & frames, Muller-Breslau principle and its application for drawing ILD, Rolling load, maximum stress resultants in a member/section, absolute maximum stress resultant in a structure.

UNIT: 2

Arches: analysis of three hinged two hinged and fixed type parabolic arches with supports at the same level and at different levels.

UNIT: 3

Cable and Suspension bridges: Analysis of cables with concentrated and continuous loading, analysis of two & three hinged stiffening girder.

UNIT: 4

Unsymmetrical bending: Definition, location of NA, computation of stresses and deflection, shear center and its location, Theories of Failures

UNIT: 5

Introduction to matrix method, Force displacement relation, flexibility and stiffness coefficients, relation between flexibility and stiffness matrices, system approach of flexibility method and stiffness method, coordinate transformation matrix, rotation matrix, element and global stiffness matrix for pin jointed structures and beam element in 2D only.

Suggested Readings:

Mechanics of Structures Vol. I & II by S.B. Junarkar & Shah, Charotar Publishing House.

2- Theory of Structures by B.C. Purnmia, Laxmi Publication (P) Ltd.

3- Theory of Structures by Timoshenko, Mc Graw Hill Book Co.

4- Structural Analysis by Ghali & Neville, E&FN Spon.

5. **Structural Analysis by Hibbler R.C., Pearsons**

6CE2A: GEOTECHNICAL ENGINEERING – II (L-3, T-1)

UNIT: 1

Stresses in Soil under surface loading: Boussinesq's and Westergaard's analysis for vertical pressure and its distribution in a soil mass. Vertical stresses due to concentrated loads, Horizontal and shear stresses due to concentrated loads. Isobar diagram, Vertical stress distribution on a horizontal plane. Influence diagram. Vertical stresses at point under line load and strip load. Vertical stresses at a point under circular and rectangular loaded area. Approximate methods of obtaining vertical pressure due to surface loading. Newmark's chart, Fensky's Chart. Pressure bulb and its significance in Foundation exploration. Contact pressure below foundations.

UNIT: 2

Compressibility and Consolidation: Introduction to consolidation, comparison of compaction and consolidation, Spring Analogy Terzaghi's one dimensional consolidation theory, Degree of consolidation, consolidation test, Compressibility parameters, co-efficient of consolidation. Preconsolidation pressure and its determination. Normally, Over and Under consolidated soils. Methods of computation of Settlement and its rate. Coefficient of consolidation for layered soil. Total and differential Settlement.

UNIT: 3

Stability of Slopes: Classifications of slopes, Stability analysis of infinite slopes. Stability analysis of finite slopes by Swedish and Friction circle method. Stability analysis by Taylor's stability number, Taylor stability number curves. Stability of slopes of earthen embankments under sudden draw down, steady seepage and during construction. Bishop's method of stability analysis.

UNIT: 4

Earth Pressure: Active, passive and earth pressure at rest. Rankine's and Coulomb's theories of earth pressure. Rebhann's and Culman's graphical methods for active earth pressure for vertical and inclined back retaining walls, horizontal and inclined cohesion less back fill. Earth pressure on cantilever sheet piles Stability analysis of retaining walls..

UNIT: 5

Bearing Capacity of Soils: Terminology related to bearing capacity, Common types of foundations. Terzaghi and Meyerhoff's theory for bearing capacity. Rankine's method for minimum depth of foundation. Skempton's method. Effect of eccentricity and water table on bearing capacity. IS code method, Plate load and penetration tests for determining bearing capacity. Introduction to pile, well and machine Foundations.

Site Investigations: Methods of explorations. Planning of Investigations, Depth of exploration, Number of boreholes, Undisturbed and Disturbed samples. Types of samplers. Brief description of procedures of sampling, Transportation and Storage of samples. Geophysical methods of investigations

Suggested Readings:

- 1.Engineering in Theory & Practice Vol. I by Alam Singh, CBS Publishers and Distributers, Delhi.
- 2- Geotechnical Engineering by Purushottam Raj, Tata Mc Graw Hills, Delhi.
- 3- Soil Mechanics in Engineering Practices by Terzaghi & Peck, John Wiley & Co.
- 4- Soil Mech. & Foundation Engineering by K.R. Arora, Standard Publishers and Distributers, Delhi.
- 5.Theory and Practice Of Foundation Design by Som and Das, PRENTICE Hall of India Delhi (PHI).
6. Soil Mechanics in Engineering and Practice by Terzaghi, CBS Publishers and Distributers.
- 7.Geotechnical Engineering by Gulhati and Datta, Tata Mc Graw Hill, Delhi.
8. An Introduction to Geotechnical Engineering by Robert D.Holtz, William D. Kovacs, Thomas C. Sheahan, Pearson Education Delhi.

6CE3A : ENVIRONMENTAL ENGINEERING –II (L-3)

UNIT: 1

General: Terms: sewerage, domestic sewage, sewage treatment, disposal scope, Role of an Environmental engineer, historical overview.

Sewage Characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards.

UNIT: 2

Collection of Sewage: Systems of sewerage, Separate, combined, and partially separate, components of sewerage systems, systems of layout, quantity of sanitary sewage and variations, quantity of storms water, rational method, shapes of sewer, Hydraulic design of sewers: diameter self cleansing velocity and slopes, construction and testing of sewer line, Sewer materials, joints and appurtenances, Sewage pumping and pumping stations, maintenance of sewerage system.

UNIT: 3

Sewage Treatment: Various units: their purpose, sequence and efficiencies, preliminary treatment, screening and grit removal units, oil and grease removal, primary treatment, secondary treatment, activated sludge process, trickling filter, sludge digestion and drying beds, stabilization pond, septic tank, soakage systems, recent trends in sewage treatment, advanced wastewater treatment :nutrient removal, solids removal.

UNIT: 4

Wastewater Disposal and Reuse: Disposal of sewage by dilution, self-purification of streams, sewage disposal by irrigation sewage farming, waste waters reuse.

Plumbing for Design of Buildings: Various systems of plumbing – one pipe, two pipes, single stack, traps, layout of house drainage.

UNIT: 5

Air and Noise Pollution: Air quality, Emission standards, vehicular pollution, Effect of air pollution on human health, Noise Pollution, global effect of air and noise pollution, green house effect, acid rain etc.

Suggested Readings:

- 1- Environmental Engineering II by B.C. Punmia, Arihant Publishers, Jodhpur.
- 2- Sanitary Engineering by SK Garg, Khanna Publishing Co.
3. Manual on Sewage and Sewage Treatment Ministry of Urban Development Govt. of India.
4. Water and Waste Water Engineering by Fair, G.M., Geyer G.C. and Okun D.A, Ann Arbor Sc.Publishing.

6CE4A: DESIGN OF CONCRETE STRUCTURES – I (L-3)

UNIT: 1

Objective and fundamental concepts of design of RC members, Types and function of reinforcement. Introduction to various related IS codes. Design Philosophies: Working stress, ultimate strength and limit states of design. Analysis and Design of singly reinforced rectangular beam section for flexure using Working Stress Method and Limit State Method.

UNIT: 2

Analysis and design of singly reinforced, flanged beams and doubly reinforced rectangular beams for flexure using Limit State Method. Limit state of serviceability for deflection, control of deflection as per codal provisions of empirical coefficients.

UNIT: 3

Limit state of collapse in shear: analysis and design of prismatic sections for shear using LSM.

Limit state of collapse in bond: concept of bond stress, anchorage length and development length, curtailment of reinforcement as per codal provisions.

UNIT: 4

Analysis and design of one way and two way slabs using LSM and Flat slab using direct design method as per code, Detailing of reinforcement.

UNIT: 5

Columns: Short and long columns, their structural behaviour. Analysis and design of axially loaded short columns, using LSM. Analysis of uniaxially eccentrically loaded short columns. Introduction to Pu-Mu interaction curves and their use for eccentrically loaded columns.

Design of Column Footings: Analysis and design of Isolated column footing and combined footing for two columns (without central beam) for axial loads using LSM.

Suggested Readings:

- 1- *Illustrated Reinforced Concrete Design* by Karve & Shah; Standard Publishers, Delhi.
- 2- *Limit State Design of Reinforced Concrete* by Verghese P.C.; PHI Delhi.
- 3- *Limit State Design* by Dayaratnam; Oxford and IBH Publishing House.
- 4- *Reinforced Concrete : Limit State Design* by A.K.Jain; Nem Cahnd and Brothers, Roorkee.
- 5- *Reinforced Concrete Structural Elements* by P Purushothaman; Mc Graw Hill
- 6- *Reinforced Concrete Fundamentals* by Phil M. Ferguson; Prentice Hall
- 7- *Design of reinforced Concrete* by Jack C. Cormac & James K. Nelson; C.H.I.P.S.
- 8- *Reinforced Concrete Design* by Wang & Salmon; Harper & Row.
- 9- *Design of Concrete Structures* by Nilson & Winter; Mc Graw Hill

6CE5A: TRANSPORTATION ENGINEERING–I (L- 3, T-1)

UNIT: 1

Introduction: Importance and Role of Transportation Systems, Technological and Operating Characteristics of Transportation Systems, Components of transportation Systems, Transportation Coordination, Transportation Modes and their comparison.

Highway Planning: Highway Planning Process, specifically in India, Transport or Highway related Agencies in India, Classification of Roads and Road Development Plans, Road Patterns, Controlling Factors and Surveys for Highway Alignment.

UNIT: 2

Highway Materials and Construction: Desirable Properties, Testing Procedures, Standards and standard values relating to Soil, Stone Aggregates, Bitumen and Tar, fly-ash/pond-ash. Methods of constructing different types of roads viz. Earth roads, Stabilized roads, WBM roads, fly ash embankments, Bituminous roads and Concrete roads. Specific features of rural roads. Equipments for highway construction of rigid and flexible pavements.

UNIT: 3

Highway Geometric Design: Cross Sectional Elements, camber, Sight Distances – definition and analysis of SSD and OSD, Design of Horizontal Alignment – Super elevation, extra widening, transition curves. Design of Vertical Alignment – Gradients, Vertical curves. Recommendations Indian Road congress code of Practice.

UNIT: 4

Elementary Traffic Engineering: Significance of different Traffic Engineering Studies viz. Speed, Volume, O & D, Parking and Accident's Study. Importance and types of Traffic Signs, Signals, Road Markings and Road Intersections.

UNIT: 5

Structural design of Highway Pavements: Design of Flexible Pavements by G. I. and CBR methods. Design of Rigid Pavements by Westergard and modified methods. Design as guide lines of relevant Indian Road congress code of Practice.

Hill Roads: Special factors in Alignment and Geometric design, Drainage and maintenance of Hill roads. Road side Arboriculture and Landscaping. Recent Developments in Urban Roads and their role in economic developments.

Suggested Readings:

- 1.Highway Engineering by Khanna SK & CG Justo, Nem Chand and Brothers, Roorkee.
- 2-Highway Engg. by L.R. Kadiyali, Khanna Tech Publications, Delhi.
- 3- Specification for Roads & Bridges by Ministry of Road Transports & Highways and Indian Road Congress.
4. Transportation Engineering and Planning, 3rd ed., Papacostas & Prevedouros, PHI Publishers.
5. Highway Engineering by Rangawala, Charotar Publishing House.

6CE6.1A: REMOTE SENSING AND GIS (L-3)

UNIT: 1

Photogrammetry: Definition of Photogrammetric Terms, Geometry of aerial and terrestrial photographs, Aerial camera and photo-theodolite, Scale of a Photograph, Tilt and Height displacements, Stereoscopic vision and stereoscopes, Height determination from parallax measurements, Flight planning, Maps and Map substitutes and their uses.

UNIT: 2

Remote Sensing: Introduction and definition of remote sensing terms, Remote Sensing System, Electromagnetic radiation and spectrum, Spectral signature, Atmospheric windows.

UNIT: 3

Different types of platforms, sensors and their characteristics, Orbital parameters of a satellite, Multi concept in Remote Sensing.

UNIT: 4

Image Interpretation: Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantages of multirate and multiband images. Digital Image Processing concept.

UNIT: 5

Geographic Information System (GIS) : Introduction & applications of GIS in map revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology, water resources, Soil Erosion, Land suitability analysis, change detection.

Suggested Readings:

- 1.- Basics of Remote Sensing & GIS by Dr. S.Kumar , Univertsity Sc. Press.
- 2- Geographic Information System by Kang Tsung Chang, Tata Mc Graw Hills.
3. Remote Sensing and GIS by Legg.C.A., Ellis Horwood, London.
4. Remote sensing and GIS by Bhatt Oxford University Press.

6CE6.2A: ROCK MECHANICS (L- 3)

UNIT: 1

ENGINEERING CLASSIFICATION OF ROCKS: Objectives, Intact rock classification, Rock mass Classification. Terzaghi's, Rock load classification, Austrian classification, Deere's rock quality classification, rock structure rating concept, RMR classification, Q classification. Inter relation between Q and RMR, prediction of ground condition and support pressure. Effect of Tunnel size on support pressure.

UNIT: 2

ENGINEERING PROPERTIES AND LABORATORY TESTS ON ROCKS: Porosity, Density, Moisture content, Degree of saturation, Co-efficient of permeability, Durability, Compressive strength, Tensile strength, Shear strength, elasticity, Plasticity Deformability.

Sampling and Samples Preparations, Uniaxial Compressive strength, Tensile Strength – Brazilian test, Shear strength test – Direct Shear test and Punch shear test, Triaxial Test, Flexural strength.

UNIT: 3

INSITU TESTS ON ROCKS: Necessity of Insitu test, Plate load test for deformability, Shear test, Test for internal stresses – flat Jack, pressure meter test.

JOINTED ROCKS: Rocks Joint properties, Joint properties, Joint Roughness Co-efficient, Scale effects, Dilation, Orientation of Joints, Gouge, Joint Intensity, Uniaxial Compressive strength of Jointed Rocks.

UNIT: 4

STRENGTH OF ROCKS IN UNCONFINED CONDITION: Ramamurthy Strength Criteria, Singh and Rao Strength Criteria, Kulatilake Methodology, Hoek Criteria, Barton Methodology.

STRENGTH OF ROCKS IN CONFINED CONDITION: History of Hoek and Brown Failure Criterions and latest methodology, Parabolic Strength Criteria.

UNIT: 5

GROUTING AND ROCK BOLTING: Grouting materials, Grouting operations, methods of Grouting, Mechanism of Rock Bolting, Principal of design.

BEARING CAPACITY OF ROCKS: Bearing capacity of intact rocks, jointed rocks, IS Code methodology, Singh and Rao Method and latest methodologies.

Suggested Readings:

- 1- Rock Engg. For Engineers by B.P. Verma , Khanna Publishers.
- 2- Rock Engg. By Bhawani Singh, Elsevier Science Ltd.
3. Foundation on Rocks by Duncan C.Wyllie, Spon Press.
4. Engineering in Rock for Slopes, Foundation and Tunnels, by Ramamurthy, PHI Delhi.
5. IS Codes on Rocks

6CE6.3A REPAIR AND REHABILITATION OF BUILDINGS (L- 3)

UNIT: 1

Deterioration of concrete in structures: physical processes of deterioration like F & T abrasion, erosion, pitting, chemical processes like carbonation, chloride ingress, corrosion, alkali aggregate reaction, sulphate attack; their causes, mechanism, effect, preventive measures.

Cracks: Cracks in concrete, type, pattern, quantification, measurement & preventive measures etc.

UNIT: 2

N.D.T.: Non destructive test methods for concrete including rebound hammer, ultrasonic pulse velocity, rebar locator, corrosion meter, penetration resistance and pull out test, core cutting etc.

Corrosion: Methods for corrosion measurement and assessment including half-cell potential and resistivity, Mapping of data.

UNIT: 3

Materials for repair: polymers and resins, self curing compound, FRP, Ferro cement etc; properties, selection criterion, bonding aspect.

UNIT: 4

Repair Techniques: grouting, jacketing, shotcrete, externally bonded plates and under water repair; materials, equipments, precautions process etc.

UNIT: 5

Investigation for structures: Distress, observation and preliminary test methods.

Case studies: related to rehabilitation of bridge piers, dams, canals, heritage structures, corrosion damaged structures.

Suggested Readings:

- 1- Properties of Concrete by A.M. Neville, Pearson.
- 2- Concrete Technology by M.S. Shetty, S.Cahnd & Comp.
- 3- Hand book of Analytical Techniques in Concrete Tech by V.S.. Ram Chandran, Standard Publishers.

Typical list of experiments for VI Semester Labs

6CE7A:GEOTECHNICAL ENGG. DESIGN AND LABORATORY. – II (P-3)

1. To determine the differential free swell index of soil.
2. To determine the grain size distribution of fine grained soil by Hydrometer.
3. To determine the CBR of soil.
4. To determine the compressibility parameters of soil by consolidation test.
5. To determine the swelling pressure of soil.
6. To determine the permeability of soil by constant and falling head methods.
7. To determine the shear strength parameters of soil by tri-axial test.
8. Design problems based different units of theory syllabus.

6CE8A: ENVIRONMENTAL ENGINEERING LAB. & DESIGN – II (P- 3)

1. To determine the pH of the given sample of sewage.
2. To determine Total Solids of the given sewage sample.
3. To determine the Total Dissolved Solids of the given sewage sample.
4. To find out Total Settle-able Solids of the given sewage sample.
5. To determine Total Suspended Solids of the given sewage sample.
6. To find out the Quantity of Dissolved Oxygen present in the given water sample by Winkler's Method.
7. To determine Biochemical Oxygen Demand exerted by the given wastewater sample.
8. To find out Chemical Oxygen Demand of the waste water sample.
9. To study various Sanitary Fittings.

Design as per syllabus of theory.

6CE9A : DESIGN OF CONCRETE STRUCTURES- I (P-3)

Design problems as per different units of syllabus of theory.

6CE10A : ROAD MATERIAL TESTING LAB (P- 3)

1. Aggregate Impact test
2. To determine the flakiness index & Angularity number test of given sample of aggregate.
3. To determine fineness modulus of a given sample of coarse aggregate.
4. Los angles abrasion test
5. Aggregate crushing value test
6. Specific gravity and water absorption test of aggregate.
7. Standard tar viscometer test
8. To determine the elongation index for given sample of aggregate.
9. Ductility test
10. To determine the softening point for give sample of bitumen.
11. Marshell stability test
12. Float test

RAJASTHAN TECHNICAL UNIVERSITY
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FINAL YEAR (7th SEMESTER)

7CE1A: WATER RESOURCES ENGINEERING – I (L- 3)

UNIT: 1

Introduction: Definitions, functions and advantages of irrigation, present status of irrigation in India, classification for agriculture, soil moisture and crop water relations, Irrigation water quality. Consumptive use of water, principal Indian crop seasons and water requirements, multiple cropping, hybrid crops, water harvesting and conservation.

UNIT: 2

Canal Irrigation: Types of canals, parts of canal irrigation system, channel alignment, assessment of water requirements, estimation of channel losses, design of channels, regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory), cross section of channels, silt control in canals.

Water Distribution System: Rotational delivery (Warabandi, Jama Bandi, Khasra Bandi, Sajra Sheets), continuous delivery and delivery on demand, Role of command area development authority, Functions and organizational structures.

UNIT: 3

Distribution of Canal Water: System of regulation and control, outlets, assessment of canal revenue.

Hydraulics of Alluvial Rivers : Critical tractive force, regimes of flow, resistance relationship for natural streams, bed load, suspended load and total equations, different stages of rivers, meandering, aggradations, and degradation, river training & bank protection works.

UNIT: 4

Water Logging: Causes, preventive and curative measures, drainage of irrigated lands, saline and alkaline lands, types of channels lining and design of lined channel.

Well Irrigation: Open wells and tube wells, types of tube wells, duty of tube well water.

UNIT: 5

Hydrology: Definition, Hydrologic cycle, Application to Engineering problems, measurement of rainfall, rain gauge, peak flow, flood frequency method, catchment area formulae, Flood hydrograph, Rainfall analysis, Infiltration, Run off, Unit hydrograph and its determination, Estimation of run off.

Suggested Readings:

- 1- Irrigation Water Power and Water Resource Engineering By KR Arora, Standard Publishers and Distributers, Delhi.
- 2- Water Resource Engineering by Modi, Standard Publishers.
- 3-Irrigation and Water Power Engineering by BC Punmia & B B Lal, Laxmi Publication (P) Ltd.
- 4.Irrigation Engineering by G.L.Asawa, New Age International Publishers, New Delhi.

7CE2A DESIGN OF STEEL STRUCTURES – I L 3

(Design procedure shall be conforming to IS 800-2007)

UNIT: 1

Introduction: Types of steels and their broad specifications.

Plastic Analysis:

Plastic analysis of steel structures, fundamentals, static and mechanism method of analysis, bending of beams of rectangular and I sections beams, shape factor.

Classification of Cross Sections: As per IS 800-2007 Plastic, compact, semi compact, slender sections, their characteristics including moment- rotation.

UNIT 2

Connections: Types of bolts, load transfer mechanism, prying action. Design of bolted and welded connections under axial and eccentric loadings.

Tension Members: Design strength in gross section yielding, net section rupture and block shear. Design of axially loaded tension members.

UNIT: 3

Compression Member: Types of buckling. Column buckling curves, Imperfection factor, Buckling curves for different cross sections. Design of compression member; Axially loaded compression members including angle section design: single and in pair, built up columns, design of lacings and battens.

UNIT: 4

Beams: Design of beams: simple and compound sections, main and subsidiary beams and their connections. Laterally supported and unsupported beam design, Web buckling, web crippling, lateral torsional buckling.

UNIT: 5

Member design under combined forces:

Compressive load and uniaxial moment. tension and uniaxial moment

Column Bases: Design of column bases, Slab base, gusseted base for axial and eccentric compressive load. Grillage foundation design.

Reference Books:

- 1-Design of Steel Structures by N. Subramanian, Oxford University Press.
2. Limit state Design of Steel Structures: S K Duggal, TMH publication
- 3- Design of Steel Structures by S. Bhavikatti, I.K. International Pvt. Ltd.
- 4- Design of Steel Structures by V.L. Shah, Structures Publications.

7CE3A : DESIGN OF CONCRETE STRUCTURES-II (L- 3)

UNIT: 1

Elements of Pre-stressed Concrete: Principles and systems, material properties, losses of pre-stress, I.S. specifications, analysis and design of rectangular and T sections for flexure and shear.

UNIT: 2

Torsion: Analysis and Design of beams for torsion as per codal method..

Continuous and Curved Beams: Analysis and Design of continuous beams using coefficients (IS Code), concept of moment redistribution. Analysis and design of beams curved in plan.

UNIT: 3

Circular Domes: Analysis and design of Circular domes with u.d.l. & concentrated load at crown.

Water Tanks and Towers: Water Tanks and Water Towers-design of rectangular, circular and Intze type tanks, column brace type staging.

UNIT: 4

Yield Line Theory: Introduction to Yield line concept, Application of Y.L.T. to slabs with simple support conditions.

Retaining walls: Analysis and design of Cantilever Retaining Walls: Introduction to counterfort and buttress type retaining walls, their structural behaviour and stability analysis.

UNIT: 5

Culverts and Bridges: Analysis and Design of super structure of slab culverts and T-bridge for I.R.C. loading.

Suggested Readings:

1. *Reinforced Concrete Vol. II* by H.J. Shah; Charotar Publication House.
2. *Advanced Reinforced Concrete Design* by Verghese; Tata Mc Graw Hill.
3. *Advanced Reinforced Concrete Design* by Krishnaraju; Tata Mc Graw Hill.
4. *Bridge Engineering* by Ponnuswamy; Tata Mc Graw Hill
5. *Prestressed Concrete Structures* by N. Krishna Raju; Tata Mc Graw Hill.
6. *Bridge Engineering* by Johnson Victor; Oxford and IBH Publishers.
7. *Prestressed Concrete* by T.Y.Lin and Burn; John Wiley & Sons.
8. *Reinforced Concrete Structures* by Park & Poulay; Willey.
9. *Reinforced Concrete Designers Hand Book* By Reynolds & Steedman
10. *Manual of Concrete Practice ACI* (www.concrete.org)
11. *Prestressed concrete structures* by Praveen Nagrajan, Pearsons

7CE4A: TRANSPORTATION ENGINEERING – II (L-3)

UNIT: 1

Introduction and Permanent Way Components: Types and Selection of Gauges, Selection of Alignment, Ideal Permanent Ways and Cross-sections in different conditions, Drainage, Salient Features and types of Components viz. Rails, Sleepers, Ballast, Rail Fastenings.

Study of Specific Aspects: Coning of Wheels, Creep, Wear, failures in Rails, Rail Joints, Length of Rail, Sleeper Density and Spacing, Stations, Yards and Sidings, Turn-Table, Signaling.

UNIT: 2

Points and Crossings: Types of Turnouts, Points or Switches, layout Plans of different types of Crossings, Design calculations of turnouts.

Railway Systems Specific to Urban Movements: Surface railways (sub urban railway system of Mumbai, Chennai and Delhi), Underground system (Metro of Kolkata/ Delhi), Elevated Systems (as Proposed for Jaipur, Delhi, Mumbai), Light Rail System (MRTS, Thane). Recent Developments in Railway Networking.

UNIT: 3

Geometric Design: Gradient and Grade Compensation, Super elevation and cant, cant deficiency, Types of Curves, Transition curves, their designs, Widening of Gauges.

UNIT: 4

Airport Engineering:-Introduction: Requirements to Airport Planning, Airport Classifications, Factors in Airport Site Selection, Airport Size, Obstructions, Zoning.

Planning and Design of Airport: Requirements of Airport, Planning of Terminal Area, and different Layouts, Location of Gates, Types of Runway patterns, Runway Layout, Runway Length, Geometric Design of Runways, Layout of Taxiways, Geometric Standards, Exit or Turnaround Taxiways, Apron and Hangers.

UNIT: 5

Airport Pavement Design: Factors Affecting Pavement Design, Design methods of Flexible Pavements, Design methods of Rigid Pavements.

Suggested Readings:

- 1- Transportation Engineering by A.K. Upadhyay, S.K.Kataria and Sons.
- 2- Airport Engineering by Rangwala, Charotar Publishing House.
- 3- Railway Engineering by Sexena S.C. and Arora S.P, Dahnpat Rai Publishers, Delhi.
4. Railway Engineering by Satish Chandra and M.M Agarwal, Oxford University Press, Delhi.

7CE5A : Applications Numerical Methods in Civil Engineering (L-3, T-1)

UNIT 1

Errors & Approximations in Numerical Computation: Introduction to Mathematical Modeling and Engineering Problem Solving. Decimal & Binary Number system. Accuracy, Precision and Significant Digits. Errors and their types.: absolute and relative errors, approximations and round off errors, truncation errors and Taylor's series. Propagation of errors.

UNIT 2

Roots of Equations: Iterative processes and their Convergence. Existence of roots in engineering practices & their geometrical representation. Roots of the equations by: Graphical Method, Method of Successive Substitution, Bisection Method, False Position Method, Newton-Raphson Method, Secant Method, Regula Falsi Method. Application to simple civil engineering problems.

UNIT 3

Matrices and Determinants: Their types and basic operations. Rank of a matrix. Solution of Linear system of equations by Direct methods: Cramer's Rule, Gaussian elimination method, Gauss-Jordan Method and Cholesky Method. Application to simple civil engineering problems.

UNIT 4

Iterative Methods for solving Linear system of equations: Jacobi Method, LU decomposition and Matrix inversion, Gauss Seidel method. Application to simple civil engineering problems.

UNIT 5

Interpolation and Curve Fitting: Newton's Forward Difference, Newton's Backward Difference, Newton's Central Difference, Newton's Divided Difference, Lagrangian Interpolation, Hermitian Interpolation, Method of least square. Application to simple civil engineering problems.

1. Introductory Methods of Numerical Analysis, Sastry S.S., Prentice Hall India
2. Numerical Methods for Engineering and Scientific Computation, Jain and Jain, New Age International Pvt. Ltd. New Delhi.
3. Engineering Statistics, Bowker, A.H. and Liberman G.J., Prentice Hall.
4. Probability and Statics in Engineering, Hines, John Willey and Sons.
5. Applied Statistics and Probability for Engineers, Montgomery, John Wiley and Sons.
6. Numerical Methods for Engineers by S.C. Chapra & R.P. Canale, Tata McGraw Hill
7. Numerical Methods in Science and Engineering by S. Rajasekaran, Wheeler Publishing

7CE6.1A: ADVANCE TRANSPORTATION ENGINEERING (L- 3)

UNIT: 1

Traffic Studies: Road inventories, Traffic Volume Studies, Spot Speed Studies, Travel Time and delay Studies, Origin-Destination studies, Methodology and Analysis of O-D data, Traffic capacity, Parking studies and characteristics, Accident studies and characteristics, causes and preventive measures.

UNIT: 2

Statistical Methods for Traffic Engineering: Elementary concepts and Probability, Mean, Standard Deviation and variance, Poisson and Binomial Distribution, Normal distribution, sampling Theory and Significance testing, Linear Regression and correlation.

UNIT: 3

Traffic Characteristics: Macroscopic and Microscopic Characteristics related to Volume, Speed and Density, their relationships, Road User Characteristics – Human and vehicular Characteristics.

Traffic Engineering Design: Principles of Road Junction design, Design of Roundabouts, Bus Stops and Parking Lots, Design of Signals.

UNIT: 4

Traffic Management: Traffic Laws, Regulations and Ordinances for Drivers, Pedestrians and Mixed Traffic. Traffic control Measures – One Way streets, Kerb Parking Control, Intersection Control, Speed Control, Access Control. Expressways. Traffic Control Devices – Traffic Markings, Signs, Signals, Traffic Islands, their Classification, types and Sketches, Street Lighting.

UNIT: 5

Traffic and Environment: Detrimental Effects of Traffic on the environment – air pollution, noise pollution, visual intrusion, aesthetics etc.

Road Safety: The identification of problem, causation and Prevention, Road layout and Improvements, Safety equipment.

Suggested Readings:

1. Principles of Transportation Engineering by Parbha Chakraborty & Animesh Dash, PHI.
2. Traffic Engineering and Transport Planning by L.R.Kadiyali, Khanna Tech Publications, Delhi.
3. Traffic System Analysis Wohl and Martin, Mc Graw Hill Co.
4. Adolf D May, Traffic Flow Fundamentals, Prentice Hall Inc.

7CE 6.2A : DESIGN OF PRE-STRESSED CONCRETE STRUCTURES (L-3)

UNIT 1:

Introduction: Systems of pre-stressing in detail, pre-stressing techniques, transfer of pre-stress, types of commercially available jacks, computation of losses of pre-stress.

Anchorage Zone: end block stresses, design.

UNIT 2:

Cable profiles: Concordant and non-concordant cable profile and associated factors in continuous members. Modern cable laying: materials & practices, precautions etc. Computation of deflection in pre-stressed concrete members.

UNIT 3:

Design of Pre-stressed Concrete Sections: Flexural, shear and torsion resistance of members, preliminary and final design of sections, design of pre and post tensioned flexural members; simply supported and continuous members.

UNIT 4:

Pre-stressed Slab: Design of slabs, tendon layout, precast slab, production and their applications.

Partial Prestressing: Principles and advantages, methods, practices and design.

UNIT 5:

Design of circular pipes and circular water retaining structures etc. Case study of one bridge girder with design and constructional features.

Suggested Readings:

- 1- Design of Pre stressed Concrete by T.Y. Lin, Wiley Eastern International.
- 2- Design of Pre stressed Concrete by N.Krishnan Raju, Tata Mc Graw Hills.
- 3- Design of Pre stressed Concrete Structures by N.Sinha Ray, S.Chand Co.
4. Prestressed concrete structures by Praveen Nagrajan, Pearsons

7CE6.3A : RURAL WATER SUPPLY AND SANITATION (L- 3)

Unit 1

General: Importance of village community in India, Condition of Indian villages with special regard to economics, social and health aspects.

Sources of water: Traditional sources of water in rural areas. Different types of wells, sanitary aspects in well construction, pumps used for village wells, Hand pump Technology, its operation and maintenance. Water harvesting techniques.

Unit 2

Quality of water: Estimation of total water requirement including cattle water demand, quality of water needed for village community, water quality surveillance, standards of water quality.

Communicable Diseases: Diseases and immunity, Source of communicable diseases, Mode of transfer, Control of communicable diseases, Guinea worm Eradication.

Unit 3

Water Treatment: Slow sand filter, horizontal roughing filter and their combination. Disinfection of rural water sources, Fluoride and its removal.

Schemes of Rural water supply: Different Schemes of Rural water supply in Rajasthan, Their Design and project formulation including the programmes and standards laid by Govt. of India and Govt. of Rajasthan.

Unit 4

Milk and Food sanitation: Essentials of dairy farm and cattle shed sanitation, Tests for milk and dairy products, food epidemics, food poisoning, Botulism.

Fly and Mosquito control: Life cycle of flies and mosquitoes, various methods of flies and mosquito control.

Unit 5

Rural Sanitation: Village latrines, VIP latrines, pour flush latrines, materials, construction and cost of the latrines, Pollution aspects and pollution travel from latrines. Storm water and sludge problems. Septic tank, soak pit, small bore sewer system; its design and construction. Animal waste, method of composting, Biogas, collection and disposal of wastes.

Community Awareness and user participation: Planning of communication support in rural supply and sanitation projects.

Suggested Readings:

- 1 Rural Water Supply & Sanitation Manual by Govt. of India
2. Municipal and Rural Sanitation E.W.Steel, Mc Graw Hill Book Co.
- 3.Reports of Rajeev Gandhi National Drinking Water Mission

Typical list of experiments for VII Semester Labs

7CE 7A : DESIGN OF WATER RESOURCES STRUCTURES– I (P-2)

Design Problems as per syllabus of theory.

7CE8A : STEEL STRUCTURES DESIGN - I (P-3)

Design Problems as per different units of syllabus of theory.

7CE9A: CONCRETE STRUCTURES DESIGN -II (P-3)

Design Problems as per different units of syllabus of theory.

7CE10A :APPLICATION OF NUMERICAL METHODS IN CIVIL ENGINEERING (P-3)

Computer programming for application of numerical methods (as described in 7CE5) in solving problems related to Civil Engineering.

7CE 11A: PRACTICAL TRAINING AND INDUSTRIAL VISIT (P-2)

7CE 12A : PROJECT Part- I (P-2)

RAJASTHAN TECHNICAL UNIVERSITY
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FOURTH YEAR (8th SEMESTER)

8CE1A : WATER RESOURCES ENGINEERING- II (L-3, T-1)

UNIT: 1

Regulation of works: Falls, Classification of falls, Design of falls, Distributory head regulator and cross-head regulator, Escape, bed bars.

Cross-Drainage Structure: Necessity of Cross-drainage structures, their types and selection, comparative merits and demerits, design of various types of cross-drainage structure-aqueducts, siphon aqueduct, super passage siphon, level crossing and other types.

UNIT: 2

Diversion Head works: Design for surface and subsurface flows, Bligh's and Khosla's methods. Selection of site and layout, different parts of diversion head works, types of weirs and barrages, design of weirs on permeable foundation, silt excluders and different types of silt ejectors. Energy dissipation.

UNIT: 3

Embankment Dams: Suitable sites, causes of failures, stability and seepage analysis, flownet, slope stability analysis, precautions of piping, principles of design of earth dams.

Gravity Dams: Force acting on a gravity dam, stability requirements, Instrumentation.

UNIT: 4

Spillways: Spillway capacity, flood routing through spillways, different types of spillways and gates, energy dissipation below spillways.

Hydro Power Plant: General features of hydroelectric schemes, elements of power house structure, selection of turbines, draft tube and setting of turbine, cavitations.

UNIT: 5

Reservoirs: Evaluation of impact of water projects on river regimes and environment. Reservoir sedimentation and water shed management.

Optimization: Introduction to optimization techniques and system approach. Introduction to G.I.S. and Computer aided irrigation design.

Suggested Readings:

- 1- Irrigation Water Power and Water Resource Engineering By KR Arora, Standard Publishers and Distributors, Delhi.
- 2- Water Resources Engineering by Modi ,Standard Publishers.
- 3.Theory and Design of Irrigation Structures by Varshney Gupta and Gupta, Nem Chand & Brothers, Roorkee.
4. Fundamentals of Irrigation Engineering by Bharat Singh, Nem Chand Brothers, Roorkee.

8CE2A DESIGN OF STEEL STRUCTURES–II L 3

Unit: 1

Design of gantry girder. Design of roof trusses including wind loading and purlin design, Introduction to Pre Engineered Buildings and tubular sections and their applications.

Unit : 2

Design of plate girder: Design of welded and bolted sections. Connections for flange plate to flange angles and flange angles to web, etc. Design of welded connections. Web and flange splicing. Horizontal, Intermediate and Bearing stiffeners. Curtailment of plates. Shear strength determination by post critical and tension field action methods. End panel design options and procedure as per IS 800.

Unit: 3

Bridges: Types of bridges, Loadings, Standard loading for railway bridges, Design of Deck type plate-girder bridges, design of its bracings and frames.

Unit 4

Design aspects of foot over bridges. Design of through type truss girder bridges including stringer design , cross girder design , main truss members , portal and sway bracings etc.

Unit: 5

Water tanks, circular tanks with segmental bottoms, rectangular tanks, pressed steel tanks, design of staging.

Reference Books:

- 1-Design of Steel Structures by S. Bhavikatti, I.K. International Pvt. Ltd.
- 2- Design of Steel Structures by V.L Shah, Structures Publications.
3. Limit State Design of Steel Structures: S K Duggal- Tat Mc Graw Hill
- 4-Design of Steel Structures by N. Subramanian, Oxford University Press.
- 5-Design of Steel Structures by B.C. Punmia Laxmi Publication
- 6-Design of Steel Structures Vol. II by Ram Chandra, Standard Publishers.

8CE3A: PROJECT PLANNING & CONSTRUCTION MANAGEMENT (L-3)

UNIT-1

FINANCIAL EVALUATION OF PROJECTS AND PROJECT PLANNING: Capital investment proposals, criterions to judge the worth whileness of capital projects viz. net present value, benefit cost ratio, internal rate of return, Risk cost management, main causes of project failure. Categories of construction projects, objectives, project development process, Functions of project management, Project management organization and staffing, Stages and steps involved in project planning, Plan development process, objectives of construction project management.

UNIT-2

PROJECT SCHEDULING: Importance of project scheduling, project work breakdown process – determining activities involved, work breakdown structure, assessing activity duration, duration estimate procedure, Project work scheduling, Project management techniques – CPM and PERT networks analysis, concept of precedence network analysis.

UNIT-3

PROJECT COST AND TIME CONTROL: Monitoring the time progress and cost controlling measures in a construction project, Time cost trade-off process: direct and indirect project costs, cost slope, Process of crashing of activities, determination of the optimum duration of a project, updating of project networks, resources allocation.

UNIT-4

CONTRACT MANAGEMENT: Elements of tender operation, Types of tenders and contracts, Contract document, Legal aspects of contracts, Contract negotiation & award of work, breach of contract, determination of a contract, arbitration.

UNIT-5

SAFETY AND OTHER ASPECTS OF CONSTRUCTION MANAGEMENT: Causes and prevention of accidents at construction sites, Safety measures to be followed in various construction works like excavation, demolition of structures, explosive handling, hot bitumen work. Project Management Information System – Concept, frame work, benefits of computerized information system. Environmental and social aspects of various types of construction projects.

Suggested Readings:

1. Construction Project Management by K.K. Chitkara, Tata Mc Graw Hills.
- 2- Project Management with CPM /PERT by B.C. Punmia, Laxmi Publication (P) Ltd.
- 3- Project Management by Modder & Phillph, CBS Publishers.

8CE 4.1A: BRIDGE ENGINEERING (L- 3)

UNIT 1

Introduction: Type of bridges & classification of road & railways bridges. IRC & Railway loadings for bridges, wind load & Earthquake forces. Steel bridges Design of through type & deck type steel bridges for IRC loading. Design of deck type & through type truss bridges for railway loadings.

UNIT 2

Reinforced concrete culverts & bridges: Reinforced concrete slab culvert, T-beam bridges-courbons & Hendry-Jaegar methods. Design of balanced cantilever bridge.

UNIT 3

Prestressed Concrete bridges: Prestressed & Post stressed concrete bridges Design of deck slab & girder sections.

UNIT 4

Bearings: Bearings for slab bridges and girder bridges. Elastomeric bearings, design concepts as per IRC 83 (Part II).

UNIT 5

Joints: Expansion joints.

Suggested Readings:

- 1- Design of Bridge Structures by T.R. Jagadeesh & M.A. Jayaram, Prentice Hall Of India (PHI).
- 2- Bridge Engineering by Victor, Oxford and IBH Publishers.
- 3- Design of Bridges by Krishna Raju, Oxford and IBH Publishers.
- 4- Bridge Super Structures by Raj Gopalan, Standard Publishers & Distributers.
- 5- Concrete Bridge Practice by Raina V.K., Tata Mc Graw Hill Co.
- 6- Bridge Engineering by Ponnuswamy, Tata Mc Graw Hills.

SCE4.2A: ADVANCED FOUNDATION ENGINEERING (L- 3)

Unit 1

Shallow Foundation: Methods of estimation of bearing capacity, computation of bearing capacity factors, Effect of eccentric and inclined loads, effect of water table on bearing capacity, Terzaghi, Vesic, Hansen, Moyerhof's analysis, Bearing capacity of stratified soils. IS code recommendations for minimum depth, factor of safety, design for local shear and general shear failure.

Unit 2

Settlement Under Foundation: Methods of estimation of settlement of footings. Limits of settlements for various structures, Indian Standard Code Provisions (IS: 1904, 6403, 8009). Determination of allowable bearing capacity as per IS code. Schemartman's method, Dee beer's and Mortin method of finding out settlement from static cone penetration test. Methods of finding out bearing capacity from plate load test, standard penetration test data.

Unit 3

Pile Foundation: types of pile and their use, modes of failure. Bearing capacity and settlement of pile foundation. Types of piles, Allowable load, Pile load test, Dynamic and static formulae. Bearing Capacity factors. Pile group bearing capacity and settlement. Negative skin friction. Behavior of piles under lateral loading. Winkler's assumption. Pile resistance and deflection under lateral loads, elastic method, Brooms method.

Unit 4

Foundation on Difficult Soils: Collapsible soil; identification, Collapse settlement: foundation design. Sanitary land fills settlement of sanitary land fill.

Expensive soils: Behaviour of expansive soil, foundation practices, under-reamed piles. Methods of finding out load carrying capacity of under reamed piles in clayey and sandy soil. Provision of IS 2911 Part III-1980 for design of under-reamed pile foundations.

Unit 5

Raft foundation: Common types of raft, combined footing. Bearing capacity of raft, differential settlement of raft; semi empirical method of design of raft foundation.

Well foundations: design and construction. Bearing capacity, settlement and lateral resistance. Tilts and shifts, IS and IRC codes methods.

Suggested Readings:

- 1- Basic & Applied Soil Mechanics -by Ranjan & Rao, New Age International Publishers.
- 2- Geotechnical Engineering by Gulhati & Dutta , Tata Mc Graw Hills, Delhi.
- 3- Design Aids in foundation Engineering by Kaniraj, Tata Mc Graw Hills, Delhi.

8CE4.3A : EARTHQUAKE RESISTANT CONSTRUCTION & DESIGN (L-3)

UNIT-1

Introductory Seismology: Various terminology related with earthquake, Causes of earthquake, plate tectonics, Tsunami. Seismic wave propagation. Magnitude, intensity & energy of earthquake, magnitude & intensity scales, classifications of earthquakes, Seismic zoning case histories of earthquakes. Seismic hazards, induced hazards.

UNIT-2

Earthquake recording, Seismic instruments, Seismographs & Seismograms. Basic concept of liquefaction and isolation. Introduction to various IS related codes. Structural systems, Effects of earthquake on buildings in general, structural and nonstructural failures.

Dynamic characteristics of buildings, natural period of vibration, damping, stiffness etc.

Seismic performance of traditionally built masonry constructions, typical failure mechanism of masonry buildings under earthquakes.

UNIT-3

IS 4326: 1993: Planning consideration & architectural concept, provisions for earthquake resistant construction/ seismic strengthening of masonry constructions.

UNIT-4

Seismic performance of reinforced concrete buildings. Plan, elevation & stiffness irregularities & their effects. Typical earthquake damages of RC constructions, short column effect, soft storey effect, strong column-weak beam analogy. IS 13920: 1993: Ductile detailing of reinforced concrete buildings and shear wall concept.

UNIT 5

Seismic design philosophy, IS 1893 (part I):2002 codal provisions : Load combinations, Design lateral loads, response reduction factors, structural modeling of building frames, equivalent load method for earthquake analysis of multistory frames.

Suggested Readings:

1. Structural Dynamics by Anil K Chopra , Pearson Education.
2. Dynamics of Structures by Clough & Penzin, Mc Graw Hill Book Co.
3. Earthquake Engineering by Pankaj Agarwal & Manish Shree Khande, Prentice Hall of India.
4. Earthquake Tips by C.V R. Murthy, IIT Kanpur.
5. Earthquake-Resistant Design of Steel Structures by Duggal, Oxford University Press.

8CE5A : DESIGN OF WATER RESOURCES STRUCTURES– II (P- 3)

Design as per syllabus of theory.

6CE6A : STEEL STRUCTURES DESIGN - II (P- 3)

Design problems as per different units of syllabus of theory

8CE 7A : PROFESSIONAL PRACTICES AND ESTIMATING (P-3)

1. Estimates – Methods of building estimates, types; site plan, index plan, layout plan, plinth area, floor area; Technical sanction, Administrative approval; estimate of buildings, roads, earthwork and R.C.C. works.
2. Analysis of rates- for earthwork, concrete work, D.P.C., stone masonry,, plastering, pointing and 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. Arbitration
6. Valuation of real estate.

8CE7A : STRUCTURAL ANALYSIS BY MATRIX METHODS OF (P- 2)

Introduction to matrix methods; Stiffness (Deflection) and Flexibility (Force) matrices for bar, plate, and beam elements w.r.t. local axes and global axes, for entire structure w.r.t. global axes (Direct method and by assembly method. Introduction of Finite Element Methods.

8CE 8A : DESIGN of FOUNDATIONS (P- 3)

1. Design of isolated shallow footings, combined footings, raft foundations.
2. Design of pile foundations.
3. Design of wells and cassions.
4. Design of machine foundation.
5. Design of retaining structures etc.

8CE 9A: SEMINAR (P-2)

8CE 10A: PROJECT Part II (P-2)