

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

**A: THEORY PAPERS**

S.No.	Subject Code	Subject	Teaching Hours (Per Week)		Exam. Duration (Hours)	Maximum Marks
			Lectures	Tutorial		
1	3CE1	Strength of Materials and Mechanics of Structures – I	03	1	3	100
2	3CE2	Building Material & Construction	03	-	3	100
3	3CE3	Engineering Geology	03	-	3	100
4	3CE4	Computer Applications in Civil Engineering	03	-	3	100
5	3CE5	Fluid Mechanics	03	1	3	100
6	3CE6	Engineering Mathematics	03	-	3	100
<b>TOTAL</b>			<b>18</b>	<b>02</b>		<b>600</b>

**B: PRACTICAL AND SESSIONALS**

S.No.	Subject Code	Subject	Hrs./Week	IA	Exam	Max. Marks
				60%	40%	
1	3CE7	Engineering Mechanics & Experimental Techniques Lab.	02	45	30	<b>75</b>
2	3CE8	Civil Engineering Material & Geology Lab.	03	45	30	<b>75</b>
3	3CE9	Computer Programming Lab.	03	45	30	<b>75</b>
4	3CE10	Building Planning & Design – I	02	30	20	<b>50</b>
5	3CE11	Fluid Mechanics Lab.	02	45	30	<b>75</b>
6	3CEDC	Discipline & Extra Curricular Activities		50		<b>50</b>
<b>TOTAL</b>			<b>12</b>	<b>260</b>	<b>140</b>	<b>400</b>
<b>GRAND TOTAL</b>			<b>32 Hrs./Week</b>			<b>1000</b>

## **3CE1 STRENGTH OF MATERIALS AND MECHANICS OF STRUCTURES – I L-3, T-1**

### **UNIT 1**

**Simple Stresses and Strains** : Concept of stress and strain in three dimensions and generalized Hooke's law; Direct stress and strain: free body diagrams, 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; Strain energy for gradually applied, suddenly applied and impact loads.

### **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.

**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.

### **UNIT 3**

**Centroid and Moment of Inertia** : First moment of area, Centroid and moment of inertia of symmetrical & unsymmetrical sections, radius of gyration, polar moment of inertia, product moment of inertia, parallel axis theorem, principal axes and principal moment of inertia.

**Plane trusses** : Simple pin jointed trusses and their analysis: method of joints, method of section and introduction to computer methods.

### **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.

### **UNIT 5**

**Theory of simple bending**: Distribution of bending and shear stresses for simple and composite sections; Shear center and its location in flanged sections. Introduction to unsymmetrical bending.

## **3CE2 BUILDING MATERIAL AND CONSTRUCTION**

**L-3**

### **UNIT 1**

**Stones** : Classification, quarrying of stones, Dressing 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.

**Clay Products** : Bricks such as water absorption, compressive strength, effloresces, dimension and tolerance test– Manufacture process, properties, Classification, standard tests as per IS code, Types of Tiles, standard tests for tiles as per IS code such as water absorption, tolerance, impact value, glazing.

### **UNIT 2**

**Cement and Lime** : Raw materials, constituents of cement and their role, type of cement, manufacture of OPC, Chemistry of setting and hardening, Various standard tests on Portland cements, as per IS code including consistency, setting time, fineness, soundness and strength. Lime: Classification, Manufacture, properties, tests for lime.

**Mortar and Plaster:** Functions and types of sand, bulking of sand, tests for sand, classification, preparation method, tests, uses and properties of mortar and plaster.

### UNIT 3

**Timber :** Definitions of related terms, classifications and properties, conversion of wood, seasoning, preservation, fire proofing, Ply woods, fiber boards, defects in wood.

**Plastics :** Introduction, properties, classification, uses.

**Miscellaneous:** Properties and uses of glass, steel, aluminum, Asbestos, G.I., various types of paints and Varnishes, Prestressed and precast concrete.

### UNIT 4

**Building Requirements :** Building components, their functions and requirements, classification, of building by occupancy and by types of construction, load bearing construction and framed structure construction.

**Foundation :** Purpose, types of foundation, bearing capacity of soil, depth of footing, foundation for black cotton soil, causes of failure of foundation and remedial measure.

### UNIT 5

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

**Pointing & Plastering :** Definition uses and Relative merits, types of panting, types of plastering.

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

## 3CE3 ENGINEERING GEOLOGY

L-3

### UNIT 1

**General Geology :** Subdivision of Geology; Importance of Geology in Civil Engg.; Internal Structure of the Earth; Physical properties of Minerals; Weathering and Work of Wind & River ; Geological Time Scale.

### UNIT 2

**Petrology :** Origin, Classification, Texture & Structures of Igneous, Sedimentary and Metamorphic Rocks; Engineering Properties of Rocks.

### UNIT 3

**Structural Geology:** Causes & Classification of Fold, Fault, Joints & Unconformities.

**Geophysical Methods:** Electrical resistivity & Seismic refraction method for civil engineering importance.

### UNIT 4

**Engineering Geology:** Geological investigation for site selection of site for Dams, Tunnels, Reservoirs and Bridges. Site improvement for different engineering projects.

### UNIT 5

**Remote Sensing:** Introduction and applications in Civil Engineering.

### 3CE3 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

L-3

#### UNIT 1

**Approximation & Error analysis:** Approximations and round of errors, Truncation errors and Taylor Series.

**Roots of Non-linear Equations:** Determination of roots of polynomials and transcendental equations by Bisection, Secant and Bairstow's method, Newton-Raphson method, Successive substitution method etc .

#### UNIT 2

**Linear Algebraic Equation:** Solutions of linear simultaneous linear algebraic equations by Gauss Elimination and Gauss-Siedel iteration methods Successive substitution method and Decomposition methods.

#### UNIT 3

**Curve fitting & Numerical Differentiation:** Curve fitting – linear and nonlinear regression analysis; Backward, Forward and Central difference relations and their uses in numerical differentiation and integration, Application of difference relations in the solution of differential equations.

#### UNIT 4

**Numerical Integration and Area under a Curve:** Introduction to numerical integration and Area under a Curve; Trapezoidal method, Simpson's 1/3 method, Simpson's 3/8 method and Newton's method for integration.

#### UNIT 5

**Ordinary Differential Equation:** Numerical solution of ordinary differential equations by Euler, Modified Euler, Runge-Kutta and Predictor-Corrector method.

**Partial Differential Equation:** Elliptic equation & parabolic equation & their solution techniques. Finite Element Method: – General approach, application in one dimension. Computer programming using C/ C++ on these topics.

### 3CE5 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 metacentric height experimental and analytical determination of metacentric 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 vorticity

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 – Boarda'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 Moody's diagram, loss of head due to friction and other causes. Hydraulic gradient, total energy line Chezy's, Darcys and Mannings 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.

### 3CE6 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.

## Typical list of experiments

### **3CE7 ENGINEERING MECHANICS & EXPERIMENTAL TECHNIQUES LAB.**

**P-2**

1. Law of Parallelogram of Forces
2. Polygon Law of Forces
3. Support Reactions of a Simply Supported Beam
4. Coefficient of Static Friction
5. Efficiency of Compound Lever
6. Efficiency Bell Crank Lever
7. Efficiency of Worm and Worm Wheel
8. Theorem of Super Position
9. Efficiency of Screw Jack
10. Efficiency of Double Purchase Crab Winch
11. Efficiency of Differential Wheel & Axle
12. Study of System of Pulleys
13. Study of Behaviour of Struts

### **3CE8 CIVIL ENGINEERING MATERIAL & GEOLOGY LABORATORY**

**P-3**

#### **Part I**

1. Identification of Materials by Visual Inspection
2. To Study the Procedure for Testing of Portland 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 Find out the Water Absorption and Tolerance Limit of Bricks

#### **Part II**

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.)

**3CE9 COMPUTER PROGRAMMING LAB.****P-3**

1. To develop computer programmes in C/C+ for revision of basic tools of programming.
2. To develop computer programmes in C/C+ for solving linear and non-linear equations by methods as covered in theory.
- 3.
4. To develop computer programmes in C/C+ for solutions of differential equations by methods as covered in theory.
5. To develop computer programmes in C/C+ for Integration and area calculation by methods as covered in theory.
6. To develop computer programmes in C/C+ for best fitting curves by methods as covered in theory.
7. Writing computer programmes for solving simple problems related to Engineering, (in general Civil Engineering).

**3CE10 BUILDING PLANNING AND DESIGN I****P-2****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

**3CE11 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.

**RAJASTHAN TECHNICAL UNIVERSITY**  
**TEACHING SCHEME, B.Tech. [CIVIL ENGINEERING]**  
**SECOND YEAR (4<sup>th</sup> SEMESTER)**

**A: THEORY PAPERS**

S.No.	Subject Code	Subject	Teaching Hours (Per Week)		Exam. duration (Hours)	Maximum Marks
			Lectures	Tutorial		
1	4CE1	Strength of Materials and Mechanics of Structures – II	03	1	3	<b>100</b>
2	4CE2	Concrete & Construction Technology	03	-	3	<b>100</b>
3	4CE3	Hydraulics & Hydraulic Machines	03	-	3	<b>100</b>
4	4CE4	Surveying – I	03	-	3	<b>100</b>
5	4CE5	Building Technology	03	-	3	<b>100</b>
6		<b>Elective – I</b>	03	-	3	<b>100</b>
	4CE6.1	Rock Mechanics				
	4CE6.2	Optimization Techniques				
	4CE6.3	Advanced Mathematics				
<b>TOTAL</b>			<b>18</b>	<b>01</b>		<b>600</b>

**B: PRACTICAL AND SESSIONALS**

S.No.	Subject Code	Subject	Hrs./ Week	IA	Exam	<b>Max. Marks</b>
				60%	40%	
1	4CE7	Material Testing Lab.	02	30	20	<b>50</b>
2	4CE8	Concrete Lab.	03	45	30	<b>75</b>
3	4CE9	Hydraulic Lab.	02	45	30	<b>75</b>
4	4CE10	Surveying Lab. – I	03	45	30	<b>75</b>
5	4CE11	Building Planning & Design – II	03	45	30	<b>75</b>
6	4CEDC	Discipline & Extra Curricular Activities		50		<b>50</b>
<b>TOTAL</b>			<b>13</b>	<b>260</b>	<b>140</b>	<b>400</b>
<b>GRAND TOTAL</b>			<b>32 Hrs./Week</b>			<b>1000</b>

## **B. TECH. SECOND YEAR CIVIL (4<sup>TH</sup> SEMESTER)**

### **4CE1 STRENGTH OF MATERIALS AND MECHANICS OF STRUCTURES–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**

**Fixed Beams & Continuous Beams :** Analysis of fixed beams & continuous beams by three moment theorem and area moment method.

#### **UNIT 3**

**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, close coiled helical springs, springs in series and parallel, laminated plate springs.

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

#### **UNIT 4**

**Introduction to Energy Methods :** Strain energy due to bending, shear and torsion; Castiglino's theorems, unit load method & their applications in analysis of redundant frames upto two degree of redundancy and deflection of determinate beams, frames and trussed beams; Stresses due to temperature & lack of fit in redundant frames. Theories of Failures

#### **UNIT 5**

**Vibrations :** Stress tensor and failure criterion. Elementary concepts of structural vibration, degree of freedom, free vibration of undamped single degree of freedom systems. Newton's law of motion, D'Alembert's principle, solution of differential equation of motion, frequency & period of vibration, amplitude of motion; Damped single degree of freedom system: types of damping, analysis of viscously damped, under-damped, over-damped & critically-damped systems, logarithmic decrement.

### **4CE2**

### **CONCRETE & CONSTRUCTION TECHNOLOGY**

**L-3**

#### **UNIT 1**

**Concrete :** Grade of concrete, proportioning of ingredients, water content and its quality for concrete, water/cement ratio and its role, gel/pore ratio, concrete mix design (ACI, IS method), quality control for concrete. Properties of fresh concrete including workability, air content, flow ability, methods to determine and factors affecting. 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.

#### **UNIT 2**

**Concrete Handling in Field :** Interaction to mixing & batching methods, placing, transportation and Compaction methods, curing methods and compounds.

**Admixture in concrete:** Chemical and mineral admixtures, their types, use of water reducers, accelerator, retarders, water-proofing plasticizers and super plasticizers, use of fly ash and silica fume in concrete, their properties, effect and production of high strength concrete, properties of high strength concrete & application.

### UNIT 3

**Form work:** Requirements, Indian standard on form work, loads on form work, type & method to provide centering and shuttering for Columns, beams, slabs, walls and staircase, slip and moving formwork.

**Site Preparation and temporary Structures:** Sequence of construction activity and co-ordination, site clearance, marking, foundation plan, earthwork in dry and loose soil, different methods and their suitability, dewatering, construction of temporary shed, types of shoring, methods of underpinning and types of scaffolding.

**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.

### UNIT 4

**Joints :** Requirements, types and material used, construction details.

**Arches and Lintels :** Terms used, types of arches and their construction detail, types of lintels and constructions.

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

**Construction System :** Prefabricated/precast construction; advantages & disadvantage of prefabrication. Precast R.C. plank flooring/roofing, Thin R.C. ribbed slab for floors & roofs, thin precast RCC lintels in brickwalls, Modular co-ordination. Multi storied building frames, Concrete skeleton system, lift slab system, cast one house system, L-shaped panel system.

### UNIT 5

**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.

## 4CE3

## HYDRAULICS AND HYDRAULIC MACHINES

L – 3 T – 1

### UNIT 1

**Dimensional Analysis & Models :** Dynamical Similarity and Dimensional Homogeneity Model experiment, geometric, Kinematic and Dynamic similarity. Reynold's, Froude's, 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. Hydrodynamically smooth & rough boundaries. Laminar, Sublayer, 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.

### 4CE4 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.

#### 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.

**UNIT 1**

**Introduction:** Types of buildings, 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, biclimatic 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.

**UNIT 4****Functional design and Accommodation requirements**

(A) **Residential Buildings :** Anthrometry, 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 centres, post office, bank, college library, cinema theatres etc.

**UNIT 5****Services in Buildings**

(A) Lighting and ventilation, doors and windows.

(B) Acoustics, sound insulation and noise control.

**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 Criteria 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.

**4CE6.2 OPTIMIZATION METHODS**

**L-3**

**UNIT 1**

**Introduction:** Historical development, Engineering application of optimization, Formulation of design problems as a mathematical programming problems, Classification of optimization problems.

**UNIT 2**

**Linear Programming :** Simplex methods, Revised simplex method, Duality in linear programming, post optimality analysis.

**UNIT 3**

**Applications of Linear programming :** Transportation and assignment problems.

**UNIT 4**

**Non Linear Programming :** Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and Indirect methods.

**UNIT 5**

**Dynamic Programming:** Introduction, multi-decision processes, computational procedure.

**4CE6.3 ADVANCED MATHEMATICS**

**L-3**

**UNIT 1**

**Elementary Statistics & Probability:** Elementary theory of probability, Baye's Theorem with its simple applications, Theoretical probability distributions – Binomial, Poisson, Normal distribution.

**UNIT 2**

**Advance Statistics:** Chisquare test as test of goodness of fit. Line of regression, Coefficient of correlation and rank correlation.

**UNIT 3**

**Tensor Analysis:** Definition of a tensor, Transformation of co-ordinates, contra variant and co-variant vectors, addition and multiplication of tensors, contraction of tensors, inner product, fundamental tensors, Christoffel symbols, covariant differentiation.

**UNIT 4**

**Bessel's Functions:** Bessel functions of first and second kind, simple recurrence relations, orthogonal, property of Bessel's function.

**UNIT 5**

**Legendre's function:** Legendre's function, simple recurrence relations, Rodrigues formula, orthogonal property of Legendre's function, generating function.

**4CE7****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

**4CE8****CONCRETE LAB.****P-3**

1. To determine standard (Normal) consistency of cement.
2. To determine Initial & Final setting time of cement.
3. To determine specific gravity of cement.
4. To determine the fineness of Cement by sieving through a 90 micron I.S. Sieve.
5. To determine the Compressive Strength of Cement.
6. To determine Soundness of cement by Le-chatelier apparatus.
7. To determine the specific gravity of fine aggregate (sand) by Pycnometer.
8. To determine the bulking of fine aggregate and to draw curve between water content and bulking.
9. To determine the fineness modulus of coarse aggregates and fine aggregates by sieve analysis.
10. To determine the workability of given concrete mix by slump test.
11. To determine the workability of given fresh concrete mix by compaction factor test.
12. To determine the workability of given concrete mix by Flow table test.
13. To design concrete mix in accordance with I S recommendations.

**4CE9****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.

**4CE10****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.
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.
9. 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.
13. To determine the area of a figure using a planimeter.

**4CE11****BUILDING PLANNING AND DESIGN II****P-3**

- 1- To design 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

**RAJASTHAN TECHNICAL UNIVERSITY**  
**TEACHING SCHEME, B.Tech. [CIVIL ENGINEERING]**  
**THIRD YEAR (5<sup>th</sup> SEMESTER)**

**A: THEORY PAPERS**

S.No.	Subject Code	Subject	Teaching Hours (Per Week)		Exam. Duration (Hours)	Maximum Marks
			Lectures	Tutorials		
1	5CE1	Theory of Structures – I	03	1	3	<b>100</b>
2	5CE2	Concrete Structures-I	03	-	3	<b>100</b>
3	5CE3	Steel Structures-I	03	-	3	<b>100</b>
4	5CE4	Surveying-II	03	-	3	<b>100</b>
5	5CE5	Quantity Surveying & Valuation	03	-	3	<b>100</b>
6		<b>Elective II</b>	03	-	3	<b>100</b>
	5CE6.1	Modern concrete technology and practice				
	5CE6.2	Construction Equipments and Material Management				
	5CE6.3	Solid Waste Management				
<b>TOTAL</b>			18	01		<b>600</b>

**B: PRACTICAL AND SESSIONALS**

S.No.	Subject Code	Subject	Hrs./ Week	I A 60%	Exam 40%	Max. Marks
1	5CE7	Design of Concrete Structures I	03	45	30	<b>75</b>
2	5CE8	Design of Steel Structures I	03	45	30	<b>75</b>
3	5CE9	Surveying Lab. II	03	45	30	<b>75</b>
4	5CE10	Structural Engineering Lab	02	45	30	<b>75</b>
5	5CE11	Engineering Economics & Management	02	30	20	<b>50</b>
6	5CEDC	Discipline & Extra Curricular Activities		50		<b>50</b>
<b>TOTAL</b>			13	260	140	<b>400</b>
<b>GRAND TOTAL</b>			32 Hrs./Week			<b>1000</b>

**5CE1 THEORY OF STRUCTURES –I**  
**T 1**

**L 3**

**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 Indeterminate Structures using Moment Area method.

**UNIT: 2**

Analysis of Statically Indeterminate Structures using Slope-deflection method and Moment-distribution methods.

**UNIT: 3**

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

**UNIT: 4**

Energy methods and related theorems, solution of determinate & indeterminate structures using energy methods (i.e. determination of deflection and forces in structures)

**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.

**5CE2 CONCRETE STRUCTURES – I**  
**L 3**

**UNIT: 1**

Design Philosophies: Working stress, ultimate strength and limit states of design. Introduction to working stress method. Analysis and Design of prismatic Sections in flexure using limit state methods: singly and doubly reinforced prismatic sections and lintels.

**UNIT: 2**

Design of one way slabs. Shear and Bond: Behavior of beams in shear and bond, design for shear, anchorage, curtailment and splicing of reinforcement, detailing of reinforcement. Serviceability Conditions: Limit states of deflection and cracking, calculation of deflections & crack width as per code provisions.

**UNIT: 3**

Design of two way slabs and flat slabs by direct design method.

**UNIT: 4**

Design of Columns: Short and long rectangular and circular columns, eccentrically loaded columns.

**UNIT: 5**

Design of Column Footings: Isolated and combined column footings and circular raft foundations.

5CE3                      STEEL                      STRUCTURES                      –                      I  
L 3

**UNIT: 1**

**Introduction:** Types of steels and their permissible stresses

**Connections:** Design of riveted, bolted and welded connections under axial and eccentric loadings

**UNIT: 2**

**Compression Member:** Design of compression member; Axially and eccentrically loaded compression members, built up columns, design of lacing and battens.

**UNIT: 3**

**Beams:** Design of beams; simple and compound sections, main and subsidiary beams and their connections, grillage foundation.

**UNIT: 4**

**Tension Members:** Design of axially and eccentrically loaded tension members.

**Column Bases:** Design of column bases, Slab base, gusseted base.

## UNIT: 5

Plastic analysis of steel structures, fundamentals, static and mechanism method of analysis, bending of beams of rectangular and I sections beams, shape factor, design of simply supported beams, fixed beams, continuous beams and single span rectangular frames.

5CE4

SURVEYING

-

II

L 3

## UNIT: 1

**Trigonometric Levelling:** Methods of trigonometric levelling direct method and reciprocal method, axis Signal corrections. Determination of difference in elevations of points.

## UNIT: 2

**Curve Surveying:** Elements of circular (Simple, compound and reverse) curves, transition curves, degrees of curves 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. Intervisibility 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.**

**Survey camp:** (including exercise on triangulation, topographic, or project survey) with duration of maximum 10 days.

5CE5            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.

**5 CE 6.1 MODERN CONCRETE TECHNOLOGY AND PRACTICE**

L 3

**UNIT: 1**

**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. Mineral and Chemical admixtures in Concrete: types and their uses.

#### **UNIT: 2**

**Concrete Production:** Vibrator compacted concrete in buildings, pavements and infrastructure projects etc., pumpable concrete, roller compacted concrete and Ready Mixed Concrete- methods, specific features and uses etc.

**Rheology of Concrete:** Flow ability, Segregation, Bleeding and Viscosity etc. - Factors affecting, methods of determination, related standards etc.

#### **UNIT 3:**

**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 available standard.

#### **UNIT 4:**

**Microstructure of Concrete:** Interfacial transition zone, hydration kinetics, hydrated cement paste (hcp), 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- case studies.

#### **UNIT 5:**

**Special Aggregates:** Light weight, heavy weight- their characteristics and uses in concrete.

Specific purpose Concretes and Cement based composites: Self Compacting Concrete, 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 - some case studies of specific tailored HPC in India.

### **UNIT – I: 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 – II: Equipment Management**

Planning of construction equipments, Forecasting equipment requirement, Operation & Utilisation, Equipment replacement, Manpower planning & Maintenance of equipments.

### **UNIT – III: Economics of Construction Equipments**

Operation Cost & Its types. Investment Cost, Cost of Repairs, Overheads Cost accounting, Break-even point theory, Replacement of equipment.

### **UNIT-IV: Materials Management**

Scope, objectives & importance of materials management, Selective control techniques, Disposal of surplus material.

### **UNIT – V: Inventory Control & Spare Part Management**

Need, function, steps in inventory control. Advantages, Economic order quantity, Inspection & procurement of spares, stores & stock management.

## **5CE6.3 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.

### **5CE7 DESIGN of CONCRETE STRUCTURES I**

**P 3**

Design as per syllabus of theory.

### **5CE8 DESIGN of STEEL STRUCTURES I**

**P 3**

Design as per syllabus of theory.

### **5CE9 SURVEY LAB. II**

**P 3**

1. To measure the horizontal and vertical angles by Theodolite.
2. To determine the Height of an object by trigonometrical leveling (single plane method).
3. To determine the Height of an object by trigonometrical leveling (two plane method).
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

### **5CE10 STRUCTURAL ENGINEERING LAB**

**P 2**

1. Deflection of a truss
2. Clark-Maxwell reciprocal theorem with truss
3. Funicular polygon for flexible cable
4. Analysis of redundant frame
5. Deflection of curved members
6. Buckling of columns
7. Clark-Maxwell reciprocal theorem with simply supported beam
8. ILD for deflection in a steel beam using unit load method
9. ILD for support reaction using Muller-Breslau Principle
10. Unsymmetrical bending

### **5CE11 ENGINEERING ECONOMICS & MANAGEMENT**

**P 2**

1. **Microeconomics**:- Law of demand and supply, utility approach and indifference curves, elasticity of demand & supply and applications, consumer surplus, Law of returns to factors and return to scale.

2. **Macroeconomics:-** concepts relating to National product- National income and its measurement, Simple Keynesian theory, simple multiplier, money and banking. Meaning and concept of international trade, determination of exchange rate, balance of payment.
3. **Project Evaluation:-** Meaning, Capital and OMR cost, Project life, Stages, Methods of Evaluations with their limitations.
4. **India:-** Brief history of Indian Constitution, framing-features, fundamental rights, duties, directive principles of state. History of Indian National Movement. Socioeconomic growth after independence.
5. **Management:-** Principles of management, functions-planning, organization, staffing, directing, controlling, coordination , decision making.

**RAJASTHAN TECHNICAL UNIVERSITY**  
**TEACHING SCHEME, B. Tech. [CIVIL ENGINEERING]**  
**THIRD YEAR (6<sup>th</sup> SEMESTER)**

**A: THEORY PAPERS**

S.No.	Subject Code	Subject	Teaching Hours (Per Week)		Exam. duration (Hours)	Max. Marks
			Lectures	Tutorials		
1	6CE1	Theory of Structures – II	03	1	3	<b>100</b>
2	6CE2	Concrete Structures-II	03	-	3	<b>100</b>
3	6CE3	Steel Structures-II	03	-	3	<b>100</b>
4	6CE4	Environmental Engineering– I	03	-	3	<b>100</b>
5	6CE5	Transportation Engineering-I	03	-	3	<b>100</b>
6		<b>Elective – III</b>	03	-		<b>100</b>
	6CE6.1	Repair And Rehabilitation of Structures				
	6CE6.2	Remote Sensing and GIS				
	6CE6.3	Design of Pre-stressed Concrete Structures				
<b>TOTAL</b>			18	01		<b>600</b>

**B: PRACTICAL AND SESSIONALS**

S.No.	Subject Code	Subject	Hrs./ Week	IA 60%	Exa. 40%	Max. Marks
1	6CE7	Matrix Methods of Structural Analysis	03	45	30	<b>75</b>
2	6CE8	Design of Concrete Structures II	03	45	30	<b>75</b>
3	6CE9	Design of Steel Structures II	03	45	30	<b>75</b>
4	6CE10	Environmental Engg. Design & Lab. I	02	30	20	<b>50</b>
5	6CE11	Road Materials Testing Lab.	02	45	30	<b>75</b>
6	6CEDC	Discipline & Extra Curricular Activities		50		<b>50</b>
<b>TOTAL</b>			13	260	140	<b>400</b>
<b>GRAND TOTAL</b>			32Hrs./week			<b>1000</b>

## 6CE1 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

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

### UNIT: 5

**Unsymmetrical bending:** Definition, location of NA, computation of stresses and deflection, shear center and its location.

**Composite Sections:** Flexural analysis of composite sections.

## 6CE2- 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 sections for flexure and shear, Introduction to continuous beams.

### UNIT: 2

**Torsion:** Design of beams for torsion.

**Continuous and Curved Beams:** Design of continuous R.C. beams, moment redistribution, beams curved in plan.

### UNIT: 3

**Circular Domes:** Circular domes with u.d.l. & concentrated load at crown.

**Yield Line Theory:** Application of Y.L.T. to slabs with simple support conditions.

### UNIT: 4

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

## UNIT: 5

**Culverts and Bridges:** Design of slab culverts for I.R.C. loading.

Cantilever Retaining Walls: Design of cantilever type retaining walls & introduction and stability analysis of counter-fort and buttress type retaining walls.

## 6CE3 STEEL STRUCTURES-II

L 3

### UNIT: 1

Design of gantry girder, Design of roof trusses

### UNIT: 2

**Design of plate girder:** design of section, connections for flange plate to flange angles & flange angles to web, web and flange splicing. Vertical, Horizontal, Intermediate and Bearing stiffeners. Curtailment of plates.

### UNIT: 3

**Bridges:** Standard loading for railway bridges, design of Deck type plate-girder bridges, design of bracings and frames. Application of ILD to the design of bridges, design of through type truss bridges, design of members and joints, design of stringers, cross girder, lateral, sway and portal bracings.

### UNIT: 4

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

**NOTE: Only four units are sufficient as the questions are long.**

## 6CE4 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.

**6CE5 TRANSPORTATION ENGINEERING–I****L 3****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 Planing:** 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.

**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.

**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. (As per guidelines of IRC)

**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.

**6CE6.1 REPAIR AND REHABILITATION OF STRUCTURES****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.

## 6CE6.2- 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.

## 6CE 6.3 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.

**6CE7      MATRIX METHODS of STRUCTURAL ANALYSIS      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.

**6CE8                  DESIGN of CONCRETE STRUCTURES II      P 3**  
Design as per syllabus of theory.

**6CE9                  DESIGN of STEEL STRUCTURES II      P 3**  
Design as per syllabus of theory

**6CE10                ENVIRONMENTAL ENGINEERING DESIGN & Lab. I      P 3**

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.

**6CE11                ROAD MATERIAL TESTING LAB      P 2**

1. Aggregate impact test
2. Angularity number test
3. To determine fineness modulus of a given sample of coarse aggregate.
4. Los angles abrasion test
5. Aggregate crushing value test
6. Standard tar viscometer test
7. Specific gravity and water absorption test
8. To determine the elongation index for given sample of aggregate.
9. To determine the flakiness index of given sample of aggregate.

10. Ductility test

11. To determine the softening point for give sample of bitumen.

12. Marshall stability test

**13.** Float test

**RAJASTHAN TECHNICAL UNIVERSITY**  
**TEACHING SCHEME, B.Tech. [CIVIL ENGINEERING]**  
**FINAL YEAR (7<sup>th</sup> SEMESTER)**

**A: THEORY PAPERS**

S.No.	Subject Code	Subject	Teaching Hours (Per Week)		Exam. duration (Hours)	Max. Marks
			Lectures	Tutorials		
1	7CE1	Geotechnical Engineering – I	03	-		<b>100</b>
2	7CE2	Water Resources Engineering -I	03	-		<b>100</b>
3	7CE3	Environmental Engineering– II	03	-		<b>100</b>
4	7CE4	Building Design	03	-		<b>100</b>
5	7CE5	Transportation Engineering - II	03	1		<b>100</b>
6		<b>Elective IV</b>	03	-		<b>100</b>
	7CE6.1	Earthquake Resistant Design & Construction				
	7CE6.2	Ground Improvement Techniques				
	7CE6.3	Rural Water Supply & Sanitation				
<b>TOTAL</b>			<b>18</b>	<b>01</b>		<b>600</b>

**B: PRACTICAL AND SESSIONALS**

S.No.	Subject Code	Subject	Hrs./ Week	IA	Exam	Max. Marks
1	7CE7	Geotechnical Engg. Design & Lab.-I	03	30	20	<b>50</b>
2	7CE8	Water Resources Engineering Design-I	02	30	20	<b>50</b>
3	7CE9	Environmental Engg. Design & Lab. II	02	30	20	<b>50</b>
4	7CE10	Computer Aided Building Design	03	30	20	<b>50</b>
5	7CE11	Practical Training and Industrial Visit	02	60	40	<b>100</b>
6	7CE12	Project-Part I	02	50	-	<b>50</b>
7	7CEDC	Discipline & Extra Curricular Activities		50		<b>50</b>
<b>TOTAL</b>			<b>13</b>	<b>280</b>	<b>120</b>	<b>400</b>
<b>GRAND TOTAL</b>			<b>32 Hrs./Week</b>			<b>1000</b>

## **7CE1-GEOTECHNICAL ENGINEERING – I**

**L 3**

### **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. Soil stabilization, Mechanical Stabilization. Stabilization with cement, lime and bitumen.

## **7CE2 – 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.

## **7CE3 ENVIRONMENTAL ENGINEERING – I**

**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.

### **7CE4 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.

### **7CE5-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.

## **7CE6.1 EARTHQUAKE RESISTANT DESIGN & CONSTRUCTION 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.

## **7CE6.2 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, Reinforcement of soil beneath roads, foundation.

### **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**

## **7CE6.3-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.

## **7CE7 GEOTECHNICAL ENGG. DESIGN AND LABORATORY. I**

**P 3**

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- $\phi$  values by Direct Shear Test Apparatus
12. Determination of unconfined compressive strength by unconfined compression Test Apparatus

**Design as per syllabus of theory.**

**7CE 8 WATER RESOURCES ENGINEERING DESIGN – I P 2**

**Design as per syllabus of theory.**

**7CE9 ENVIRONMENTAL ENGINEERING LAB. & DESIGN – II P 2**

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.**

**7CE 10 COMPUTERS AIDED BUILDING DESIGN P 3**

**(Syllabus to be attached )**

**7CE 11 PRACTICAL TRAINING AND INDUSTRIAL VISIT**

**7CE 12 PROJECT Part I**

**RAJASTHAN TECHNICAL UNIVERSITY**  
**TEACHING SCHEME, B. Tech. [CIVIL ENGINEERING]**  
**FINAL YEAR (8<sup>th</sup> SEMESTER)**

**A: THEORY PAPERS**

S.No	Subject Code	Subject	Teaching Hours (Per Week)		Exam. duration (Hours)	Max. Marks
			Lectures	Tutorials		
1	8CE1	Geotechnical Engineering-II	03	1	3	<b>100</b>
2	8CE2	Water Resources Engineering-II	03	-	3	<b>100</b>
3	8CE3	Project Planning & Construction Management	03	1	3	<b>100</b>
4		<b>Elective – V</b>	03	-	3	<b>100</b>
	8CE4.1	Bridge Engineering				
	8CE4.2	Advance Foundation Engineering				
	8CE4.3	Advanced Transportation Engg.				
<b>TOTAL</b>			12	02		<b>400</b>

**B: PRACTICAL AND SESSIONALS**

S.No.	Subject Code	Subject	Hrs./ Week	IA 60%	Exam 40%	Max. Marks
1	8CE7	Geotechnical Engg. Design & Lab.-II	02	30	20	<b>50</b>
2	8CE8	Water Resources Engineering Design-II	03	45	30	<b>75</b>
3	8CE9	Professional Practice and Estimating	03	45	30	<b>75</b>
4	8CE10	Design of Foundations	02	30	20	<b>50</b>
5	8CE11	Seminar	02	60	40	<b>100</b>
6	8CE12	Project-Part II	04	120	80	<b>200</b>
	8CEDC	Discipline & Extra Curricular Activities		50		<b>50</b>
<b>TOTAL</b>			16	380	220	<b>600</b>
<b>GRAND TOTAL</b>			30Hrs./week			<b>1000</b>

## **SCE1 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, coefficient of consolidation. Preconsolidation pressure and its determination. Normally, over and under consolidated soils. Methods of predicting Settlement and its rate. Total and differential Settlement.

### **UNIT: 3**

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

**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

### **UNIT: 4**

**Earth Pressure:** Active, passive and earth pressure at rest. Rankine's and Coulomb's theories. 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. Stability analysis of retaining walls. Earth pressure on cantilever sheet piles, rigid bulk heads.

### **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.

## **SCE2-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, syphon aqueduct, superpassage syphon, 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 headworks, 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.

### **8CE3 -PROJECT PLANNING & CONSTRUCTION MANAGEMENT L 3**

#### **UNIT-1**

**FINANCIAL EVALUATION OF PROJECTS AND PROJECT PLANNING:** Capital investment proposals, criteria to judge the worthwhileness 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.

### **8CE 4.1-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.

### **8CE4.2-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, Moyerhof's analysis, Bearing capacity of stratified soils, Methods of estimation of settlement of footings.

## **Unit 2**

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 foundations:** 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.

**Expansive 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.

## **SCE4.3-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.

**8CE7 GEOTECHNICAL ENGG. DESIGN AND LABORATORY. – II P 3**

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

**Design as per syllabus of theory.**

**8CE8 WATER RESOURCES ENGINEERING DESIGN – II P 3**

**Design as per syllabus of theory.**

**8CE 9 PROFESSIONAL PRACTICES AND ESTIMATING**

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.

**8CE 10 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 11 SEMINAR****8CE 12 PROJECT Part II**