

# **S Y L L A B U S**

**BACHELOR OF TECHNOLOGY**

**CIVIL ENGINEERING**

(Semester Scheme)

**Four Year Degree Course**

B.Tech., Second Year Examination, 2016

B.Tech., Third Year Examination, 2017

B.Tech., Fourth Year Examination, 2018



**JODHPUR NATIONAL UNIVERSITY**  
**JODHPUR**

# Jodhpur National University, Jodhpur

Teaching & Examination Scheme

## B.Tech II Year (Civil Engineering)

### III Semester

<b>A: THEORY PAPERS</b>						
S. No.	Code No.	Subject	L	T	MM	Ex. Hrs.
1.	BCE301	Strength of Materials and Mechanics of Structures – I	3	1	100	03
2.	BCE302	Building Material & Construction	3	1	100	03
3.	BCE303	Engineering Geology	3	0	100	03
4.	BCE304	Computer Applications in Civil Engineering	3	0	100	03
5.	BCE305	Fluid Mechanics-I	3	1	100	03
6.	BCE306	Engineering Mathematics	3	1	100	03
7.	BGE307 A*	Special Mathematics- I	3	1	100	3
<b>TOTAL</b>			<b>21</b>	<b>05</b>	<b>700</b>	

<b>B: PRACTICAL AND SESSIONALS</b>				
S. No.	Code No.	Subject	P	MM
1.	BCE307	Engineering Mechanics & Experimental Techniques Lab.	3	100
2.	BCE308	Computer Programming Lab.	3	100
3.	BCE309	Building Planning & Design – I	3	100
4.	BCE310	Fluid Mechanics Lab.-I	3	100
<b>TOTAL</b>			<b>12</b>	<b>400</b>
<b>GRAND TOTAL</b>				<b>1000</b>

**\* It will be sessional paper: marks shall not be counted for awarding division.**

## BCE 301 STRENGTH OF MATERIALS AND MECHANICS OF STRUCTURES – I

L-3, T-1

Exam. Hrs.:- 3

M.M. :- 100

### 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 & it's 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.

#### References Books:-

1. "Mechanics of Materials," by B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain.
2. "Elements of Strength of Materials," by S.P. Timoshenko & D.H. Young.
3. "Strength of Materials," by R.S. Khurmi.
4. "Structural Analysis," by G.S.Pandit & S.P. Gupta.
5. "Strength of Materials and Structural Analysis," by Ashok Kumar Jain.
6. "Strength of Materials," by G.H. Ryder.
7. "Mechanics of Materials," by Ferdinand Beer & E. Russell, Johnston & John T De Wolf.
8. Strength of Materials," by Nash W.A.
9. Advanced Strength and Applied Stress Analysis," by Richard Budynas.

## BCE 302 BUILDING MATERIAL AND CONSTRUCTION

L-3,T-1

Exam. Hrs.:- 3

M.M. :- 100

### 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 masonary work, different types of bonds, relative merits merit and demerits of English, single flemish and double flemish bond. Comparison between stone and brick masonary. General principles, classification of stone masonary.

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

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

### References Books:-

1. "Building Constriction," by Dr. BC.Punmia, Ashok Kumar Jain & Arun Kumar Jain
2. "A Text Book of Building Construction," by S.K.Sharma & B.K.Kaul.
3. "Building Construction," by S.C.Rangwala, K.S.Rangwala & P.S.Rangwala.
4. "Building Construction," by Sushil Kumar.
5. "Building Construction," by Janardan Jha & S.K.Sinha.
6. "The Text Book of Building Construction," by S.P. Bindra & S.P.Arora.
7. "Manual of Tropical Housing and Building," by O.H.Koenisberger.
8. "Building Construction Hand book," by Roy Chudley & Roger Greeno.

9. "Building Construction," by P.C. Varghese.
10. "Building Materials ," by Gurcharan Singh.
11. "Building Construction, by Francis D.K. Ching & Cassandra Adams.
12. "Civil Engineering Materials and construction Practice," by R.K. Gupta.

## **BCE 303 ENGINEERING GEOLOGY**

**L-3**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

### **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.

### **References Books:-**

1. "Structural Geology," by Marland P. Billings
2. "Engineering and General Geology," by Prof. Prabin Singh
3. "Geology of Engineering," by J.M.Treteth.
4. "Principle Engineering Geology and Geotechnics," by Krynine and Judd
5. "Geology and Engineering," by Leggot, R.F.
6. "A Text book of Geology," P.K. Mukerjee

**BCE304      COMPUTER APPLICATIONS IN CIVIL ENGINEERING**

**L-3**

**Exam. Hrs.:- 3**

**M.M. :- 100**

**UNIT 1**

Introduction to Raster scan display.

**Scan conversion & line algo:** Scan conversion technique, image representation, line drawing, simple DDA, Bresenham's algorithm, Circle drawing, general method, symmetric DDA, curves, Beizier method, B-sp-line method.

**UNIT 2**

**2D & 3D System:** 2D & 3D co-ordinate system, Translation rotation, scaling, reflection inverse transformation, composite transformation, screen coordinate system, parallel and perspective projection, representation of 3D object on 2D screen.

**UNIT 3**

**AutoCAD:** Introduction, Brief history, Graphics primer.

**Basics:** Scale, The AutoCAD interface

**UNIT 4**

**AutoCad Drawing objects:** Line, Circles, Text, Arcs, Rectangles, Complex entities.

**Navigation & control:** World coordinate system, zoom & pan, snapping, layers, Colors, Line types, List & inquiry

**UNIT 5**

**Intranet:** Introductions. Intranet vs LANs components of an intranet, Workstations and client software, Server and Network operating systems, Network cards, cabling and hubs, steps for creating an intranet,

**E-mail technology:** Features and concepts- message headers, address book, attachment, filtering and forwarding mails.

**Reference Books:-**

1. "Computer Oriented Numerical Methods," by R.S.Salaria.

## BCE305 FLUID MECHANICS-I

L-3 T-1

Exam. Hrs.:- 3

M.M. :- 100

### 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 :** Reynolds experiment, Minor losses, loss of head due to sudden enlargement, sudden contraction, bend, entry and exit; loss of head due to friction- Darcy- Weisbach equation. Hydraulic gradient and total energy lines. Pipes in series and parallel. Equivalent pipe. Flow along a by pass. Power transmission through pipe, condition for maximum power. Water hammer concept.

**Reference Books:-**

1. "Fluid Mechanics and Machines," by V.P. Gupta & Alam Singh.
2. "Fluid Mechanics and Fluid Power Engineering," by D.S. Kumar.
3. "Engineering Fluid Mechanics (Including Hydraulic Machines) by Prof. R.J.Garde & A.G. Miragaoker.
4. "Fluid Mechanics," by Dr. S. Subrahmiyam.
5. "Fluid Mechanics and Its Applications," by Vijay Gupta & Santosh K. Gupta.
6. "Fluid Mechanics," by White, Frank M.

### **BCE 306 ENGINEERING MATHEMATICS**

**L-3,T-1**

**Exam. Hrs.:- 3  
M.M. :- 100**

#### **UNIT 1**

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

#### **UNIT 2**

**Laplace Transform** - Laplace transform with its simple properties. Unit step function, Dirac delta functiontheir 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.

#### **Reference Books:-**

1. "Advanced Engineering Mathematics III," by Mehta D.M.& Sharma.
2. "Higher Engineering Mathematics III," by Gokhroo, Mehta.
3. "Engineering Mathematics, by Dr. Hari Arora.



## **BGE 307A\* Special Mathematics I**

**L-3,T-1**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

### **UNIT 1**

**Trigonometry** - Trigonometric functions, simple identities, range and values of trigonometric functions, inverse functions, De Moivre's theorem, Euler's theorem

### **UNIT 2**

**Basic Algebra** - Binomial theorem for positive and negative index, logarithmic and simple properties, exponential, Logarithmic and trigonometric series.

### **UNIT 3**

**Differential Calculus** – Function single variable and multivariable function, polynomial trigonometric, logarithmic and exponential functions, derivative of a function elementary formulae.

### **UNIT 4**

**Differential Calculus**- Derivative of sum and difference of two functions, derivative of product and quotient of two functions, logarithmic differentiation, partial differentiation.

### **UNIT 5**

**Integral Calculus**- Integration of a function standard integrals and properties, integration by substitution, Integration by parts, definite integral and properties.

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**Jodhpur National University, Jodhpur**  
Teaching & Examination Scheme  
**B.Tech II Year (Civil Engineering)**  
**IV Semester**

<b>A: THEORY PAPERS</b>						
S. No.	Code No.	Subject	L	T	MM	Ex. Hrs.
1.	BCE401	Strength of Materials and Mechanics of Structures – II	3	1	100	03
2.	BCE402	Concrete & Construction Technology	3	1	100	03
3.	BCE403	Fluid Mechanics-II	3	0	100	03
4.	BCE404	Surveying – I	3	1	100	03
5.	BCE405	Building Technology	3	0	100	03
6.		<b>Elective – I</b>	3	1	100	03
	BCE406.1	Rock Mechanics				
	BCE406.2	Optimization Techniques				
	BCE406.3	Advanced Mathematics				
7	BGE407 *A	Special Mathematics II	3	1	100	3
<b>TOTAL</b>			<b>21</b>	<b>05</b>	<b>700</b>	

<b>B: PRACTICAL AND SESSIONALS</b>				
S. No.	Code No.	Subject	P	MM
1.	BCE407	Material Testing and Concrete Lab.	3	100
2.	BCE408	Fluid Mechanics Lab.-II	3	100
3.	BCE409	Surveying Lab. – I	3	100
4.	BCE410	Building Planning & Design – II	3	100
<b>TOTAL</b>			<b>12</b>	<b>400</b>
<b>GRAND TOTAL</b>				<b>1000</b>

**It will be sessional paper: marks shall not be counted for awarding division.**

## B. TECH. SECOND YEAR (4TH SEMESTER)

### BCE 401 STRENGTH OF MATERIALS AND MECHANICS OF STRUCTURES–II

L-3, T-1

Exam. Hrs.:- 3  
M.M. :- 100

#### 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'Almbert'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

**Reference Books:-**

1. "Structural Analysis," by Negi and Jangid.
2. "Basic Structural Analysis," by C.S. Reddy.
3. "Advanced Theory of Structures and Matrix Method," by M.M. Ratwani & V.N. Vazirani.
4. "Analytical Methods in Structural Analysis," by Prof. Sarwar A. Raz.
5. "Analysis of Structures Vol I & II," V.N. Vazirani.
6. "Analysis and Design of Structures," by R.S. Vaishwanor. & M.M. Malhotra.
7. "Strength of Materials," by Surendra Singh.
8. "Strength of Materials," by S.S. Rattan.
9. "Structure and Properties of Engineering Materials," by V.S.R. Murthy.

**BCE 402 CONCRETE & CONSTRUCTION TECHNOLOGY**

**L-3**

**Exam. Hrs.:- 3  
M.M. :- 100**

**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.

#### **Reference Books:-**

1. "R.C.C. Design," by Dr. B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain.
2. "Fundamentals of Reinforced Concrete Design," by M.L.Gambhir.
3. "Concrete for Construction," by V.K.Raina.
4. "Concrete Technology," by M.S.Shetty.
5. "R.C.C. Theory and Design," by M.G.Shah & C.M.Kale.
6. "Plain and Reinforced Concrete Structures," by Krishna & Jain.
7. "Reinforced Concrete Structures," by S.K.Solomen.
8. "Treasure of R.C.C. Design," by Sushil Kumar.

### **BCE 403 FLUID MECHANICS-II**

**L3**

**Exam. Hrs.:- 3**

**M.M. :- 100**

#### **UNIT 1**

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

#### **UNIT 2**

**Laminar Flow**: Simple solution of Navier Stokes equations. Hagen- Poiseulli's equation, Effect of viscosity on fluid flows, Stoke's law, Measurement of viscosity, Flow through parallel plates, Laminar flow through pipes, cavitation.

**Turbulent Flow**: Turbulence in pipe flow. The Prandtl Mixing length hypothesis applied to pipe flow, Variation of friction factor with Reynolds number, velocity distribution in smooth and rough pipes. The Universal pipe friction laws, Nikuradse's curves, Moody's diagram..

#### **UNIT 3**

**The Boundary Layer**: Description of the boundary layer. Boundary layer thickness, boundary layer separation and control. The Prandtl boundary layer equation. Solution for laminar boundary layer. The momentum equation for the boundary layer. The flat plate in uniform free stream with zero pressure gradients. Flow Round A Body: Drag, friction drag, pressure drag, combined skin friction and pressure drag. Flow past-sphere and cylinder. Magnus effect, Airfoil theory. Induced drag.

#### **UNIT 4**

**Flow through channels** : Uniform, Non-Uniform and variable flow. Resistance equations of Chezy, Mannring 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 emergy 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 5

**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.

### Reference Books:-

1. "Fluid Mechanics and Machines," by V.P. Gupta & Alam Singh.
2. "Experimental Fluid Mechanics Vol I," by Asawa G.L.
3. "Flow through Open Channels," by Ranga Raju, K.G.
4. "Basic Fluid Mechanics," by C.P.Kothandarama & R. Rudramoorthy.
5. "Flow Through Open Channels," by Prof. Rajesh Srivastava.
6. "Fluid Mechanics (Including Hydraulic Machines)," by Dr. A.K.Jain.
7. "Hydraulics and Fluid Mechanics," by Modi P.N. & Seth S.H.
8. "Fluid Mechanics," by Jagdish Lal.
9. "Flow in Open channels," by K.Subramanya.

## BCE 404 SURVEYING – I

L-3, T-1

Exam. Hrs.:- 3  
M.M. :- 100

### 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.

### Reference Books:-

1. "Surveying Vol I," by Dr. B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain.
2. "Surveying Vol II," by Dr. B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain.
3. "Surveying Vol I," by Dr. K.R.Arora.
4. "Surveying and Levelling Part I," by T.P.Kanet Kar & S.V. Kulkarni.
5. "A Text Book of Surveying and Levelling," by R. Agor.
6. "Surveying and Levelling," by N.N.Basak.
7. "Fundamental of Surveying," by S.K. Roy.

## BCE 405 BUILDING TECHNOLOGY

L-3

Exam. Hrs.:- 3  
M.M. :- 100

### 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, bi-climatic chart, climate modulating devices.

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

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

### UNIT 3

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

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

## UNIT 4

### Functional design and Accommodation requirements

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

(B) **Non Residential Buildings** : viz-school buildings, rest house, primary health 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.

### Reference Books:-

1. "Manual of Tropical Housing and Building (Part I) :- Climatic Design," by Koenigs Berger Ingersoll & Szokolay.
2. "Man, Climate and Architecture," by Givony.
3. "Time Saver Standards," by E & OE.
4. "Refrigeration, Air Conditioning and Ventilation," by Croome & Roberts.
5. "I S I Spl. Publication No. 26 on Ventilation,"
6. "Climate Responsive Architecture," by Arvind Krishans, Nick Baker, Simos Yannas & S.V. Szokolay.
7. "Defect free Buildings," by Robert S Mann.

## BCE 406.1 ROCK MECHANICS

L 3, T-1

Exam. Hrs.:- 3

M.M. :- 100

### UNIT: 1

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

### UNIT: 2

**ENGINEERING PROPERTIES AND LABORATORY TESTS ON ROCKS:** Porosity, Density, Moisture content, Degree of saturation, Co-efficient of permeability, Durability, Compressive strength, Tensile strength, Shear strength, elasticity, Plasticity Deformability. Sampling and Samples Preparations, Uniaxial Compressive strength, Tensile Strength – Brazilian test, Shear strength test – Direct Shear test and Punch shear test, Triaxial Test, Flexural strength.

### UNIT: 3

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



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

**UNIT: 4**

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

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

**UNIT: 5**

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

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

**Reference Books:-**

1. "Rock Mechanics for Engineers" by Dr. B.P.Verma.
2. "Rock Mechanics with Emphasis on Stress," by Fritz Rummel
3. "Rock Mass Classification System- A Practical Engg. Approach," by Singh B. & Goel R.K.
4. "Underground Excavations," by Hoek E & Brown E.T.
5. "Rock Slope Engineering," Hock E. & Bray J.W.

**BCE 406.2 OPTIMIZATION TECHNIQUES**

**L-3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

**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.

### **Reference Books:-**

1. “Engineering Optimization Theory and Practice,” by Singiresu S. Rao.
2. “Experiments Planning Analysis and Parameter Design Optimization,” by Wu.
3. “Optimization for Engineering Design,” by Deb Kalyanmay.

## **BCE 406.3 ADVANCED MATHEMATICS**

**L-3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **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.

#### **Reference Books:-**

1. "Advanced Engineering Mathematics," by H.S.Govinda Rao.
2. "Advanced Engineering Mathematics," by Dennis G. Zill & Michael R. Cullen.
3. "Fourier Series and B.V.P.," by James Brawn & Churchill.
4. "Mathematics IV," by Mehta D.M., Sharma.
5. "Engineering Mathematics," by Gokhroo, Mehta.

### **BGE 407A\* Special Mathematics II**

**L-3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

#### **UNIT 1**

**Differential equation of first Order-** Definition, order and degree of differential equation, Method of separation of variable, Homogeneous differential equation.

#### **UNIT 2**

**Differential equation of first Order-** Exact differential equation of first order, Reducible to exact form, Linear form, Reducible to linear form.

#### **UNIT 3**

**Differential equation of second Order-** Linear differential equation with constant coefficients, complementary function, particular integral.

#### **UNIT 4**

**Elementary Complex variable-** Complex Numbers, Real and imaginary parts of complex, complex conjugate, modulus and argument of complex number. Euler's theorem and De'Moivre's theorem (only statement) polar form of complex number.

#### **UNIT 5**

**Matrices and Determinants-** Determinants and Matrices of order two and three properties of determinants, Evaluation of Determinants, Addition, Subtraction, Multiplication, Transpose, Adjoint and inverse of Matrix.

**It will be sessional paper: marks shall not be counted for awarding division.**

# Jodhpur National University, Jodhpur

Teaching & Examination Scheme

## B.Tech III Year (Civil Engineering)

### V Semester

<b>A: THEORY PAPERS</b>						
S. No.	Code No.	Subject	L	T	MM	Ex. Hrs.
1.	BCE501	Theory of Structures – I	3	1	100	03
2.	BCE502	Concrete Structures-I	3	1	100	03
3.	BCE503	Steel Structures-I	3	0	100	03
4.	BCE504	Surveying-II	3	1	100	03
5.	BCE505	Quantity Surveying & Valuation	3	0	100	03
6.		<b>Elective II</b>	3	1	100	03
	BCE506.1	Modern concrete technology and practice				
	BCE506.2	Construction Equipments and Material Management				
	BCE506.3	Solid Waste Management				
	BCE506.4	Hydraulic Machine				
<b>TOTAL</b>			<b>18</b>	<b>04</b>	<b>600</b>	

<b>B: PRACTICAL AND SESSIONALS</b>				
S. No.	Code No.	Subject	P	MM
1.	BCE507	Design of Concrete Structures I	3	100
2.	BCE508	Design of Steel Structures I	3	100
3.	BCE509	Surveying Lab. II	3	100
4.	BCE510	Structural Engineering Lab	3	100
<b>TOTAL</b>			<b>12</b>	<b>400</b>
<b>GRAND TOTAL</b>				<b>1000</b>

## **B.TECH. THIRD YEAR (5th SEMESTER)**

### **BCE 501 THEORY OF STRUCTURES –I**

**L 3, T-1**

**Exam. Hrs.:- 3  
M.M. :- 100**

#### **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.

#### **Reference Books:-**

1. "Theory of structures," by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain.
2. "Structural Analysis Vol I," by Vaidya Nathan & Dr. P. Perumal
3. "Matrix Method of Structural Analysis," by Pandit & Gupta
4. "Structural Analysis," by C.K. Wang

## **BCE 502 CONCRETE STRUCTURES – I**

**L3, T-1**

**Exam. Hrs.:- 3  
M.M. :- 100**

### **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 codal 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.

### **References Books:-**

1. "Plain and Reinforced Concrete Structures," by Krisuna & Jain.
2. "R.C.C. Design," by B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain.
- 3 "Reinforced Concrete Structures, by S.K.Solomen
4. "Treasure of R.C.C Design," by Sushil Kumar.
5. "Advance Reinforced Concrete Design," by P.C.Varghese.
6. "Concrete Technology," by A.R.& Santha Kumar.
7. "Reinforced Concrete Structures," by Pillar & Menon.
8. "Advance R.C.C. Design," by S.S. Bhavikatti.

## **BCE 503 STEEL STRUCTURES – I**

**L3**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

### **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 lacings 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.

### **References Books:-**

1. "Designs of Steel Structures Vol I," by Dr. Ram chandres
2. "Designs of Steel Structures Vol II," by Dr. Ram chandres
3. "Design of Steel Structures," by B.C.Punna, A.Kumar.Jain & Arun Kumar Jain.
4. "Design of Steel Structure," by Duggal S.K.
5. "Design of Steel Structures," by A.S. Arya & J.L. Ajmani.



## BCE 504 SURVEYING – II

L3, T-1

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **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.

### **References Books:-**

1. "Surveying Vol III," by B.C.Punna, A.Kumar.Jain & Arun Kumar Jain.
2. "Surveying Vol I," by Dr. K.R, Arora.
3. "Surveying Vol II," by Dr. K.R, Arora.
4. "Surveying Vol III," by Dr. K.R, Arora.
5. "A Text Book of Surveying," by C.L. Kochher.
6. "Surveying and levelling," by R. Subramaniam.
7. "Surveying and levelling Part II," by T.P.Kanetkar and S.V.Kulkarni.
8. "Surveying and Levelling," by S.S. Bhavikatti.

9. "Higher Surveying," by A.M. Chandra.

## **BCE 505 QUANTITY SURVEYING & VALUATION**

**L3**

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **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.

### **References Books:-**

1. "Civil Engineering Estimating Costing and valuation," by V.N.Vazirani & S.P.Chandola.
2. "Estimating and Costing in Civil Engineering," by Dutta
3. "Estimating Costing Specification and Valuation in Civil Engineering," by M. Chakraborti.
4. "Indian Standard Methods of Measurement of Bldg & Civil Engineering works," - I.S. :1200 (PartI) 1992
5. "Text Book of Estimating & Costing," by G.S. Birdie.

## **BCE 506.1 MODERN CONCRETE TECHNOLOGY AND PRACTICE**

**L3, T-1**

**Exam. Hrs.:- 3  
M.M. :- 100**

### **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.

**Reference Books:-**

1. "R.C.C. Design," by Dr. B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain
2. "Concrete for Construction," by V.K.Raina.
3. "R.C.C. Theory and Design," by M.G.Shah & C.M.Kale.
4. "Plain and Reinforced Concrete Structures," by Krishna & Jain.
5. "Reinforced Concrete Structures," by S.K.Solomen.

## **BCE 506.2 CONSTRUCTION EQUIPMENTS & MATERIALS MANAGEMENT**

**L3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **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.

### **References Books:-**

1. "Construction Equipment and its Management," by S.C.Sharma
2. "Construction Planning Equipment and Methods," by R.L. Peurifoy
3. "Heavy Construction Planning Equipment and Methods," by Jagmohan Singh

## **BCE 506.3 SOLID WASTE MANAGEMENT**

**L 3, T1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **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

### **References Books:-**

1. "Integrated Solid Waste Management – Engineering Principles & Management Issues," by George Tchobanoglous Hilary Theiser & Samuel Vigil.
2. "Solid Waste Management," by Velma Grover, B.K.Guha, William Hogland & Stuart McRae.
3. "Soil Waste Engineering," by P.A. Vesilind, W.Worrell & Reinhart.
4. "Management of Municipal Solid Waste," by T.V.Ramchandra
5. "Text Book of Solid Waste Management," by Iqbal H. Khan & Naved Ahsan.

## BCE 506.4 HYDRAULIC MACHINES

L3, T-1

Exam. Hrs.:- 3  
M.M. :- 100

### UNIT: 1

**Introduction:** Application of the momentum, and moment of momentum equations to flow through hydraulic machinery, Euler's fundamental equation, Classification of machines.

**Dynamics of free jet:** Impact of free jet on single and series of plates-plane and curved. Calculation of forces, work done, and efficiency. Jet striking centrally, inclined, tangentially. Velocity vector diagrams.

### UNIT: 2

**Hydraulic Turbines:** Classification of turbines, Impulse turbine, Constructional details, velocity triangles, power and efficiency calculations, governing of pelton wheels, Reaction turbines, Francis and Kaplan turbines, constructional details; Velocity triangles, power and efficiency calculation; degree of reaction, draft tube, cavitation. Unit and specific quantities, performance characteristics of water turbines.

### UNIT: 3

**Centrifugal Pump:** Classification, Centrifugal pumps, Vector diagrams, Specific speed, head, power and efficiency calculations, Parallel and series connection of pump of common pipe line. model testing, performance characteristics. Experimental determination of Pump Characteristics. Pumped storage plants.

### UNIT: 4

**Reciprocating Pumps:** Reciprocating pump, theory, indicator diagram, slip, effect of friction and acceleration. Theory of air vessel.

**Axial Flow Pump:** Description, velocity triangles, work done on the fluid, energy transfer, Axial pump characteristics, cavitation.

**Selection of Pumps:** Cavitation and abrasive wear of pumps, unstable operation of pump.

### UNIT: 5

**Miscellaneous Hydraulic Machines:** Gear pumps, Vane pumps, Hydraulic ram, Jet pumps, Well pumps, Air lift pump, reversible hydraulic machines (pump turbine). Type, construction and their characteristics.

**Hydraulic Power Transmission:** Hydro kinematics systems, methods of control, constant and variable delivery systems, common uses of hydrostatic systems, Hydro-kinematics transmission systems, theory of hydraulic couplings and torque converters, operating characteristics, kinematics.

**References Books:-**

1. “Hydraulics and Fluid Mechanics including Hydraulic Machines,” by Dr. P.N.Modi & Dr. S.M.Seth.
2. “Introduction to Fluid Mechanics and Fluid Machines,” by S.K. Som.

**Jodhpur National University, Jodhpur**

Teaching & Examination Scheme

**B.Tech III Year (Civil Engineering)**

**VI Semester**

<b>A: THEORY PAPERS</b>						
S. No.	Code No.	Subject	L	T	MM	Ex. Hrs.
1.	BCE601	Theory of Structures – II	3	1	100	03
2.	BCE602	Concrete Structures-II	3	1	100	03
3.	BCE603	Steel Structures-II	3	0	100	03
4.	BCE604	Environmental Engineering– I	3	0	100	03
5.	BCE605	Transportation Engineering-I	3	1	100	03
6.	BCE606.1 BCE606.2 BCE606.3	<b>Elective – III</b>	3	1	100	03
		Repair And Rehabilitation of Structures				
		Remote Sensing and GIS				
		Design of Pre-stressed Concrete Structures				
<b>TOTAL</b>			<b>18</b>	<b>04</b>	<b>600</b>	

<b>B: PRACTICAL AND SESSIONALS</b>				
S. No.	Code No.	Subject	P	MM
1.	BCE607	Design of Concrete Structures II	3	100
2.	BCE608	Design of Steel Structures II	3	100
3.	BCE609	Environmental Engg. Design & Lab. I	3	100
4.	BCE610	Road Materials Testing Lab.	3	100
<b>TOTAL</b>			<b>12</b>	<b>400</b>
<b>GRAND TOTAL</b>				<b>1000</b>

**B.TECH. THIRD YEAR (6th SEMESTER)**

**BCE 601 THEORY OF STRUCTURES – II**

**L 3, T 1**

**Exam. Hrs.:- 3  
M.M. :- 100**

**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.

**Reference Books:-**



1. "Theory of Struts," by B.C.Punmia
2. "Structul Analysis Vol II," by Dr. R.Vaidganathen & Dr. P.Perunal

## **BCE 602 CONCRETE STRUCTURES-II**

**L 3,T-1**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

### **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.

**Reference Books:-**

1. "R.C.C. Design," by Dr. B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain.
2. "Plain and Reinforced Concrete Structures," by Krishna & Jain.
3. "Reinforced Concrete Structures," by S.K.Solomen.
4. "Treasure of R.C.C. Design," by Sushil Kumar.
5. "Concrete Technology," by A.M. Neville & J.J. Brooks.
6. "Design of Concrete Structures, by J.N.Bandyopadhyay.

**BCE 603 STEEL STRUCTURES–II****L 3****Exam. Hrs.:- 3  
M.M. :- 100****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.

**References Books:-**

1. "Design of Steel struts Vol II," by Dr. Ram Chandra.

2. "Design of Steel Struts Vol III," by Dr. Ram Chandra.
3. "Designs of Steel Structures," by B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain
4. "Designs of Steel Structures," by L.S. Negi.
5. "Design of Steel Structures," by I.C. Syal.
6. "Design of Steel Structures," by S. Ramamathan
7. "Design of Steel Structures," by S.K. Duggal.

## **BCE 604 ENVIRONMENTAL ENGINEERING-I**

**L 3**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

### **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.

**References Books:-**

1. "Environmental Studies," by Rajagopalas.
2. "Water Pollution – Causes, effects and control," by P.K.Goel.
3. "Water and wastewater Technology," by Mark J. Hanmer & Mark J. Hanmer Jr.
4. "Water Supply and Waste Water Engineering," by Lal and A.K.Upadhaya.
5. "Environmental Engineering," by B.C.Punmia.
6. "Basic Environmental Technology Water Supply Waste Management & Pollution Control," by Jerry A.Nathanson.

**BCE 605 TRANSPORTATION ENGINEERING–I****L 3, T-1****Exam. Hrs.:- 3  
M.M. :- 100****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.

**References Books:-**

1. "Highway Engineering," by Gurcharan Singh & Jagdish Singh.
2. "Principles & Practises of Highway Engineering," by Dr. L.R. Kadiyali & Dr. N.B.Lal.
3. "Transportations Engineering," by A.K.Upadhyay.
4. "Transportations Engineering Vol I," by V.N.Vazirani & S.P. Chandola.
5. "Transportation Engineering An Introduction," by C.Jotin Khisty & B.Kent Lall.
6. "Transportation Engineering and Planning," by C.S. Papu Costas & P.D.Prevedouros.
7. "Principles of Highway Engineering and Traffic Analyses," by Mannering.

**BCE 606.1 REPAIR AND REHABILITATION OF STRUCTURES**

**L 3,T-1**

**Exam. Hrs.:- 3  
M.M. :- 100**

**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.

**References Books:-**

1. "Concrete Bridge Practise Constn, Maintenamce & Rehabilitates," by V.K. Raina.
2. "Concrete Micro Structure Properties and Materials," by P. Kumar Mehta & Paulo J.M. Monteiro.
3. "Concrete Admixtures Hand book," by V.S. Ramachandran.

**BCE 606.2 REMOTE SENSING AND GIS**

**L 3, T-1**

**Exam. Hrs.:- 3  
M.M. :- 100**

**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 multiband 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.

**References Books:-**

1. “Elements of Photogrammetry with applications in GIS,” by Paul R. Wolf.
2. “Remote Sensing in Natural Resources Monitoring and Management,” by Garg P.K. & Agarwal C.S.
3. “Remote Sensing and Image Interpretation,” by Lillesand T.L. & Kiefer R.W.
4. “Remote Sensing and Geographical Information System,” by Chandra A.M. & Ghosh S.K.
5. “Fundamentals of Geographic Information System,” by De. Mers M.N.
6. “Remote Sensing & GIS,” by Bhatia.

**BCE 606.3 DESIGN OF PRE-STRESSED CONCRETE STRUCTURES**

**L3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

**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.

**References Books:-**

1. "Prestressed Concrete," by N. Krishna Raju.
2. "Prestressed Concrete Bridges," by N. Krishna Raju.

**Jodhpur National University, Jodhpur**

Teaching & Examination Scheme

**B.Tech IV Year (Civil Engineering)**

**VII Semester**

<b>A: THEORY PAPERS</b>						
S. No.	Code No.	Subject	L	T	MM	Ex. Hrs.
1.	BCE701	Geotechnical Engineering – I	3	1	100	03
2.	BCE702	Water Resources Engineering –I	3	0	100	03
3.	BCE703	Environmental Engineering– II	3	1	100	03
4.	BCE704	Building Design	3	0	100	03
5.	BCE705	Transportation Engineering – II	3	1	100	03
6.		<b>Elective IV</b>	3	1	100	03



	BCE706.1	Earthquake Resistant Design & Construction				
	BCE706.2	Ground Improvement Techniques				
	BCE706.3	Rural Water Supply & Sanitation				
<b>TOTAL</b>			<b>18</b>	<b>04</b>	<b>600</b>	

<b>B: PRACTICALS AND SESSIONALS</b>				
S. No.	Code No.	Subject	P	MM
7.	BCE707	Geotechnical Engg. Design & Lab.-I	3	75
8.	BCE708	Water Resources Engineering Design-I	3	100
9.	BCE709	Environmental Engg. Design & Lab. II	2	75
<b>TOTAL</b>			<b>08</b>	<b>250</b>

<b>C: PROJECT AND TRAINING</b>				
S. No.	Code No.	Subject	P	MM
1.	BCE710	Practical Training and Industrial Visit	2	100
2.	BCE711	Project-Part I	2	50
<b>TOTAL</b>			<b>04</b>	<b>150</b>
<b>GRAND TOTAL</b>				<b>1000</b>

## **B.TECH. FINAL YEAR (7th SEMESTER)**

### **BCE 701 GEOTECHNICAL ENGINEERING – I**

**L 3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

#### **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, phriatic 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.

#### **Reference Books:-**

1. "Basic Soil Mechanics and Foundations," Alaw Singh.
2. "Soil Mechanics and Foundations," by B.C.Punmia.
3. "Soil Mechanics and Foundation Engineering," by Dr. K.R.Arora.
4. "Soil Mechanics and Foundation Engineering," by Prof. Bharat Singh & Prof. Shamsher Prakash.
5. "Analysis and Prediction of Soil Behaviors," by T.S. Nagaray, B.R.Srinivasa Murthy & A.Vatsala.
6. "Basic Concepts Soil Science," by A.K.Kolay.

## BCE 702 WATER RESOURCES ENGINEERING – I

L 3

Exam. Hrs.:- 3  
M.M. :- 100

### 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.

### Reference Books:-

1. "Irrigations and Water Power Engineering," by Dr. B.C.Punmia.
2. "Imigation Engineering & Hydraulic Structures," by Santosh Kumar Garg.
3. "Elementary Irrigations Engineering," by G.L. Asawa
4. "Fundamentals of Imigation Engineering," by Bharat Singh.
5. "Irrigations Engineering," by N.N.Basak.
6. "Engineering Hydrology," by Ozha.
7. "Elements of Water Resource Engineering," by Prof. K.N.Dugal & Prof. J.P. Soni.

## BCE 703 ENVIRONMENTAL ENGINEERING – II

L 3, T-1

Exam. Hrs.:- 3  
M.M. :- 100

### 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.

### Reference Books:-

1. "Text Book of Solid Waste Management," by Iqbal H.Khan & Naved Ahsan.
2. "Water Supply and Waste Water Engineering," by D.Lal & A.K. Upadhaya.
3. "Water Supply Waster Disposal and Environmental Engineering," by A. K. Chatterjee.
4. "Air Pollution and Control," by M.N. Rao & H.N. Roa.
5. " Environment Engineering and Management," by Dr. Suresh & K. Dhameja.
6. "Water and Wastewater Technology," by Mask I. Hanurs & Mask J. Hamu Ir.

## **BCE 704 BUILDING DESIGN**

**L 3**

**Exam. Hrs.:- 3  
M.M. :- 100**

### **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.

### **Reference Books:-**

1. “Sustainable Building Design Vol I & Vol II – Design Manual.

**BCE 705 TRANSPORTATION ENGINEERING – II L 3, T-1**

**Exam. Hrs.:- 3  
M.M. :- 100**

**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.

**References Books:-**

1. "Roads, Railways Bridge and Tunnels Engineering," by T.D.Ahuja & G.S.Birdi.
2. "Airport Engineering Planning and Design," by Subhash C.Saxena.
3. "Railway Engineering," by Saxena.
4. "Airport Planning & Design," by Khanna
5. "Transportation Engineering," by C. Jotin Khisty & B. Kent Lall.
6. "Traffic Engineering and Transport Planning," by Kadiyali L.R.
7. "Principles and Design of Highway Engineering," by Sharma S.K.
8. "A Course in Traffic Planning and Design," by Subhash C.Saxena
9. "Principles of Transportation Engineering," by Partha Chakroborty.
10. "Railway Engineering," by Chandra.

## **BCE 706.1 EARTHQUAKE RESISTANT DESIGN & CONSTRUCTION**

**L 3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **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.

### **References Books:-**

1. "Earthquake Resistant Design of Structures Part 4," by S.K. Duggal.
2. "Earthquake A Natural Disaster," by A. Shutosh Gautans.
3. "Dynamics of Structures Theory and Applications to Earthquake Engineering," by Anil K. Chopra.
4. "Earthquake Disaster Reduction – Masonry Bldgs & Constn," by Dr. Anand & S. Arya.
5. "Earthquake Resistant Design & Constn of Bldgs IS: 4326:1993,"
6. "Geotechnical Earthquake Engineering," by Steven L. Kramer.
7. "Improving Earthquake Resistance of Earthen Building- IS: 13827:1993,"
8. "Improving of Earthen Bldgs," by
9. "Fundamentals of Soil Dynamics and Earthquake Engineering," by Bharat Bhusan Prasad.
10. "Earthquake – Resistant Design of Steel Structures," by Duggal.

## BCE 706.2 GROUND IMPROVEMENT TECHNIQUES

L 3, T-1

Exam. Hrs.:- 3

M.M. :- 100

### 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**

### References Books:-

1. “Ground Improvement Techniques,” by Dr. P. Purushothama Raj.
2. “Ground Water (Hydrogeology, Ground water Survey & Pumping tests, rural water supply & irrigation Systems),” by H.M.Raghunath.



## BCE 706.3 RURAL WATER SUPPLY AND SANITATION

L 3, T-1

Exam. Hrs.:- 3  
M.M. :- 100

### 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.

### References Books:-

1. "Water Pollution – Causes, effects and control," by P.K.Goel.
2. "Water Supply and Waste Water Engineering," by Lal and A.K.Upadhaya.

3. "Sewage Disposal and Air Pollution Engineering Vol I," by Santosh Kumar Garg.
4. "Sewage Disposal and Air Pollution Engineering Vol II," by Santosh Kumar Garg.
5. "Sewage Treatment & Disposal & Waste Water Engineering Vol II," by Dr. P.N.Modi.

## Jodhpur National University, Jodhpur

Teaching & Examination Scheme

### B.Tech IV Year (Civil Engineering)

#### VIII Semester

<b>A: THEORY PAPERS</b>						
S. No.	Code No.	Subject	L	T	MM	Ex. Hrs.
1.	BCE801	Geotechnical Engineering-II	3	1	100	03
2.	BCE802	Water Resources Engineering-II	3	0	100	03
3.	BCE803	Project Planning & Construction Management	3	1	100	03
4.		<b>Elective – V</b>	3	1	100	03
	BCE804.1	Bridge Engineering				
	BCE804.2	Advance Foundation Engineering				
	BCE804.3	Matrix Methods of Structural Analysis				
<b>TOTAL</b>			<b>12</b>	<b>03</b>	<b>400</b>	

<b>B: PRACTICAL AND SESSIONALS</b>				
S. No.	Code No.	Subject	P	MM
5.	BCE805	Geotechnical Engg. Design & Lab.-II	3	100
6.	BCE806	Water Resources Engineering Design-II	3	100
7.	BCE807	Professional Practice and Estimating	3	100
<b>TOTAL</b>			<b>09</b>	<b>300</b>

<b>C: PROJECT AND SEMINAR</b>				
S. No.	Code No.	Subject	P	MM
1.	BCE808	Seminar	2	100
2.	BCE809	Project-Part II	4	200
<b>TOTAL</b>			<b>06</b>	<b>300</b>
<b>GRAND TOTAL</b>				<b>1000</b>

## B.TECH. FINAL YEAR (8th SEMESTER)

### BCE 801 GEOTECHNICAL ENGINEERING – II

L 3, T-1

Exam. Hrs.:- 3  
M.M. :- 100

#### 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, Fenski'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.

#### Reference Books:-

1. "Modern Geotechnical engineering," by Prof. Alam Singh.
2. "Soil Mechanics and Foundation," by Dr. B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain.
3. "Soil Mechanics and Foundation Engineering," by Dr. K.R.Arora.
4. "Soil Mechanics and Geotechnical Engineering," by Prof. Arvind V.Shroff & Prof. Dhananjay L.Shah.
5. "Problems in Soil Mechanics & Foundation Engineering," by Dr. B.P. Verma.

6. "Soil Mechanics and Foundation Engineering," by Prof. Bharat Singh & Prof. Shamsher Prakash.

## **BCE 802 WATER RESOURCES ENGINEERING II**

**L 3**

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **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.

### **Reference Books:-**

1. "Irrigation Engineering and Hydraulic Structures," by Santosh Kumar Garg.
2. "Irrigation and Water Power Engineering," by Dr. B.C.Punmia, Pandit B.B.L & Arun Kumar Jain.
3. "Irrigation Water Resources and Water Power Engineering," by Dr. P.N. Modi
4. "Integrated Water Resources Planning and Management," by K.S.Basu & A.K.Sorkar.
5. "Water Resource Engineering," by Larry W. Mays

## **BCE 803 PROJECT PLANNING & CONSTRUCTION MANAGEMENT**

**L 3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **UNIT-1**

**FINANCIAL EVALUATION OF PROJECTS AND PROJECT PLANNING:** Capital investment proposals, criterions 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.

### **Reference Books:-**

1. "Construction Engineering and Management," by S.C.Sharma.
2. "Hand book of Construction Management," by P.K.Joy.
3. "Construction Management and Accounts," by V.N. Vazirani.
4. "Construction Planning and Management ISBN:0136958591," by Frederick E.Gould.
5. "Construction Project Management," by K.K. Chitkara.
6. "Fire Safety of Building IS:1642- 1989.,"

## **BCE 804.1 BRIDGE ENGINEERING**

**L 3, T-1**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

### **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.

### **References Books:-**

1. "Essentials of Bridge Engineering," by D. Johnson Victor.
2. "Bridge Engineering Design Rehabilitation of Modern Highway Bridges," by Demotrios E. Toniais & Jim J. Zhao.
3. "Bridge Superstructure," by N. Rajagopalan
4. "Design of Bridges," by N. Krishna Raju.
5. "Design of Bridge Structures," by T.R.Jagadeesh & M.A.Jayaram.
6. "Design of Concrete Bridges," by V.N.Vazirani, M.G.Aswani
7. "Concrete Poridges," by Mondorf P.E.
8. "Prestresed Concrete Bridges," by M.Krishna Raju.

## **BCE 804.2 ADVANCED FOUNDATION ENGINEERING**

**L 3**

**Exam. Hrs.:- 3**

**M.M. :- 100**

### **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.

### **References Books:-**

1. "Construction and Foundation Engineering," by J.Jha
2. "Design of Foundation Systemis," by Nainan P Kurian.
3. "Design of Reinforced Concrete Foundations," by P.C.Vergheese.
4. "Foundation Analysis and Design," by Joseph E. Bowles.
5. "Foundation Design in Practice," by Karuna Moy & Ghosh.

### **BCE 804.3 MATRIX METHODS OF STRUCTURAL ANALYSIS**

**L3, T-1**

**Exam. Hrs.:- 3**

**M.M. :- 100**

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.

#### **References Books:-**

1. "Structural Analysis A Matrix approach," by G.S.Pandit.



### **BCE 407 CONCRETE LAB.**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

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 Concrete Cubes.
6. To determine the Soundness of cement by Le-chatelier apparatus.
7. To determine the specific gravity of fine aggregate (sand) by Pyconometer.
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. Compressive Strength Test of Bricks.
14. Compressive Strength Test of Mortar Cubes.
15. To study concrete mix design in accordance with IS recommendation.
16. Tensile strength test of mortar briquettes.

### **BCE 407 MATERIAL TESTING LAB.**

1. Study of universal testing machine.
2. Determination of rock well hardness number of a given metal on Hardness Testing machine.
3. To perform the Izod impact test of given specimen.
4. To perform the Charpy impact test of given specimen.
5. To perform fatigue test of given specimen.
6. To conduct the Tensile test of mild steel by universal testing machine.

7. To conduct torsion test on mild steel or cast iron specimen to find out modulus of rigidity.
8. To conduct bend test of mild steel and find out the values of bending stress and young's modulus of elasticity
9. To determine stiffness of spring and modulus of rigidity of the spring wire.

**BCE 307 Engineering Mechanics & Experimental Techniques Lab.**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

1. To verify the law of parallelogram of forces using force board.
2. To find the mechanical advantage (M.A.) velocity ratio (V.R.) and percentage efficiency ( $\eta$ ) of screw Jack.
3. To find the mechanical advantage (M.A.) velocity ratio (V.R.) and efficiency for single start worm and worm wheel.
4. To find the mechanical advantage (M.A.) velocity ratio (V.R.) and efficiency for double start worm and worm wheel.
5. To determine coefficient of friction between the two surfaces on horizontal plane and mechanical advantage.
6. Determination of mechanical advantage velocity ratio efficiency of double purchase crab winch.
7. To verify the principle of lever using compound lever system.
8. To find the mechanical advantage, velocity ratio and efficiency for triple start worm and worm wheel.
9. To find the mechanical advantage (M.A.) velocity ratio (V.R.) and efficiency for simple wheel and Axle.
10. To verify the law of moment using bell crank lever.
11. To determine coefficient of friction between various surface on inclined plane.
12. To verify law of parallel vertical forces.

**BCE 404 SURVEYING LAB - I.**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

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 Auto Level.
6. To determine reduced levels in closed circuit using Dumpy Level.
7. To carry out profile leveling and plot longitudinal and cross sections for road.
8. To carry out temporary adjustment of Theodolite.
9. Measurement of horizontal angle.
  - a. By method of repetition.
  - b. By method of Reiteration.
10. To shift R.L of known point by double levelling.
11. To study the various minor instruments.

**BCE 410 BUILDING PLANNING & DESIGN – II**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

1. To design and draw working drawing of a residential building with following detail.
  - a. Plan.
  - b. Two sectional elevations.
  - c. Front elevation.
  - d. Furniture Plan.
  - e. Electric fitting plan.
  - f. Sanitary 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 Post Office.
5. To design and draw a College Library.

### **BCE 504 SURVEYING LAB – II**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

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 measure and adjust the angles of a braced quadrilateral.
5. To prepare a contour map by indirect contouring.
6. To prepare the map of given area by plane tabling.
7. To determine the tachometric constant.
8. To determine the horizontal and vertical distance by tachometric survey.
9. To determine the area of a figure using a planimeter.
10. To determine Distance, Height, angles (vertical & Horizontal) with the help of electronic theodolite  
Digital total station survey instrument.
11. Survey Camp.

### **BCE 510 STRUCTURAL ENGINEERING LAB.**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

1. Clark Maxwell reciprocal theorem with simply supported beam.
2. To determine the horizontal thrust in a three hinged arch for a given system of loads experimentally and verify the same with calculated

3. To draw influence line diagram for horizontal thrust using a model of two hinge arch experimentally and to verify these results analytically.
4. To determine the elastic displacement of the curved members experimentally and compare these values with those obtained theoretically.
5. To verify moment area theorem regarding slope deflection of beam.
6. To study the behavior of a portal frame under different end conditions.
7. To study the behavior of a cantilever beam.
8. To verify Clerk's Maxwell theorem of reciprocal deflection with the help of truss model.
9. Calculate experimentally and theoretically the loads in the three suspension rods supporting an elastic beam with a concentrated load hung midway between two of the suspension rods.
10. To study behavior of different types of struts and columns to calculate the Euler's Buckling load for each case.
11. To study the suspension Bridge.
12. To compare the calculated value and observed value of Bending moment at a cross section of the beam supported at its ends.

### **BCE 609 ENVIRONMENTAL ENGINEERING LAB.**

**Exam. Hrs.:- 3**  
**M.M. :- 100**

1. To find the turbidity, Odour and Colour of a given sample of water.
2. To determine the pH value of a given sample of water.
3. To determine the Carbonate, Bicarbonate and Hydroxide alkalinity of given sample of water.
4. To find out the concentration of Chlorides in a given sample of water.
5. To estimate the Hardness of a given sample of water by standard E.D.T.A. method.
6. To determine Residual Chlorine in a given sample of water by Chloroscope Apparatus.
7. To determine Residual Chlorine in a water sample volumetrically.
8. To determine the amount of Dissolved Oxygen in the given sample of water by Winkler's method & Digital D.O. Meter.
9. To determine 5 days B.O.D. of a given sample of effluent & Instant D.O. by D.O. Analyzer.
10. To determine the quantity of Alum dose required to coagulate a given sample of water by Jar Test.
11. To determine the Total Solids (Dissolved, Volatile and Suspended) in a water sample.

### **BCE 610 Roads Material Testing LAB.**

**Exam. Hrs.:- 3**

1. To Determine the gradation value of Aggregate (sieve Analysis)
2. To Determine Flakiness Index and Elongation Index of Aggregate.
3. To Determine Specific Gravity and water Absorption of Aggregates.
4. To Determine The Aggregate Impact value of coarse Aggregate.
5. To Determine Aggregates crushing value
6. To Determine Aggregates Abrasion Value.
7. To Determine the softening point of Bitumen.
8. To Determine the penetration of Bitumen.
9. To Determine the stripping value of Aggregates.
10. To Determine the Binder Content of Paving mix.
11. Viscometer Test (flow of emulsion Bitumen).
12. To Determine the Ductility of Bitumen.
13. To study Marshall stability Test.