BS 111 MATHEMATICS – I

Cr. Hrs. 3 (3 + 0)

L T P

Credit 3 0 0

Hours 3 0 0

Course Outcomes: At the end of the course, the student will be able to:

CO1	Perform Taylor's and Maclaurin's expansions, Understand Asymptotes, Curvature and tracing of simple curves
CO2	Perform partial differentiation, apply Euler's theorem, Understand Composite functions and total differential coefficients, Jacobians and find error and do approximations
CO3	Perform double and triple integrals, change the order of integreation, rectification of curves and to find volume and surface of revolution of curves
CO4	Solve differential equations of higher order, find complementary function and particular intregrals

Unit-I

Taylor's and Maclaurin's expansions; Asymptotes, Curvatures, Simple curve tracing.

Unit-II

Partial differentiation; Homogeneous functions and Euler's theorem; Composite functions and total differential coefficient; Jacobians; Error and Approximations.

Unit-III

Double and Triple integrals; Change of order of integration; Rectification of standard curves; Volumes and surfaces of revolution of curves.

Unit-IV

Differential equations of higher order with constant coefficients: Methods of finding complementary functions and particular integrals; Homogeneous equations with constant and variable coefficient.

Text Books/References

1. Y.N. Guar and C.L. Koul. (2005). Engineering Mathematics, (Vols.-I, II), Jaipur Publishing House, Jaipur.

2. N.P. Bali and N.Ch.S.N. Iyengar. (2003). A text book of Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi.

BS 121 MATHEMATICS – II

Cr. Hrs. 3 (3 + 0)

L T P

Credit 3 0 0

Hours 3 0 0

Course Outcomes: At the end of the course, the student will be able to:

CO1	Perform differentiation of vectors
CO2	Solve ordinary differential equations
CO3	Solve partial differential equations
CO4	Perform operations on matrices

Unit-I

Differentiation of Vectors: scalar and vector point functions, vector differential operator Del, Gradient of a scalar point function, Divergence and Curl of vector point functions; Directional derivatives; Line, Surface and Volume integrals; Gauss, Stoke's and Green theorems (Statement only) and their applications.

Unit-II

Ordinary Differential Equations: Second order differential equations with variable coefficients; Exact form; Part of complimentary function is known; Change of dependent and independent variables; Method of variation of parameters.

Unit-III

Partial Differential Equations: Formation of partial differential equations; Lagrange's linear equations; Higher order linear partial differential equations with constant coefficients. Standard forms of partial differential equations.

Unit-IV

Matrices: Elementary transformations; Rank of a matrix; Reduction to normal form; Gauss Jordan method to find inverse of a matrix; Consistency and solutions of linear equations; Eigen values and Eigen vectors; Cayley-Hamilton theorem.

Text Books/References

1. Y.N. Guar and C.L. Koul. (2005). Engineering Mathematics, (Vols.-I, II), Jaipur Publishing House, Jaipur.

2. J.L. Bansal and H.S. Dhami. (2005). Differential Equation, (Vols.- I), Jaipur Publishing House, Jaipur.

3. N.P. Bali and N.Ch.S.N. Iyengar. (2003). A text book of Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi.

CE 100 ENGINEERING MECHANICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Draw free body diagrams and determine the resultant of forces and/or moments.
CO2	Determine the centroid and second moment of area of sections.
CO3	Apply laws of mechanics to determine efficiency of simple machines with consideration of friction.
CO4	Analyse statically determinate planar frames.
CO5	Analyse the motion and calculate trajectory characteristics.
CO6	Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies.

(A) STATICS

Unit-I

Introduction of condition of equilibrium: Force, system of force, coplanar forces.

Moment and couples: Moment and parallel forces, Couples, General conditions of equilibrium

Practical Applications: Levers, Cracked levers, Steel yards. Sagging chains and toggle joints.

Centre of Gravity: Centre of parallel forces, C.G. in some simple cases, C.G. of Solids.

Moment of Inertia: Moment of inertia, Radius of gyration and perpendicular axis. Determination of moment of inertia of simple sections. Mass of moment of inertia.

Unit-II

Friction: Introduction, Critical angle of friction, Friction on horizontal planes, Friction on inclined planes, Wedge and block, Screw jacks, Rolling friction.

Machines: Introduction, Effects of friction, Loss of work, Reversible and irreversible machine, Law of machine, Wheel and axle, Differential wheel and axle, Pulley block, Screw jack, Single and double purchase crab, Worm and Worm wheel, System of pulleys.

Frames: Statically determinate plane frames, Method of joints, Method of sections, Graphical method.

(B) DYNAMICS

Unit-III

Rectilinear Motion, Motion under gravity, Projectiles equation of the path, Maximum height attained, Time of flight, Horizontal range. Angle of projection, Projectile from a given height, Projectile on an inclined plane, Problems.

Work, Power and Energy: Work, Power, Work done by torque, Energy, Law of conservation.

Unit-IV

Centripetal and centrifugal forces, Laws of motion: Newton's Law of motion and their explanation, Collision of elastic bodies; Impulse and impulsive force, Principle of conservation of momentum, Loss of kinetic energy during impact.

Practicals

1. Verification of law of polygon of forces.
2. Verification of principle of moment in case of compound level.
3. Verification of principle of moment in case of bell crack level.
4. Determination of reaction in case simply supported beam with or without overhang.
5. To determine coefficient of friction between different surfaces on horizontal plane.
6. To determine coefficient of friction between different surfaces in inclined plane.
7. Study of different wheel and Axle.
8. Study of single purchase crab.
9. Study of worm and worm wheel.
10. Study of Weston's pulley block.
11. Determination of mechanical advantage, velocity ratio and efficiency of single purchase crab.
12. Determination of mechanical advantage, velocity ratio and efficiency of double purchase crab.
13. Determination of mechanical advantage, velocity ratio and efficiency of first system of pulley.
14. Determination of mechanical advantage, velocity ratio and efficiency of second system of pulleys.
15. Determination of mechanical advantage, velocity ratio and efficiency of third system of pulleys Flywheel.

Text Books/References

1. I.B. Prasad. Engineering Mechanics, Khanna Publisher, New Delhi.
2. R.S. Khurmi. Applied Mechanics, S. Chand & Company Ltd., New Delhi
3. S.B. Junnarkar. Applied Mechanics, Charotar Publishing House, New Delhi.
4. Saluja. Applied Mechanics, Satya Prakashan, New Delhi.

CE 115 ENGINEERING DRAWING

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Select, Construct and Interpret appropriate drawing scale as per the situation.
CO2	Draw simple curves like ellipse, cycloid and spiral.
CO3	Draw Orthographic projections of points, lines and planes.
CO4	Draw orthographic projection of solids like cylinders, cones, prisms and pyramids including sections.
CO5	Layout development of solids for practical situations.
CO6	Draw isometric projections of simple objects.

Introduction and letter writing. Construction and use of plain, diagonal and vernier scale. Methods of drawing ellipse, parabola and hyperbola. Methods of drawing cycloids, spirals. Orthographic projection and projection of points.

Projection of lines, projection of planes, projection of solids. Introduction of prism, pyramid, cylinder and cone.

Section of solids, introduction of intersection of surfaces. Development of plane and curved surface. Isometric projection.

Text/Reference

1. N.D. Bhatt. Elementary Engineering Drawing, Rupalee publication, Anand.
2. Lakshmi Narayan and Vaishwanar. A Text Book of Practical Geometry, Jain Brother, New Delhi.
3. R.B. Gupta. A Text Book of Engineering Drawing, Satry Prakashan, New Delhi.
4. Fundamentals of Technical Drawing, Parkinson.

CE 122 CIVIL ENGINEERING

Cr. Hrs. 2 (1 + 1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Demonstrate knowledge of various surveying methods.
CO2	Conduct a chain survey.
CO3	Conduct a compass survey.
CO4	Conduct levelling survey and be able to do RL calculations.
CO5	Demonstrate knowledge of properties of various building materials.

(A) SURVEYING AND LEVELING

Unit-I

Principle and purpose of plane surveying.

Chain Surveying : Instrument for chaining, Direct & indirect ranging. Methods of chain along plane & sloping ground, Base line, check line, Tie line, Offset, Chain angle & recording in field book.

Compass Surveying : True & Magnetic meridian, whole circle bearing & quadrantal bearing system, construction & use of Prismatic & Surveyor Compass, Local attraction.

Unit-II

Level and leveling : Definition of various terms used in leveling. Types of Bench mark and their uses. Construction and use of Dumpy and Tilting levels, Leveling staves. Temporary adjustment of Dumpy level. Simple, differential leveling, fly leveling, longitudinal and cross sectioning, plotting of profile leveling. Determination of level by line of collimation and rise and fall method, Arithmetical checks. Level book and record keeping, leveling difficulties and errors in leveling.

(B) BUILDING MATERIAL

Unit-III

Stones: Different types, properties of good building stones, common testing of stones, Dressing of stones and use of stones in construction.

Bricks: Types, raw materials, identification, composition. Properties and uses of ordinary bricks, fire resistant and chemical resistant bricks.

Limes: Definition, sources of lime, slaking of lime, ISI classification of lime.

Unit-IV

Cement: Chemical composition, types of cement, properties, uses and tests on cement.

Mortars: Proportioning, properties of ingredients and use of lime, cement and gauge mortars.

Cement Concrete: Ingredients, common proportions, properties of fresh hardened concrete,Water cement ratio, curing and consolidation of concrete.

Text Books/References

1. S.C. Rangwala. Engineering Materials, Charotar Book Stall, Anand.
2. B.C. Punmiya. Surveying & Field Work (Vol. I), Laxmi Publications, New Delhi.

BS211: Mathematics – III (All Branches)

3(3+0) Sem. I

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand Finite differences, various difference operators and their relationships, factorial notation
CO2	Use of numerical methods in modern scientific computing
CO3	Find the Inverse Laplace Transform By Partial Fractions
CO4	Use the Laplace Transform to solve differential equation with constant coefficients
CO5	Numerically integrate any function by Trapezoidal and Simpson's rule

UNIT - I

Interpolation: Finite differences, various difference operators and their relationships, factorial notation. Interpolation with equal intervals; Newton's forward and backward interpolation formulae, Lagrange's interpolation formula for unequal intervals.

UNIT -II

Gauss forward and backward interpolation formulae, Stirling's and Bessel's central difference interpolation formulae. **Numerical Differentiation:** Numerical differentiation based on Newton's forward and backward, Gauss forward and backward interpolation formulae.

UNIT -III

Numerical Integration: Numerical integration by Trapezoidal, Simpson's rule.

Numerical Solutions of Ordinary Differential Equations: Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta methods.

UNIT- IV

Laplace Transform: Laplace transforms of elementary functions; Basic properties of Laplace transform; Initial value theorem, final value theorem and convolution property of Laplace transform; Inverse Laplace transforms. Applications of Laplace transform to solve ordinary differential equations.

Suggested Books & References:

- H.C. Saxena: Text Book of Finite Differences and Numerical Analysis, S. Chand and Co.
- M.K. Jain, S.R.K. Iyengar and R.K. Jain: Numerical Methods for Scientific and Engineering computation, New Age International (P) Ltd.
- N.P. Bali and Manish Goyal: A Text book of Engineering Mathematics, Laxmi Publication Pvt. Ltd., New Delhi (VII Edition).
- S.P. Goyal and A.K. Goyal: Integral Transforms, Jaipur Publishing House, Jaipur.

Department of Civil Engineering

Prerequisite: Nil

CE 211 (CE, AE, EE, MI) STRENGTH OF MATERIAL

Cr. Hrs. 3 (2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**1**	**2**

Course Outcome	Upon completion of this course the students will able to:
CO1	Analyze behavior of materials under simple stress and strains
CO2	Analysis of stress and strains by various methods, stresses in thin cylinder and special shells
CO3	Plot SFD and BMD of beams under various loading and determine shearing and bending stresses
CO4	Analyze various shafts under torque
CO5	Analyze and design columns using different formulae

Unit-I

Fundamentals : Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagrams, mechanical properties of materials, elasticity and plasticity. Shear stress and strain, pure shear, complementary shear. Linear elasticity and Hooke's law. Poison's ratio, volumetric strain, bulk modulus of elasticity. Elastic constants and relation between elastic modulie. Stress and strain in axially loaded members. Temperature stresses and effects.

Unit-II

Analysis of Stress and Strain : Stress at a point, stress components. Stresses on inclined planes. Plane stress and strain. Mohr's circle representation of plain stress and strain. Principle stresses and strains, maximum shear stresses. Hooke's law for plain stress. Stresses in thin cylinder and special shells subjected to internal & external pressures.

Unit-III

Beam under Flexural Loads : Bending moment and shear force, relation between load, Shear force and bending moment. Bending moment and shear force diagrams for simply supported, Cantilever and overhang beams under static loading of different types viz. point loads, Uniformly distributed loads, linearly varying loads, Pure bending. Theory of simple bending of initially straight beams. Flexural stresses in beams. Built up and composite beams. Shear stresses in beams of Rectangular, Circular and I-section. Shear formula, effect of shear strain.

Unit-IV

Torsion: Torsion of solid and hollow circular shafts. Non-uniform torsion.

Columns: Buckling and stability, critical load. Euler's theory for initially straight column with different end conditions, equivalent length, Limitation of Eulor's formula. Rankine's

formula. Column under eccentric loading. Secant, Perry's and Indian standard Formulae.

Practicals

1. Study of Universal Testing Machine, its part and functions.
2. Operation of U.T.M, fixing of specimen for different testing.
3. Tensile test on mild steel specimen to failure and computing, Stresses, % elongation, Contraction etc.
4. Compression test on timber.
5. Compression test on mild steel.
6. Compression test on concrete cube.
7. Determination of toughness test of mild steel, Brass and Aluminum by Charpy test.
8. Determination of toughness by Izod test for wood, Aluminum & Brass.
9. Study of torsion testing machine.
10. Performance of torsion test on circular shaft specimen.
11. Bending test on wooden beam and determination of modulus of rupture.
12. Deflection test on wooden beam.

Suggested Books & References

1. Junarkar S.B. and Shah H.J., 'Mechanics of Structures' Vol.-I Charoter Publishing, Anand.
2. Punima B.C., 'Strength of Materials and Mechanics of Structures', Vol-I, Standard Publisher distributors, New Delhi.
3. Fedinard L., 'Strength of Materials', Singer & Andrew Pytel'.
4. Fenner, 'Mechanics of Solids'.
5. Davis H. E, Trophell, G.E. & Hanck, G.F.W., 'The Testing of Engineering Materials', McGraw Hill.
6. Timoshenko, S.P. & Young, D.H., 'Strength of Materials', East West Press Limited.

Department of Civil Engineering

Prerequisite: Nil

CE 212 FLUID MECHANICS

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

1

Course Outcome	Upon completion of this course the students will be will able to:
CO1	Demonstrate the knowledge of fluid properties
CO2	Analyze forces and pressure variations on submerged bodies
CO3	Analyze fluid flow pattern, characteristics and apply the same to solve general flow problems
CO4	Apply energy and momentum equations to determine fluid flow parameters
CO5	Apply the knowledge to solve civil engineering problems relating to fluid flow.

Unit-I

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. Surface tension and Capillary. Compressibility and Elasticity.

Hydro-Statics: Pressure at a point in a static fluid (pressure variation in compressible static fluid; atmospheric pressure). Gauge pressure, vacuum pressure, absolute pressure, Manometers, Bourdon pressure gauge.

Unit- II

Forces acting on immersed plane surface. Centre of pressure, forces on curved surfaces.

Buoyancy: Conditions of equilibrium of floating bodies, meta-centre and metacentric height.

Unit- III

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 irrational motions, velocity potential and stream function.

Dynamics of Fluid Flow: Euler's equations of motion in Cartesian co-ordinate and its integration, Bernoulli's equation for incompressible fluids, assumptions in Bernoulli's equation, Energy correction factor.

Application of Energy Equation: Application of energy equation for simple problem, pitot tube, orifice meter and venturi meter,

Unit IV

Momentum Equation: Development of momentum equation by control volume concept, Momentum correction factor.

Application of Momentum Equation: Application of momentum equation for simple problem, Force on a pipe bend.

Elementary concept of Boundary Layer.

Force on immersed bodies, drag and lift force, drag and lift coefficients.

Practicals

1. Flow through Orifice (Determination of Hydraulic Co-efficient): Constant Head Method.
2. Flow through Triangular Notch (Calibration).
3. Flow through Rectangular Notch (Calibration).
4. Flow through Venturimeter (Calibration).
5. Flow through Orifice Meter (Calibration).
6. Determination of Metacentretic height of floating bodies.
7. To verify the momentum equation

Suggested Books & References

1. H.M. Raghunath, 'Fluid Mechanics'.
2. P.N. Modi & S.M. Seth, 'Hydraulics & Fluid Mechanics'.
3. K.R. Arora, 'Fluid mechanics, Huydraulics & Hydraulic Machines'.
4. Garde & Mirajgaokar, 'Fluid Mechanics'.
5. R.K.Bansal, 'Fluid Mechanics & Hydraulic Machines', Laxmi Publication (P) Ltd., New Delhi.

Department of Civil Engineering

Prerequisite: Nil

CE 213 BUILDING CONSTRUCTIONS

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Course Outcome	Upon completion of this course the students will be able to:
CO1	Demonstrate knowledge of buildings & its components and apply different type of foundation for construction work.
CO2	Understand the application of damp proofing and masonry works
CO3	Construct scaffolding ,floors & roofs.
CO4	Demonstrate knowledge of building material like timber, stone etc.
CO5	Draw plan of doors,windows & staircase.

Building: Components of a building & their function.

Foundation: Objectives, shallow foundation, grillage, raft, inverteal arches, pile foundation. Causes of failure of foundation & remedial measures.

Dewatering: Dewatering of the foundation trenches (Pumping providing sumps & side drains, cement grouting chemical grouting).

Unit-II

Damp Proofing: Objective, materials used for damp proofing. General principles of damp proofing methods.

Stone Masonry: Materials required for stone masonry, Types of stone masonry (rubble & Ashlar masonry), Essentials of good stone masonry.

Brick Masonry: Types of brick masonry, English and Flemish bond (for 1 and 1 ½ bricks), Essentials of good brick masonry.

Unit-III

Shoring, Underpinning and Scaffolding: Horizontal & vertical shores. Purpose and methods of under- pinning. Different types of scaffolding.

Floors: Various Types (stone patti, timber and R.C.C. floors), details of construction. Floor finishes (Lime, Cement concrete, terrazzo, marble and P.V.C. tiles).

Roofs: Simple roof trusses, lean to verandah roof, king post roof truss, queen post roof truss, North light truss.

Unit-IV

Timber: Defects in timber, properties of good quality timber and their uses. Decay of timber,

preservation of timber. Laminates and composites.

Doors: Paneled door, Glazed door, Flush door, Collapsible steel door, Rolling steel shutter door.

Windows: Casement windows, Sash window, Skylight window.

Staircase: Dog-legged Staircase, Requirement of a good Staircase. Proportioning rules of a Staircase.

Practicals

1. Visiting of various construction sites.
2. To the scale sketching would be done in the sketch book by hand.
3. The final drawings would be drafted using Drawing instruments. Detailing of parts would be done as per standard professional practice and relevant IS codes.
4. Report of a site visit shall be prepared mentioning functional arrangement of various parts of the building.

Suggested Books & References

1. Rangwala, S.C., 'Engineering Materials', Charotar Book Stall, Anand.
2. Arora, S.P. and Bindra, 'Building Construction', Dhanpat Rai & Sons, New Delhi.
3. Awaasthy, S.N., 'Building Construction', Publishing House, Bhopal.

Department of Civil Engineering

Prerequisite:

CE 214 COMPUTER AIDED DRAWING

Cr. Hrs. 1 (0+1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Enables application of AutoCAD software.
CO2	Do 2D Drafting
CO3	Draw entities.
CO4	Enables print for a drawing work with dimensioning.

Introduction to Computer Aided Drafting using popular software like AutoCad. Drawing entities. Drawing, modifying, viewing, printing and dimensioning commands. Drawing aids, coordinates systems, layers, hatching, etc. Blocks. Simple 2-D drawing and dimensioning exercises.

Suggested Books & References

1.AutoCad Reference Manual.

2.George Omura, 'Mastering AutoCad'.

Department of Civil Engineering

Prerequisite:

IT 215 (CE) PRINCIPLES OF OBJECT ORIENTED PROGRAMMING

Cr. Hrs. 3 (2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome	Upon completion of this course the students will be will able to:
CO1	Understand the basic concepts of C++ language
CO2	Understand the program structure and use various functions in programming
CO3	Work with class and derived classes
CO4	Write programs in C++ language

Unit-I

OOP Fundamentals: Concept of class and object, attributes, public private and protected members, derived classes, single & multiple inheritance.

Programming in C++: Enhancements in C++ over C in data types operators and functions.

Unit-II

Program structure, Functions. cin, cout, iomanip.h, for, while, do-while loops. If, if-else, nested if-else, switch, logical and, or and not operators, break, continue, goto and exit statement, functions, declarations, definations, returns. Parameters by values, by reference, default arguments.

Unit-III

Inline functions, Automatic, external, static, variables. Constructors and distracters. Objects and Memory allocations, const and classes, Objects as arguments to functions. Arrays and strings. Friend function, function and operator overloading.

Unit-IV

Working with class and derived classes, Single, multiple and multilevel inheritances and their combinations, virtual functions, pointers to objects, Input-output flags and formatting operations.

Practicals: Will be as per theory syllabus.

Suggested Books & References

1.C Gottfried, ‘ Programming in C’, Schaum Series

2.E. Balaguruswamy, ‘Programming in C’.

3.Balaguruswamy, ‘Object Oriented Programming in C++’.

Department of Civil Engineering

Prerequisite:

MI 217 (CE) ENGINEERING GEOLOGY

Cr. Hrs. 3 (2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome	Upon completion of this course the students will be will able to:
CO1	Identify the structure of earth
CO2	Distinguish between different rocks and their properties
CO3	Select sites for different structures in different zones
CO4	Explore subsurface using different techniques

Unit-I

General Geology: Subdivision of Geology. Importance of Geology in Civil Engineering. Internal Structure of the Earth, physical properties of minerals, weathering and erosion. Geological work of wind, river and ocean. Stratigraphic aspects of rocks for civil engineers. Geological Time Scale, rock provinces.

Unit-II

Petrology: Origin & classification of rocks. Texture & Structures of Igneous, Sedimentary and Metamorphic Rocks. Engineering Properties of rocks. Rocks and dimensional stones as a construction material. Suitability of rocks for different Civil Engineering purposes.

Structural Geology: Causes & Classification of fold, fault, joints & unconformities. Outcrop pattern. Recognition of structure from rock outcrops.

Unit- III

Natural Disasters and Geological Investigations (in reference to Civil Engineering): Earthquake, its causes, intensity scale and seismic zone of India. Site selection for dam, tunnels, multistoried buildings, reservoirs and bridge structures

Improvement Techniques: Sites improvement techniques practiced in different civil engineering projects. Introduction to drilling methods.

Unit-IV

Geophysical Methods for Subsurface Exploration: Electrical resistivity, Seismic refraction & Ground Penetrating Radar method of civil engineering importance.

Remote Sensing: Introduction and applications in Civil Engineering. Image acquisition, image interpretation (visual and digital, digital terrain model, airborne lithological identification). Remote sensing software used in civil engineering interpretation.

Practicals

1. Identification of Minerals for a given specimen.
2. Identification of Rocks in a given specimen.
3. Identification of Geological features through wooden Models.
4. Structural Geological Models.
5. Petrological Models.
6. Engineering Geological Models.
7. Interpretation of Geological Map.
8. Plotting of Geological section of project site.
9. Plotting of concealed rocks and their trend with the help of outcrop pattern of project site.
10. Three point problem.
11. Dip & Strike Problems.
12. Stereo-Net Plotting.
13. Air Photo interpretation.
14. Satellite imageries interpretation.
15. Electrical resistivity exercise.

Suggested Books & References

1. Goodman, R. E., 'Engineering Geology - Rock in Engineering Construction', John Wiley and Sons.
2. Parbin Singh, 'Text Book Engineering Geology'.
3. Blyth, F.G. and De Freitas, M.H., 'A Geology for Engineers', (7th Edition), Edward Arnold.
4. N.Chenna Kesavulu, 'Text Book of Engineering Geology'.
5. Leggot R.F., 'Geology for Engineers'.
6. Kryinine & Judd, 'Engineering Geology and Geo-techniques'.
7. John Pitts, 'Manual of Geology for Civil Engineers'.
8. Tony Waltham, 'Foundations of Engineering Geology'.

Department of Civil Engineering

Prerequisite: ***CE 211*** Strength of Materials

SECOND YEAR B.E. (IV SEMESTER)
CE221 STRUCTURAL ANALYSIS

Cr. Hrs. 4(3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Calculate deflection of Beams at various load condition.
CO2	Analysis of Fixed beam, continuous beam & propped cantilever beam.
CO3	Acquired knowledge of different types of springs and its properties.
CO4	Understand type of failure in structure. Analysis of determinate space frames
CO5	Calculate strain energy & deflection of frames

Unit-I

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

Unit-II

Propped Cantilever Beam: Analysis of propped cantilever beam.

Fixed Beams & Continuous Beams: Analysis of fixed beams & continuous beams by three moment theorem.

Springs: Stiffness of springs, close coiled helical springs, springs in series and parallel. Laminated plate springs.

Unit-III

Theories of Failures: Concepts of maximum principal stress theory, maximum principal strain theory, maximum shear stress theory, maximum strain energy theory and maximum shear strain energy theory.

Reciprocal Theorem: Maxwell's reciprocal theorem. Betti's theorem.

Space Frames: Analysis of determinate space frames by tension coefficient method.

Unit-IV

Introduction to Energy Methods: Strain energy due to bending, shear and torsion. Castiglione's first theorem, Unit load method and deflection of determinate beams & frames.

Practicals

1. Bending test on wooden beam and determination of modulus of rupture.
2. Deflection test on wooden beam.
3. Stiffness of open coiled helical spring.
4. Stiffness of close coiled helical spring.
5. Deflection test on laminated plate spring.
6. Determination of the reaction of beam by graphical method.
7. Analysis of a truss by graphical method.
8. Other practical exercises based on course syllabus.
9. Numerical problems based on theory syllabus.

Suggested Books & References

1. Fedinard L. Singer & Andrew Pytel, “Strength of Materials”.
2. Fenner, “Mechanics of Solids”.
3. Punamia B.C. “Strength of Material & Mechanics of Structures”.
4. Junarkar,”Mechanics of structures vol. I & II”.

Department of Civil Engineering

Prerequisite:

CE 222 HYDRAULICS & HYDRAULIC MACHINES

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand flow in pipes and power transmission
CO2	Understand flow through open channels. Design economical channel section.
CO3	Acquired knowledge of laminar and turbulent flow in channel flow.
CO4	Acquired knowledge about hydraulic machines like pumps and turbines

Unit-I

Flow in Pipes: Laminar flow, Reynolds experiment, transition from laminar to turbulent flow. Turbulent Flow (Laws of fluid friction factor, loss of head due to friction and other causes). Hydraulic gradient total energy line, Chezy's and Mannings's formula. Flow through parallel pipes and pipes in series. Power transmission through pipe, condition for maximum power. Elementary water hammer concept.

Unit- II

Flow Through Open Channels: Steady and uniform flow in open channel, Discharge formulae of Chezy, Manning and Bazin. Most economic section for rectangular, trapezoidal and circular channels. Non-Uniform Flow in open channel. Specific energy of flow. Alternate depths. Critical depth in prismatic channels. Rapid, critical and sub critical flow. Mild, steep and critical slopes. Classification of surface curves in prismatic channels and elementary computation.

Hydraulic jump: Hydraulic jump in rectangular channels, conjugate or sequent depths.

Unit- III

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

Turbulent Flow in Pipes: Theories of Turbulence, Nikuradse's Experiments Hydro-dynamically smooth & rough boundaries, Laminar sublayer, Equations of velocity distribution and friction coefficient, Stanton Diagram, Moddy's diagram.

Unit-IV

Impact of Free Jets: Impact of a jet on a flat or a curved vane, moving and stationary vane.

Centrifugal Pumps and Reciprocating pumps: Elementary concept of single and multistage pumps, Efficiencies, Specific speed, characteristic curves.

Turbines: Reaction and Impulse turbines, specific speed, Mixed flow turbines, Elementary concept of Pelton wheel turbine, Francis turbine, Propeller turbine and Kaplan turbine. Efficiency & characteristics of turbines

Practicals

1. To determine the minor losses.
2. Flow through Pipes (Determination of co-efficient of friction).
3. To Reynolds apparatus (Determination of Reynolds Number).
4. To determine Manning's roughness co-efficient
5. To Determine Chezy's coefficient of roughness for the bed of a given flume.
6. To plot characteristics curve of Pelton Wheel.
7. To plot characteristics curve of Centrifugal Pump.

Suggested Books & References

1. Modi & Seth, 'Hydraulics and Hydraulic Machines.
2. Dr. K.R. Arora, 'Fluid Mechanics, Hydraulics and Hydraulic Machines
3. H.M. Raghunath, 'Fluid Mechanics.

Dr. R. K. Bansal, 'Fluid Mechanics & Hydraulic Machines', Laxmi Publication (P) Ltd.,

Department of Civil Engineering

Prerequisite:

CE 223 BUILDING PLANNING & DESIGN

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Draw the plan of buildings.
CO2	Understand functional requirement, orientation and ventilation of building.
CO3	Acquired knowledge of energy efficient building. acoustics & sound insulation.
CO4	Understand the fire resisting properties of building material.

Unit -I

Introduction: Type of building**,** criteria for site selection, site plan.

Planning of Building: Planning, regulations and bylaws. Regulation regarding: lines of building frontages, built up area of buildings, open space around buildings and their heights, provision to size, height and ventilation of rooms and apartments and sanitary provisions.

Principal of Planning: Factors affecting planning (aspect, prospect, privacy, grouping, roominess, furniture requirement, sanitation, flexibility, circulation, elegance, economy etc).

Unit-II

Functional Requirements: Functional requirement of a building and its components. Structural component of a building.

Orientation of Buildings: Factors affecting orientation, orientation criteria under Indian condition. Sun diagram and relevant details.

Ventilation in Buildings: Necessity of ventilation, factors affecting ventilation. Functional requirements of a good ventilation system, systems of ventilation.

Unit -III

Air Conditioning of Buildings: Purpose, classification, principle and systems of air conditioning.

Thermal Insulation of Buildings: Objectives, advantages, general principle and method of thermal insulation.

Energy Efficient Buildings: Concepts of Energy Efficient Buildings.

Unit -IV

Acoustic: Definition, velocity, frequency, intensity & reflection of sound, reverberation,

absorption of sound, Sabin's equation. Types of absorbent material. Noise & its effect. Types & transmission of noise. Sound insulation of walls & floors.

Fire Protection in Building: General, causes & effect of fire. Characteristics of fire resisting material. Fire resisting properties of common building material. General rules for fire resisting buildings. Concept of strong room construction.

Practicals: Will be as per theory syllabus.

Suggested Books & References

1 Rangwala, S.C., 'Engineering Materials', Charotar Book Stall, Anand,.

2 Arora, S.P. and Bindra, 'Building Construction', Dhanpat Rai & Sons, New Delhi.

3 Awaasthy, S.N., 'Building Construction', Publishing House, Bhopal

Department of Civil Engineering

Prerequisite:

CE 224 CONCRETE TECHNOLOGY

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Acquired knowledge of composition & characteristics of cement, aggregates and concrete.
CO2	Understand various types of admixture used in concrete.
CO3	Design concrete mix based on IS 10262: 2009
CO4	Understand properties of concrete and some special type of concrete and form work.

Unit-I

Cement: Constituents of cement and their role, composition of cement (Bogue's equation) hydration of cement, structure of hydrated cement, heat of hydration. Tests of cement as per IS code.

Aggregates: Classification, properties and grading of aggregates. Tests on aggregates as per IS code.

Admixture in Concrete: Chemical and mineral admixtures (their types and use under different conditions). Use of fly ash and silica fume in concrete.

Unit-II

Concrete: Grade of concrete, proportioning of ingredients, water content and its quality for concrete, water/cement ratio and its role.

Concrete Mix Design: Controlling factors and Design of mix by IS method.

Properties of Fresh Concrete: workability, air content, flowability, factors affecting and methods to determine these properties. Standard tests on fresh concrete as per IS code. Acceptance Criteria. Quality control for concrete.

Unit-III

Properties of Hardened Concrete: Strength, permeability, creep and shrinkage, factors influencing these properties. Standard tests on fresh and hardened concrete as per IS code.

Concrete Handling in Field: Introduction to mixing & batching methods, placing, transportation, compaction and curing methods.

Form Work: Requirements, loads on formwork, type & method to provide centering and shuttering for volumes, beams, slabs, walls and staircase, slip and moving formwork, Indian

standard on formwork.

Unit-IV

High Strength Concrete: Production, properties & application.

Special Concretes: Introduction to: High performance Concrete, Light weight concrete, High density concrete, Fibre reinforced concrete, Polymer concrete composites, Self Compacting Concrete – Ready mix concrete.

Practicals

1. To determine the percentage of water required to prepare a cement paste of standard consistency.
2. To determine the Initial Setting Time for a cement sample.
3. To determine the specific gravity and void ratio for a cement sample.
4. To determine the compressive strength for a cement sample.
5. To determine the specific gravity and void ratio for a sample of (i) Fine aggregate (ii) Coarse aggregate.
6. To determine the bulking of sand for varying water content.
7. To determine the Fine modulus and Grading for a sample of (i) Fine aggregate (ii) Coarse aggregate.
8. To determine characteristics compressive strength of concrete with varying water cement ratio.
9. To determine Slump and Compaction factor of concrete.
10. To determine the modulus of rupture of concrete and relation with its compressive strength.
11. To determine the effect of compaction and curing on compressive strength of concrete.
12. To determine the effect of quantity of fine aggregate on compressive strength of concrete.
13. To design a concrete mix using I.S. method.

Suggested Books & References

1.Shetty M.S. "Concrete Technology"

2.Mehta PK & Monteriro P.J.M., "Concrete Microstructure, Properties and Materials".

3.Neville A M. & Brooks J.J. "Concrete Technology"

Department of Civil Engineering

Prerequisite:

CE 225 SURVEYING-I

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Conduct chain survey & compass survey.
CO2	Conduct traversing survey,contour mapping & calculate area & volume
CO3	Conduct detailed theodolite Surveying
CO4	Understand process of leveling and conduct plane table surveying

Unit-I

Measurement of Distances: Plan and Maps (selection of scale), Error in chaining/tape and various precautions. Corrections to tape measurements. Degree of accuracy in chaining/tape. Field problems in distance measurement. Obstacle to ranging & chaining. Accuracy & errors (sources, kinds & law of probability).

Measurement of Angle & Direction: Reference meridians, bearing and azimuths, magnetic declination and its variation.

Unit-II

Traversing: Chain**,** compass traversing, open traverse, close traverse, closing error and magnitude of closing error. Graphical adjustment of close traverse.

Area Calculation: Area of regular boundaries by mathematical formulae, use of trapezoidal & Simpsons formula, their limitations. Planimeter (construction, use & area calculations), use of zero circle & solution of numerical problems.

Unit-III

Theodolite surveying : Details of transit theodolite, definition & terms, temporary adjustment of and permanent adjustment of vernier theodolite. Measurement of horizontal and vertical angle. Application of theodolite in field problems. Sources of error in the thedolite work & procedure to eliminate/minimize the errors.

Unit-IV

Leveling: Definitions of various terms in leveling. Types of leveling, sources of errors in leveling. Curvature and refraction corrections. Temporary and permanent adjustment of dumpy & tilting levels. Computation of levels. Profile leveling (L-Section and cross-sections). Special method of spirit leveling, differential leveling.

Plane Table Surveying: Elements of plane table survey, working operations. Methods of plane table survey (intersection, radiation, traversing and resection). Two point and three point problems by Lehmann's method.

Practicals

1. Obstacle to chain Surveying & procedure to overcome them.
2. Adjustment of closing error by graphical method.
3. Study of various levels and their temporary adjustments.
4. Permanent adjustment of dumpy level.
5. Reduced level calculations obtained from dumpy level.
6. Setting up of plane table, use of various accessories and practice for orientation and change of point.
7. Radiation method of plane tabling.
8. Intersection method of plane tabling.
9. Two point problem and its solution.
10. Three point problem (Lehmann's method) and its solution.
11. Study of theodolite and its temporary adjustment.
12. Measurement of horizontal angle with the help of repetition method.
13. Measurement of horizontal angle with the help of reiteration method.
14. Measurement of vertical angle with the help of theodolite.
15. Use of planimeter and determine its constants. Calculation of areas of irregular boundaries

Suggested Books & References

1. Arora K. R., 'Surveying', Vol. I & II.
2. Punmia B.C., 'Surveying' Vol. I & II.
3. Clendinning and Oliver, 'Principles and use of surveying instruments'.
4. Kanetkar T. P., 'Surveying and leveling', Vol. I & II.
5. Duggal S. K., 'Text book-Surveying', Vol. I & II.

CE 226 DISASTER MANAGEMENT

Cr. Hrs. 2 (1+1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand the nature of disasters
CO2	Prevent manmade disasters and be prepared for natural disasters
CO3	Respond efficiently in case of disasters
CO4	Apply recovery measures in case of disasters

Unit- I

Definition of Disasters/Hazards, Types of Disasters: Natural and Manmade Disasters. Introduction to Tsunami, Flood and Cyclone disasters. Mitigation, Prevention, Preparedness, Response, Rehabilitation and Recovery of these disasters.

Unit- II

Introduction to Landslide, Nuclear, Chemical and Fire disasters. Mitigation, Prevention, Preparedness, Response, Rehabilitation and Recovery of these disasters.

Unit- III

Earthquakes: Earthquake terminology, Earthquake Magnitude & Intensity and their measuring scales, Occurrence of earthquakes : Plate tectonic theory.

Effect of earthquake on structures Planning/architectural concepts, Earth quake resistant practices/features.

Unit- IV

Vulnerability of Indian continent to different types of disasters.

Various Case studies: Case study of Bhuj Earthquake (2001), Case of study Bhopal Gas Tragedy (1984), Case study of Tsunami in Indian Continent (2006), Case study of Japan Nuclear Tragedy (2011).

Assignments/Practicals: As per theory syllabus.

Suggested Books & References

1. G.K. Ghosh , *"Disaster Management",* A.P.H. Publishing Corporation
2. B Narayan , *"Disaster Management",* A.P.H. Publishing Corporation
3. Nikuj Kumar , *"Disaster Management",* Alfa Publications

4. Day R.W. (2002). Geotechnical Earthquake Engineering Handbook, McGraw-Hill Handbooks, New york.

Department of Civil Engineering

Prerequisite:

CE 227 BUILDING DRAWING

Cr. Hrs. 1 (0+1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Demonstrate knowledge of blue print reading and detailed drawings for various building components.
CO2	Plan elevation and section of building.
CO3	Plan and drawing of dispensary.
CO4	Planning, designing and detailed drawings of staircase.

Blue print reading.

Detailed drawings for doors, windows, rolling shutters and collapsible gates.

Detailed Drawings (Plan, Elevation and section for the following);

Simple residential buildings, office & institutional building with flat roof.

Dispensary – Provision for Handicapped people.

Workshop – Trussed roof.

Planning, design and detailed drawings of staircase.

Suggested Books & References

1. Singh, Gurucharan, 'Building Drawing'.
2. Shah, M. G., 'Building Drawing'.

Department of Civil Engineering

Prerequisite:

THIRD YEAR B.E. (V SEMESTER)

CE311 THEORY OF STRUCTURES-I

Cr. Hrs. 4 (3+1)

	L	T	P
Credits	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Analyze static and kinematic indeterminacy of beam and frames.
CO2	Analyze continuous beams and portal frames by slope deflection method.
CO3	Analyze continuous beams and portal frames (with and without sway) by moment distribution method.
CO4	Analyze trussed beam & portal frame by energy method.
CO5	Analyze multi storey frames.

Unit-I

Static and Kinematic Indeterminacy: Static and kinematic indeterminacy (beam, frames: with & without sway), Introduction of Indeterminate structures.

Slope Deflection Method: Analysis of continuous beams and portal frames (without inclined members).

Unit-II

Moment Distribution Method: Analysis of continuous beams and portal frames (with and without sway).

Unit-III

Energy Methods: Castigliano's second theorem. Principle of minimum strain energy. Application to frames with one and two redundant members. Trussed beam, portal frames.

Unit-IV

Approximate Analysis: Analysis of multi storey frames by approximate methods: Portal and Cantilever method.

Practicals

1 Analysis of a portal frame by slope deflection method.

2 Analysis of a portal frame by moment distribution method.

3 Application of Catigliano's II theorem to frames with one redundant member.

4 Analysis of multistory frames by portal method.

5 Analysis of multistory frames by cantilever method.

Suggested Books & References

1. Junarkar, ‘Mechanics of Structures’, Vol II.
2. Punmia, B.C., 'Strength of materials and theory of structures’, Vol –II.
3. Vazirani & Ratwani, 'Analysis of Structures’, Vol. II

Department of Civil Engineering

Prerequisite: CE-211 strength of material, CE 221- structural analysis, CE 311 Theory of structure I, CE 321 Theory of structure I, CE 224 Concrete Technology

CE 312 DESIGN OF CONCRETE STRUCTURES-I

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

1

Course Outcome	Upon completion of this course the students will be able to:
CO1	Analyze static and kinematic indeterminacy of beam and frames.
CO2	Analyze continuous beams and portal frames by slope deflection method.
CO3	Analyze continuous beams and portal frames (with and without sway) by moment distribution method.
CO4	Analyze trussed beam & portal frame by energy method.
CO5	Analyze multi storey frames.

Unit-I

Design Philosophies: Introduction to Working stress, ultimate load and limit state methods.

Analysis and Design of Flexural Members (Using limit state design method):

Rectangular sections: Singly and doubly reinforced.

T section: Singly reinforced.

Unit-II

Shear and Bond: Behaviour of beams in shear and bond, design for shear, anchorage curtailment and splicing of reinforcement, detailing of reinforcement.

Torsion: I.S. code provisions for torsion in beams.

Serviceability Conditions: I.S. code provisions for limit states of deflection and cracking.

Slabs, Lintels: Design of one way and two way slabs, design of lintels and introduction of flat slab.

Unit-III

Design of Columns: Short and long columns, eccentrically loaded columns (uni-axial).

Column Footings: Isolated column footing and combined footing for two columns (without central beam).

Unit-IV

Staircases: Design of dog-legged staircases.

Cantilever Retaining Walls: Design of cantilever type retaining walls & introduction to counter-fort retaining wall.

Note: The use of IS 456:2000, SP16 shall be allowed in the examination.

Practicals

1. Design of Flexural Members
2. Design of Lintels
3. Design of slabs (one way and two way).
4. Design of columns and its footings.
5. Design of dog-legged staircase.
6. Design of cantilever type retaining walls.
7. Site visits for structural arrangement of members.

Note

- To the scale sketching would be done in the sketch book by hand and then the drawings would be drafted using Drafting Package/ Auto Cad.
- Detailing of parts would be done as per standard professional practice and relevant IS codes.
- Emphasis would be given on structural detailing of various members as per relevant codal provisions.
- Report of a site visit shall be prepared mentioning structural arrangement of members.

Suggested Text Books & References

1. Jain A.K., 'Reinforced Concrete-Limit State Design', Nem Chand & Bros. Roorkee.
2. Krishna J. and Jain O.P., 'Plain and Reinforced Concrete, Vol. I. New Chand & Bros. Roorkee.
3. Dayaratnam P., ‘Reinforced Concrete Structures', Oxford and IBH Publishing Co.
4. Punamia B.C., 'Limit State Design of Reinforced Concrete', Laxmi Publication Pvt. Ltd.
5. Pillai and Menon, ‘Reinforced Concrete Design ', Tata McGraw Hill, New Delhi.
6. Nilson A. II and George Winter, 'Design of Concrete Structures' McGraw Hill Book Co 10th Ed.
7. Park R and Pauley T., ‘Reinforced Concrete Structures’, John Wiley and Sons.
8. ‘Design Aids for Reinforced Concrete-to I.S.-456: SP-16’, Bureau of Indian Standards, New Delhi.
9. Relevant IS Codes.

Department of Civil Engineering

Prerequisite: CE 212 Fluid mechanics, CE 222 Hydraulic and Hydraulic machines

CE 313 GEOTECHNICAL ENGINEERING-I

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Find out fundamental properties of soil and their relationship with determining index properties of soil.
CO2	Acquired knowledge of soil classification. Phenomenon of flow of water through soil.
CO3	Calculate various stresses in soil mass.
CO4	Understand the process of soil compaction and soil stabilization.

Unit- I

Fundamental Definitions & Relationship: Soil and soil mass constituents, Water content, specific gravity, void ratio, porosity, degree of saturation, air void and air content, unit weights, density index. Interrelationship of these terms.

Index Properties: Determination of index properties of soil, water content, specific gravity, particle size distribution, sieve and sedimentation analysis, consistency limits, void ratio and density index.

Unit- II

Soil Classification: Classification of soil for general engineering purposes, particle size, textural H.R.B. Unified and I.S. Classification systems.

Flow through Soils: 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.

Seepage: Seepage pressure, Laplace's equation for seepage. Flownet and its construction. Uplift pressure, piping, principle of drainage by Electro Osmosis, pheritic line.

Unit- III

Stresses in Soil Mass: Total effective and neutral pressure, calculation of stresses. Influence of water table on effective stress, quicksand phenomenon.

Shear Strength of Soils: 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.

Unit- IV

Soil Compaction: 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: Soil stabilization, Mechanical Stabilization, Stabilization with cement, Lime and bitumen.

Practicals

1. Determination of Moisture Content of a given sample of soil.
2. Determination of Specific Gravity & Relative Density for a given sample of soil.
3. Field Density Test on a given sample of soil.
4. Determination of Sieve Analysis for a given sample of Coarse Grained soil.
5. Determination of Consistency Limits and Indices for a given sample of soil.
6. Standard Proctor's Compaction Test on a given sample of soil.
7. Permeability Test on a given sample of soil.
8. Unconfined Compression Test for a given sample of Cohesive Soil.
9. Determination of Vane Shear Strength for a given sample of Cohesive Soil.
10. Direct Shear Test on for a given sample Sand.
11. Triaxial Compression Test on a given sample soil.

Suggested Books & References

1. Punmia, B.C., 'Soil Mechanics and Foundations'.
2. Ranjan G. & Rao, 'Basic and Applied Soil Mechanics'.
3. Singh Alam, 'Soil Engineering in Theory and Practice'.
4. Arora, K.R., 'Soil Mechanics & Foundation Engineering'.
5. Gulhati, Shashi K & Datta Manoj, 'Geotechnical Engineering Principles and Practices', Pearson Education Ltd.
6. Prasad, 'Soil Dynamics & Earth Quake Engineering', Prentice-Hall of India.
7. Varghese, 'Foundation Engineering', Prentice –Hall of India.
8. Coduto, Donald P., 'Geotechnical Engineering Principles and Practices', Pearson Education Ltd.

Department of Civil Engineering

Prerequisite: CE225 Surveying I

CE 314 SURVEYING – II

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Draw contour and find area and volume using contour.
CO2	Conduct tachometric survey and draw plan of land piece by techeometric survey
CO3	Set on ground various curves by using theodolite
.CO4	Condut trigonometry leveling and understand arial photograph and fundamentals of Field astronomy.

Unit -I

Contour & Contouring: Definition of contour, contour internal, choice of contour internal, characteristics of contour. Method of locating contours by square method, cross sections & tacheometric method. Interpolation of contours. Use of contour maps.

Computation of Volumes: Volume of reservoir from contour map Volume from spot levels & contour plans. Earthwork calculations, Level, two level & side hill two level section,

Unit –II

Tacheometry: Principle of tacheometric survey & its field application, Stadia method, constants of tacheometer, distance & elevation formulae for staff held vertical & normal. Reduction tables Use of anallactic lens. Errors and precision of tacheometry.

Unit–III

Circular Curves : Necessity of curves, classification of curves (Simple, compound, reverse & vertical curves), Elements of simple circular curve(definition & notation, designation of curve), setting out of simple circular curve by ordination from the long chord by successive bisection of arc, by offsets from the tangents & by two theodolite method.

Transition Curve: General requirement of super elevation, ideal transition curve. Length of transition curve. Methods of setting out a transition curve.

Unit -IV

Trigonometrical Leveling: Determination of differences of elevations: base of the object

accessible, base of the object inaccessible axis at the same level & at different level.

Ariel Photography: Introduction to Ariel Photography.

Field Astronomy: Definitions and basic concepts of Field Astronomy.

Practicals

1. Use of tacheometery with inclined sight and staff held vertical.
2. Use of tacheometery with inclined sight and staff held inclined.
3. Contouring by grid method.
4. Contouring by radial line method.
5. Contouring by spot level method.
6. Practice of contour plotting by various methods.
7. Problems of height and distance when base of object is accessible.
8. Problems of height and distance when base of object is inaccessible.
9. Computation of volume of reservoir by contours.
10. Elements of simple circular curve & their calculation.
11. Setting of simple circular curve by linear measurement techniques.
12. Introduction of Total Station.
13. Distance and angle (horizontal & vertical) by Total Station.

Suggested Books & References

1. Arora K. R. 'Surveying', Volume I & II.
2. Punmia B.C. 'Surveying', Vol. I & II.
3. Clendinning and Oliver, 'Principles and use of surveying instruments'.
4. Kanetkar T. P., 'Surveying and leveling' Vol. I & II.
5. Duggal S.K., 'Surveying', Vol. I & II.

Department of Civil Engineering

Prerequisite: Nil

CE 315 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

Cr. Hrs. 1 (0+1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Solving errors & flow chart by computer algorithms
CO2	Determine roots of polynomials and transcendental equations
CO3	To solve simultaneous linear algebraic equations
CO4	Fit the curve by various analysis
CO5	Analyze various structurl elements using C/C++

Algorithms and flow charts: Computer Algorithms for problem solution and flow charts.

Error Analysis: Approximations and errors, rounding of errors Truncation errors (using Taylor Series), Absolute Error.

Roots of Equation: Determination of roots of polynomials and transcendental equations by Secant, Bisection and Newton-Raphson methods.

Linear Algebraic Equation: Solutions of simultaneous linear algebraic equations by Gauss Elimination and Gauss- Jordan methods.

Curve Fitting: Linear regression analysis, Least square of fit of a straight line, Least square of fit of second order polynomials.

Simple Programs: To analyze various Structural elements using C/C++.

Introduction to software used in Civil Engineering: STAAD Pro, SAP etc.

Suggested Books & References

1. Sastry, S. S. "Introductory Methods of Numerical Analysis", 4th ed. Prentice- Hall of India, New Delhi.
2. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International, New Delhi.
3. Grewal B.S., "Numerical Methods in Engineering and Science", Khanna Publishers, Delhi.

Department of Civil Engineering

Prerequisite: Nil

CE 316 DESIGN OF STEEL STRUCTURES-I

Cr. Hrs. 4 (3+1)

	L	T	P
Credits	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand various grade of structural steel and able to design joints in riveted ,bolted & welded connection.
CO2	Design of axially loaded member in tension and compression.
CO3	Design of rectangular & I sections for continuous beam.
CO4	Design of structural steel beams and girders.

Unit-I

*Introduction***:** Types of steels as a structural material, various grades of structural steel, properties and their permissible stresses. Various rolled steel sections and their properties. Introduction to various codes related to steel design of structures (IS 800, 875 etc.)

Structural Fasteners: Riveted, bolted and welded connections. Strength, efficiency and design of joints. Introduction to high strength friction grip bolts.

Unit-II

Design of Axially Loaded Members: Tension and compression members.

Design axially loaded and eccentrically loaded columns.

Design of lacings and battens for built-up columns.

Column Bases: Slab base, Gusseted base.

Unit-III

Plastic Design**:** Fundamentals of plastic theory for steel structures, shape factor, plastic analysis. Design of rectangular & I sections for Continuous beam.

Unit-IV

Design of Simple and Built-up Beams: Laterally restrained and unrestrained (symmetrical section only). Curtailment of flange plates.

Gantry Girder: Design of gantry girder.

Note: The use of IS 800, IS: 875, Structural Handbook No.1 shall be allowed in the

examination.

Design Assignments shall consist of the following

1 Design of built-up columns

2 Design of beams

3 Design of gantry girder.

4 Design of industrial shed.

- To the scale sketching would be done in the sketch book by hand and then the drawings would be drafted using Drafting Package/ Auto Cad. Six half imperial size drawing sheets would be drawn using drafting software/ Auto CAD
- Detailing of parts would be done as per standard professional practice and relevant IS codes.
- Emphasis would be given on structural detailing of various connections in structural steel work.
- Report of a site visit shall be prepared mentioning structural details with relevant sketches of structural connections.

One site visits would be carried out as a part of practical work. Practical Examination would include a sketching session.

Suggested Books & References

1. Arya & Ajmani, 'Design of Steel Structures'.
2. Duggal,S.K. 'Design of Steel Structures'.
3. Punmia B.C., 'Design of Steel Structures'.
4. Negi L.S., 'Design of steel Structures'.
5. Ramchandra, 'Design of Steel Structures'.
6. Steel Hand Book
7. Relevant IS Codes.

Department of Civil Engineering

Prerequisite: ***CE 211*** Strength of Materials-***CE 221*** Structural Analysis-***CE 311*** Theory of Structures-I

CE321 THEORY OF STRUCTURES-II

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Analyze effect of rolling load using Influence Line method.
CO2	Able to understand & analysis of unsymmetrical Bending.
CO3	Analysis and design of arches.
CO4	Analysis and design of cable and suspension bridges.

Unit-I

Rolling Load: Rolling load on beams and statically determinate frames. Shear force and bending moments due to concerted loads, uniformly distributed loads (longer and shorter than span).

Influence Lines: Influence Line Diagrams for shear force, bending moment, stress, deflection for simple supported beams & statically determinate frames. Muller-Breslau principle and its applications.

Unit-II

Unsymmetrical Bending: Definition, location of Neutral Axis, computation of stresses, shear center and its location for common structural shapes.

Unit-III

Arches: Linear arch, Eddy's theorem. Analysis of three hinged arch & two hinged arches. Moving loads on three hinged and two hinged arches.

Unit-IV

Cable and Suspension Bridges: Analysis of cables with concentrated and continuous loading. Analysis of two & three hinged stiffening girder: Influence lines for Bending Moment and Shear Force.

Practicals

1 Analysis of a statically determinate frame for rolling load by influence line diagram.

2 Determination of stresses and shear centre for a beam for unsymmetrical bending.

3 Analysis of three hinged arch.

4 Analysis of two hinged arch

5 Analysis of cables for continuous loading.

6 Analysis of frame without sway by Kani's method.

Suggested Books & References

1. Junarkar,' Mechanics of Structures' Vol. II.
2. Punmia, B.C., 'Strength of materials and Theory of structures' Vol. II.
3. Vazirani & Ratwani, 'Analysis of Structures' Vol. II.

Department of Civil Engineering

Prerequisite: CE224 concrete technology, CE312 Design of concrete structure –I

CE 322 DESIGN OF CONCRETE STRUCTURES-II

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Design continuous beam, rectangular portal frame as per I.S. code. & Understand concept of yield line theory.
CO2	Design beam in curved in plan.
CO3	Design of water tanks as per I.S. 3370
CO4	Design of prestressed concrete structure.

Unit- I

Continuous Beams: Design of continuous R.C. beams (using I.S. code coefficients)

Portal Frame: Design of rectangular portal frame (one storey and one bay) with fixed end at base.

Yield Line Theory: Concept of yield line theory, Design of rectangular slab with U.D.L. & simple support conditions.

Unit-II

Beams Curved in Plan: Analysis of ring beams uniformly loaded & supported on equi-spaced columns

Domes: Design of circular domes with UDL, concentrated load at crown.

Unit-III

Water Tanks (Using working stress design method): Design of rectangular and circular tanks (as per I.S. 3370). Design of Intze type tanks (membrane analysis only). Design of column brace type staging. Design of annular raft foundation.

Unit-IV

Elements of Prestress Concrete: Principles, systems and advantages, Material properties, Losses of prestress, Analysis of rectangular and I section, I.S. specifications. Design of a simple rectangular beam for flexure as per I.S. 1343 (excluding end block).

Note: The use of IS 456:2000, SP16, 'Reinforced Concrete Design Hand Book by Reynolds & Steedman, IS 1343, IS 3370 (Part 1 to 3) shall be allowed in the examination.

Practicals

1. Design of Continuous beams.
2. Design of Portal frame.
3. Design of rectangular slab with U.D.L using yield line method.
4. Design of water Tanks.
5. Design of a prestressed rectangular beam (simple supported) for flexure.
6. Site visits for structural arrangement of members.

Note

- To the scale sketching would be done in the sketch book by hand and then the drawings would be drafted using Drafting Package/ Auto Cad.
- Detailing of parts would be done as per standard professional practice and relevant IS codes.
- Emphasis would be given on structural detailing of various members as per relevant codal provisions.
- Report of a site visit shall be prepared mentioning structural arrangement of members.

Suggested Text Books & References

1. Jain A.K., 'Reinforced Concrete-Limit State Design', Nem Chand & Bros. Roorkee.
2. Krishna J. and Jain O.P., 'Plain and Reinforced Concrete, Vol. II. New Chand & Bros. Roorkee.
3. Dayaratnam P., "Reinforced Concrete Structures' Oxford and IBH Publishing Co.
4. Punamia B.C., ' Reinforced Concrete Structures II', Laxmi Publication Pvt. Ltd.
5. Pillai and Menon, ‘Reinforced Concrete Design ', Tata McGraw Hill, New Delhi.
6. Gray W.S. and Mannings G.L. 'Reinforced Concrete Water Towers, Bunkers, Silos & Grantries', Concrete Publication Limited.
7. Reynolds C.E. and Steadman, J.C., 'Reinforced Concrete Design Hand Book',
8. Relevant IS Codes.

Department of Civil Engineering

Prerequisite: CE 212 Fluid mechanics, CE 222 Hydraulic and Hydraulic machines ***CE 313*** Geotechnical Engineering-I

CE 324 GEOTECHNICAL ENGINEERING-II

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Calculate stresses in soil under various types of loading.
CO2	Find compressibility & consolidation characteristics .
CO3	Check slope strability of embankment & calculate amount of Earth pressure.
CO4	Calculate safe bearing capacity .
CO5	Carried out Soil investigation , geophysical investigation for foundation.

Unit-I

Stress in Soil under Surface Loading: Bossinesq's and Westergaard's analysis for vertical pressure and its distribution in a soil mass. Vertical stresses, 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, New Marks' chart. Pressure bulb and its significance in Foundation exploration. Stresses in soil below foundations.

Unit-II

Compressibility and Consolidation: One-dimensional consolidation of soil, Degree of consolidation, consolidation test. Terzaghis one-dimensional consolidation theory, Compressibitliy parameters, co-efficient of consolidation. Preconsolidation pressure and its determination. Normally, over and under consolidated soils. Methods of predicting settlement & its rate. Total and differential Settlement.

Stability of Slopes: Classification of slopes, Stability analysis of infinite slopes. Stability of finite slopes by Swedish and Friction circle method. Taylor's stability number curves. .

Unit-III

Earth Pressure: Active, passive and earth pressure at rest Rankine's and Coulomb's theories

Rebhann's and Culman's graphical method for active earth pressure (vertical and inclined back retaining walls), horizontal and inclined cohessionless back fill. Stability analysis of retaining walls.

Bearing Capacity of Soils: Terminology related to bearing capcaity. Common types of foundations. Terzaghi and Meyehoffs theory for bearing capacity. Rankine's method for minimum depth to foundation Skempton's method. Effect of water table on bearing capacity. IS code method to determine bearing capacity. Plate load and penetration tests.

Unit-IV

Site Investigations: Planning of Investigations. Methods of explorations, depth of exploration. Undisturbed and disturbed samples. Types of Samples. Brief description of procedures of sampling, Transportation and storage of samples, Depth, number &extent of boreholes Geophysical methods of investigations.

Foundations: Introduction to pile, well and machine foundations.

Practicals : Will be as per theory syllabus.

Suggested Books & References

1. Punmia, B.C., 'Soil Mechanics and Foundations'.
2. Ranjan G. & Rao, 'Basic and Applied Soil Mechanics'.
3. Singh Alam, 'Soil Engineering in Theory and Practice'.
4. Arora, K.R., 'Soil Mechanics & Foundation Engineering'.
5. Varghese, ‘Foundation Engineering’, Prentice’ –Hall of India.

Department of Civil Engineering

Prerequisite: Nil

CE 325 TRANSPORTATION ENGINEERING-I

Cr. Hrs. 4 (3+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand the role of transportation system and highway planning.
CO2	Calculate geometrical design parameters of highway.
CO3	Analyze different traffic studies.
CO4	Construct different type of highway roads.
CO5	Design highway & pavements.

Unit-I

Introduction: Importance and Role of Transportation Systems. Transportation Modes and their comparison.

Highway Planning : Highway planning Process (specifically of India), Preparation of master plan, Classification of Roads, Road Patterns, Highway Alignment (Controlling Factors and Surveys), Introduction to hill roads & rural roads.

Unit- II

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), Vertical Alignment (Gradients and types of vertical curves).

Unit-III

Elementary Traffic Engineering: Significance of different Traffic Engineering Studies (Speed, Volume, O & D, Parking and Accident's Study), Importance and type of Traffic Signs, Signals, Road Marking and Road Intersections.

Highway Materials: Desirable Properties, Testing Procedures and Standard values relating to Stone Aggregates, Bitumen and Tar.

Construction: Methods of constructing different types of roads (Stabilized roads, WBM roads, Bituminous roads and Concrete roads).

Unit-IV

Structural Design of Pavements: Factors affecting design of flexible and rigid Pavements, Concept of equivalent single wheel load, Design of Flexible Pavements by CBR method (as per guidelines of IRC).

Highway Maintenance: Brief introduction of failure pattern and maintenance for WBM, Bitumen and Concrete Roads.

Highway Drainage: Introduction to various types of C.D. works.

Practicals

1. To determine the elongation and flakiness index for an aggregate sample.
2. To determine the Crushing value for an aggregate sample.
3. To determine the Impact value for an aggregate sample.
4. To determine the Abrasion value for an aggregate sample.
5. To determine the Softening point for a bitumen sample.
6. To determine the Penetration value for a bitumen sample.
7. To determine the Ductility value for a bitumen sample.
8. Introduction to design a bitumen mix using Marshall method

Suggested Books & References

1. Khanna and Justo, 'Highway Engineering'.
2. L.R. Kadiyali, 'Highway Engineering'.
3. G.R.Rao , 'Traffic Engineering and Transportation Planning'.
4. Chakrobrati and Das, ‘Principles of Transportation Engineering’.

Department of Civil Engineering

Prerequisite: Nil

CE 326 MATRIX METHODS OF STRUCTURAL ANALYSIS

Cr. Hrs. 2(0+2)

L T P

Credit 0 0 2

Hours 0 0 4

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand flexibility & stiffness matrices
CO2	Do Stiffness matrix analysis of space trusses
CO3	Solve flexibility & stiffness matrices by different computer techniques
CO4	Do Finite element analysis

Introduction to Flexibility & Stiffness Matrices: Static and kinematic indeterminacy. Properties of stiffness and flexibility matrices. Compatibility condition. Analysis of simple structures.

Plane Trusses and Plane Frames: Stiffness matrix for axial force members (plane truss). Stiffness matrix for flexural members (plane frame). Stiffness matrix for combined axial force, flexure and torsion.

Transformation matrix, stiffness matrices in global coordinates.

Formation of global equations. Solution for displacement and forces under gravity and lateral loads.

Space Truss: Stiffness matrix analysis of space trusses.

Computer Technique: Computer solution of problems by stiffness method. Advantage of the stiffness method.

Introduction to Finite Element Analysis: Introduction (background & general description of the method). Analysis procedure. Element stiffness matrix, overall stiffness matrix for a structure. Solution of a problem.

Suggested Books & References

1. Pandit G.S., & Gupta S.P., "Structural Analysis (A matrix approach)", Tata McGraw Hill Publishing Ltd.
2. J.S.Przemieniecki, "Theory of Matrix Structural Analysis", McGraw-Hill.
3. Meek,J.L., "Matrix Structural Analysis".

4. Kanchi, “Matrix Structural Analysis”, Wiley Eastern Ltd., New Delhi
5. Cook R.D., Malkas D.S. & Plesha M.E, “Concepts and applications of Finite element analysis”, John Wiley & Sons.
6. Bathe, K. J., “Finite Element Procedures in Engineering Analysis”.
7. Desai, C. S. and Kundu T., “Introductory Finite Element Method”.

Dave, D. J. “Matrix and F.E.M.: Displacement Analysis”.

Department of Civil Engineering

Prerequisite: Nil

CE 411 BRIDGE ENGINEERING

Cr. Hrs. 4 (3+1)

	L	T	P
Credits	**3**	**0**	**1**
Hours	**3**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand different types of bridges and their suitability and their maintenance.
CO2	Design of culverts and T-beam bridges.
CO3	Design of substructure and foundation.
CO4	Design of bearing of slab bridges and joints as per IRC 83.

Unit-I

Introduction: Type of bridges & classification of road & railways bridges. Economical span. IRC loadings for bridges, wind load & Earthquake forces. Various load distribution theories.

Investigation for Bridges: Site selection and preliminary data.

Maintenance: Maintenance of bridges.

Unit-II

Reinforced Concrete Culverts & Bridges: Design of reinforced concrete slab culvert, T-beam bridges (Courbons & Hendry-Jaegar methods) for IRC Loading. Use of Pigeaud's coefficients.

Unit-III

Substructure: Principle of design of substructure elements, Design of pier, abutment and wing wall**.**

Design of Foundation: Introduction of Well foundation.

Unit-IV

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

Joints: Expansion joints.

Note: 1. The use of IS 800, IS: 875, Structural Handbook No.1 shall be allowed in the examination.

Design Assignments shall consist of the following:

1. Design of Slab culvert.
2. Design of T-beam bridge.
3. Design of substructure elements for T-beam bridge.

- Detailing of parts would be done as per standard professional practice and relevant IS codes.
- To the scale sketching would be done in the sketch book by hand.
- Report of a site visit shall be prepared mentioning structural details with relevant sketches of structural connections.

Site visit would be carried out as a part of practical work. Practical Examination would also include a sketching session.

Suggested Books & References

1. Victor Johnson, 'Bridge Engineering'.
2. Relevant IRC codes.

Note: The use of IRC Book shall be allowed in the examination.

Department of Civil Engineering

Prerequisite: CE 212 Fluid mechanics, CE 222 Hydraulic and Hydraulic machines ***CE 313*** Geotechnical Engineering-I

CE 412 WATER RESOURCES ENGINEERING

Cr. Hrs. 4 (3+1)

L T P

Credit 3 0 1

Hours 3 0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Analyze surface hydrological data and drawing hydrograph and other useful parameters.
CO2	Understand ground water hydrology. Planning reservoirs.
CO3	Select and design various types of dams and spillways.
CO4	Design Cross drainage structure and understanding working of Hydro power plant.

Surface Water Hydrology: Hydrological Cycle, Types & forms of precipitations. Rainfall measurements & interpretation of rainfall data, missing rainfall data.

Runoff: Factor affecting runoff, annual runoff volume, computation of runoff, infiltration indices.

Hydrograph Analysis: Hydrograph elements and factor affecting. Unit hydrograph & its applications.

Unit- II

Ground Water Hydrology: Ground water aquifers. Permeability & transmissibility of aquifers: steady flow towards a well in confined & water table aquifer (Dupits & Theims equation). Measurement of yield of an open well, tube well & infiltration galleries, interference among wells (well losses, comparison of well and flow irrigation).

Reservoirs: Planning of reservoir, types of reservoir and their site selection, capacity & yield of reservoir, Reservoir sedimentation and useful life of reservoirs.

Unit-III

Gravity Dams: Force acting on a gravity dam, stability requirements, Design and construction features.

Embankment Dams: Suitable sites, causes of failures. Design & stability analysis (flownet, slope stability analysis, precautions of piping).

Spillways: Spillway capacity, flood routing through spillway. Different types of spillways and gate, energy dissipation below spillways.

Unit- IV

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, super-passage syphon, level crossing and other types.

Hydro Power Plant: Hydro-electric power generation, Hydro-electric plant. General features of hydroelectric projects.

Practicals : Will be as per theory syllabus.

Suggested Books & References

1. Asawa,G.L., 'Irrigation Engineering', 2nd Ed. New Age International Publisher. New Delhi.
2. Singh Bharat, 'Fundamental of Irrigation Engineering', 7th Ed, Nem Chand & Bros. Roorkee.
3. Varshney, R.S., Gupta S.C. and Gupta R.L., 'Theory and Design of Irrigation Structures'. Nem Chand and Bros. Roorkee.
4. Arora K.R.,' Irrigation Water Power and Water Resources Engineering', Standard Publishers Distributors.

Department of Civil Engineering

Prerequisite: Nil

CE 413 PUBLIC HEALTH ENGINEERING- I

Cr. Hrs. 4 (3+1)

L T P

Credit 3 0 1

Hours 3 0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Distinguish various sources of water supply and assessment of water quantity and quality.
CO2	Understand treatment of water .
CO3	Understand the procedure of filtration disinfection and water softening.
CO4	Justify type of pipes ,joints in pipe & various valves useful in water supply
CO5	Draw layout of distribution system.

Unit-I

Sources of Water Supply: Surface water, ground water, springs, wells & galleries.

Quantity and Quality of Water: Quantity of water per capita, variation in seasonal and hourly consumption. Forecasting of population. Standards of purity for public water supply (I.S. and WHO standards).

Unit -II

Raw Water : Lakes and river intakes, raw water pumping.

Treatment of Water: Aeration, screening, simple sedimentation, Quiescent and continuous flow types of tanks. Coagulation of water, principle of coagulation, coagulation followed by sedimentation, mixing basins.

Unit-III

Filtration: Slow sand filters, rapid sand filters, comparison of two filters.

Disinfection: Treatment with excess lime, ozone, ultraviolet rays, boiling, chlorine and compound of chlorine for disinfection.

Water Softening: Zeolite process, its limitation & advantages.

Unit-IV

Pipes for Water Supply: Different types of pipes used in water supplies.

Joints in Pipes: Bell & spigot joint, cement joint, mechanical joint, flanged joint.

Valves: Air valve, reflux valve, safety valve, sluice valve.

System of Supply: Constant & intermittent supply of water & its disadvantage. Layout of distribution system. Pressure in pipe, water hammer in distribution system.

Practicals

1. To determine the total, suspended, dissolved and fixed solid in a given sample.
2. To determine the turbidity of a given sample of water.
3. To determine the odour and colour of a given sample of water.
4. To determine the pH value of a given sample of water.
5. To determine the type and extent of acidity.
6. To determine the carbonate and bicarbonate.
7. To determine concentration of chlorides in the given sample of water.
8. To estimate the hardness of the given sample of water by standard E.D.T.A. method.
9. To determine residual chlorine in a given sample of water.
10. Standards of purity for public water supply. (I.S. and WHO standard)

Suggested Books & References

1. Hussain, S.K., 'Text book of water supply & sanitary engineering ', Oxford & IBH Publishing co. pvt. Ltd., New Delhi.
2. Rangewala, S.C., 'Fundamentals of water supply & sanitary engineering',Charotar Publisher House, Anand.
3. Punamia, B.C., 'Water supply & sanitary engineering'. Laxmi publishers. Jodhpur
4. Garg, S.K., 'Water supply & sanitary engineering', Khanna Publishers. New Delhi.
5. 'Manual on Water Supply and Water treatment', Ministry of Urban Development, Govt. of India, New Delhi

Department of Civil Engineering

Prerequisite: CE325 Transportation Engineering I

CE 414 TRANSPORTATION ENGINEERING-II

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2 0

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand the role of permanent way components & specific aspect for railway planning.
CO2	Design geometrical features of railway track.
CO3	Design runway for airport & plan of an airport
CO4	Draw airport layout.

Unit-I

Introduction and Permanent Way Components: Types and selection of gauges. Ideal permanent ways & cross sections in different conditions. Salient features of components (Rails, Sleepers, Ballast, Rail Fastenings).

Study of Specific Aspects: Coning of wheels, creep, wear, failures in rails, Rail- joints, length of rail. Sleepers (Functions and requirement of ideal sleeper, types of sleeper, sleeper density). Railway stations (site selection and facilities required by passengers). Platforms (goods and passengers). Yards (goods and passengers, marshalling yards).

Unit-II

Geometric Design: Basic principles & factor affecting geometric design of railway track. Gradient, speed, super elevation, cant deficiency, grade compensation.

Points and Crossings: Points & switches, Types of turnouts. Layout plans of different types of crossing.

Railway Systems Specific to Urban Movements: Introduction of surface railway system, Underground system and Elevated System.

Unit-III

Airport Engineering: Airport planning, Airport classifications, Aircraft characteristics (important in planning), Factors in Airport site selection, Obstructions & Zoning laws.

Runway Orientation and Design: Factors affecting, Wind Rose diagram, Cross wind component, Basic runway length, Corrections for elevation and temperature as per ICAO,

Types of runway pattern, Runway Layout, Runway & Taxiway width, Gradient, Minimum turning radius.

Unit-IV

Airport Layout and Control: Layout plans of an air-port with single and multiple runways, Planning of Terminal Area (Terminal building), Location of Gates, Aprons and Hangers, Wind direction and Landing direction indicators, Airport lighting system and Airport Drainage System (brief description).

Practicals

1. Detailed drawing of a railway station with platform.
2. Detailed drawings of railway track system showing different types of crossing.
3. Detailed drawing showing runway and taxiway of an airport.
4. Basic planning of terminal building of an airport.
5. Site visit for arrangement of various elements.

Note

- Scaled sketching would be done in the sketch-book by hand.
- Report of a site visit shall be prepared.

Suggested Books & References

1. Saxena, S. C. and Arora, S. P., ‘A Text Book of Railway Engineering'.
2. Agarwal M. M., 'Railway Engineering'.
3. Mundrey J S, 'Railway Track Eengineering'.
4. ‘Track Manuals of Indian Railways’.
5. Khanna and Arora, 'Airport Engineering'.
6. Rangwala, 'Airport Engineering'.

Department of Civil Engineering

Prerequisite: Nil

CE 415 ESTIMATING AND COSTING

Cr. Hrs. 3(2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand terminology related to estimate.
CO2	Acquire knowledge of rate analysis of building.
CO3	Calculate quantity of material used in building, road and canal earthwork.
CO4	Calculate valuation of building and rent fixation.

Unit-I

Estimating: Objects & general principles for estimating & costing.Types of estimates. Rules & methods of measurement. Procedure for estimating. Various items of work in building construction. General considerations for preparing report.

Unit-II

Specification: Types of specification (Brief and detail). Detailed specification for building works. Detailed specification for canal & road works items.

Rate Analysis: **C**oncepts of rate analysis. Requirements of an item for analysis of rate. Quantity calculation of materials for an item. Calculation of labour (task of labour as per N.B.O.) & Overhead cost.

Unit-III

Calculation of Quantity: Various formulae for calculation of quantity of concrete, bricks & reinforcement. Earth work calculations of roadwork for level & side hill sections (two level) only. Calculations of quantity of Road works,

Canal Earthwork: Balancing depth of earthwork in a canal. Use of L-section & cross-section for earthwork calculations of quantity of materials for canal lines.

Unit-IV

Accounting: Accounting & procedure of works, classification of works. Contract & contract document. Tender; Notice for inviting tenders (NIT), opening of tenders, processing of

tenders. Running & final bill, earnest money, security money & measurement book. General discussion of a works department.

Valuation : Purpose of valuation, , Scrap value, Salvage value, Market value, Book value, Annuity capitalized value. Methods of calculating depreciation (Straight line & Sinking fund method), Valuation of a building, rent fixation.

Practicals

1. Blue print reading & finding dimensions for quantity calculations.
2. Use of Long-wall & Short-wall methods of estimation for a building .
3. Use of Centre line method of estimation for a building.
4. Earthwork in excavation & masonry work in foundation & up-to plinth.
5. Detailed estimates for super structure items, wood work, plasters etc.,
6. Estimate of R.C.C and steel work for - Slab - beam – column & trusses.
7. Rate analysis & preparation of bills – Data analysis of rates for various items of works – abstract estimates Building projects – submission & execution.
8. Estimates of simple structures (under ground tank).
9. Detailed estimate of small residential building (two roomed)
10. Earthwork calculation for Road work – earthwork in cutting / filling. Detailed estimate for WBM, Bituminous road.
11. Estimate of Slab Culvert- including all the components
12. Earthwork Calculation for canal works in embankment & cutting.

Suggested Books & References

1. Datta B. N., 'Estimating and Costing in Civil Engineering Theory and Practice'**,** Publishing Distributors Ltd., New Delhi.
2. Birdi, 'Estimating and costing in Civil Engineering', Dhanpat Rai & Sons, New Delhi.
3. Bellis H.F. & Schmidt, W.A., 'Architectural Drafting', McGraw-Hill Book Co. Inc., London.

Department of Civil Engineering

Prerequisite: Nil

CE 416 (a) CONSTRUCTION ECONOMICS AND FINANCE

Cr. Hrs. 3 (2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Acquire knowledge of Economic Terms & Construction Accounting.
CO2	Understand benefit-cost analysis
CO3	Understand pricing and inflation
CO4	Understand working of capital management

Unit-I

Principles and Explanation of Economic Terms: Land, labour, capital rent, wages, interest, production.

Construction Accounting: Profit & Loss, Balance Sheet, Income statement, Ratio analysis.

Engineering Economics: Time value of money, discounted cash flow, Net Present Value (NPV), Internal Rate of Return (IRR), Price Index (PI).

Unit-II

Benefit-Cost Analysis: Replacement analysis, Break-even analysis. Risks, uncertainties and management decision in capital budgeting.

Unit-III

Work Pricing and Inflation: Cost elements of contract, bidding and award, revision due to unforeseen causes, escalation. Project appraisal and project yield.

Unit-IV

Working Capital Management: Financial plan and multiple source of finance. Budgeting and budgetary control, Performance budgeting, appraisal through financial statements, Project cash flow.

Practicals

1. Preparing a double entry Balance Sheet for an organization

2. Preparing a ledger Sheet for an organization
3. Cash flow diagram for a construction Equipment
4. Risk Analysis of a project
5. Analysis for working capital requirement of a typical construction project

Suggested Books & References

E. Paul DeGarmo, “Engineering Economy”, Macmillan Publishing Company, New York

CE 416 (b) TALL BUILDINGS

Cr. Hrs. 3 (2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome	Upon completion of this course the students will be able to:
CO1	Calculate different loads acting on a building
CO2	Analyze frames
CO3	Analyze shear walls
CO4	Design earthquake resistant buildings

Unit-I

Introduction to Tall Building: **C**lassification of tall buildings. Types of loads: Gravity load, wind load, seismic load & combination of loads. Floor systems. Structural forms.

RC Frames: Introduction to rigid frame system.

Unit-II

Analysis of Frames: Gravity load: Substitute frame method for dead load and live loads.

Lateral Load: Approximate method for wind load (Factor method).

Infilled Frames: Behaviour of the frames. Forces in the infill and frame. Design of infill.

Unit-III

Shear Wall: Behaviour of shear wall systems. Interaction of shear wall & frames. Introduction to coupled shear walls.

Unit-IV

Earthquake Resistant Buildings: [Introduction] Response of a tall building to ground motion. Response Spectrum Method. Codal provisions for earthquake resistant buildings (IS 1893:2002)

Practicals : Will be as per theory syllabus.

Suggested Books & References

1. Smith, B.S. and Coull A., 'Tall buildings Structures: Analysis and Design', John Wiley and Sons.
2. Schuller, Wolfgang, 'High rise Buildings Structures', John Wiley and Sons.
3. Sarwar Alam Raz, 'Analytical methods in Structural Engineering', Wiley Eastern Private Limited, New Delhi

4. Relevant IS Codes.

Department of Civil Engineering

Prerequisite: CE224 concrete technology, CE312 Design of concrete structure –I CE 322 Design of concrete structure –II

CE 416 (c) DESIGN OF PRE-STRESS STRUCTURES

Cr. Hrs. 3(2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Demonstrate knowledge of prestressed concrete and Analysis of sections by load balancing and strength concept.
CO2	Able to design simply supported beams of rectangular and flanged sections for flexure and shear as per I.S. code (using limit state design).
CO3	Design of end blocks. Transmission & Anchorage zone stresses (Anchorage zone renforcement).
CO4	Design of continuous beam and analysis of composite members.

Unit- I

Basics of Pre-stressed Concrete: Concepts, materials, various pre-tensioning and post tensioning systems, losses in pre-stressing. Concept of partial pre-stressing. Machinery and equipments of pre-stressing.

Analysis: Analysis of sections (Stress concept, Load balancing concept and Strength concept).

Unit- II

Design: Design of simply supported beams of rectangular and flanged sections for flexure and shear as per I.S. code (using limit state design).

Unit- III

End Blocks: Design of end blocks. Transmission & anchorage zone stresses (anchorage zone reinforcement).

Continuous Beams: Analysis of continuous beams of two spans. Concept of cable profile.

Unit- IV

Indeterminate Structures: Design of continuous beams (Two Span).

Composite Construction: **A**nalysis for flexural stresses and strength of composite members.

Note: The use of IS 1343 shall be allowed in the examination.

Practicals

1. Analysis of losses.
2. Design of Simple supported beam for flexure and shear.
3. Design of Flanged section beam for flexure and shear.
4. Design of End block.
6. Analysis of continuous beams of two spans.
7. Design of two span continuous beams.
8. Site visit for structural arrangement of members.

Note

- Detailing of parts would be done as per standard professional practice and relevant IS codes.
- To the scale sketching would be done in the sketch book by hand.
- Report of a site visit shall be prepared mentioning structural details with relevant sketches of structural connections.

Suggested Books & References

1. Lin T.Y. 'Design of Pre-stress concrete structures'.
2. Krinsharaju N, ‘Pre-stressed concrete’, Tata Mcgraw Hill, New Delhi.
3. Ramamurtham, 'Pre stress concrete'.
4. Edward Nawy, 'Pre-stressed Concrete Structures'
5. Relevant IS Codes.

Department of Civil Engineering

Prerequisite: NIL

CE416 (d) DESIGN OF INDUSTRIAL STRUCTURES

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2

0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Design industrial buildings
CO2	Design multi story buildings of steel: simple industrial and mill buildings.
CO3	Design steel chimneys
CO4	Design steel bunkers, silos & light gauge structures.

Connections: Design of semi rigid connections (column and bracket connections)

Design of Industrial Buildings: Analysis and design of major components; Roof truss, gantry girders, gable girder, side rails.

Unit-II

Multi-story Buildings: Design of multi story buildings of steel: simple industrial and mill buildings.

Unit-III

Chimneys: Design of steel chimneys.

Unit-IV

Bunkers and Silos: Design of steel bunkers and silos.

Light-gauge Structures: Design of steel light gauge structures.

Note: The use of IS 800, IS: 875, Structural Handbook No.1 shall be allowed in the examination.

Practicals

1. Design of a industrial building
2. Design of a multi story buildings of steel (simple industrial and mill buildings).

3. Design of a steel chimney.
4. Design of a steel bunkers and silo.
5. Site visit for structural arrangement of members.

Note

- Detailing of parts would be done as per standard professional practice and relevant IS codes.
- To the scale sketching would be done in the sketch-book by hand.
- Report of a site visit shall be prepared mentioning structural details with relevant sketches of structural connections.

Suggested Books & References

1. Gaylord and Gaylord,' Steel Design'.
2. Arya & Ajmani, Design of Steel Structures'.
3. Ramchandra, ‘Design of Steel Structures'.
4. Relevant IS Codes.

Department of Civil Engineering

Prerequisite: Nil

CE 416 (e) SOLID WASTE MANAGEMENT

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2

0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Demonstrate knowledge of Problems & National & global scenario of solid waste management.
CO2	Acquired knowledge of solid waste, collections, transfer and transport
CO3	Analysis of solid waste & chemical characteristic of refuse
CO4	Understand sanitary land filling

Unit -I

General: Problems associated with Solid Waste Disposal. National & global scenario of solid waste management.

Generation of Solid Waste: Objectives of solid waste management, Classification of solid waste. Activities associated with generation of solid waste, quantity of waste generation, factors affecting solid waste generation.

Unit -II

Types of Solid Waste: Sources of solid waste. Food & biodegradable waste, recyclable waste. hazardous waste.

*Waste Collections, Transfer and Transport***:** Storage of waste at source & source separation of waste. Primary collection of waste, secondary storage of waste. Waste storage depot. Transportation of waste..

Unit-III

Analysis of Solid Waste: Need for physio-chemical analysis of municipal solid waste. Physical characteristic of refuse : specific weight & category analysis.

Chemical Characteristic of Refuse: Determination of moisture content, volatile solid, pH, carbon, nitrogen, phosphorus, potassium & calorific value.

Composting & incineration, their advantages & disadvantages.

Unit-IV

Sanitary Land Filling: Introduction, approach to design of sanitary land filling. Typical component of land-fill cover. Various guide lines for design of land-fill. Trench of municipal solid waste disposal. Environmental quality monitoring at land-fill site. Recommendation for problems of municipal solid waste.

Practicals: Will be as per theory syllabus.

Suggested Books & References

1. G. Techobanogious, H. Theisen & R. Blassen, 'Solid Waste Engineering, Principles and Management Issues', McGraw Hills, Book Co. New York.
2. C.L. Mentell, 'Solid Waste Management, 'John Whely, New York.
3. Bhide & Sundrashen, 'Solid Waste Management in Developing Countries'

Department of Civil Engineering

Prerequisite:

BS-411 OPERATION RESEARCH

Cr. Hrs. 3 (3 +0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome	Upon completion of this course the students will able to:
CO1	Solve problems relating to operation
CO2	Use simplex methods
CO3	Solve transportation problems
CO4	Manage projects using PERT and CPM

Unit – I

Introduction and importance of OR, Meaning and classification of models, Linear Programming, Mathematical formulation, Graphical Solutions.

Unit–II

Simplex Methods: Degeneracy and duality.

Unit-III

Transportation type problems, Assignment problems.

Unit-IV

Concepts of waiting line and simple problems, Project management by PERT/CPM methods.

Suggested Books & References

1. S.D. Sharma, 'Operation Research', Pragati Prakashan, Meerut.
2. Goyal and Mittal., 'Operations Research', Pragati Prakashan, Meerut.

FM 414

HUMAN ENGINEERING AND SAFETY

Cr. Hrs. 3 (2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome	Upon completion of this course the students will be will able to:
CO1	Understand and process the concepts of system development
CO2	Calculate energy cost and acceptable workload
CO3	Arrange and utilize workplace
CO4	Manage dangerous operation in accordance with Dangerous Machines (Regulation) Act

Unit-I

Human Factor in System Development: concept of systems, basic processes in system development, performance reliability, human performance, information input process, visual displays, major types and use of displays, auditory and factual displays.

Unit-II

Measurement of Energy, Direct and Indirect Methods: Energy cost of different activities and Acceptable work load. Noise and vibration, its measurement and control.

Unit-III

Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance.

Unit-IV

Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

Practicals

1. Calibration of the subject in the laboratory using bi-cycle Ergometer as loading device versus different physiological parameters.

2. Calibration of the subject in the laboratory using mechanical treadmill as loading device versus different physiological parameters.

3. Study of Respiration gas meter and its use in selected farm operation and their comparison from energy point of view.

4. Calibration of the subject using Heart Rate Monitor in farm operation.

5. Study of general fatigue of the subject using Blink ratio method.

6. Anthropometric measurements of a selected group of workers and its statistical analysis.

7. Study of optimum work space layout and locations of controls of different factors. Familiarization with the noise and vibration equipment.

Suggested Books & References

1. P.O. Astrant and K. Rodhal, 'A Test Book of Work Physiology', McGraw Hill Book Co., New York.

2. E.J. Mc Cormic, 'Human Factors in Engineering Design', Tata McGraw Hill Pub., Co., New Delhi.

3. J.A. Roebuchk. K.H.E. Kroenor and M.S. Thomson, 'Engineering Anthropometry', John Willey & Sons, New Delhi.

SW 415 REMOTE SENSING AND GIS APPLICATION

Cr. Hrs. 3 (2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome	Upon completion of this course the students will able to:
CO1	Understand and use remote sensing techniques
CO2	Use process and interpret data and images
CO3	Use DBMS
CO4	Understand and use geographic information system

Unit – I

Remote Sensing: Definition stages in remote sensing, modern remote sensing technology versus conventional aerial photography: basic principle of image interpretation, factors governing the quality of an image: factors governing interpretability, visibility of objects, elements of image interpretation.

Unit – II

Techniques of image interpretation, visual image interpretation, digital image processing, digital image: remote sensing in agriculture progress and prospects, microwave radiometry for monitoring agriculture crops and hydrologic forecasting: aerial photo interpretation for water resources development and soil conservation survey.

Unit – III

GIS: History of development of GIS definition, basic components, and standard GIS packages: data-entry, storage and maintenance; data types-spatial-non-spatial (attribute data), data structure.

Unit – IV

Data Format- Point line vector-raster – polygon-object structural model, files, files organization-data base management systems (DBMS), entering data in computer-digitizer-scanner-data compression.

Practicals

1. Familiarization with remote sensing and GIS hardware.
2. Use of instruments for aerial photo interpretation.
3. Interpretation of aerial photographs and satellite imagery.

4. Basic GIS operations such as image display.
5. Study the various features of GIS software package.
6. Scanning and digitization of maps.
7. Data base query and map algebra.
8. GIS supported case studies in water resources management.

Suggested Books & References

1. M.A. Reddy, 'Remote sensing and Geographical Information Systems', Second Edition, B.S. Publication, Hyderabad.
2. Lillsand and Kiefer, 'Remote Sensing and Image Interpretation', John Weiley & Sons
3. P.A. Longley, M.F. Good Child, D.J. Maguire and D.W. Rhind 'Geographic Information. System and Science', John Wiley & Sons Ltd., New York.

ME 416 (a) FINITE ELEMENT METHOD

Cr. Hrs. 3 (3 + 0)

L T P

Credit 3 0 0

Hours 3 0 0

Course Outcome	Upon completion of this course the students will be will able to:
CO1	Use matrix system for stress strain analysis
CO2	Use energy approach for solving structural problems
CO3	Analyze beam, trusses and frames
CO4	Solve heat transfer problems in different elements

Unit – I

Review of matrix algebra, theory of elasticity, stress-strain relations, strain-temperature relations, plane stress, plane strain, axisymmetric case. Introduction to FEM with direct or stiffness formulation for bar problem. Element stiffness matrix, assembly, imposition of boundary conditions, solution of global system, stress and support reaction computation. Computation details, storage schemes for global matrices. Solution of equations in static analysis. Gauss elimination, Cholesky's factorisation.

Unit– II

Principle of stationary (or minimum) potential energy, principle of virtual work. Rayleigh-Ritz method. Galerkin method. Variational formulation of FEM. Piecewise polynomial interpolation. Shape functions, degree of continuity. Shape functions for C0 and C1 elements. Lagrangian and Hermite interpolations. General displacement based formulation for structural problems. Consistent element model loads. Equilibrium and compatibility in FE model. Convergence requirements. Finite element formulation for one dimensional bar and heat transfer problems. Linear and quadratic elements. Natural Coordinartes, isoparametric formulation.

Unit – III

Finite elements formulation of one dimensional beam problem for minimum potential energy and Galerkin approach. Beam element. Coordinate transformations, truss and frame elements. Application to simple beam, truss and frame problem.

Unit – IV

Finite element formulation for two dimensional structural and heat transfer problems - minimum potential energy and Galerkin approaches. Natural (area) coordinates. Linear triangular element for structural (CST element) and heat transfer problems. Plane bilinear element. Isoparametric plane bilinear and triangular elements. Numerical integration, Gauss

quadrature. Jacobian matrix. Applications to simple stress analysis and heat transfer problem (restricted to CST element only)

Suggested Books & References

1. T.R. Chandrupatla and A.D. Belegundu, 'Introduction to Finite Elements in Engineering', Prentice Hall of India, New Delhi.
2. R.D. Cook, D.S. Malkus and M.E. Plesha, 'Concepts and Applications of Finite Element Analysis', John Wiley & Sons.
3. P. Sheshu, 'Test Book of Finite Element Analysis', Prentice Hall of India.
4. K.J. Bathe, 'Finite Element Procedure', Prentice Hall of India.

Department of Civil Engineering

Prerequisite: Nil

CE 421 PROJECT EVALUATION & CONSTRUCTION MANAGEMENT

Cr. Hrs. 3 (2+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Construct planning.
CO2	Understand network techniques
CO3	Contract management
CO4	Demonstrate knowledge of safety in construction & management information System

Unit- I

Introduction: Construction project management frame work, Planning scope objectives & function of project management.

Construction Planning: Introduction, different types of planning. Scheduling, methods of scheduling, job planning & job lay outs.

Unit- II

Network Techniques: Elements of CPM and PERT as applied to the construction projects. Errors & updating of Network & control of progress.

Unit- III

Contract Management: Legal aspect of contracts, laws related to contract, Different types of contract. Elements of tender operation. Contract negotiation & award of work, settlement of disputes.

Unit- IV

Safety in Construction: Introduction, Accidents prevention, causes of accidents, safety measure to be followed in various construction work like excavation, demolition, explosive handling, hot bitumen work etc.

Management Information System: Concept of Project Management Information System. Benefits of computerized information system.

Practicals

1. Work Breakdown Structure (WBS) of a typical construction project.
2. Scheduling and Bar Chart of a typical Boundary Wall Project.
3. Preparation of a network for typical Building Project.
4. CPM Network of a Pipe Line Project.
5. Resource leveling of a Project.
6. Study of a Tender Document.
7. Safety measure at excavation site.
8. Introduction to Project Management Software.
9. Use of Microsoft Excel for Project Management.

Suggested Books & References

1. Chitkara K.K., ’Construction Project Management.
2. Gupta & Gupta, 'Construction Management & Accounts.

Department of Civil Engineering

Prerequisite: Public Health Engineering-I

CE 422 PUBLIC HEALTH ENGINEERING-II

Cr. Hrs. 4 (3+1)

L T P

Credit 3 0 1

Hours 3 0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand types of sewage and its Disposal techniques.
CO2	Design of sewers system.
CO3	Carried out sewage treatment methods.
CO4	Solid waste management.

Sewage Disposal: Introduction, systems of sewage disposal, conservancy system & water carriage system. Separate, Combined and partially separate system, their advantage & disadvantage. Suitability of separate sewerage system for India. Manhole, drop manhole, catch basins, flushing devices, grease & sand traps. Material for sewer pipes. Shape of sewers. Laying the sewers.

Unit -II

Design of Sewers: Quantity of sewage, provision for future population, Quantity of storm water, design of sewers, Estimating storm water by time of concentration method. Testing of sewer line. Cleaning of sewers.

Preliminary Treatment: screening, disposal of screening, skimming tank, grit chamber, disposal of grit.

Unit -III

Sewage Treatment: Principle of sewage, sedimentation, filtration, intermittent sand filter, contact bed, introduction of trickling filter. Advantage & disadvantage of trickling filter.

Unit -IV

Introduction of Solid Waste Management: General, classification of municipal solid waste, quantity of waste generation. Objectives of solid waste management. Environmental problem associated with solid waste. Activities associated with generation of solid waste. Factors affecting solid waste. Introduction of sanitary land filling.

Practicals

1. To determine the amount of dissolved oxygen in the given sample of water by

Winkler method.

2. To determine 5 day BOD of a given sample of effluent.
3. To determine the quality of Alum required to coagulate a given sample of water by jar test.
4. To determine the chemical oxygen demand (COD) of given sample of effluent.
5. Introduction of separate combined & partially separate system.
6. Design of sewers.
7. Estimating storm water by time of concentration methods.
8. Introduction of disposal alternatives: Sanitary land filling.
9. Composting & incineration.
10. Visit to a local polluted site.

Suggested Books & References

1 Hussain, S.K., 'Text book of water supply & sanitary engineering ', Oxford & IBH Publishing co. pvt. Ltd., New Delhi.

2 Rangwala, S.C., ‘Fundamentals of water supply & sanitary engineering’, Charotar Publisher House, Anand.

3 Punamia, B.C., 'Water supply & sanitary engineering’. Laxmi publishers. Jodhpur

4 Garg, S.K., 'Water supply & sanitary engineering’, Khanna publishers. New Delhi.

5 ‘Standard Methods for the examination of water and waste water’, 19th edition, prepared and published jointly by ALPHA, AWWA, WEF.

Department of Civil Engineering

Prerequisite: CE 212 Fluid mechanics, CE 222 Hydraulic and Hydraulic machines ***CE 313*** Geotechnical Engineering-I CE 324 Geotechnical Engineering-II CE 412 Water resource Engineering

CE 423 IRRIGATION ENGINEERING AND HYDRAULIC STRUCTURES

Cr. Hrs. 4 (3+1)

L T P

Credit 3 0 1

Hours 3 0

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand need of Irrigation.
CO2	Demonstrate knowledge of canal Irrigation and water logging.
CO3	Understand diversion of headwork.
CO4	Demonstrate knowledge of different type of falls, drainage systems.

Irrigation Practices: Need for Irrigation in India, scope (soil moisture & plant growth). System of irrigation (surface & subsurface irrigation method). Irrigation water quality, water requirements & irrigation scheduling of crops. Duty & Delta (Base period-relationship). Irrigation efficiencies. Assessment of irrigation water. Environmental impact of irrigation projects

Unit-II

Canal Irrigation: Sediment Transport; Importance & Mechanics of transport, Estimation of bed load & suspended load. Design of channels in India, regime channels, Kennedy and Lacey's theory.

Water Logging: Water logging & salt efflorescence, causes, effects & control measures (canal lining).

Unit- III

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

Regulator: Types of canals head regulators, cross regulator.

Unit-IV

Falls: Classification of falls, Design of falls.

Canal Transitions: Cross drainage works. Flood control works (flood forecasting-methods).
River Training Works: sediment control and silt exclusion devices, Escape bed bars.
Drainage: Necessity, reclaimation of land and water resources. Surface and sub surface drainage system and their design.
Practicals: Will be as per theory syllabus.

Suggested Books & References

1. S.K. Garg, 'Irrigation Engineering & Hydraulic Structures', Khanna Publishers
2. V.T. Chow, 'Open Channel Hydraulics', McGraw Hill Publishing Co
3. Satyanarayana Murthy, C, 'Design and Drawing', New Age International Publishers.
4. Modi & Seth, 'Fluid Mechanics and Hydraulic Machinery', Standard Publications.

Department of Civil Engineering

Prerequisite: Nil

CE 424 (a) REPAIR AND REHABILITATION OF CONCRETE STRUCTURES

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2 0

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand deterioration of concrete Structures
CO2	Understand corrosion of Reinforcement
CO3	Investigate of deteriorated structures & N.D.T
CO4	Understand materials for Repair

Unit-I

Deterioration of Concrete Structures: Causes of Deterioration: permeability, carbonation, sulphate attack, chloride attack, alkali-aggregate reaction, corrosion. Factors affecting deterioration (environment, cover, types of constituent material, cement content, W/C ratio & workmanship). Preventive measures.

Unit- II

Corrosion of Reinforcement: Anodic, cathodic reaction, chloride ion presence, factor affecting corrosion, Codal provisions for limiting chloride content, Methods for corrosion measurement and assessment: Half cell potential and Resistivity.

Cracks: Factors contributing cracks in concrete. Type of cracks & pattern.

Unit- III

Investigation of deteriorated structures: Preliminary test methods (visual observation).

N.D.T. Non destructive test methods for concrete: Rebound hammer, ultrasonic pulse velocity, penetration techniques and pull out test.

Unit-IV

Materials for Repair: Properties, selection criterion, Types of material (polymers and resins).

Special Repair Techniques: Grouting, shotcrete & under water repair: materials, equipments, precautions process etc.

Practicals: Will be as per theory syllabus.

Suggested Books & References

1. Bungey and Milard ,'Testing of concrete structures'.
2. Allen & Edward, ‘The repair of concrete structures'
3. Mehta, PK &. Monteriro, P.J.M ‘Concrete Microstructure, Properties and Materials’.
4. Neville, 'Properties of Concrete'.

Department of Civil Engineering

Prerequisite: Nil

CE424 (b) EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2 0

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Demonstrate knowledge earthquakes, causes and past events.
CO2	Understand the effects of earthquake and various zones in India.
CO3	Response to earthquake.
CO4	Design of earthquake resistant building.

Unit-I

Earthquakes: Introduction to earthquakes, causes of earthquakes, Indian past earthquakes. Types of earthquake waves, Epi-centre, Hypo-centre, focus, magnitude, intensity of earthquake.

Unit-II

Effect of Earthquake: Consequence of Earthquake Seismic zones of India, Seismic Instruments. Dynamic loads on structures due to earthquake. Damages to various Civil Engineering Structures.

Unit-III

Response to Earthquake: Response to harmonic and periodic dynamic loading, Force distribution on flexible and rigid floor systems in a building. Mode super position method.

Unit-IV

Design: Principles of Earthquake Resistant Design, Application of response spectrum method to seismic design of structures, Codal provisions for design and ductility.

Note: The use of IS 1893 shall be allowed in the examination.

Practicals: Will be as per theory syllabus.

Suggested Books & References

1.Anil K. Chopra, 'Structural Dynamics'.

2.Agrawal and Shrikhadi, ‘Earthquake Resistant Design of Structures’

3.Arya, 'Timber & Masonry structures including Earthquake resistant design'.

4.Clough & Penzien, 'Structural Dynamics'.

5.Mario Paz, 'Structural Dynamics'.

6.Relevant IS Codes.

Department of Civil Engineering

Prerequisite: Transportation engineering –I Transportation engineering –I I

CE 424 (c) ADVANCED TRANSPORTATION ENGINEERING

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2 0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand traffic characteristics & traffic studies.
CO2	Frame statistical methods for traffic engineering
CO3	Demonstrate knowledge of traffic management and control techniques.
CO4	Evaluate environmental effect on traffic.

Unit-I

Traffic Characteristics: Macroscopic & Microscopic characteristics related to Volume, Speed and Density, Road User Characteristics (Human and vehicular Characteristics).

Traffic Studies: Traffic Volume Studies, Speed Studies, Travel Time & Delay Studies, Origin & Destination, Methodology & Analysis of O-D data, Traffic capacity studies, Accident studies & preventive measures.

Unit-II

Statistical Methods for Traffic Engineering: Elementary concepts and probability, Mean, Standard Deviation and Binomial distribution. Normal distribution, sampling theory and significance testing, Linear regression and correlation.

Traffic Engineering Design: Principles of Road junction design. Design of Roundabouts. Bus stops and Parking spaces. Design of signals.

Unit-III

Traffic Management: Traffic laws, Regulations and ordinance for Drivers, Pedestrians & Mixed Traffic. Control Measures: One way streets, Kerb Parking control, Intersection Control, Speed Control. Traffic Control Devices (Traffic Markings, Signs, Signals, Traffic Islands), Street Lighting.

Unit-IV

Traffic and Environment: Detrimental effects of Traffic on the environment (air pollution, noise pollution, visual intrusion, aesthetics etc).

Road Safety: The identification of problem, causes and prevention, road layout & improvements, safety equipments.

Practicals : Will be as per theory syllabus.

Suggested Book & References

1. L.R. Kadiyali, 'Traffic Engineering and Transportation Planning'.
2. FD Hobes, 'Traffic Planning and Engineering'.
3. Wohl and Martin, 'Traffic System Analysis'.

Adolf D May, 'Traffic Flow Fundamentals'

Department of Civil Engineering
Prerequisite: CE 212 Fluid Mechanics CE 222 Hydraulic & Hydraulic machines.
CE 424 (d) OPEN CHANNEL HYDRAULICS

Cr. Hrs. 3(2+1)

L T P

Credit 2 0 1

Hours 2 0

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Demonstrate knowledge of fluid flow concepts
CO2	Understand uniform flow in rigid boundary channels
CO3	Understand uniform flow in mobile boundary channels
CO4	Evaluate hydraulic jump & understand the procedure of channel controls and transitions

Unit-I

Basic Fluid Flow Concepts: Introduction, types of channels and flows, velocity distribution, Pressure distribution, Basic equations, Energy and momentum coefficients.

Unit-II

Uniform Flow in Rigid Boundary Channels: Shear stress distribution, Chezy's and Manning's equations, conveyance, section factor curves for rectangular and trapezoidal channels, flow in circular channel, Relation between conveyance and depth.

Specific energy & critical depth, section factor, hydraulic exponent, applications.

Unit-III

Uniform Flow in Mobile Boundary Channels: Incipient motion condition, Regimes of flow, resistance to flow in alluvial streams.

Gradually Varied Flow: Governing equation, characteristics & classification of surface curves, Computation in prismatic and non prismatic channels.

Unit-IV

Hydraulic Jump: Types of jump, hydraulic jump in horizontal & sloping rectangular channels, location of jump, forced hydraulic jump.

Channel Controls and Transitions: Free over fall, thin plate weirs, broad crested weir, side weir, spillways, sluice gates, standing wave flume.

Practicals : Will be as per theory syllabus.

Suggested Books & References

1. K.G. Ranga Raju, 'Flow Through Open Channels'.
2. K. Subramanya, 'Flow in Open Channels'.

Department of Civil Engineering

Prerequisite:

CE 424 (e) EXPERIMENTAL STRESS ANALYSIS

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2

0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Analysis structural model
CO2	Demonstrate knowledge of Begg's Deformeter
CO3	Demonstrate knowledge of Moire Fringe Techniques
CO4	Demonstrate knowledge of Electric Resistance Strain Gages

Unit-I

Strain Measuring Devices- Mechanical Extensometers

Structural Model Analysis: Direct and indirect methods, Principles of direct model analysis – dimensional analysis, Buckingham theorem, scale factors design for flexural members, scaling model to prototype stresses, various model materials.

Unit-II

Begg's Deformeter: Use of spline models, Beggs deformeter.

Photo Elastic Methods: Light and optics as related to photo-elasticity. Polarised light. Plane polariscope. Diffused light polariscope. Photoelastic model materials for two-dimensional application, criterion for selection, properties, various calibration methods.

Unit-III

Moire Fringe Techniques: Optical methods of stress analysis, Moire-fringe methods introduction, mechanism of formation. Geometrical approach, displacement – field approach, sharpening and multiplication of Morie-fringes experimental procedure

Brittle Coating Methods: Introduction to coating stresses and strains, coating sensitivity, coating materials, Applications of coatings. Effects of coating thickness, stress separation methods.

Unit-IV

Electric Resistance Strain Gages: Strain measurements, Strain gauges – introduction different types of strain gauges and their principle. Construction, types, temperature compensation gauge sensitivities and gauge factors, correction for transverse strain effects.

Wheat Stone Bridge : Introduction of three element rectangular rosette & delta rosette. Mohr's strain circle to get principal strains. Strain gauge circuits introduction, Wheatstone bridge circuit Temperature compensation.

Practicals : Will be as per theory syllabus.

Suggested Books & References

1. Dally, James W. and Rielly, William F, "Experimental Stress Analysis", Tata-McGraw Hill, New Delhi
2. Srinath, L.S., "Experimental Stress Analysis", Tata-McGraw Hill, New Delhi

Department of Civil Engineering

Prerequisite:

CE 424 (f) GROUND IMPROVEMENT TECHNIQUES

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2 0

2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Ground Improvement Techniques & Methods of soil stabilization
CO2	Understand soil cements stabilization and Fly ash stabilization.
CO3	Demonstrate knowledge of Soil Bituminous stabilization and Thermal stabilization.
CO4	Understand Granular column and soil reinforcement.

Unit -I

Ground Improvement Techniques: Shallow and deep techniques. Soil stabilization; Purpose, mechanical mixing of different types of soils, grading land plasticity charcteristics, Mehra's method mixing, Proportioning of soils.

Soil Lime Stabilisation: Base exchange, Pozzolinic reaction, curing, Types of soils, stabilised, density, effect on consistency properties. Effect of lime on liquid limit, plastic limit, plasticity index and shrinkage limit. Relationship of strength with curing period & density.

Unit -II

Soil Cement Stabilisation: Soil cement stabilisation, Mechanism of soil cement stabilisation. Various theories; Modified soil cement & plastic soil cement. Effect of amount, density, curing period and surface area on strength.

Soil Fly-Ash Stabilisation: Soil-lime fly ash stabilisation, principles of pozzolanic reaction. Proportions used in practice. Stabilisation of dune sand by lime fly ash.

Unit-III

Soil Bituminous Stabilisation: Soil bituminous stabilization Intimate mix theory & plug theory. Effect of mixing, moisture, aerating, density & compaction.

Thermal Stabilisation: Theory of thermal stabilisation, Electroosmotic drainage. Double layers, 'Ke' electro osmotic coefficient of permeating, Full scale field test, Electro osmotic chemical hardening Field construction methods and equipment.

Dynamic compaction of soil Equipments used, tests performed in field, Pre compression and

Vertical Drains.

Unit -IV

Granular Columns: Methods of construction, bearing capacity of composite soil. Empirical methods/charts, Theory of determination of settlement of composite soil. Vibro-flotation & vibro-compaction.

Soil Reinforcement: Geosynthetics, Geomembrane, Retaining Walls.

Practicals : Will be as per theory syllabus.

Suggested Books & References

1. Purushotham, P. Raj, 'Ground improvement Techniques'.
2. Venkaramiah, C., 'Ground Improvement'.
3. Madhav, M.R., 'Development in Reinforcement of Ground and Slopes'.

Department of Civil Engineering

Prerequisite:

CE 424 (g) RURAL WATER SUPPLY & SANITATION

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2

0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand Village Community in India & Rural water supply.
CO2	Demonstrate knowledge of sources and water treatment methods.
CO3	Understand Fly and Mosquito Control & Milk and Food Sanitation
CO4	Demonstrate knowledge of Rural Sanitation

Unit– I

Rural Water Supply: Importance of Village Community in India (condition of Indian villages with special regard to economic, social & health aspects). Quality of water needed for village community (human & cattle population & their water requirement standards of potable water).

Sources of Water : Sources of water for village water supplies (surface water, ground water, springs & wells). Types of wells, disinfection of wells. Different types of pumps used for village wells.

Unit– II

Treatment of Water: screening, plain sedimentation, filtration & disinfection, desalination, de fluoridation.

Communicable Diseases : Disease and immunity, communicable disease sources. Mode of transfer. Control of communicable diseases.

Unit – III

Fly and Mosquito Control: Life cycle of flies & mosquitoes. Various methods of fly & mosquito control.

Milk and Food Sanitation: Essentials of dairy farm and cattle shed sanitation. Tests for milk

and dairy products. Food epidemics. Food poisoning.

Unit – IV

Rural Sanitation: Village latrines, storm water & sullage problem, animal waste, methods of composting, bio gas. Collection and disposal of waste (septic tank, percolation pits, subsurface disposal). Digestion of methane & manure recovery.

Practicals : Will be as per theory syllabus.

Suggested Books & References

1. Hussain, S.K., 'Text book of water supply & sanitary engineering ', Oxford & IBH Publishing co. pvt. Ltd., New Delhi.
2. Rangewala, S.C., 'Fundamentals of water supply & sanitary engineering',Charotar Publisher House, Anand.
3. Punamia, B.C., 'Water supply & sanitary engineering'. Laxmi publishers. Jodhpur
4. Garg, S.K., 'Water supply & sanitary engineering'
5. Steel, E.W., 'Municipal Rural Sanitation'.

Department of Civil Engineering

Prerequisite:

CE 424 (h) ADVANCED FOUNDATION ENGINEERING

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2 0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Determine bearing capacity under various conditions
CO2	Design and analyze various foundation
CO3	Perform test on soils for different foundation
CO4	Determine deflection in soils and foundations

Unit-I

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. Mayerhof's analysis, Bearing capacity of stratified soils. Methods of estimation of settlement of footings. Limits of settlement for various structures. Indian Standard Code Provisions (IS: 1904,6403-8009).

Unit-II

Bearing Capacity: Determination for 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 tent, standard penetration test data.

Unit-III

Pile Foundations: Types of pile and their use. Modes of failure. Bearing capacity and settlement pile foundation. Types of piles. Allowable load. Pile load test. Dynamic and static formulae. Bearing capacity factors. Pile under lateral loading. Winklers assumption. Pile resistance and deflection under lateral loads, elastic method, Broms method.

Raft Foundation: Semi empirical method of Design of raft foundation.

Unit-IV

Expansive Soils: Behaviour of expansive soil. foundation practice, 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.

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

Practicals : Will be as per theory syllabus.

Suggested Books & References

1. Bowles, 'Design and construction of foundation'.
2. Prakash,Ranajan & Saran, 'Design of foundation and retaining structures'.
3. Tomlinson, 'Foundation Enginnering'.
4. Swami Saran, 'Analysis and design of Substructures'.

Relevant IS codes.

EE 428 (CE) NEURAL NETWORKS

Cr.Hrs. 3 (2+ 1)

L T P

Credit 2 0 1

Hours 2 0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Understand artificial neural system
CO2	Apply neural systems in Civil Engineering
CO3	Use fuzzy sets
CO4	Understand dynamical systems

Unit-I

Artificial neural systems: Preliminaries, fundamental concepts & models of artificical system, neural networks. Learning rules: Hebbian, perceptron, delta Widrow-Hoff learning rules. Single layer perceptron classification: Classification model, features & decision regions training & classification using discrete perception, algorithm.

Unit –II

Single layer feedback networks: Basic concepts of dynamical systems, mathematical modeling of discrete time & gradient type Hopfield networks, transient response of continuous time network solution optimization problems. Multilayer feedback work networks: Generalized delta learning rule, feed-forward recall & error, back propagation training, learning factors.

Unit –III

Neural network for Civil Engineering: Classical solution of Civil Engineering problems. Application of Neural Networks to Civil Engineering problems. Introduction to modular networks.

Unit –IV

Mathematical fuzzy control: fuzzy sets, fuzzy set theory, properties of fuzzy sets, Operations of fuzzy sets, fuzzy relations. Non linear fuzzy control: The control problem, FKBC as non linear transfer element PID & sliding mode type FKBC, some typical application of fuzzy based control systems to Civil Engineering problems. Introduction to Neuro-Fuzzy control.

Practicals : As per theory syllabus.

Suggested Books & References

1. Zurada J.M., 'Introduction of artificial neural systems' - Jaico publication House.

2. Haykin S., ‘Neural networks. Comprehensive foundation’- McMillian College Publishing company inc.

3. Omatu, M. Khalid, R. Yusof, ‘Neuro control and its application’, Spring Verlag London Ltd.

4. Driankov D., H. Hellendoorn and M Reinfrank, ‘An introduction to fuzzy control’, Narosa Publication House, 2nd reprint.

5. ‘Neuro, Fuzzy and soft computing’, PHI publication

6. Yen, John, ‘Fuzzy logic. Intelligence control and Information’, - Pearson publication.

7. Mehrotra K., Mohan C. K., Raka S., ’Artificial Neural Networks’, Penaram Pub.

Department of Civil Engineering

Prerequisite:

MI 428 (CE) ADVANCED ENGINEERING GEOLOGY

Cr. Hrs. 3 (2+1)

L T P

Credit 2 0 1

Hours 2 0 2

Course Outcome	Upon completion of this course the students will be able to:
CO1	Select sites according to geological features
CO2	Determine engineering properties of rocks
CO3	Distinguish between rocks using different parameters
CO4	Understand the importance of geological features in different structures

Unit- I

Geological Study: Importance of engineering geological study in civil engineering. Dependence of design of civil structure on geological features at project site. Case studies of civil engineering projects, importance of geological parameters. Wasteful expenditures due to neglect of subsurface explorations. Engineering characteristics of major rock formations of India.

Unit-II

Engineering Properties of Rocks: Porosity, density, moisture, permeability, durability, strength (compressive, tensile and shear). Modulus of elasticity, Poisson's ratio, thermal conductivity, plasticity and deformability.

Unit-III

Engineering Classification of Rocks: Terzaghi's rock classification, Deeres rock quality classification. Rock Quality Designation (RQD), Rock Mass Rating (RMR), Rock Structure Rating (RSR), Quality System, Geological Strength Index (GSI). Analysis for stability of rock slopes and cuttings.

Unit-IV

Rock Structures: Mechanics of Rock structures. Rock joints types (nature, properties, roughness, gouge, gap, persistence, spacing, sets, orientation, intensity, frequency). Joints analysis techniques. Significance of rock structures and joints in Civil engineering.

Vibrations, Sub-surface Strata and Civil Engineering Structures: Impact, vibrations, frequency, intensity and their interpretation. Standards and provisions recommended by National and International agencies for safety and stability of structures to sustain the Earthquake & blasting vibration.

Practicals

1. Uniaxial compressive strength measurement.
2. Tensile strength-Brazilian test.
3. Direct shear test.
4. Triaxial test.
5. Plate load test for deformability.
6. Test for internal stresses-Flat jack.
7. Calculation of bearing capacity of rocks.
8. Joint data plotting.
9. Stereo-net plotting of planar surfaces.
10. Stereo-net plotting of linear structure.
11. Stereo-net plotting of folded strata.
12. Dip-Isogon plotting.
13. Geo-electrical survey exercise for subsurface investigation.
14. RQD calculation.
15. RMR calculation.

Suggested Books & References

1. Goodman, R. E., 'Engineering Geology - Rock in Engineering Construction', John Wiley and Sons, Inc.
2. Parbin Singh, 'Text Book of Engineering Geology'.
3. N.Chenna Kesavulu, 'Text Book of Engineering Geology'.
4. Kryinine & Judd, 'Engineering Geology and Geo-techniques'.
5. John Pitts, 'Manual of Geology for Civil Engineers'.
6. Tony Waltham, 'Foundations of Engineering Geology'.
7. Obert & Duall., 'Rock Mechanics and Design of Structures in rock', John Witey & Sons.
8. Railey & Dalley. , 'Experimental Stress analysis', McGraw Hill Book Company.
9. J.C. Jeager & NGW Look, 'Fundamentals of Rock Mechanics', Publisher Chapman & Hall London.
10. 'Manual of Rock Mechanics', Prepared by Central Soil & Material Research Station, New Delhi.
11. Z.T. Bieniawski, 'Rock Mechanics Design in Mining & Tunneling', Publisher – A.A Balkema. Rotterdam, Neatherlands.
12. E.T. Brown, 'Rock Charactive action, testing & Monitoring', ISRM Suggested method. Pergaman Press, Oxford.

13. M.P. Bilkings, ‘Structural Geology’.
14. Ragan, ‘Geometrical analysis of Geological Data’, John Wiley & Sons.