Appendix " H " Item No. 8

Civil Engineering

B.Tech. (CIVIL ENGINEERING) & B.Tech.+ M. Tech. Dual Degree (CIVIL ENGINEERING)

 (Effective from 2019-20 Admitted Batch)

II Year – I Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE2101 BSC Mathematics-IV 2 1 - 3 30 70 100

 2 CE2102 ESC Engineering Geology 3 - - 3 30 70 100

 3 CE2103 PCC Mechanics of Materials 3 - - 3 30 70 100

 4 CE2104 PCC Surveying-I 3 - - 3 30 70 100

 5 CE2105 ESC Engineering Mechanics 3 2 - 3 30 70 100

 6 CE2106 PCC Building Material and Building
 Construction 3 - - 3 30 70 100

 7 CE2107 PCC Materials Testing and Evaluation Lab - - 3 1.5 50 50 100

 8 CE2108 PCC Surveying Field Work - 1 2 1.5 50 50 100

 Total 17 5 5 21.0 280 520 800

II Year - II Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE2101 PCC Surveying - II 3 1 - 3 30 70 100

 2 CE2202 PCC Fluid Mechanics - I 3 1 - 3 30 70 100

 3 CE2203 PCC Structural Analysis - I 4 1 - 3 30 70 100

 4 CE2204 PCC Environmental Engineering - I 3 1 - 3 30 70 100

 5 CE2205 PCC Geotechnical Engineering - I 3 - - 3 30 70 100

 6 CE2206 OEC Open Elective-I Managerial Economics 3 - - 2 30 70 100

 7 CE2207 PCC Building Planning and Design - 1 2 2 30 70 100

 8 CE2208 PCC Total Station and Geomatics Lab - - 3 1.5 50 50 100

 9 CE2209 PCC Fluid Mechanics Lab-I - - 3 1.5 50 50 100

 Total 19 4 8 22.0 310 590 900

III Year - I Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE3101 PCC Structural Analysis - II 3 1 - 3 30 70 100

 2 CE3102 PCC Environmental Engineering-II 3 1 - 3 30 70 100

 3 CE3103 PCC Reinforced Concrete Structures - I 4 1 - 3 30 70 100

 4 CE3104 PCC Steel Structures - I 4 1 - 3 30 70 100

 Professional Elective - I

 CE3105A PEC Concrete Technology

 5 CE3105B PEC Remote Sensing and
 GIS Applications 3 - - 3 30 70 100

 CE3105C PEC Geo-Environmental Engineering

 6 CE3106 OEC Open Elective - II Building Services
 and Maintenance 3 - - 2 30 70 100

 7 CE3107 PCC Geotechnical Engineering Lab - I - - 3 1.5 50 50 100

 8 CE3108 PCC Environmental Engineering Lab - - 3 1.5 50 50 100

 Total 20 4 6 20.0 280 520 800

III Year - II Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE3201 PCC Estimation, Specifications and Contracts 3 1 - 3 30 70 100

 2 CE3202 PCC Fluid Mechanics -II 4 1 - 3 30 70 100

 3 CE3203 PCC Reinforced Concrete Structures - II 3 1 - 3 30 70 100

 4 CE3204 PCC Transportation Engineering - I 3 1 - 3 30 70 100 Professional Elective - II

 CE3205A PEC Steel Structures- II

 5 CE3205B PEC Ground Improvement Techniques 3 - - 3 30 70 100

 CE3205C PEC Irrigation Engineering

 6 CE3206 PCC Highway Material Lab - - 3 1.5 50 50 100

 7 CE3207 PCC Concrete Lab - - 3 1.5 50 50 100

 8 CE3208 PCC Computer Applications in Civil
 Engineering Lab - 1 2 1.5 50 50 100

 Total 16 5 8 19.5 300 500 800

IV Year - I Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE4101 PCC Geotechnical Engineering - II 3 1 - 3 30 70 100

 2 CE4102 PCC Fluid Mechanics - III 3 1 - 3 30 70 100

 3 CE4103 PCC Water Resources Engineering-I 3 1 - 3 30 70 100

 4 CE4104 PCC Construction Management 3 - - 3 30 70 100 Professional Elective - III

 CE4105A PEC Prestressed Concrete Structures

 5 CE4105B PEC Elements of Coastal Engineering 3 - - 3 30 70 100

 CE4105C PEC Introduction to Rock Mechanics

 CE4105D PEC Solid Waste Management
 Professional Elective - IV

 CE4106A PEC Environmental Impact Assessment

 6 CE4106B PEC Earth Retaining Structures 3 - - 3 30 70 100

 CE4106C PEC Airport Planning and Design

 CE4106D PEC Finite Element Method of Analysis

 7 CE4107 PCC Geotechnical Engineering Lab - II - - 3 1.5 50 50 100

 8 CE4108 PCC Fluid Mechanics Lab-II - - 3 1.5 50 50 100

 Total 18 3 6 21.0 280 520 800

IV Year - II Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE4201 PCC Water Resources Engineering-II 3 - - 3 30 70 100

 2 CE4202 PCC Transportation Engineering-II 3 - - 3 30 70 100

 3 CE4205 HSC Industrial Management and 3 - - 2 30 70 100 Entrepreneurship Professional Elective - V

 CE4204A PEC Industrial Waste Treatment

 4 CE4204B PEC Hydroulic Structures 3 - - 3 30 70 100

 CE4204C PEC Traffic Engineering and Management

 CE4204D PEC Bridge Engineering

 Professional Elective - VI

 CE4205A PEC Air Pollution and Control

 CE4205B PEC Design and Drawing of Reinforeced 3 - - 3 30 70 100 Concrete and Steel Structures

 CE4205C PEC Watershed Management

 6 CE4206 PCC Design and Drawing of Irrigation - - 3 1.5 50 50 100 Structures

 7 CE4207 PW Project Work - - 12 5 100 100 200

 Total 15 - 15 20.5 300 500 800

SUMMARY OF CREDITS SEMESTER WISE

I B. Tech I Semester 19.0

I B. Tech II Semester 20.0

II B. Tech I Semester 21.0

II B. Tech II Semester 22.0

III B. Tech I Semester 20.0

III B. Tech II Semester 19.5

IV B. Tech I Semester 21.0

IV B. Tech II Semester 20.5

TOTAL CREDITS 163

Civil Engineering

SYLLABUS FOR B.Tech. (CIVIL ENGINEERING), B.Tech.+M.Tech. Dual Degree (CIVIL ENGINEERING)

(Effective from 2019-20 Admitted Batch)

II Year – I Semester

CE2101 : MATHEMATICS –IV

Vector Calculus-1: Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator  applied to scalar point functions– gradient,  applied to vector point functions– divergence and curl.

Physical interpretation of applied twice to point functions, applied to products of two functions; Irrotational and Solenoidal fields. Vector Calculus-2: Integration of vectors, line integral, circulation, work done, surface integralflux, Green’s theorem in the plane, Stoke’s theorem, volume integral, Gauss Divergence theorem. Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates Introduction of Partial Differential Equations: Formation of partial differential equations, solutions of partial differential equations– equations solvable by direct integration, linear equations of first order: Lagrange’s Linear equation, non-linear equations of first order, Charpit’s method. Homogeneous linear equations with constant coefficients– rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations. Applications of Partial Differential Equations: Method of separation of variables, One dimensional wave equation–vibrations of a stretched string, one dimensional Heat equation, Two dimensional heat flow in steady state – solution of Laplace’s equation in Cartesian and polar coordinates (two dimensional). Integral Transforms: Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms, Convolution theorem for Fourier transforms, Parseval’s identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

Text Books

1. Higher Engineering Mathematics by Dr. B.S.Grewal, Khanna Publishers.

Reference Books

1. A Text Book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.

2. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.

3. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley Publication .

4. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publishing Co. Ltd.

5. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

6. Higher Engineering Mathematics by Dr. M.K.Venkataraman, The National Publishing Company.

CE2102 ENGINEERING GEOLOGY

General geology: Importance of geology from Civil Engineering point of view. Weathering and soils: soil profile, erosion, and soil formation, types of Indian soils. Landforms produced by running water, glaciers, wind, sea waves and currents. Ground water: Origin and Occurrence of ground water. Porosity and permeability. Aquifers and ground water moment and water bearing properties of rocks. Petrology & Mineralogy: Petrology: Definitions of rock. Rock classification, structure, texture and mineralogical composition. Types of rocks– ingenious rocks and structures-dykes and sills: granite, dolerite, basalt. Sedimentary rocks: conglomerate, sandstone, shale, limestone.

Metamorphic rocks: Gneiss, khondalite, schist, marble, charnokite, engineering properties of rocks. Mineralogy: Physical properties: form, colour. lustre, cleavage, fracture, hardness and specific gravity. Study of important rock forming minerals: feldspar, micas and clays Stratigraphy and Structural Geology: Stratigraphy: major geological formations of India. Archaeans. Cuddapahs, vindyana, gondwanas and deccan traps. Mineral resources of Andhra Pradesh. Structural geology: elements of structural geology–strike and dip, plunge. Clinometers compass and Brunton compass. Classification of folds, faults and joints. Geological methods of investigation: geological formations, preparations of geological maps, structural features and groundwater parameters. Natural hazards: earthquake origin and distribution. Volcanoes, landslides and mass moment. Tsunamis. Remote Sensing and Geo Physical Methods: Remote sensing: Introduction, electromagnetic spectrum, aerial photo, types of aerial photos and flight planning aerial mosaics. Elements of photo interpretation. Satellite, remote sensing, Satellite, sensors and data products, principles of GIS. RS and GIS applications to Civil Engineering–town planning, dams and reservoirs, Geophysical Methods: Principles of geophysical methods, electrical methods, seismic methods. Principles of resistivity method and configurations. Applications of resistivity method in prediction of soil profile, hard rock and ground water table. principles of seismic refraction and reflections methods and their applications to Civil Engineering problems. Geological applications to Civil Engineering structures: Role of engineering geologists in planning, design and construction stages in Civil Engineering works. Geological investigations for dams and reservoir; geological investigations for bridges and multi-storied structures. geological investigation for highways. Geological investigations for tunnels and coastal structures. (sea walls, groins and bulkheads). Environmental geology.

Text Books

1. Principles of Engineering Geology by K.V.G.K.Gokhale.B.S. Publications-2005

2. Engineering Geology by N.Chennakesavalu, Mc-Millan, Indian Ltd-2005

3. A Text Book of Geology by P.K.Mukherjee, World Press

4. Engineering and General Geology by Parbin Singh, Katson Publishing House

5. Fundamentals of Remote Sensing by George Jospeh, University Press (India) Private Ltd.

CE2103 MECHANICS OF MATERIALS

Duties/Obligations Accountability of Structural Engineer for the Design of a Structure: a) Economy b) Safety: (i) Strength Consideration (ii) Stiffness Consideration. Need for Assessment of Strength of a Material – Analysis for Strength Requirement for Design Purposes – Review of IS Code Provisions.

Effects of Force: Tension, Compression and Shear. Stress as Internally Elastic Resistance of a Material – Strain – Property of Elasticity – Hooke’s Law – Stress-Strain Diagrams. Characteristic Strengths, Factors of Safety and Working Stresses for Materials and Various Types of Application of Load. Elastic Strain – Energy, Stress due to Gradually Applied Load, Sudden Load, Impact Load and Shock Load. Lateral Strain, Poisson’s Ratio. Complementary Shear Stress, Shear Strain, Shear Modulus. Relation Between Modulus of Elasticity, Modulus of Rigidity and Bulk Modulus. Stresses in Composite Assemblies due to Axial Load and Temperature Change. Effect of Transverse Force, Shear Force, Bending Moment and Axial Thrust Diagrams for A) Cantilever B) Simply Supported and C) Over Hanging Beams for various patterns of Loading. Relation between (i) Intensity of Loading (ii) Shear Force and (iii) Bending Moment at a Section. Theory of Simple Bending: Flexural Normal Stress Distribution; Flexural Shear Stress Distribution for Various Shapes of Cross Section.

Deflections of Beams: (i) Cantilever (ii) Simply Supported and (iii) Over Hanging Beams, using (a) Double Integration and (b) Macaulay’s Method. Stresses on Oblique Plane – Resultant Stress – Principal Stress and Maximum Shear Stress and Location of their Planes. Mohr’s Circle for Various Cases of Stresses; Theory of Pure Torsion for Solid and Hollow Circular Sections – Torsional Shear Stress Distribution, Effect of Combined Torsion, Bending and Axial Thrust – Equivalent B.M and T.M. Longitudinal and Hoop stresses in Thin Cylinders subjected to Internal Pressure. Wire Wound Thin Cylinders. Columns and Struts: Combined Bending and Direct Stresses – Kern of a Section – Euler’s Theory – End Conditions. Rankine-Gordon Formula – Eccentrically Loaded Columns. Open and Closed Coiled Helical Springs subjected to Axial Load.

Text books

1. Strength of materials by S.Ramamrutham and R.Narayana, Dhanpat Rai Publishing Company, New Delhi.

 2. Mechanics of Materials by B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications. 3. Analysis of Structures, Vol. I, 1993 edition, by V.N.Vazirani and M.M.Ratwani, Khanna Publishers Books.

Reference Books 1. Strength of Materials (Elementary Theory and Problems) by S.Timoshenko and D.H.Young, CBS Publishers & Distributors Pvt. Ltd. 2. Introduction to Mechanics of Solids by Popov, Prentice-Hall. 3. Strength of Materials by Hyder, Universities Press. 4. Elementary Mechanics of Solids by P.N. Singer and P.K.Jha, New Age International Publishers.

CE2104 SURVEYING – I

Introduction: Classification and Principles of Surveying, Triangulation and Trilateration – Earth as Spheroid, Datum, Geoid, Azimuth, Latitude, Longitude, Map Projections, Scales, Plans and Maps. Chain Surveying: Instrumentation for Chaining – Errors due to Incorrect Chain–Chaining on uneven and sloping Ground – Errors in Chaining –Tape Corrections – Problems: Base Line

Measurement – Chain Triangulation – Check Lines, Tie Lines, Offsets. Basic Problems in Chaining – Obstacles in Chaining – Problems – Conventional Signs. Compass Survey: (a) Introduction to Compass Survey Definitions of Bearing. True bearing, True meridian, Magnetic Meridian, Magnetic Bearing – Arbitrary Meridian, R.B & B.B of Lines – Designation of Bearing – W.C.B. & R.B. – Conversion of Bearings from one system to the other – Related Problems – Calculation of Angles for Bearings, Calculation of Bearings for Angles, Related Problems – Theory of Magnetic Compass (i.e. Prismatic Compass) – Magnetic Dip – Description of Prismatic Compass. Temporary Adjustments of Compass – Magnetic Declination – Local Attraction – Related Problems – Errors in Compass Survey. (b) Traverse Surveying: Chain and Compass Traversing – Free or Loose Needle Method – Fast Needle Method – Checks in Closed and Open Traverse – Plotting Methods of Traverse Survey – Closing Error – Balancing the Traverse – Bowditch’s Method –Transit Method, Gale’s Traverse Table.

Plane Table Surveying: Introduction – Advantages, Accessories – Working Operations such as Fixing the Table to Tripod, Leveling – Centering – Orientation by Back – Sighting. Methods of Plane Tabling – Plane Table Traversing – Three Point Problem – Mechanical Method – Graphical Method – Two Point Problem – Errors in Plane Tabling. Levelling: Definitions of Terms – Methods of Levelling – Uses and Adjustments of Dumpy Level – Temporary and Permanent Adjustments of Dumpy Level Levelling Staves – Differential Levelling, Profile Levelling – Cross Sections – Reciprocal levelling. Precise Levelling – Definition of BS, IS, FS, HI, TP – Booking and Reduction of Levels, H.I. Methods – Rise and Fall Method – Checks – Related Problems – Curvature and Refraction Related Problems – Correction – Reciprocal Levelling – Related Problems – L.S & C.S Leveling – Problems in Levelling – Errors in Levelling. Minor Instruments: Uses and Adjustments of the following Minor Instruments: Line Ranger, Optical Square, Abney Level and Clinometer, Ceylon Ghat Tracer, Pentagraph, Sextant and Planimeter. Contouring: Definitions – Contour Intervals, Characteristics of Contours – Methods of Locating Contours – Direct and Indirect methods – Interpolation of Contours – Contour Gradient – Uses of Contour Maps. Contours Mapping using Computer Techniques (Surfer, CAD).

Text Books

1. Surveying Vol. I, II and III by B.C.Punmia, Standard Book House.

2. Surveying Vol. I, II and III by K.R. Arora, Standard Book House.

Reference Books

1. Surveying Vol. I and II by S.K. Duggal, Tata McGraw-Hill Publishing Co. Ltd.

2. Surveying: Theory & Practices by James M. Anderson and Edward M. Mikhail, Tata McGraw-Hill Publishing Co. Ltd.

3. Advanced Surveying by Satheesh Gopi, Sathikumar and Madhu, Pearson India.

4. Geomatics Engineering by M.K.Arora and R.C.Badjatia, Nemchand & Bros.

CE2105 ENGINEERING MECHANICS

Basic Concepts: Introduction to Engineering Mechanics – Scalar and Vector quantities – Forces – Characteristics of a Force – Definitions and Examples of Various Types of Force Systems – Definition of Resultant – Composition and Resolution of Forces – Moment of a Force – Principles of Moments of Force – Couples – Characteristics of a Couple – Transformations of a Couple – Resolution of a Force into a Force and Couple. Resultants of Force Systems, Possible Resultants of Different Types of Force Systems – Resultant of a Concurrent, Coplanar Force System – Resultant of a Non-concurrent Coplanar Force System – Resultant of a Concurrent Non-coplanar Force System – Resultant of a Parallel, Non-coplanar Force System – Resultant of a System of Couples in Space – Resultant of Non-concurrent, Non-coplanar, Non-parallel Force System – Screw of Wrench.

Equilibrium: Free Body Diagrams – Equations of Equilibrium for a Concurrent Coplanar Force System – Equilibrium of Bodies Acted on by Two or Three Forces – Equilibrium of Bodies Acted on by Non-concurrent Coplanar Force System – Equilibrium of Bodies Acted on by Parallel, Non-coplanar Force System – Equilibrium of Non-concurrent, Non-coplanar NonParallel Force System. Analysis of Statically Determinate Trusses by (a) Method of Joints and (b) Method of Sections.

Centroids and Centres of Gravity: Centre of Gravity of Parallel Forces in a Plane – Centre of Gravity of Parallel Forces in Space – Centroid and Centre of Gravity of Composite Bodies – Theorems of Pappus – Distributed Loads on Beams. Moments of Inertia, Definition – Parallel Axis Theorem for Areas – Second Moments of Areas by Integration – Radius of Gyration of Areas – Moments of Inertia of Composite Areas – Parallel Axis and Parallel Plane Theorems for Masses – Moments of Inertia of Masses by Integration – Radius of Gyration of Mass – Moments of Inertia of Composite Masses.

Friction: Nature of Friction – Laws of Friction – Coefficient of Friction – Angle of Friction – Cone of Friction – Problems Involving Frictional Forces Method of Virtual Work: Principle of Virtual Work – Equilibrium of Ideal System – Stability of Equilibrium.

Kinematics: Absolute Motion: Introduction – Recapitulation of Basic Terminology of Mechanics – Newton’s Laws – Introduction to Kinematics of Absolute Motion – Rectilinear Motion of a Particle – Angular Motion – Curvilinear Motion of a Particle using Rectangular Components – Motion of Projectiles – Curvilinear Motion using Radial and Transverse Components – (Simple Problems only) – Basics of Simple Harmonic Motion (Simple Problems) – Motion of Rigid Bodies. Kinematics: Relative Motion: Introduction to Kinematics of Relative Motion – Relative Displacement – Relative Velocity – Instantaneous Centre – Relative Acceleration.

Kinetics: Introduction to Kinetics – Newton’s Laws of Motion – Equation of Motion for a Particle. Motion of the Mass Centre of a System of Particles – D’Alembert’s Principle – Rectilinear Translation of a Rigid Body – Curvilinear Translation of a Rigid Body – Rotation of a Rigid Body – Plane Motion of a Rigid Body.

Kinetics: Work and Energy Approach – Work Done by a Force – Work Done by a Couple – Work Done by a Force System – Energy: Potential Energy – Kinetic Energy of a Particle – Kinetic Energy of a Rigid Body – Principle of Work – Energy and Application to Particle and Rigid Body in Planar Motion – Conservation of Energy Impulse – Momentum Approach – Linear Impulse – Linear Momentum – Principle of Linear Impulse and Linear Momentum – Conservation of Linear Momentum – Elastic Impact - Principle of Angular Momentum.

Text Books

1. Engineering Mechanics by Fredin and Leon Singer, B.S.Publications.

2. Applied Mechanics by I.B. Prasad, Khanna Publishers.

Reference Books

1. Engineering Mechanics by S.Timoshenko and D.H. Young, Tata McGraw-Hill Publishing Co. Ltd. India.

2. Engineering Mechanics Vol. I and Vol. II by J.L.Meriam and L.G.Kraige, Wiley Publications.

3. Mechanics for Engineers Statics and Dynamics by F.B. Beer and E.R. Johnston.

4. Engineering Mechanics by R.S.Kurmi, S.Chand Publishing.

CE 2106 BUILDING MATERIALS AND BUILDING CONSTRUCTION

Masonry: Different Types of Stone Masonry – Plan, Elevation, Sections of Stone Masonry Works – Brick Masonry – Different Types of Bonds – Plan, Elevation and Section of Brick Bonds up to Two-Brick Wall Thickness – Partition walls – Different Types of Block Masonry – Hollow Concrete Blocks – FAL-G Blocks, Hollow Clay Blocks.

Foundations: Types of Foundations: Strip, Isolated, Strap, Combined Footings, Raft – Mat – Slab and Beam Raft, Box Type Raft, Inverted Arch Foundations, Shell Foundations, Grillage Foundations – Minimum Depth of Foundation – Bearing Capacity of Soils.

Paints, Varnishes: Paints and Varnishes: Constituents and Characteristics of Paints, Types of Paint, their uses and preparation on Different Surfaces, Painting Defects, Causes and Remedies. Constituents of Varnishes, Uses of Varnishes, Different Kinds of Varnishes, Polishes. Painting of Interior Walls, Exterior Walls, Wooden Doors and Windows – Steel Windows – Various Types of Paints (Chemistry of Paints not included) Including Distempers; Emulsion Paints etc., Varnishes Wood Work Finishing Types. Asbestos, Asphalt Bitumen and Tar: Availability and uses of Asbestos, Properties of Asbestos, Various Types of Asbestos, Difference Between Asphalt and Bitumen, Types, Uses and Properties of Asphalt and Bitumen, Composition of Coal Tar, Wood Tar, Mineral Tar and Naphtha.

Roofing: Mangalore Tiled Roof, RCC Roof, Madras Terrace, Hollow Tiled Roof, Asbestos Cement, Fibre Glass, Aluminium, G.I. Sheet Roofings.

Trusses: King Post and Queen Post Trusses – Steel Roof Truss for 12 m Span with details. Wooden Doors and Windows: Parallel – Glazed – Flush Shutters, Plywood, Particle Board Shutters – Aluminum, PVC, Steel Doors, Windows and Ventilators, various types of Windows, Glazing – Different Varieties. Stair Cases: Stair Cases or Stairway Design (Architectural Design or Planning only) various types such as, Straight Flight, Dog-legged, Quarter Landing, Open Spiral, Spiral Stairs etc.

Concrete Technology and Mix Design: Polymer Concrete, Types of Cement Concretes, Ingredients and their Characteristics, Cement Concrete Properties and Relevant Tests, Storage, Batching, Mixing and Transporting, Placing, Vibrating and Curing. Concrete Grades and Mix Designs up to M30 as per IS Code. Introduction to Polymer Concrete and its applications.

Text Books

1. Engineering Materials [Material Science] by Rangwala, Charotar Publications.

2. Concrete Technology Theory & Practice by M.S. Shetty, S. Chand & Company Ltd.

3. Building Construction by B.C. Punmia, Laxmi Publications.

4. Civil Engineering Construction Materials, S.K. Sharma, KBP House.

Reference Books

1. Concrete: Microstructure, Properties & Materials, PK Mehta, Tata McGra-Hill Publications.

2. Building Construction, Vol.II & III By W.B. Mckay, E.L.B.S. and Longman, UK.

3. Building Materials by S.K. Duggal, New Age International Publishers.

4. Construction Technology by R. Chudly Vols I & II, 2nd Edition, Longman, UK.

CE2107 : MATERIALS, TESTING AND EVALUATION LABORATORY

(1) Tension Test on Mild steel/HYSD bars (2) Compression Test on Wood (Parallel and Perpendicular to Grains) (3) Tests on Springs for the Determination of Rigidity Modulus and Spring Constant (4) Brinell’s and Rockwell Hardness Tests (5) Charpy and Izod Impact Tests (6) Double Shear Test on Mild Steel Specimen (7) Bending Test: Load Deflection Test for the Determination of Young’s Modulus on Simply Supported and Cantilever Beams of Wood and Steel (8) Buckling of Wooden Column.

CE2108 : SURVEYING FIELD WORK

Chain Surveying: Introduction of Instruments used for Chain Survey, Folding and Unfolding of Chain – Line Ranging (Direct Method) – Pacing. Chain Traversing – Preparation of Plan of a Residential Building by making use of Chain, Ranging Rods, Oblique Off – Set Method, Introduction of Check Line. Preparation of Residential Building by Perpendicular Offset, Introduction of Tie Lines. Finding the Distance Between Inaccessible Points by making Use of Chain, Cross Staff, Tape, Ranging Rods; Arrows and Field Problems of Obstacles to Chaining.

Compass Survey: Introduction to Prismatic Compass – Temporary Adjustments. Finding the Distance Between Inaccessible Points by Making use of Compass, Tape and Ranging Rods. Compass Traversing – Plotting of a Residential Building.

Plane Table Survey: Introduction to Plane Table – Use of its Accessories: Two and Three Point Problem. Finding the Distance between Inaccessible Points by Making use of Plane Table, Accessories – Ranging Rods and Tape.

Levelling: Introduction to Dumpy Level, Levelling Staff. Reading of Level Staff, Temporary Adjustments of Dumpy Level. Introduction to Fly Levelling – Booking the Readings by Height of Collimation Method. Introduction to Fly Levelling–Booking the Readings by Rise and Fall Method – To Find Closing Error. Check Levelling – L.S. and C.S. of a Road Profile. Preparation of Contour Plan for an Open Area by taking Level of the Site.

II Year – II Semester

CE2201 SURVEYING – II

Theodolite – Types of Theodolites – Temporary Adjustments, Measurements of Horizontal Angle – Method of Repetition, Method of Reiteration – Uses of Theodolites – Errors in Theodolite or Permanent Adjustments of a Theodolite – Identification – Rectifying the Errors. Theodolite Traversing – Open and Closed Traverse – Closing Errors, Balancing the Error – Bowditch Method – Transit Method, Omitted Measurements – Gale’s Traverse Table or Trigonometric Levelling – Elevation of Top of the Tower – Same Plane – Different Planes. Tacheometry – Principle of Tachometry – Stadia Methods – Fixed Hair Method – Movable Hair Method – Tangential Method – Subtense Bar – Beaman’s Stadia, Arc – Reduction Diagrams or Triangulation – Classification – Intervisibility of Station – Signals and Towers – Base Line Measurements – Corrections – Satellite Station and Reduction to Centre – Basenet. Curves – Sample Curves – Elements of Simple Curves – Methods of Setting Simple Curves – Rankine’s Method – Two Theodolite Method – Obstacles in Curve Setting – Compound Curves – Elements of Compound Curves or Reverse Curves – Elements of Reverse Curve – Determination of Various Elements – Transition Curves – Ideal Shape – Spiral Transition Curves – Length of Transition Curve – Setting Out Methods.

Total Station Surveying: Electronic Theodolite, Electronic Distance Measurements, Total Station, Errors in Measurements, Advantages, Disadvantages, Applications; Contour Mapping, Determination of Height of Remote Point, Position of Hidden Point, Free Station, Area Measurement, Volume Measurement.

Modern Surveying and Mapping: GPS Survey – Introduction, Errors in GPS, Positioning Methods, Classification of GPS Surveying, Applications, Advantages and Disadvantages, Photogrammetric Surveying; Sensors and Platforms, Aerial Photogrammetry, Satellite Images Resolution, Concept of Stereo Models, Photogrammetric Products, Rectified Images, Orthophotography, Topographic Map, Digital Maps, DEM, GIS, Advantages and Disadvantages of Photogrammetric Surveying.

Text Books

1. Surveying Vol. I, II and III by B.C.Punmia, Standard Book House.

2. Surveying by Dr. K.R. Arora, Standard Book House.

Reference Books

1. Surveying Vol. I and II by S.K. Duggal, Tata McGraw-Hill Publishing Co. Ltd.

2. Principles of GIS for Land Resource Assessment by P.A. Burrough, Clerendon Press, Oxford.

3. Surveying: Theory and Practices by James M. Anderson and Edward M. Mikhail, McGraw-Hill Education.

4. Advanced Surveying by Satheesh Gopi, Sathikumar and Madhu, Pearson India.

5. Geometric Engineering by Arora and Badjatia, Nemchand and Co.

CE2202 FLUID MECHANICS – I

Fluid Properties and Fluid Statics: Introduction & Physical Properties of Fluids – Definition of Fluid, Fluid as Continuum; Mass Density, Specific Weight, Specific Gravity, Specific Volume, Bulk Modulus, Compressibility, Vapour Pressure, Cavitation, Viscosity – Newton’s Law of Viscosity, Rheological Diagram; Capillarity and Surface Tension. Fluid Statics, Pressure and its Measurement – Forces acting on a Fluid Element – Pascal’s law; Variation of Pressure in Static Fluid; Absolute, Gauge and Total Pressure; Pressure Measurement – Piezometers, Manometers, Micro-manometers, Mechanical Gauges and Pressure Transducers. Forces on Immersed Bodies in Static Fluids – Force on a Plane Surface – Centre of Pressure; Pressure Diagram; Forces on Curved Surfaces; Forces on Radial Crest Gates and Lock Gates. Buoyancy and Floatation – Archimedes Principle; Stability of Floating Bodies – Centre of Buoyancy, Metacentric Height and its determination.

Fluid Kinematics and Conservation of Mass: Types of Fluid Flow & Methods of Fluid Flow Analysis – Methods of Describing Fluid Motion; Types of Flow – Steady and Unsteady Flows, Uniform and Non-uniform Flows, free and forced vortex motions, Laminar and Turbulent Flows; Streamline, Path line, Streak line; Stream Surface – Stream Tube. Fluid Kinematics – Translation, Deformation and Rotation of a Fluid Element in Motion; Local, Convective and Total Accelerations; One, Two and Three Dimensional Analysis of Flows. Ideal Fluid Flow – Stream Function, Velocity Potential; Rotational & Irrotational Flows – Vorticity and Circulation; Laplace Equation in terms of Stream Function and Velocity Potential; Flow Nets. Principle of Conservation of Mass – Concepts of System and Control Volume; Continuity Equation in three dimensional Cartesian coordinates; Continuity Equation for flow through a Stream tube. Fluid Dynamics: Principle of Conservation of Energy – Equation of Motion for Ideal Fluids, Euler’s Equation in Streamline Coordinates, Derivation of Energy Equation through integration of Euler’s Equation, Bernoulli’s Equation, Energy Correction Factor. Flow measuring devices – Flow Measurement in Pipes – Measurement of Static, Stagnation and Dynamic Pressures and Velocity – Pitot Tube, Prandtl Pitot Tube; Measurement of Discharge through a Pipe using Flow Meters – Venturimeter, Flow Nozzle meter and Orifice meter. Flow through Tanks and Reservoirs – Measurement of Discharge from Tanks and Reservoirs – Steady and Unsteady Flow through Orifices and Mouthpieces – Small & Large Orifices – Different types of Mouthpieces; Discharge from tanks through Drowned Orifices, Time of Emptying Tanks, Discharge from a Tank with Inflow. Flow Measurement in Channels – Flow Measurement in Open Channels, Flow Past Weirs and Notches, Sharp Crested and Broad Crested Weirs, Weirs with and without end contractions, Ventilation of Weirs, Triangular Notches, Cipolletti Weir. Principle of Conservation of Momentum – Momentum of Fluids in Motion, Impulse Momentum Equation, Momentum Correction Factor. Application of Momentum Principle – Forces on Pipe Bends and Reducers, Flow through a Nozzle; Angular Momentum of Fluid Flow – Sprinkler Problems. Laminar flow: Equation of Motion for Real Fluids – Modifications in Equation of Motion, Stress Strain Relationships, Tangential Stress Terms.

Steady Flow between Parallel Plates, Couette's and Poiseuille's Flows; Axisymmetric Flows, Flow without and with Pressure Gradient – Hagen-Poiseuille Equation; Relationship between Friction factor and Reynolds Number for Laminar Flow through Pipes; Stokes’ law.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.

2. Fluid Mechanics by A.K.Jain, Khanna Publishers.

Reference Books

1. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co. Ltd.

2. Engineering Hydraulics, H.Rouse, John Wiley & Sons Inc.

3. Mechanics of Fluids, I.H.Shames,McGraw-Hill Professional.

CE2203 : STRUCTURAL ANALYSIS – I

Deflections of Beams Using (i) Moment Area Method, (ii) Conjugate Beam Method, (iii) Unit Load Method (iv) Castigliano’s Theorem – 1. Strain – Energy due to (i) Axial Load, (ii) Shear Force, (iii) Bending Moment and (iv) Torque; Deflections of Statically Determinate Structures: (A) Single Storey, Single Bay Rectangular Portal Frames using (i) Unit Load Method, (ii) Castigliano’s Theorem –1. (B) Trusses (Having 9 Members or less) using (i) Unit Load Method and (ii) Castigliano’s Theorem-1. Analysis of (A) Fixed Beams, (B) Three Span Continuous Beams using (i) Theorem of Three Moments, (ii) Slope Deflection Method and (iii) Moment Distribution Method Moving Loads: Maximum Shear Force and Bending Moment Diagrams for Different types of Loads. Maximum Bending Moment at a Section under a Wheel Load and Absolute Maximum Bending Moment in the case of several Wheel Loads. Equivalent Uniformly Distributed Live Load for Shear Force and Bending Moment. Reversal of Nature of Shear Force, Focal Length, Counter Bracing for Truss Panels, Influence Lines for (i) Beams and (ii) Members of Warren and Pratt Trusses.

Thick Cylinders –Lamme’s Theory, Compound Tubes – Theory of Failure (i) Principal Stress Theory, (ii) Principal Strain Theory, (iii) Maximum Shear Stress Theory and (iv) Maximum Strain Energy Theory.

Text books

1. Theory of Structures, Vol- I, by G.S.Pundit, S.P.Gupta and R.Gupta,, McGraw-Hill Education India.

2. Mechanics of structures Vol- I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House.

3. Strength of Materials by S.Ramamrutham and R.Narayanan, Dhanpat Rai Publishing House.

Reference Books

1. Elementary Strength of Materials by S.Timoshenko and D.H.Young, Affiliated East-West Press.

2. Analysis and Design of Structures Vol-I by V.N.Vazirani and M.M.Ratwani, Khanna Publishers.

3. Intermediate Structural Analysis by C.K.Wang, McGraw-Hill. 4. Strength of Materials by B.C.Punmia, Laxmi Publications.

CE2204 : ENVIRONMENTAL ENGINEERING – I

Introduction: Importance and Necessity of Protected Water Supply systems, Objectives of Protected Water Supply System, Flow Chart of Public Water Supply System, Role of Environmental Engineer, Agency Activities. Water Demand and Quantity Studies: Estimation of Water Demand for a town or city, Types of Water Demands, Per Capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design Period, Population Studies, Population Forecasting Studies.

Hydrological Concepts: Hydrological Cycle, Types of Precipitation, Measurement of Rainfall.

Surface Sources of Water: Lakes, Rivers, Impounding Reservoirs, Capacity of Storage Reservoirs, Mass Curve Analysis.

Groundwater Sources of Water: Types of Water bearing formations, Springs, Wells and Infiltration Galleries, Yields from Wells and Infiltration Galleries. Collection of Water: Factors Governing the Selection of the Intake Structure, Types of Intakes.

Conveyance of Water: Gravity and Pressure Conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of Pipe Lines, Laying of Pipe Lines. Quality and Analysis of Water: Characteristics of water – Physical, Chemical and Biological. Analysis of Water: Physical, Chemical and Biological. Impurities in Water, Water Borne Diseases. Drinking Water Quality Standards. Treatment of Water: Flowchart of Water Treatment Plant, Treatment Methods (Theory and Design) – Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration, Chlorination and other Disinfection methods, Softening of Water, Defluoridation, Removal of Odours. Distribution of Water: Methods of Distribution System, Components of Distribution System, Layouts of Distribution Networks, Pressures in the Distribution Layouts, Analysis of Distribution Networks, Water Connection to the Houses.

Text Books

1. Environmental Engineering by Peavy, Rowe, Tchenobolus. McGraw-hill Pub.

2. Elements of Environmental Engineering by K.N. Duggal, S.Chand & Company Pvt. Ltd.

Reference Books

1. Environmental Engineering Vol.I : Water Supply Engineering by S.K. Garg, Khanna Publishers.

2. Water Supply and Sanitary Engineering by G.S.Birdie and J.S.Birdie, Dhanpat Rai Publishing Company.

3. Water Supply Engineering by P.N.Modi, Standard Book House.

4. Water Supply Engineering by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd.

CE2205 : GEOTECHNICAL ENGINEERING – I

Introduction: Soil Formation, Minerals in Clays and Sand, Soil Structure, Physical properties of Soil: Void ratio, Porosity, Degree of Saturation, Water Content, Unit Weights, Specific Gravity, Weight – Volume Relationships, Relative density, Consistency Limits and Consistency Indices, Activity. Mechanical Analysis and Soil Classification: Sieve Analysis, Stoke’s Law, Hydrometer and Pipette Analysis, Textural Classification, Classification based on Size, Unified Soil Classification and Indian Standard Soil Classification Systems, Field Identification of Soils Soil Hydraulics: Types of Soil Water, Capillary Rise and Surface Tension, Darcy’s Law and its Limitations, Constant Head and Variable Head Permeability Tests, Factors Effecting Coefficient of Permeability, Permeability of Stratified Soils. Total, Neutral and Effective Stresses, Effective Stress Principle, Upward Flow Conditions, Quick Sand Conditions, Critical Hydraulic Gradient. Stress Distribution in Soils: Boussinesq’s Theory for Determination of Vertical Stress, Assumptions and Validity, Extension to Line, Strip, Rectangular and Circular Loaded Areas, Pressure Bulb and Influence Diagrams, Newmark’s Influence Chart – Construction and Use, Westergaard’s Theory, 2:1 Load Dispersion Method, Contact Pressure Distribution beneath Footings. Compaction: Mechanism of Compaction, Factors Effecting Compaction, Laboratory Compaction Tests, Effect of Compaction on Soil Properties, Field Compaction: Compaction Equipment and Evaluation of Field Compaction. Consolidation: Basic Definitions: Compression Index, Coefficient of Compressibility and Coefficient of Volume Decrease; Spring Analogy for Primary Consolidation; Initial Compression, Primary Compression and Secondary Compression, Generation of Effective Stress-Void Ratio Relationship from Consolidation Test: Height of Solids Method and Change in Void Ratio Method; Determination of Preconsolidation Pressure, Normally Consolidated, Over Consolidated and Under Consolidated Clays, Terzaghi’s One Dimensional Consolidation Theory – Assumptions, Derivation of Differential Equation and Solution, Laboratory Determination of Coefficient of Consolidation by Time Fitting Methods. Shear Strength of Soils: Stress at a Point, Mohr Circle of Stress, Mohr-Coulomb Failure Theory, Shear Parameters, Laboratory Shear Tests – Shear Box, Triaxial and Unconfined Compression Tests, Laboratory and Field Vane Shear Tests, Sensitivity of Clays, Types of Shear Tests based on Drainage Conditions, Total Stress Analysis and Effective Stress Analysis, Shear Strength of Sands, Critical Void Ratio and Dilatancy, Liquefaction of Soils, Factors affecting Shear Strength of Clays and Sands,

Text Books

1. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers

2. Basic and Applied Soil Mechanics by Gopal Rajan and A.S.R. Rao, New Age International Publishers.

3. Geotechnical Engineering by P. Purushothama Raj, Pearson Publishers

 OP-I: CE2206 : MANAGERIAL ECONOMICS

Unit -I Significance of Economics and Managerial Economics: Economics: Definitions of Economics– Wealth, Welfare and Scarcity definition Classification of Economics– Micro and Macro Economics. Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand Analysis: Demand – Definition, Meaning, Nature and types of demand, Demand function, Law of demand – Assumptions and limitations. Exceptional demand curve. Elasticity of demand – Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand. Demand Forecasting – Need for Demand forecasting, Factors governing demand forecasting, Methods of demand forecasting: Survey methods– Experts' opinion survey method and consumers Survey methods.

Utility Analysis: Utility– Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, the law of Diminishing Marginal Utility and its Limitations.

Unit -II : Theory of Production and Cost analysis: Production – Meaning, Production function and its assumptions, use of production function in decision making; Law of Variable Proportions: three stages of the law. Cost analysis – Nature of cost, Classification of costs – Fixed vs. Variable costs, Marginal cost, Controllable vs. Non – Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale.

Unit -III : Market Structures: Definition of Market, Classification of markets; Salient features or conditions of different markets – Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve; Monopolistic Competition.

Unit -IV : Pricing Analysis: Pricing – Significance: Different Pricing methods– Cost plus pricing, Target pricing, Marginal cost pricing, Going-rate pricing, Average cost pricing, Peak load pricing, Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark-down pricing of retailers.

Unit -V : Business cycles, Inflation and Deflation: Business cycles – Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles Inflation –Meaning, Types, Demand-pull and Cost push inflation, Effects of Inflation, Anti- inflationary measures Deflation– Meaning, Effects of Deflation, Control of Deflation, Choice between Inflation and Deflation

Text Books

1. Managerial Economic by Sankaran,S., Marghan Publications.

2. Managerial Economics and Financial Analysis by Aryasri, A.R., MC Graw-Hill Education.

Reference Books

1. Managerial Economics by Dwivedi, D.N., Vikhas Publishing House Pvt. Ltd. 6th Edition.

2. Modern Economic Theory by Dewett, K.K., Chand & Company Ltd.

CE2207 : BUILDING PLANNING AND DESIGN

Residential Buildings: Different types of Residential Buildings, Selection of Site for Residential Building. Brief Information of Housing Colonies for Different Income Groups in India–Sizes of Plots – Public Spaces, Evolutionary Housing Concept. Climatology: Elements of Climate: Sun, Wind, Relative Humidity, Temperature effects, Comfort Conditions for House, various types of Macro Climatic Zones. Design of Houses and Layouts with Reference to Climatic Conditions. Orientation of Buildings. Solar Charts, Ventilation. Principles of Planning Anthropometric Data Preliminary Drawings: (a) Conventional Signs of Materials various Equipment used in a Residential Building (copying exercise) (b) Plan, Section and Elevation of a Small House (one room and verandah) (copying exercise) (c) Plan, Section and Elevation of Two Bed Room House (copying exercise) (d) (e) (f) Plan, Section and Elevation of Three Bed Room House in Hot and Humid Zone, Hot and Arid Zone, Cold Zone (copying exercises) (a) Design of Individual Rooms with Particular Attention to Functional and Furniture Requirements. Building Regulations and Bye-laws of Residential Buildings; (b) AUTOCAD Drawing of Residential Building (only for internal assessment) Drawing the Plan, Section and Elevation of Houses with given Functional Requirements and Climatic Data (emphasis may be given to Hot and Humid zones.)

Text Books

1. Building Planning and Drawing by N. Kumara Swamy and A.Kameswara Rao, Charotar Publishing House.

2. Building Planning Drawing and Scheduling by Gurucharansingh and Jagadish Singh, Standard Publishers Distributors

Reference Books

1. Civil Engineering Drawing by Sharma and Gurucharan Singh, Standard Publishers.

2. Civil Engineering Drawing Series ‘B’ by R.Trimurty, M/S Premier Publishing House.

3. Building Drawing with an Integrated Approach to Built Environment by M.G.Shah, C.M.Kale and S.Y.Patki, McGraw-Hill Publishing Company Limited.

CE2208 : TOTAL STATION AND GEOMATICS LABORATORY

1. Measurement of Horizontal Angles by Repetition & Reiteration, Measurement of Vertical Angles, Heights and Distances

2. Distance between two In-accessible Points using Theodolite

3. Tachometry

4. Setting Out Curve by Deflection Angle Method using two Theodolites

5. Point Positioning using GPS

6. Contour Mapping using Total Station

7. Height of Remote Point using Total Station

8. Position of Hidden Point using Total Station

9. Area and Volume Measurement using Total Station

10. GIS related Surveying Applications

CE2209 : FLUID MECHANICS LABORATORY – I

1. Study of Small Orifice by Constant Head Method and Time of Emptying a Tank through a Small Orifice.

2. Study of Cylindrical Mouthpiece by Constant Head Method and Time of Emptying a Tank through a Cylindrical Mouthpiece.

3. Determination of Metacentric Height of Floating Body.

4. Study of Surface Profiles in Free and Forced Vortex Motions.

5. Study of Venturimeter.

6. Study of Orifice meter.

7. Study of Flow Nozzle Meter.

8. Study of Sharp-crested Full Width and Contracted Weirs.

9. Study of V-Notch and Trapezoidal Notch.

10. Study of Broad-crested Weir.

III Year – I Semester

 CE3101 : STRUCTURAL ANALYSIS – II

Analysis of Statically Indeterminate Trusses (having not more than
7 members and 3 supports) containing (a) External Redundant Supports (b) Internal Redundant Members using (i) Method of Consistent Deformation of Unit Load Method (ii) Castigliano’s Theorem – II. Analysis of Three Span Continuous Beams using Kani’s Method, Analysis of Statically Indeterminate Frames (Single Storey, Single Bay Portal Frames only) using (i) Slope-deflection method (ii) Moment Distribution Method (iii) Kani’s Method.

Arches: Normal Thrust, Radial Shear and Bending Moment in Three Hinged and Two Hinged Parabolic and Segmental Arches. Effects of Rib-shortening and Temperature Change.

Suspension Bridges: Stresses in Loaded Cables with Supports at the Same and Different Levels. Length of Cable; Two and Three Hinged Stiffening Girders. Introduction to Matrix Methods of Structural Analysis (Very elementary treatment only), Static Indeterminacy, Kinematic Indeterminacy, Stiffness and Flexibility Method for Two Span Continuous Beams only– Truss with 3 supports and 7 members.

Text books

1. Theory of Structures by S.Ramamrutham, R.Narayan, Dhanpat Rai, Publishing Company.

2. Theory of Structures by B.C.Punmia, Ashok K Jain,Arun K Jain, Laxmi Publications.

3. Mechanics of Structures Vol II by S.B.Junnarkar, H.J.Shah, Charotar Publishing House.

Reference Books

1. Statically Indeterminate Structures by C.K. Wang, Mcgraw-Hill.

2. Structural Analysis – A Matrix Approach by G.S. Pandit and S.P. Gupta, McGraw-Hill Education.

3. Indeterminate Structures by R.l. Jindal, S. Chand Publishers.

CE3102 : ENVIRONMENTAL ENGINEERING – II

Introduction to Sanitation – Systems of Sanitation – Relative Merits and Demerits – Collection and Conveyance of Wastewater – Sewerage – Classification of Sewerage Systems– Estimation of Sewage Flow and Storm Water Drainage – Fluctuations – Types of Sewers – Hydraulics of Sewers and Storm Drains – Design of Sewers – Materials for Sewers – Appurtenances in Sewerage – Cleaning and Ventilation of Sewers – Safety of Sewer Workers . Storm Sewers – Design: Pumping of Wastewater – Pumping Stations – Location – Components Parts – Types of Pumps and their Suitability with regard to Wastewaters. House Plumbing: Plumbing Systems of Drainage – Sanitary Fittings and other Accessories – Single Stack System – One Pipe and Two Pipe Systems – Design of Building Drainage. Bacteriology of Sewage: Sewage Characteristics – Physical, Chemical and Biological Examination – Decomposition – Cycles of Decomposition – Sampling and Analysis of Wastewater – BOD-COD –Treatment of Sewage – Primary Treatment: Screens–grit Chambers – Grease Traps – Floatation – Sedimentation – Design of Primary and Pretreatment Units. Secondary Treatment: Aerobic and Anaerobic Treatment Process B– Comparison. Suspended Growth Process: Activated Sludge Process, Principles, Designs and Operational Problems, Modifications of Activated Sludge Processes, Miscellaneous Methods, Oxidation Ponds, Oxidation Ditches, Aerated Lagoons.

Attached Growth Process: Trickling Filters – Mechanism of Impurities Removal – Classification – Filter Problems, Design and Recirculation. RBCs, Fluidized Bed Reactors, Sewage Disposal Methods. Anaerobic Processes: Septic Tanks and Imhoff tanks – Principles and Design – Sludge Treatment and Disposal-Fundamentals of UASB. Biosolids (Sludge): Characteristics – Thickening – Digestion, Drying and Sludge Disposal.

Text Books

1. Wastewater Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill edition.

2. Environmental Engineering by Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. McGraw-Hill international edition

3. Environmental Engineering. II: Sewage Disposal and Air Pollution Engineering, Khanna Publishers.

Reference Books

1. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, by S.K.Garg, Khanna Publishers

2. Water Supply and Sanitary Engineering by G.S.Birdie and J.S.Birdie, Dhanpat Rai Publishing Company.

3. Water Supply Engineering by P.N.Modi, Standard Book House.

4. Water Supply Engineering by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd.

CE3103 : REINFORCED CONCRETE STRUCTURES – I
(IS-456 code book is allowed for examination)

General: Loading Standards as per IS 875, Grades of Steel and Cement, Stress-Strain Characteristics of Concrete and Steel, Introduction to Working Stress Method and Limit State Method (L.S.D.) of Design. Limit State of Collapse of in Flexure: Central Value measures, Measures of Distribution, Normal Distribution Curve. Introduction and Principles of L.S.D., Characteristic Load and Strengths, Design Values, Partial Safety Factors, Factored Loads. Limit State of Collapse: Flexure of R.C.C. Beams of Rectangular section.

Under Reinforced, Balanced and Over Reinforced Sections. Compression Stress Block, Estimation of Ultimate Moment by Strain Compatibility. Guide Lines for choosing Width, Depth and Percentage of Reinforcements in Beams. Analysis and Design of Singly Reinforced Rectangular Beams and Doubly Reinforced Beams, Design of Flanged Beams (T and L), Effective Flange Width, Basis of Analysis and Design, Minimum and Maximum Steel in Flanged Beams. Design of One way and Two way Slabs: Simply Supported Slabs on all Four Sides, Moment in Two way Slabs with Corners held down. Choosing Slab Thickness. Design of Restrained Slabs (with Torsion at corners) I.S. Code Provisions. Detailing of Reinforcement. Shear, Torsion and Bond: Limit State of Collapse in Shear, Types of Shear Failures. Truss Analogy, Shear Span/Depth Ratio. Calculation of Shear Stress, Types of Shear Reinforcement. General Procedure for Design of Beams for Shear. Enhanced Shear near Supports. Shear in Slabs, Steel detailing. Analysis for Torsional Moment in a Member. Torsional Shear Stress in Rectangular and Flanged Sections. Reinforcement for Torsion in RC Beams. Principles of Design for Combined Bending Shear and Torsion. Detailing of Torsion Reinforcement – Concept of Bond, Development Length, Anchorage, Bond, Flexural Bond. Columns: Short and Long Columns, Minimum Eccentricity, Short Column under Axial Compression, Column with Helical and Tie Reinforcement. Footings: Analysis and Design of Isolated Square and Rectangular Footings.

Text Books

1. Limit State of Design of Reinforced Concrete by P. C. Vergheese, Prentice Hall India Learning.

2. Reinforced Concrete Limit state Design by A.K. Jain, Nem Chand & Brothers.

3. R.C.C Design by Unnikrishna Pillai and Devadas Menon, McGraw-Hill

Reference Books

1. Limit State Design of Reinforced Concrete Structures by P. Dayaratnam, P.Sarah, Oxford and IBH Publishers.

2. Reinforced Concrete Structures by R.Park and T.Paulay, Wiley Publishers.

CE3104 : STEEL STRUCTURES – I

Note: All the designs should be taught in the limit state design method as per IS 800-2007 Fundamental Concepts of Limit State Design of Structures, Different types of Rolled Steel Sections available to be used in Steel Structures. Stress – Strain relationship for Mild Steel Bolted Connections: Behavior of Bolted Joints, Design Strength of Ordinary Black Bolts, High Strength Friction Grip Bolts, Simple Connections, Moment Resistant Connections Welded Connections: Advantages of Welding, Types and Properties of Welds, Types of Joints, Weld Specifications Design of Welded Joints subjected to Axial Load, Eccentric Welded Connections Tension Members: Types of Tension Members, Design of Strands, Slenderness Ratio, Displacement of Tension Members, Behavior of Tension Members, Modes of Failure, Factors affecting Strength of Tension Members, Angles under Tension, Design of Tension Members, Lug Angles, Splices Compression Members: Possible Failure Modes, Classification of Cross-section, Behavior of Compression Members, Effective Length, Radius of Gyration and Slenderness of Compression Members, Allowable Stresses in Compression, Design of Axially Loaded Compression Members, Built up Compression Members, Laced and Battened Columns, Eccentrically Loaded Columns, Column Splices. Beams: Beam Types, Section Classifications, Lateral Stability of Beams, Allowable Stress in Bending, Shear and Bearing Stresses, Effective Length of Compression Flange, Laterally Supported and Unsupported beams, Design of Built up Beams.

Roof Trusses: Types of Trusses, Economical Spacing of Roof Trusses, Loads on Roof Trusses, Estimation of Wind Load on Roof Trusses as per IS: 875. Design of Members of Roof Truss and Joints, Design of Purlins.

Column Bases and Foundations: Allowable Stress in Bearing, Slab Base, Gusset Base and Grillage Foundations. Introduction to Pre-engineered Structures, Concepts, Advantages and Disadvantages.

Text Books

1. Limit State Design of steel structures by S.K.Duggal, McGraw-Hill Education Private Ltd.

2. Design of steel structures by K.S.Sai Ram, Pearson Education India.

3. Limit State Design of steel structures by Ramchandra and Virendra Gehlot, Scientific Publishers (India).

Reference Books

1. Design of Steel structures by N. Subramanian, Oxford University Press.

2. Design of steel structures by Limit State Method as per IS: 800-2007 – S.S. Bhavikatti, IK International Publishing House.

PE-I: CE3105A : CONCRETE TECHNOLOGY

Chemical and Mineral Admixtures: Water Reducers, Air Entrainers, Set Controllers, Special Admixtures – Structure, Properties and effects on Concrete Properties. Introduction to Supplementary Cementing Materials and Pozzolans – Fly ash, Blast Furnace Slag, Silica Fume, and Metakaolin – their Production, Properties, and Effects on Concrete Properties; Other Mineral Additives – Reactive and Inert.

Dimensional Stability and Durability: Creep and Relaxation – Parameters Affecting; Shrinkage of Concrete – Types and Significance. Parameters affecting Shrinkage; Measurement of Creep and Shrinkage. Durability of Concrete: Introduction to Durability; Relation between Durability and Permeability – Chemical Attack of Concrete; Corrosion of Steel Rebars; other Durability Issues.

Mix Design: Review of Methods and Philosophies of IS, BS and ACI Methods, Mix Design for Special Purposes. Acceptance Criteria for Compressive Strength of Concrete

Special Concretes: Properties and Applications of High Strength – High Performance Concrete, Reactive Powder Concrete, Lightweight, Heavyweight and Mass Concrete; Fibre Reinforced Concrete; Self-compacting Concrete; Shotcrete.

Text Book

1. Concrete Technology Theory and Practice by M.S.Shetty, S.Chand & Company Ltd, New Delhi.

Reference Books

1. Properties of Concrete by A.M.Neville, Longman 1995.

2. Concrete micro-structure, Properties and Materials by P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw-Hill, USA.

PE I: CE3105B : REMOTE SENSING AND GIS APPLICATIONS

Remote Sensing: Introduction, Basic Components of Remote Sensing, Electromagnetic Radiation, Electromagnetic Spectrum, Interaction with Atmosphere, Energy Interaction with the Earth Surfaces, Sensors – Types and Characteristics, Passive Sensor, Active Sensor, Platforms – Airborne Remote Sensing, Space Borne Remote Sensing, Data Pre-processing, Important Remote Sensing Programmes. Geographic Information System: Introduction, Key Components, Spatial Data, Raster Data Models, Vector Data Models, Raster Versus Vector, Data Input Methods and Editing, Non Spatial Data, Map Projections.

Image Analysis: Introduction, Elements of Visual Interpretations, Digital Image Processing – Digital Image Data Formats – Band Interleaved by pixel, Band Interleaved by line, Band Sequential, Image Preprocessing, Image Rectification, Image Enhancement, Image Classification, Supervised Classification, Unsupervised Classification.

GIS Analysis: Introduction, Digital Elevation Models, RS and GIS Data Integration, Overlay Function – Vector Overlay Operations, Raster Overlay Operations, Arithmetic Operators, Comparison and Logical Operators, Conditional Expressions, Overlay using a Decision Table, Some Neighbourhood Operations. RS and GIS Applications in Civil Engineering: Land Cover and Land Use, Urban Applications, Hydrological Studies, Runoff Modeling, Flood Zone Delineation and Mapping, Groundwater Prospects and Recharge, Reservoir Storage Estimation, Water Management, Irrigation Planning, Drought Monitoring, Environmental Impact Assessment and other Watershed Studies.

Text Books

1. Remote Sensing and Image Interpretation by Thomas M. Lilles and Ralph W. Kiefer, John Wiley and Sons Inc.

2. Introduction to Geographical Information Systems by Kang-tsung Chang, TMH Publications & Co.

Reference Books

1. Fundamentals of Remote Sensing and its Applications by Dr.George Joseph, Universities Press.

 2. Concepts & Techniques of GIS by C.P. Lo Albert, K.W.Young, Prentice Hall (India) Publications.

3. Principles of Geographical Information Systems by Peter A. Burragh and Rachael A. Mc Donnell, Oxford Publishers.

PE-I: CE3105C : GEO-ENVIRONMENTAL ENGINEERING

Wastes: Source, Production and Classification of Wastes, Soil Pollution Processes, Waste Characterization, Physical Characterization, Problems due to Improper Disposal of Wastes, Waste Management Strategies. Soil Pollution, Sources of Soil Pollution, Control of Soil Pollution. Waste Disposal Facilities such as Landfills, Configuration or Types of Landfill, Components of Landfill, Layout of a Landfill Site, Stages of Decomposition of Waste in a Landfill, Landfill Planning and Design. Barrier Systems – Active Systems, Passive Systems, Vertical Barriers and their Types, Bottom Barriers, Reuse of Waste Materials, Contaminated Site Remediation.

Text Book

1. Geoenvironmental Engineering – Principles and Applications by Reddi, L. N., and Inyang, H. F., Marcel Dekker.

Reference Books

1. Geotechnical Practice for Waste Disposal by Daniel, D. E., Chapman and Hall, London.

2. Clay Barrier Systems for Waste Disposal Facilities by Rowe, R.K., Quigley, R. M. and Booker, J.R., E & FN Spon, London.

OP II: CE3106 : BUILDING SERVICES AND MAINTENANCE

Ventilation and Air conditioning: Ventilation–Necessity of Ventilation – Functional Requirements– Systems of Ventilation – Types – Natural Ventilation – Artificial Ventilation – Air Conditioning – Systems of Air Conditioning – Essentials of Air Conditioning systems – Protection against fire caused by Air Conditioning Systems. Thermal Insulation: Heat Transfer – Thermal Insulating Materials – General Methods of Thermal Insulation – Economics of Thermal Insulation – Thermal Insulation of Exposed Walls, Doors, Windows and Roofs. Fire Safety: Fire Hazards, Causes of Fire in Buildings, Fire Load – Safety Regulations – Characteristics of Fire Resisting Materials – General Fire Safety Requirements for Buildings – NBC – Planning Considerations in Buildings like Non–combustible Materials, Fire Resistant Construction, Staircases and Lift Lobbies, Fire Escapes and A.C. Systems – Building Types – Heat and Smoke Detectors – Fire Alarms, Snorkel Ladder – Fire Fighting Pump and Water Storage –Dry and Wet Rises – Automatic Sprinklers. Plumbing Services: Water Supply System –Fixing the Pipe in Building – Maintenance of Building Pipe Line – Water Meters – Sanitary Fittings – Principles Governing Design of Building Drainage – Gas Supply Systems. Machineries in Buildings: Lifts – Definitions – Essential Requirements – Design Considerations – Maintenance Escalators – Essential Requirements, Pumps – Types of Pumps, Pumps for Household, Flats and Pumps for Dewatering

Electrical Installation in Buildings: Lighting for Office Buildings – School Buildings – Residential Buildings – Fannage – Air Conditioning/Heating – Reception and Distribution of Main Supply – Fittings and Accessories – Method of Internal Wiring – Earthing – Planning of Electrical Installations – Lightening Arrestors – Earthing Anti–termite Treatment: Types of Termites, Internal and External Anti-termite Treatments – Preconstruction Treatment – Post-construction Treatment – Preventive Measures.

Text Books

1. Building Construction by B.C.Punmia, Er. Ashok K Jain, Arun K Jain, Laxmi Publications (P) Ltd., New Delhi.

2. Building Construction by Janardhan Jha, S K Sinha, Khanna Publishers.

3. Building construction by Rangwala, Charotar Publishibg House.

Reference Books

1. National Building Code, Bureau of Indian Standards.

2. Building Services Engineering by David V.Chadderton, Routledge

3. Building Construction by P.C.Varghese, Prentice Hall India Learning.

CE3107 : GEOTECHNICAL ENGINEERING LABORATORY – I

1. Determination of Specific Gravity of Coarse Grained and Fine Grained Soils

2. Determination of Atterberg Limits of Clay

3. Determination of Field Density by Core Cutter and Sand Replacement Methods

4. Determination of Grain Size Distribution of Coarse Grained Soil by Sieve Analysis

5. Determination of Grain Size Distribution of Fines Fraction of Soil by Hydrometer/pipette Analysis

6. Determination of Coefficient Permeability of Coarse Grained Soil by Constant Head Permeability Test

7. Determination of Coefficient Permeability of Fine Grained Soil by Variable (Falling) Head Permeability Test

8. Determination of Compaction Characteristics of Soil by IS Light / Heavy Compaction Test.

Demonstration Experiments:

1. Rapid Moisture Meter Test for Quick Determination of Water Content

2. Determination of Water Content of Compacted Soil in Field by Proctor’s Plasticity Needle

Reference Books

1. Relevant IS Codes of Practice

CE3108 : ENVIRONMENTAL ENGINEERING LABORATORY

1. Determination of pH and Conductivity of a given water and wastewater sample

2. Measurement of Turbidity using Nephelometric Turbid meter and
Determination of optimum coagulant dosage (Jar Test).

3. Determination of Hardness in a given water sample

4. Estimation of Acidity of a water sample 5. Estimation of Alkalinity of a waste and wastewater sample

5. Determination of Available Chlorine in a given Bleaching powder sample and residual Chlorine in a water sample

6. Estimation of Fluorides in a given water sample.

7. Estimation of Iron in a water sample

8. Estimation of Total Solids: Settleable Solids: Suspended solids,
dissolved solids.

9. Measurement of D.O. by volumetric analysis

10. Estimate the B.O.D. of a wastewater sample.

11. Estimate the C.O.D. of a wastewater sample.

12. Estimation of Chlorides in a water sample

13. Estimation of Nitrates in a given sample

Text Books

1. Environmental Engineering Laboratory Manual by Kotaiah, B. and Kumara Swamy, N. Charotar Pub. House.

2. Chemical Analysis of Water and Soil: A laboratory Manual by Muralikrishan K.V.S.G.., Envir. Prot. Society.

III Year – II Semester

CE3201 : ESTIMATION, SPECIFICATIONS AND CONTRACTS

Introduction: Standard Units, Units of Measurement of Different items of Work. Meaning of Estimate, Tender, Contract, Price Escalation. Errors in Estimation, Different types of Estimates. Contingencies and Related Terms in the Estimate, Different types of Approvals. Plinth Area and Related Terms used in the Estimation of various Structures, Rules and Methods of Measurements of different Works. Specifications: Meaning, Purpose, types of Specifications, Method of preparation of Specification, General Specification, Detailed Specifications of different items of Buildings and other Structures – Rate Analysis – Data Sheet for Materials and various items of work in Buildings and other Structures, Schedule of Rates, Abstract Estimate of Buildings. Detailed Estimate of Buildings. Different items of work in Building; Principles of taking out Quantities, Detailed Measurement Form; Long Walls and Short Walls method of Building Estimate, Centre Line Method of Building Estimate. Estimate of RCC Building, Slope Roof Buildings; G.I. and A.C. Sheet, Detailed Estimate of different types of Doors and Windows, Electricity and Water Supply, Sanitation Works etc. Estimate of Earthwork; Different Formulae for Calculations, Estimate of Metalled Road, Tar Road, Concrete Road, Railway Track, Estimate of Culverts and Bridges etc. Valuation of Buildings; Purpose, Different Method of Building Valuation; Different Terms used in Valuation and their Meaning.

Text Books

1. Estimating and Costing in Civil Engineering by B.N. Dutta, Sangam Books.

2. Textbook of estimating and costing by G.S. Birdie, Dhanpat Rai Publishing Company Private Limited.

Reference Books

1. Estimation, Costing, Specifications and Valuation in Civil Engineering by M.Chakraborti.

2. Textbook on Estimating, Costing and Accounts by D.D. Kohli and R.C. Kohli, S Chand & Company Pvt. Ltd.

 CE3202 : FLUID MECHANICS – II

Navier-Stokes Equations (No Derivation), Boundary Layer Theory: Theory of Boundary Layer – Characteristics of Laminar Boundary Layer – Boundary Layer growth over a Flat Plate (without pressure gradient) – Boundary Layer Thickness and its Characteristics – Displacement, Momentum and Energy Thicknesses; Stability Parameter; Laminar and Turbulent boundary layers. Boundary Layer Separation – Mechanism of Separation, Control of
B.L. Separation; Boundary Layer on Rough Surfaces – Laminar Sublayer, Shear Friction Velocity; Friction Drag. Turbulent Flow: Critical Reynolds Number – Characteristics of Turbulent Flow – Mean and Fluctuating Components of Velocity. Analysis of Turbulent Flows – Shear Stress due to Turbulence –Velocity distribution for Hydrodynamically Smooth and Rough Pipes; Variation of Friction Factor in Turbulent Flow; Friction Factor for Commercial Pipes – Moody diagram. Flow through Pipes: Introduction to Pipe Flow and Laws of Friction – Reynolds Experiment; Steady Turbulent Flow through Pipes; Laws of Friction; Darcy-Weisbach Equation. Total Energy and Hydraulic Gradient – Energy and Hydraulic Gradient Lines; Minor Losses in Pipes; Pipes in Series and Parallel – Equivalent Length of Pipe. Flow Between Two Reservoirs; Three Reservoir Problems; Distribution Mains; Working Pressures, Design Pressure And Test Procedures; Choice Of Pipe Material; Siphon; Pipe

Network Analysis By Hardy–Cross Method; Hydraulic Power Transmission Through Pipes And Nozzles, Water Hammer (Only Concept). Drag, Lift & Propulsion: Concepts of Drag and Pressure Distribution over Immersed Bodies – Drag and Lift – Deformation Drag, Friction Drag, Form Drag – Drag coefficient. Distribution of Fluid Pressure on Immersed Bodies – Pressure Distribution for Flow Past a Circular Disk, Sphere; Effects of Eddy Pattern in Two Dimensional Flow –Distribution of Pressure for Two Dimensional Flow Past a Cylinder – von Kármán Vortex Trail, Eddy Shedding; Drag of Immersed Bodies – Variation of Drag Coefficient with Reynolds Number – Drag on Cylinder – Resistance Diagram for Bodies of Revolution; Drag Coefficient of Practical Bodies. Lift and Propulsion – Effect of Circulation in Irrotational Flow, Generation of Lift around a Cylinder, Magnus Effect. Open Channel Flows: Basic Concepts – Introduction, Classification of Open Channels – Classification of Flow; Channel Geometry – Geometric Elements of a Channel Section; Velocity Distribution in a Channel Section; Wide Open Channel; Measurement of Velocity; Velocity Distribution Coefficients; Pressure Distribution in a Channel Section – Effect of Slope on Pressure Distribution; Basic Equations – Chezy’s Equation, Manning’s Equation. Uniform Flow Computation; Conveyance of a Channel Section – Section Factor and Hydraulic Exponent. Flow Characteristics in a Closed Conduit with Open Channel Flow; Determination of Normal Depth and Velocity; Design of Channels for Uniform Flow; Design of Non-erodible Channels; Best Hydraulic Section; Determination of Section Dimensions for Uniform Flow; Most Economical Channel Sections – Rectangular, Trapezoidal, Circular and Triangular Channel Sections; Critical Flow – Computation of Critical Flow, Section Factor for Critical Flow. Application of Energy Principle in Open channels – Definition of Specific Energy, Specific Energy Diagram, Critical depth, Critical Velocity, Conjugate or Alternate Depths, Sub-critical, Critical and Super-critical Flows, Froude Number, Relationship between Critical depth and Specific Energy for Rectangular, Trapezoidal Sections; Application of Momentum Principle in Open channels – Specific Force; Canal Transitions – Change of Depth in Channels with Change in Cross-section and Hump in the Bed; Control Sections; Venturi Flume and Parshall Flume. Varied Flow in Open Channels: Analysis & computation of G.V.F: Definition of G.V.F. and Derivation of Governing Equation – Mild, Steep, Critical, Horizontal and Adverse Slopes.

Backwater and Drawdown Curves – G.V.F. Profiles for Channels with Changing Slopes; Computation of G.V.F. Profiles – Method of Direct Integration (Procedures only), Direct Step Method – Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple Slope cases only). Rapidly Varied Flow – Hydraulic Jump, Types of Jumps, Hydraulic Jump in Horizontal Rectangular Channels; Surges.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.

2. Flow in Open Channels by K.Subramanya, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Fluid Mechanics by A.K.Jain, Khanna Publishers.

2. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co. Ltd.

3. Flow through Open Channels by K.G.Ranga Raju, Tata McGraw-Hill Publishing Co.Ltd.

4. Open Channel Hydraulics by V.T.Chow, McGraw-Hill Ltd.

CE3203 : REINFORCED CONCRETE STRUCTURES – II

Retaining Walls: Types of Retaining Walls, Forces on Retaining Walls, Rankine and Coloumb Earth Pressure Theories (c and  soils). Passive Earth Pressure, Drainage of Retaining Walls. Stability Requirements. Preliminary Proportioning of Cantilever Retaining Walls. Design of Cantilever and Counterfort Retaining Walls. Water Tanks: Stress in Concrete and Steel in Water Tanks, Modular Ratio, Impermeability Requirements, Tanks resting on Ground and below Ground of Circular and Rectangular shapes; Elevated Circular and Rectangular Tanks resting on Maximum of 8 Columns; Design of Staging of Rectangular tanks.

Bridges: Components of a Bridge in Sub Structure and Super Structure. Classification of Bridges. Highway Loading Standards, Kerbs, Footpaths, Railings, Parapet Loadings, Impact, Wind, Longitudinal Forces. Design of Solid Slabs, Design of T-beam Bridge Deck Slab, Longitudinal and Cross Beams (Design any one component for exam), Courbon’s Theory. Piles and Pile Caps: Design of Bored Cast-in-situ Piles (Bearing and Friction types), Under Reamed Piles. Pile Caps Design; Bending and Truss Methods. Prestresed Concrete – Reinforced Concrete versus Prestressed Concrete – Prestressing Systems (Freyssinet, Gifford Udal, Magnel-Blatten) – Prestressing Losses – Steel and Concrete for Prestressing – Homogeneous Beam Concept, Limiting Eccentricities, Pressure Line, Elastic Stress Distribution across the Depth due to D.L., Eccentric Prestress and L.L.

Text Books

1. Reinforced Concrete structures Limit State by B. C. Punmia, Laxmi Publications.

2. Design of Reinforced Concrete Structures by M.L.Gambhir, PHI Publications.

3. R.C.C Design by Unnikrishna Pillai and Devadas Menon, McGraw-Hill

Reference Books

1. Limit State of Design of Reinforced Concrete by P. C. Vergheese, Prentice Hall India Learning.

2. Reinforced Concrete Limit state Design by P. Dayaratnam and P.Sarah, Oxford and IBH Publishers.

3. Reinforced Concrete Structures by N.Subramanyan, Oxford University Press.

CE 3204 TRANSPORTATION ENGINEERING – I

Highway Engineering-1: Highway Development and Planning, Classification of Roads, Highway Alignment, Highway Geometrics – Design of Cross Sectional Elements, Sight Distance, Horizontal and Vertical Alignment.

Highway Engineering-2: Traffic Engineering – Traffic Characteristics, Traffic Studies (Surveys), Traffic Control Devices – Design of Intersections. Design of Pavements – Design Factors, Design of Flexible Pavements – Group Index Method, CBR Methods, Design of Rigid Pavements – Westergaard Equations, I.R.C. Recommendations for Design of Concrete Roads. Highway Engineering-3: Construction of Roads – Earthen Roads – W.B.M. Roads – Bitumen Roads – Cement Concrete Roads – Highway Materials and their Properties and Tests. Maintenance of all types of Roads – Highway Drainage – Arborical Culture – Street lighting.

 Airport Engineering: Layout of Airports – Components Functions – Aircraft Characteristics – Airport Site Selection – Airport Obstructions – Runway Design – Visual Aids – Air Traffic Control.

Text Books

1. Highway Engineering by S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand

2. Airport Planning and Design by S.K.Khanna, S.G.Arora and S.S.Jain, Nem Chand and Bros.

Reference Books

1. Principle and Practice of Highway Engineering by R.C.Sharma and S.K.Sharma, Asia Publishing House.

2. Transportation Engineering by L.R. Kadiyali, Khanna Publications.

3. Principles of Transportation Engineering by Partha Chakraborty, PHI Learning.

4. Airport Engineering by Rangwala, Charotar Publications.

PE-II: CE3205A : STEEL STRUCTURES – II

Note: All the designs should be taught in the limit state design method as per IS 800-2007. Plate Girders (Bolted and Welded): Components of a Plate Girder, Economical Depth, Proportioning of Web and Flanges, Shear Buckling resistance of Web by Simple Post Critical and Tension Field Methods, Curtailment of Flange Plates, Connection of Flange Angles to Web and Flange Angles to Flange Plates. Web Stiffeners: Design of Bearing Stiffeners.
End Panel Design, Design of Intermediate Stiffeners, Connections.

Bridges: Classification, Loadings, Deck type Plate Girder Bridges. Bearings: Types of Bearings, Plate Bearing, Rocker Bearing, Roller Bearing, Knuckle Pin Bearing. Water Tanks: Introduction, Design of Elevated Circular and Rectangular Water Tanks. Plastic Analysis: Introduction, Upper and Lower Bound Theorems, Uniqueness Theorem, Shape Factor, Load Factor; Beams: Collapse Load for Fixed and Continuous Beams, Design of Beams; Frames: Collapse Load for a Frame of Single Bay Single Storey Frame.

Text Books

1. Limit State Design of steel structures by S.K.Duggal, McGraw-Hill Education Private Ltd.

2. Design of steel structures by K.S.Sai Ram, Pearson Education India.

3. Limit State Design of steel structures by Ramchandra and Virendra Gehlot, Scientific Publishers (India)

Reference Books

1. Design of Steel structures by N. Subramanian, Oxford University Press.

PE II: CE3205B : GROUND IMPROVEMENT TECHNIQUES

In-situ Densification Methods in Granular Soils: Introduction of Vibration at the Ground Surface, Impact at the Ground Surface, Vibration at Depth, Impact at Depth. In-situ Densification Methods in Cohesive Soils: Introduction, Preconsolidation Preloading using Sand Drains, Sand Wicks, Geodrains/Band drains, Forced Vacuum Preconsolidation, Stone and Lime Columns, Thermal Methods. Grouting: Objectives, Suspension, Emulsion and Solution Grouts, Categories of Grouting, Grouting Equipment, Stage Grouting in Soils by Tube-a-Manchettee, Ascending and Descending Stage Grouting, Hydrofracture, Grout Control Reinforced Earth: Principles, Components of Reinforced Earth – Fill, Reinforcing Material and Facing, Evaluation of Interfacial Friction of Fill and Reinforcing Material, Applications of Reinforced Earth, Design Principles of Reinforced Earth Walls

Geotextiles: Introduction, Types of Geotextiles; Functions and their Application, Tests for Geotextiles Soil Stabilization: Objectives, Methods of Stabilisation, Mechanical Stabilization: Proportioning of Materials by Rothfutch’s Method, Factors affecting Mechanical Stabilization, Cement and Lime Stabilization: Mechanisms, Engineering Benefits, Factors affecting Cement and Lime Stabilization, Construction Techniques, Bituminous Stabilization: Types of Soil – Bitumen, Factors affecting Bituminous Stabilization of Soils, Construction Methods. Deep Mixing of Soils with Lime/Cement: Lime-soil Columns, Soil-Cement Columns, Construction Methods, Applications. Stone Columns: Introduction, Construction Methods – Vibroflotation Technique and Rammed Stone Column, Functions and limitations.

Text Book

1. Ground Improvement Techniques, P.Purushothama Raj, Lakshmi Publications (P) Ltd.

Reference Books

1. Engineering Principles of Ground Modification, Monfred R Hausmann, McGraw-Hill Publishing Co.

2. Highway Engineering, Khanna S.K. and Justo C.E., Nem chand Publications.

PE II: CE3205C : IRRIGATION ENGINEERING

Development of Irrigation: Water Resources of India – Importance of Irrigation in Agriculture – Historical Evolution of Irrigation In India – Irrigation Development During Pre-Colonization – Colonization and Post-Colonization – National Water Policy – Inadequacy of Irrigation Management – Criteria for Good Irrigation Management.

Soil Water Plant Relationship: Soil Physical Properties Influencing Soil – Water Relationship– Forms and Occurrence of Soil Water – Classification of Soil Water – Soil Water Constants – Energy Concept of Soil Water – Forces acting on Soil Water – Soil Water Potential Concept – Soil Water Retention – Soil Moisture Measurement.

Crop Water Requirement: Water Requirement of Crops– Evapotranspiration and Consumptive Use – Methods of Estimating Evapotranspiration – Effective Rainfall – Irrigation Requirement– Duty of Water – Irrigation Efficiencies – Irrigation Scheduling – Irrigation Measurement. Surface Irrigation Methods: Canal Network and Canal Design – Surface Irrigation Methods – Types – Border Irrigation, Furrow Irrigation and Strip Irrigation– Specifications, Hydraulics and Design.

Drip and Sprinkler Irrigation Method: Sprinkler and Drip – History and Development, Types, Components, Design and Layout, Performance Evaluation, Operation and Maintenance.

Drainage Principles and Criteria: Factors to be considered in Land Drainage – Combined Irrigation and Drainage Systems – Water Balance – Equations for Water Balance – Drainage Surveys – Agricultural Drainage Criteria – Effect of Field Drainage Systems on Agriculture.

Irrigation Water Quality: Water Quality for Irrigation – Salinity and Permeability Problem – Root Zone Salinity – Irrigation Practices for Poor Quality Water – Saline Water Irrigation – Future Strategies

Text Books

1. Irrigation Engineering by G.L.Asawa, New Age International Publishers.

2. Irrigation and Water Power Engineering by B.C.Punmia and Pande B.B. Lal, Laxmi Publishing.

3. Irrigation Theory and Practices by A.M.Michael, A.M, Vikas Publishing Pvt. Ltd.

4. Irrigation Engineering by Gupta, B.L, and Amir Gupta, Satya Praheshan.

Reference Books

1. Irrigation Water Management (Principles & Practices) by Dilip Kumar Majumdar, Prentice Hall of India (P), Ltd.

2. Irrigation Engineering by N.N. Basak, Tata McGraw-Hill Publishing Co. Ltd.

3. Irrigation Engineering by R.K.Sharma, S. Chand & Company Pvt. Ltd.

CE3206 : HIGHWAY MATERIAL LABORATORY

Testing of Aggregates: Specific gravity – Sieve Analysis – Shape test – Flakiness Index – Elongation Index – Angularity Number – Aggregate Crushing value – Impact Value – Abrasion value – Stripping Value and Soundness. Testing of Bituminous Material: Specific Gravity – Penetration Value – Viscosity Value – Softening Point – Ductility Value – Flash and Fire Point. Testing on Soils: C.B.R. Test (IS 2720 – Part-XVI) – N.D.C. Penetration Test (IS 2720 PartXXXII) – Group Index. Testing on Bituminous Mixes: Bitumen Extraction Test, Marshal Stability Test (Demonstration)

Reference Book

1. Highway material testing by S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand & Brothers.

CE3207 : CONCRETE LABORATORY

1) Determination of Specific Gravity and Unit Weight of Cement

2) Determination of Specific Gravity and Unit Weight of Coarse and Fine Aggregates

3) Determination of Normal Consistency of Cement

4) Determination of Initial and Final Setting Time

5) Determination of Fineness of Cement.

6) Determination of Compressive Strength of Cement (for different grades of cement).

7) Determination of Bulking Characteristics of Sand.

8) Sieve Analysis of Coarse and Fine Aggregates and Classification as per IS 383.

9) Workability Tests on Green Concrete by using: Slump Cone, Compaction Factor Apparatus, Flow Table, Vee-Bee Consistometer.

10) Tests on Hardened Concrete. a. Determination of Compressive Strength b. Determination of Split tensile strength c. Determination of Modulus of rupture

11) Design of Concrete Mix by using IS Code Method (for class work only)

CE3208 : COMPUTER APPLICATIONS IN

 CIVIL ENGINEERING LABORATORY

Determination of Shear Force, Bending Moment, Deflection for Different Loading Conditions for a Simply Supported Beam and Cantilever Beam. Determination of Fixed End Moments for Different Loading Conditions of a Fixed Beam. Analysis and Design of Singly and Doubly Reinforced Beams. Analysis and Design of Columns, Footings. Estimation of Runoff for a Catchment. Estimation of Friction Factor for Laminar and Turbulent Flows, Minor Losses in Pipe Flow. Conversion of Angles from WCB to RB. Classification of Soils Determination of Coefficient of Permeability, Degree of Consolidation and Shear Strength. Computation of Water Surface Profiles in Open Channel Flows. Estimation of Settlement of Foundations in Cohesive soil, Stability Analysis of Slopes. Estimation of Earth Pressure in Cohesive and Cohesionless Soils. Basic AUTO CAD Commands Application of Drafting Tools and Modifying Tools Creation of 3 Dimensional Solids. Application of STAAD Pro/ETABS for the Analysis and Design of various Structural Components of Civil Engineering and Building Frames.

Text Books

1. Computer aided design-Software and Analytical tools by C.S. Krishnamoorthy and S. Rajesh, Alpha Science.

2. Computer Aided Design in Reinforced Concrete, V.L.Shah, Standard publishers distributors.

 IV Year – I Semester

CE4101 : GEOTECHNICAL ENGINEERING – II

Subsoil Exploration: Objectives, Methods of Subsoil Exploration Direct, Semi direct and Indirect Methods, Soundings by Standard, Dynamic Cone and Static Cone Penetration Tests, Types of Boring, Types of Samples, Criteria for Undisturbed Samples, Transport and Preservation of Samples, Borelogs, Planning of Exploration Programmes, Report Writing.

Bearing Capacity: Safe Bearing Capacity and Allowable Bearing Pressure, General and Local Shear Failures, Terzaghi’s Bearing Capacity Equations its modifications for Square, Rectangular and Circular Foundations, Factors affecting Bearing Capacity of Soil, Effect of Water Table on Bearing Capacity, IS Code Method for Bearing Capacity of Footings, Allowable Bearing Pressure based on N-values. Bearing Capacity from Plate Load Tests.

Shallow Foundations: Factors effecting locations of Foundation and Design considerations of Shallow Foundations, Types of Shallow Foundations and Choice of Type of Foundations, Foundations on Expansive Soils. Settlement Analysis: Types of Settlement, Causes of Settlement, Computation of Settlement of Footings in Saturated Clay and Granular Soils, Allowable Settlement. Measures to Reduce Settlement. Pile Foundations: Classification, Load carrying capacity of Pile – Dynamic Formula, Static Formula, Pile Load Tests; Efficiency of Pile Group, Load Carrying Capacity and Settlement of Pile Groups in Cohesive and Cohesionless soils, Negative Skin Friction, Under Reamed Pile. Caissons: Types of Caissons, Pneumatic Caissons, Different Shapes of Well Foundations, Relative Advantages and Disadvantages, Different Components of Well and their Functions, Bearing Capacity of Well Foundation, Grip Length, Problems in Well Sinking and Remedial Measures.

Stability Analysis of Slopes: Infinite and Finite Slopes, Stability Analysis of Infinite Slopes, Different Factors of Safety, Types of Slope Failures – Toe, Slope and Base Failure, Stability Analysis of Finite slopes – Swedish Circle Method, Friction Circle Method, Fellineous Method for Location of Critical Slip Circle, Taylor’s Stability Number. Earth Pressure: Types of Earth Pressure, Rankine’s Active and Passive Earth Pressure on Smooth Vertical Wall with Horizontal and Inclined Backfills. Coloumb’s Wedge Theory, Culmann’s and Rebhann’s Graphical Methods for Active Earth Pressure of Cohesionless Backfills, Stability Analysis of Retaining Walls.

Bulkheads: Classification, Analysis of Cantilever Sheet Piles in Sand and Saturated Clay, Analysis of Anchored Bulkhead by Free Earth Support Method in Granular Soil.

Text Books

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publishers

2. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers.

Reference Books

1. Foundation Engineering by P.C. Varghese, Prentice Hall of India

2. Foundation Analysis and Design by J. E. Bowles, Mc Graw-Hill Publishing Co.

CE4102 : FLUID MECHANICS – III

Dimensional Analysis and Similitude: Fundamental Concepts of Dimensional Analysis – Importance of Dimensional Analysis & Model Study; Units and Dimensional Formulae for Various Engineering Quantities; Fourier Concept of Dimensional Homogeneity. Methods of Arriving at Dimensionless Groups – Non-dimensional Parameters; Rayleigh’s Method; Buckingham  method – Buckingham modified method; Omitted and Superfluous variables.

Examples in Dimensional Analysis – Capillary Rise, Drag on Cylinder, Resistance of a Ship, Discharge over a Sharp Crested Weir, Fall Velocity of a Sphere, Head Characteristics of a Pump, Thrust on a Propeller, Similarity and Similarity Laws – Concepts of Similarity – Geometric, Kinematic and Dynamic Similarities; Modeling Criteria; Similarity Laws – Important Dimensionless Numbers – Reynolds Number, Froude Number, Mach Number, Euler Number, Weber Number. Application of Similarity Laws to Practical Problems – Bodies Completely Submerged in Fluids, Bodies Subjected to Gravity and Viscous Forces, River Models – Manning’s Law; Distorted Models – Depth Distortion and Slope Distortion; Problems Related to Modeling of Spillways, Ships, Pumps and Turbines.

Impact of Jets: Force Exerted by Fluid Jet on Stationary and Moving Flat and Curved Vanes, Torque and Work Done by Series of Moving Vanes.

Hydraulic Machines– Turbines: Introduction and Classification of Turbines – Function of Prime Movers and Pumps, Hydraulic Turbines, Classification Based on Head, Discharge, Hydraulic Action – Impulse and Reaction Turbines, Differences Between Impulse and Reaction Turbines; Choice of Type of Turbine – Specific Speed. Working of Impulse Turbines and Design Principles – Components and Working Principles of A Pelton Turbine – Work Done; Hydraulic and overall Efficiencies; Design of Pelton Turbine – Working Proportions; Governing Mechanism for a Pelton Turbine. Working of Reaction Turbines and Design Principles – Components and Working Principles of a Francis Turbine – Work Done; Hydraulic and overall Efficiencies; Design of Francis Turbine – Working Proportions; Governing Mechanism for a Francis Turbine. Draft Tube Theory – Functions and Types of Draft Tubes in Reaction Turbines, Efficiency of Draft Tube; Kaplan Turbine and Working Proportions of Kaplan Turbine.

Performance and Characteristics of Turbines: Unit Quantities, Specific Speed and its Importance; Model Relationships; Operating Characteristic Curves; Cavitation Problem in Turbines – Thoma’s Cavitation Factor. Hydraulic Machines – Centrifugal Pumps Functions of a Pump – Types of Pumps – Selection Criterion – Rotodynamic and Positive Displacement Pumps – Comparison between Centrifugal & Reciprocating Pumps.

Centrifugal Pumps – Components & Working principles of Centrifugal Pumps; Classification of Centrifugal Pumps – Impellers based on Shape and Type of Casing, Pump with Volute Casing, Pump with Vortex Chamber & Pump with Guide vanes, Closed, Semi-closed & Open Impellers, Axial, Radial & Mixed Flow Impellers; Working Head and Number of Stages, Single & Double Suction. Work done by Centrifugal Pumps – Pressure Change in a Pump, Manometric and Static Head – Velocity triangles – Effect of Vane Shape; Pump Losses and Efficiency – Pressure Rise in the Impeller – Minimum Starting Speed of pump – Multistage Pumps; Pumps in Parallel and Series; Cavitation – Limitation of Suction Lift, NPSH and its importance in Selection of Pumps. Performance Characteristics of Pumps – Similarity Relations and Specific speed of Pumps – Dimensionless characteristics – Constant Efficiency Curves of Centrifugal Pumps. Hydraulic Machines – Reciprocating Pump & Hydraulic Ram: Reciprocating Pumps – Fundamental concepts, Component Parts and Working principle of Single Acting and Double Acting Reciprocating Pumps – Discharge Coefficient, Volumetric Efficiency and Slip; Work done by Reciprocating pumps – Work Done and Power Input – Indicator Diagram – Effect of Acceleration and Friction on Indicator Diagram – Maximum Speed of Rotation of Crank; Air Vessels and their principles – Modified Indicator Diagram in the presence of Air Vessels, Work Saved due to Presence of Air Vessel, Flow into and from Air Vessel. Hydraulic Ram – Working Principle of Hydraulic Ram.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.

2. Fluid Mechanics by Jain, A.K., Khanna Publishers.

Reference Books

1. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co. Ltd.

2. Hydraulic Machines by Jagadish Lal, Metropoliton Book Company.

 CE4103 : WATER RESOURCES ENGINEERING – I

Introduction to Hydrological Aspects: Water Resources in India, Hydrology in Water Resources Planning – Hydrologic Planning –Water Budget Equation; Climate and Weather – Importance of Monsoon Rains, Clouds, Storms and Precipitation – Precipitation – Types, Measurement of Rainfall; Influence and Feedbacks of Hydrological Changes Due to Climate Change; Average Depth of Rainfall over an Area, Mean Annual Rainfall, Analysis of Rainfall Data – Consistency of Rainfall Record, Double Mass Curve, Depth –Intensity, Depth-Area-Duration Curves, Frequency of Point Rainfall – Intensity-DurationFrequency (IDF) Curves, Probable Maximum Precipitation (PMP) Curves; Infiltration – Factors affecting and its Determination, Infiltrometers; Evaporation and Evapo-Transpiration – Pan Evaporation; Runoff – Factors Affecting Runoff, Methods of Determination of Runoff, Hydrograph Analysis, Base Flow Separation, Unit Hydrographs, Hydrograph of Different Durations, Applications of Unit Hydrograph; S-Hydrograph, Synthetic Unit Hydrograph; Stream Flow Measurement – Gauge Discharge Curves. Groundwater Flow: Mechanics of Interstitial Flow, Definitions, Subsurface Distribution of Water, Ground Water Movement; Darcy’s Law; Permeability – Intrinsic Permeability; Well Hydraulics – Steady Flow in Different Types of Aquifers and Wells; Determination of Hydraulic Properties of Aquifer; Well Losses; Specific Capacity of Well; Well Efficiency – Pumping Tests – Recuperation Test Method for Determination of Well Yield. Rain Water Harvesting and Recharging of Underground Storage – Methods of Recharging – Infiltration Galleries, Infiltration Wells, Springs. Methods of Construction of Open Well–Yield of an Open Well – Methods of Construction of Tube Wells, Well Shrouding and Well Development, Spacing of Tube Wells, Design of Tube Well; Pumping Requirements, Centrifugal and Bore Hole Type Pumps; Collector Wells. Reservoir Planning and Flood Routing: Types of Reservoir – Investigations for Reservoir Planning, Selection of Site for a Reservoir, Zones of Storage in a Reservoir; Purpose of Reservoir, Design Studies, Reservoir Regulation, Reservoir Yield, Mass Curve and Demand Curve, Determination of Reservoir Capacity, Yield From a Reservoir of given Capacity; Operating Schedules – Rule Curve for Reservoir Operation; Economics of Water Resources Projects – Apportionment of Total Cost of a Multi Purpose Project, Benefit – Cost Ratio.

Reservoir Losses – Measures To Reduce Evaporation Loss in Reservoirs Sedimentation, Control of Reservoir Sedimentation. Flood Routing – Hydrologic Reservoir Routing by Puls Method of Routing, Channel Routing by Muskingum Method. Irrigation: Definition of Irrigation, Types of Irrigation Systems – Direct and Indirect, Lift and Inundation Irrigation Systems, Methods of Irrigation – Surface and Sprinkler Methods, Trickle or Drip Irrigation, Soil Moisture Constants, Depth of Water Held By Soil In Different Zones, Water Extraction – Quality of Irrigation Water, Irrigation Efficiencies – Soil Moisture – Irrigation Relationship – Estimating Depth and Frequency of Irrigation on the Basis of Soil Moisture Regime Concept; Water Requirements of Crops, Duty, Delta and Base Period – Their Relationship, Crops – Seasons, Factors Affecting Duty and Methods of Improving Duty, Consumptive Use of Water –Determination of Evapotranspiration – Blaney-Criddle and Penman Equations and Hargreaves Method; Determination of Canal Capacities for Cropping Patterns, Size of Reservoir, Assessment of Irrigation Water Charges. Canal Systems: Classification of Irrigation Canals – Canal Alignment, Design of Unlined Canals, Regime Theories – Kennedy’s and Lacey’s Theories, Critical Tractive Force Method, Design Problems – Balancing Depth – L.S. of a Channel – Design According to I.S: 7112, 1975; Schedule of Area Statistics, Cross Section of an Irrigation Channel – Maintenance of Irrigation Channel. Regulation of Channel System – Canal Outlets, Requirements of a Good Outlet – Types of Outlets; Water Logging – Causes and Control – Land Drainage; Canal Lining – Methods, Design of Lined Canals, Canal Navigation – Requirements, Methods to make Navigability Feasible.

Text Books

1. Irrigation and Water Power Engineering by B.C.Punmia and P.B.B. Lal, Laxmi Publications Pvt. Ltd.

2. Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House.

Reference Books

1. Irrigation and Hydraulic Structures by S.K.Garg, Khanna Publishers.

2. Engineering Hydrology by K.Subramanya, Tata McGraw-Hill Education Private Limited.

3. Hand Book of Applied Hydrology by V.T.Chow, McGraw-Hill Book Co.

4. Impacts of Climate Change and Climate Variability on Hydrological Regimes by Jan C. van Dam, Cambridge University Press.

5. Hydrology: Principles, Analysis and Design by H.M.Raghunath, New Age International.

6. Ground Water by H.M.Raghunath, New Age International.

CE4104 : CONSTRUCTION MANAGEMENT

Bar Charts, Milestone Charts, Weaknesses in Bar Charts PERT and CPM: Introduction, Event, Activity, Dummy Activities, Rules for Drawing Networks, Numbering the Events (Fulkerson’s Law) Time Estimates and Evaluation of Critical Path – Optimistic Time, Most Likely Time, Pessimistic Time, Expected Time, Earliest Allowable Occurrence Time, Latest Allowable Occurrence Time, Slack, Project Duration, Probability of Completion, Start and Finish Time Estimates, Floats, Project Scheduling, Critical and Sub-Critical Paths. Cost-Time Optimization: Direct and Indirect Costs, Normal and Crash Costs and Times, Crashing of The Activity, Optimization of Project Cost. Updating and Resource Allocation – Process of Updating, Updating Cycle, Updated Networks, Resource Histograms, Resource Smoothening, Resource Leveling. Works Management and Contracts – Department Execution of Works, Master Roll Form 21, Piece Work Agreement Form, Work Order, Definition of Contract, Element of Contract, Valid Contract, Notice Inviting Tender, Tender Forms, Bidding Process, Earnest Money, Security Deposit, Award of Contract, Types of Contracts – Lumpsum Contract, Item Rate Contract, Cost Plus Percentage Contract, Special Contracts, Disputes, Claim Settlement Through Arbitration. Management – Significance of Construction Management, Concept of Scientific Management, Qualities of Manager, Organization – Authority, Policy, Recruitment Process and Training Development of Personnel. Labour Problems, Labour Legislation in India, Workmen Compensation Act 1923, and Subsequent Amendments, Minimum Wages Act 1948.

Text books

1. PERT and CPM Principles and Applications by L. S. Srinath, Affiliated East-West press Pvt. Ltd.

2. Estimating and Costing in Civil Engineering (Theory & Practice) by B.N.Dutta UBS Publishers Distributors Pvt. Ltd; 28th Revised Edition.

Reference Books

1. Project Planning and Control with PERT and CPM by B.C. Punmia, Laxmi Publications.

2. Construction Management and Planning by H.Guha and Sen Gupta, Tata McGraw – Hill Publishing Co. Ltd.

PE-III: CE4105A : PRESTRESSED CONCRETE STRUCTURES

Introduction, Basic Concepts of Prestressing, Need for High Strength Steel and Concrete, Advantages of Prestressed Concrete; Materials for Prestressed Concrete, High Strength Concrete and High Strength Steel. Prestressing Systems (1) Freyssinet System (2) Gifford Udall (3) Magnel-Blatan System, Tensioning Devices, Anchoring Devices. (D) Pretensioning and Post Tensioning Prestressing Losses, Elastic Shortening, Loss due to Shrinkage, Loss due to Creep, Loss due to Friction, Loss due to Curvature etc.; I.S. Code Provisions Analysis of Prestressed Members, Assumptions, Pressure or Thrust Line; Concept of Load Balancing, Cable Profile, Kern Distance, Stress in Tendons as Per IS 1343, Cracking Moment. Deflection of Prestressed Concrete Beams Limit State Design of Flexural Members, Stresses, I.S. Code Provisions, Design of Symmetrical Beams, Design of Prestressed Concrete Poles, Design for Shear, I.S. Code Provisions. Transfer of Prestress (Pretensioned Members), Transmission Length, Bond Stress, Transverse Tensile Stress, End Zone Reinforcement, Flexural Bond Stress, I.S. Code Provisions. Anchorage Zone in Post Tensioned Members, Stress Distribution in End Block, Guyon’s Method of Approach of Analysis of End Block (not more than 2 Cables).

Text Book

1. Prestressed Concrete by N.Krishna Raju., Tata McGraw-Hill Education

Reference Books

1. Prestressed Concrete by N.Rajagopalan, Alpha Science International.

2. Prestressed Concrete by P. Dayaratnam, Oxford and IBH Publishers.

3. Design of Prestressed Concrete Structures by T.Y. Lin and Ned.H. Burns, Wiley India.

PE III: CE4105B : ELEMENTS OF COASTAL ENGINEERING

Introduction, General Design Considerations for Coastal Engineering. Long Period Waves: Tides, Seiches, Tsunamis, Storm Surge and Wind Set Up. Solutions of Linear Wave Equation for Progressive and Standing Waves – Pressure Velocity Fields – Surface Profile and Dispersion Relationship – Principle of Super Position – Wave Energy, Energy Flux and Energy Principle – Group Velocity. Wave Mechanics. Celerity and Group Velocity. Wind Generated Waves. Wave Statistics. Wave Transformation: Shoaling, Refraction, Diffraction and Reflection. Wave Breaking Criteria. Wave Forecasting for Deepwater Waves. Beach Profiles and Surf Zone Wave Breaking. Sediment Transport. Impacts of Coastal Structures on Shoreline Changes. Seawalls, Breakwaters, Groins, Jetties, Wharves. Wave Forces on Walls. Design of Breakwaters: Rubble Mound-Type, Wall-Type, Structural Cross-Section. Wave Forces on Piles – Basic Assumptions – Values of the Inertia and Drag Coefficients and Their Dependence on the Wave Theory used.

Text Books

1. Water Wave Mechanics for Engineers and Scientists by R.G.Dean and R.A.Darlymple, World Scientific Publishers.

2. Coastal Hydrodynamics by J.S.Mani. PHI Publishers 2nd Edition.

Reference Books

1. Basic Coastal Engineering by R.M.Sorense, 3rd Edition, Springer.

2. Coastal Engineering Manual (CEM). US Army Coastal Engineering Research Center, 2002-2006. (Download from CECIL or USACE website).

 PE III: CE4105C : INTRODUCTION TO ROCK MECHANICS

Introduction: Geological Formation of Rocks, Structural Geology, Classification of Rocks, Defects in Rock, Physical, Mechanical Properties of Rocks, Exploration Techniques – RQD and RMR, Laboratory Tests for Shear Strength, Tensile Strength, Flexural Strength, Elastic Constants, Field Tests – Test for Deformability, Shear Tests and Strength Tests Improvement Techniques for Rock: Grouting, Rock Bolting, Rock Reinforcement - Mechanism, Types of Reinforcement, Steps Involved in Installation, Foundations on Rock, Rock Blasting– Explosives, Selection Criteria for Explosives, Steps Involved in Blasting

Text book

1. Rock Mechanics for Engineers by B.P.Verma, Khanna Publishers

Reference Books

1. Rock Characterization, Testing and Monitoring by E.T.Brown, Pergamon Press, London, U.K

2. Rock Mechanics on the Design of Structures in Rock by Oberti and Duvalk, W. L. John Wiley & Sons.

3. Rock Mass Classification Systems – A Practical Approach in Civil Engineering by B.Singh and R.K.Goel, Elsevier Publisher.

 PE III: CE4105D : SOLID WASTE MANAGEMENT

Introduction: Definition of Solid Waste, Garbage, Rubbish–Sources and Types of Solid Wastes. Characteristics of Solid Wastes: Physical, Chemical and Biological Characteristics– Problems due to Improper Disposal of Solid Waste.

Solid Waste Management: Definition– Reduction, Reuse, Recycling and Recovery Principles of Waste Management – Functional Elements of Solid Waste Management – Waste Generation and Handling at Source – Collection of Solid Wastes – Collection Methods and Services– Guidelines for Collection Route Layout. Transfer and Transport of Wastes: Transfer Station – Processing and Segregation of the Solid Waste – Various Methods of Material Segregation.

Processing and Transformation of Solid Wastes: Composting: Definition–Methods of Composting – Advantages of Composting – Incineration: Definition – Methods of Incineration– Advantages and Disadvantages of Incineration.

Disposal of Solid Waste: Volume Reduction, Open Dumping, Land Filling Techniques. Landfills: Classification–Design and Operation of Landfills, Land Farming, Deep Well Injection.

Text Books

1. Integrated Solid Waste Management: Engineering Principles and Management Issues by George Tchobanoglous, Hilary Theisen, Samuel A Vigil. McGraw-Hill Series in Water Resources and Environmental Engineering.

2. Environmental Engineering by Howard S.Peavy, Donald R.Rowe and George Techobanoglous.

PE-IV: CE4106A : ENVIRONMENTAL IMPACT ASSESMENT

Concept of Environment – Definition of EIA and EIS – Elements of EIA – Guidelines for the Preparation of EIS – Governmental Policies for Environmental Protection. Environmental Setting – Environmental Attributes – Air, Water, Soil, Noise, Ecological, Social, Economical, Cultural, Human and Aesthetic Aspects – Environmental Indices.

Methodology for the Identification of Impacts – Criteria for the Selection of Methods – Methodologies – Adhoc, Checklist, Overlaying, Matrix and Network Methods. Prediction and Assessment of Impacts on – Air, Water, Soil, Noise, Ecological, Social, Economical, Cultural, Human Environments and Aesthetic Aspects. Review of Environmental Impact Statement – Cost Benefit Analysis – Measures for Environmental Impact Mitigation and Control – Case Studies.

Text Books

1. Environmental Impact Assessment by Larry W. Canter. McGraw-Hill Co.

2. Environmental Impact Assessment Methodologies by Y.Anjaneyulu, and Valli Manikkam, BSP Books PVT Ltd.

Reference Book

1. Environmental Impact Assessment by R.K.Jain, L.V.Urban, G.S.Stacey and H.E. Balbach, McGraw-Hill Co.

PE-IV: CE4106B : EARTH RETAINING STRUCTURES

Earth Pressure: Basic Concepts, Rankine and Coulomb Earth Pressure Theories, Determination of Active and Passive Pressures: Culmann’s Graphical Method, Logarithmic Spiral Methods, Friction Circle Method. Consideration of Surcharge, Seepage, Earthquake, Wave Effect, Stratification, Type of Backfill, Wall Friction and Adhesion. Retaining Structures: Uses, Types, Stability and Design Principles of Retaining Walls, Backfill Drainage, Settlement and Tilting.

Sheet Pile Walls: Types, Design of Cantilever Sheet Pile Walls in Granular and Cohesive Soils; Design of Anchored Sheet Pile Walls by Free and Fixed Earth Support Methods, Rowe’s Theory of Moment Reduction, Design of Anchors.

Braced Excavations: Types of Sheeting and Bracing Systems, Lateral Earth Pressure on Sheeting in Sand and Clay, Design Components of Braced Cuts. Cellular Cofferdams: Types – Diaphragm and Circular Type, Design by TVA Method. Stability of Cellular Cofferdams, Cellular Cofferdams in Rocks and Soils.

Text Book

1. Foundation design by W. C. Teng, Prentice Hall

Reference Books

1. Basic and Applied Soil Mechanics by Gopal Rajan and A.S.R. Rao, New Age International Publishers.

2. Soil Mechanics in Engineering Practice by K.Terzaghi and R.B.Peck, John Wiley & Sons.

3. Foundation Analysis and Design by J. E. Bowles, Mc Graw-Hill Publishing Co.

 PE-IV: CE4106C : AIRPORT PLANNING AND DESIGN

Air Transport: History of Air Transport, Structure and Organisation of Air Transport, National Airports Authority, Airports Authority of India, International Civil Aviation Organisation. Airport Characteristics: Requirements of Aircraft Types, Weight Components, Aeroplane Component Parts, Classification of Flying Activity, Aircraft Characteristics. Airport Planning: Airport Master Plan, Regional Planning, Airport Site Selection, Estimation of Future Air-Traffic Needs. Airport Obstructions: Zoning Laws, Classification Of Obstructions. Runway Design: Runway Orientation, Basic Runway Length, Corrections, Airport Classification, Runway Geometry Design. Airport Capacity and Configuration, Runway Intersection Design, Taxiway Design: Geometric Design Standards, Exit Taxiways, Holding Aprons. Terminal Area and Airport Layout: Building Area, Terminal Area, Apron, Hangar, Typical Airport Layouts. Visual Aids: Airport Marking, Airport Lighting Air Traffic Control: Need of Air Traffic Control Air Traffic Control Network, Air Traffic Control Aids – Enroute Aids and Landing Aids, Instrumental Landing System

Text Book

1. Airport Planning and Design by S.K. Khanna, M.G. Arora, S.S. Jain, Nem-Chand and Bro.

Reference Book

1. Airport Engineering by Rangwala, Charotar Publications.

PE IV: CE4106D : FINITE ELEMENT METHOD OF ANALYSIS

Matrix Methods of Analysis – Introduction, Analysis of Beams and Portal Frames (One Bay, One Storey Two Bay, Two Storey) by Stiffness Method and Flexibility Method.

Introduction: A Brief History of F.E.M, Need of the Method, Applications of FEM, Review of Basic Principles of Solid Mechanics, Basic Equation in Elasticity Equations of Equilibrium, Constitutive Relationship, Concept of Plane Stress, Plain Strain, Concept of Axi-Symmetric Elements. Concept of Energy Principles and Methods. Basic Theory Relating to the Formulation of the Finite Element Method, Element Shapes, Nodes, Nodal Degree of Freedom, Node Numbering, Coordinate System (Local and Global), Convergence Requirements, Compatibility Requirement, Geometric Invariance. Finite Element Analysis of Single Bar Element (One-Dimensional Problem) – Shape Functions, Derivation of Stiffness Matrix, Stress-Strain Relations – All with Reference to Bar Element and Trusses under Axial Forces.

Text Books

1. Structural Analysis – A Matrix Approach by G.S.Pandit and S.P.Gupta, Tata McGrawHill Publishing Co. Ltd.

2. Introduction to the Finite Element Method by C.S.Desai and J.F.Abel, Van Nostrand.

3. Finite Element Analysis by C.S.Krishnamoorthy, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla, Ashok D.Belegundu, Prentice-Hall of India Private Limited.

2. Finite Element Analysis by S.S.Bhavikatti, New Age International Publishers.

3. Basic Structural Analysis by C.S. Reddy, Tata McGraw-Hill, New Delhi.

4. Finite Element Methods for Engineers by Reger, T. Fenuer, The Macmillan Ltd., London.

CE4107 : GEOTECHNICAL ENGINEERING LABORATORY – II

1. Field identification and Classification of Soils

2. Determination of Relative Density of Sand

3. Determination of Unconfined Compressive Strength of Clay

4. Determination of Shear Parameters of Soil by Direct Shear Test

5. Determination of Undrained Shear Parameters of Soil by Triaxial Compression Test

6. Determination of Undrained Shear Strength and Cohesion of Soft Clay by Vane Shear Test

7. Determination of Differential Free Swell and Swell Pressure of Clay

8. Determination of Coefficient of Consolidation of Clay by Taylor and Casagrande Methods of Time Fitting

Demonstration experiments

1. Standard Penetration Test 2. Determination of Compression Index of Clay by Oedometer Test

Reference Books

1. Relevant IS Codes of Practice

CE4108 : FLUID MECHANICS LABORATORY– II

1) Study of Characteristics of a hydraulic jump – To measure and draw (E1-E2)/E1 vs F1 and Lj / y2 vs F1, and compare with theoretical results wherever possible.

2) Study of Rugosity Coefficients in an Open Channel Flow.

3) Study of Major Losses in Pipes – Pipe Friction – To Compute Darcy-Weisbach Friction Factor.

4) Study of Drag Characteristics of a Circular Cylinder with its Axis Normal to the Direction of Flow. To measure the Pressure Distribution on the Surface of a Cylinder and Plot the Dimensionless Pressure Variation around the Cylinder and Compute the Pressure Drag. To measure the Velocity Variation in the Wake of the Cylinder, Velocity of Approach, and Compute the Total Drag by Momentum Principle.

5) Study of Performance Characteristics of a Centrifugal Pump – To Measure the Discharge, Head Developed and Power Input at Various Discharges for Centrifugal Pump and Draw the Performance Characteristics.

6) Study of Performance Characteristics of a Reciprocating Pump – To Measure the Discharge, Head Developed and Power Input at Various Discharges for Reciprocating Pump and Calculate Percentage Slip and Efficiency.

7) Study of Performance Characteristics of a Pelton Turbine – To Measure the Discharge, Head Difference across the Turbine, the Brake load, Speed of Turbine for Various Discharges and Draw the Performance Characteristics.

8) Study of Performance Characteristics of a Francis Turbine – To Measure the Discharge, Head difference across the Turbine, the Brake Load, Speed of Turbine for Various Discharges and Draw the Performance Characteristics. 9) Study of Impact of a Jet on Flat and Curved Vanes.

IV Year – II Semester

 CE4201 : WATER RESOURCES ENGINEERING – II

Storage Works: Classification of Dams, Factors Governing Selection of Types of Dam, Selection of Site, Preliminary Investigation.

Gravity Dams: Forces acting on a Gravity Dam, Stability Criteria, Modes of Failure – Elementary and Practical Profiles, Stability Analysis, Principal and Shear Stress – Construction Joints, Openings in Dams – Galleries, Foundation Treatment of Gravity Dam. Earth Dams: Types, Foundation for Earth Dams, Design of Earth Dams, Causes for Failure of Earth Dams, Criteria for Safe Design, Phreatic Line, Seepage Analysis – Seepage Control Through Body and Foundation.

Spillways: Essential Requirements, Spillway Capacity, Components, Types of Spillways and Their Working, Design of Ogee Spillway, Energy Dissipation Below Spill Way, Scour Protection, Use of Hydraulic Jump as Energy Dissipater – Design of Stilling Basins – USBR and IS Standard Basins; Spillway Crest Gates – Different Types. Diversion Head Works: Types, Location and Components, Effects of Construction of Weirs on Permeable Foundation, Bligh’s, Lanes and Khosla’s Theories, Method of Independent Variables, Design Principles of Weirs and Barrages, Design of Weirs on Permeable Foundations, Design of Vertical Drop Weir, Silt Control Devices. Regulation Works: Canal Falls – Definition, Necessity and Location, Classification of Falls, Design Principles of Syphon Well Drop, Notch Fall, Sarada Fall, Straight Glacis Fall; Offtake Alignment; Cross Regulator and Distributary Head Regulator – Design of Cross Regulator and Distributor Head Regulator.

Cross Drainage Works: Types, Factors Affecting the Suitability of Each Types, Classification of Aqueducts, Design Principles of Different Types of Aqueducts. River Training Works: River Training and its Objectives, Classification of River Training Works, Marginal Embankment, Guide Banks, Groynes, Cutoffs, Bank Pitching, Launching Aprons, Miscellaneous Types of River Training Works.

Water Power Engineering: Development of Hydro Power in India, Assessment of Available Power, Utilisation Factor, Load Factor, Diversity Factor, Storage and Pondage; Types of Hydro Power Schemes; Components of Hydel Schemes – Fore Bay, Intake Structure, Trash Racks, Surge Tanks; Water Hammer Pressure, Substructure and Superstructure of Power House.

Text Books

1. Irrigation and Water Power Engineering by Punmia, B.C. and P.B.B. Lal, Laxmi Publications Pvt. Ltd.

2. Irrigation Water Resources and Water Power Engineering by Modi, P.N., Standard Book House.

3. Irrigation and Hydraulic Structures by Garg, S.K., Khanna Publishers.

Reference Book

1. Hand book of Applied Hydrology, Chow, V.T., McGraw-Hill Book Co.

 CE4202 : TRANSPORTATION ENGINEERING– II

Railway Engineering-1: Historical Development of Railways in India – Advantages of Railways – Classification of Indian Railways – Permanent Way – Components and their Functions – Rail Joints – Welding of Rails – Creep of Rails – Rail Fixtures and Fastenings. Railway Engineering-2: Track Geometric Design – Points and Crossings – Track Drainage – Layout of Railway Stations and Yards – Signals – Interlocking – Track Circuiting – Track Maintenance. Dock and Harbour Engineering: Layout of Port Components – Functions – Classification of Ports – Site Selection – Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – Navigational Aids.

Tunnel Engineering: Alignment of Tunnels – Cross-Section of Tunnels – Construction Methods of Tunnels – Tunnel Lining – Ventilation – Drainage – Muck Disposal.

 Text Books

1. Railway Engineering by S.C. Saxena and S. Arora, Dhanpat Rai Publications Pvt. Ltd.

2. Roads Railways Bridges Tunnel Engineering by T.D.Ahuja and G.S.Birdie, Standard Book House.

3. Dock and Harbour Engineering by P. Hasmukh, Oza and H.Gautam Oza, Charotar Publishing House Pvt. Ltd.

 Reference Books

1. Harbour, Dock and Tunnel Engineering by R.Srinivasan, Charotar Publications.

2. Railway Engineering by S.C.Rangwala, Charotar Publishing House.

3. Railway Bridge and Tunnel Engineering by Rangwala, Charotar Publishing House.

CE4203 : INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Unit-I : Basic Concepts of Management Management:- Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Unit-II : Forms of Business Organizations: Introduction, Types of Business Organizations: Private Sector – Individual Ownership, Partnership, Joint Stock Companies and Co-Operative Organizations; Public Sector– Departmental Organizations, Public Corporations and Government Companies; The Joint Sector Management.

Unit-III : Production and Operations Management: Plant Location– Factors to be considered in the Selection of Plant Location; Break-even Analysis– Significance and Managerial Applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Unit-IV : Entrepreneurship : Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs Professional Managers, Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Unit-V : Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea Generation: Sources and Techniques; Stages in Project formulation; Steps for starting a Small Enterprise – Incentives for Small Scale Industries by Government.

Text Books

1. Industrial Organization and Engineering Economics by T.R.Banga and S.C.Sharma , Khanna Publishers.

2. The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth) by Vasant Desai, HImalayan Publishing House.

Reference Books

1. Management Science by A.R.Aryasri, McGraw-Hill Education (India Private Limited.

 2. Entrepreneurship, P.Sheela and K.Jagadeswara Rao, Shree Publishing House.

 PE-V: CE4204A : INDUSTRIAL WASTE TREATMENT

Characteristics of Waste Water of Specific Industries, Characteristics of Treatment Plant Effluents, Effect of Waste Water on Self Purification Capacity of Streams, Primary Treatment of Waste Water. Principles of Biological Waste Treatment; Microbiological Growth Rate Kinetic Equations, Sludge Production, Oxygen Requirements, Continuous Flow Treatment Models. Aerobic Treatment Studies in Continuous and Semi-Continuous Reactors. Anaerobic Treatment, Studies, Nitrogen and Phosphorus Removal. Biological Treatment Facilities: Process Designs of the following Units W.R.T. Industrial Wastes; Activated Sludge Process; Trickling Filter; Sludge Digestion Units; Aerated Lagoons; Stabilization Ponds (Oxidation Ponds); Oxidation Ditches (Paveer Ditches); Rotating Biological Contactor; Anaerobic Filter. Principles of Industrial Waste Treatment: Waste Reduction Pretreatment of Wastes, Collection and Segregation of Wastes, Reduction in Volume and Strength Neutralisation; Equalisation; Proportioning. Manufacturing Processes, Flow sheets; Characteristics and Treatment of Wastes and Disposal Methods of the following Industries – Sugar, Dairy, Distillery, Paper, Tannery, Textile, Sheet, Fertiliser, Oil Refinery and Petrochemicals.

Text Books

1. Industrial Wastewater Treatment by A.K. Patwardhan. PHI.

2. Waste Water Treatment by M.N. Rao and A. K. Datta.3rd Ed. Oxford & IBH Publishing Co Pvt. Ltd .

Reference Book

1. Industrial Pollution Control by Eckenfelder Jr., McGraw-Hill Co.

 PE-V: CE4204B : HYDRAULIC STRUCTURES

Types of Dams, Merits and Demerits, Dam Site Selection, Selection of Dam, Forces acting on Gravity Dam, Methods of Analysis of Gravity Dam, Modes of Failure and Stability Requirements, Design Criteria and Factor of Safety. Elementary Profile of a Gravity Dam, Low and High Gravity Dams, Zoning of Dams, Galleries in Dams, Temperature Control in Mass Concrete; Foundation Treatment for Concrete Dams; Gravity Dams Subjected to Earthquakes. Buttress and Arch Dams, Types, Selection, Merits and Demerits, Elementary Design Principles of Arch and Buttress Dams. Earth Dams, their Components and Functions, Causes of Failure, Factors Influencing the Design of an Earth Dam. Design Criteria for Earth Dam. Spillways, Types of Spillways and their Design Principles, Energy Dissipation in Spillways, Use of Hydraulic Jump as Energy Dissipater and Design of Stilling Basins, Types of Spillway Gates. Principal Components of Hydro Power Station: Intakes and Trash Racks, Water Conductor System, Tunnels, Surge Tanks, Penstocks, Draft Tubes, Scroll Casing, Anchor Blocks, Water Hammer Analysis.

 Text Books

1. Theory and Design of Irrigation Structures Vol. I & II by R.S. Varshney,, S.C. Gupta and R.L.Gupta, 7th edition, Nem Chand & Brothers.

2. Irrigation: Practice and Design – Vol. II & III by K.B.Khushalani, and M. Khushalani, Oxford of IBH Publishing Co.

3. Irrigation and Hydraulic structures by S.K. Garg, Khanna Publishers.

Reference Books

1. Engineering for Dams – Vols. I, II & III by Creager, W.P, J.D. Justin and J. Hinds, John Wiley & Sons.

2. Hand Book of Applied Hydraulics by C.V.Davis and K.E.Sorensen, Third Edition, McGraw-Hill Book Co.

3. U.S.B.R., Design of Small Dams, 1960.

4. Soil Mechanics J.I.Version by T.W.Lambe and R.V.Whitman, John Wiley & Sons.

5. Hydraulic Transients by V.L.Streeter and G.B.Wylie, Mc Graw-Hill Book Company.

6. Applied Hydraulic Transients by M. Hanif Chaudhry Van Nostrand Reinhold Company.

PE-V: CE4204C : TRAFFIC ENGINEERING AND MANAGEMENT

Traffic Engineering: Introduction, Importance of Traffic Engineering under Indian Conditions, Traffic Characteristics, Road User and Vehicle. Traffic Surveys: Speed, Journey Time and Delay Surveys, Methods of Measuring Spot Speeds, Methods of Measurement of Running Speed and Journey Speed, Moving Observer Method, Traffic Volume Studies – Types of Counts, Automatic Devices, Presentation of Traffic Volume Study Data. Origin and Destination Survey – Need For O–D Surveys, Survey Methods, Presentation of Results, Parking Surveys – Types of Parking Surveys, Parking Space Inventory, Cordon Count, Questionnaire Type Parking Usage Survey – Design of Parking Facility. Analysis and Interpretations of Traffic Studies. Statistical Methods for Traffic Engineering – Mean, Standard Deviation and Variance. Traffic Flow Characteristics, Traffic Capacity Studies – Factors Affecting Practical Capacity, Design Capacity and Level of Service, Passenger Car Unit. Accident Studies – Accident Studies and Records, Accident Investigations, Measures for Reduction in Accident Rates, Traffic Safety. Relationship between Speed, Travel Time, Volume, Density and Capacity. Traffic Operations – Traffic Regulation, Traffic Control Devices, Intersections – Intersection at Grade – Channelized and Unchannelized Intersections, Rotary Intersections, Grade – Separated Intersections, Grade – Separated Structures.

Traffic Management – Transportation System Management, Travel Demand Management Techniques, Traffic Management Measures.

Text Book

1. Highway Engineering By S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand & Bros.

Reference Book

1. Traffic Engineering and Transport Planning By L.R. Kadiyali, Khanna Publishers.

PE-V: CE4204D : BRIDGE ENGINEERING

Concrete Bridges: Introduction – Types of Bridges – Economic Span Length, Importance of Site Investigation in Bridge Design – Types of Loading – Dead Load – Live Load (IRC Standards) – Impact Effect – Centrifugal Force–Wind Loads – Lateral Loads – Longitudinal Forces – Seismic Loads – Frictional Resistance of Expansion Bearings – Secondary Stresses – Temperature Effect – Erection Forces and Effects – Width of Roadway and Footway – General Design Requirements. Box Culvert: General Aspects, Design Loads, Design of Box Culvert subjected to IRC Loading Solid Slab Bridges: Introduction – Method of Analysis and Design of Solid Slab Bridge subjected to IRC Loading. Beam and Slab Bridge (T-Beam Girder Bridge): General Features – Design of Interior Panel of Slab – Pigeaud’s Method – Analysis and Design of T-beam Longitudinal Girder subjected to IRC Loading – Analysis and Design of Cross Girder. Piers and Abutments: General Features – Bed Block – Materials for Piers and Abutments, Types of Piers – Forces acting on Piers – Design and Stability Analysis of Piers – General Features of Abutments – Forces acting on Abutments – Design and Stability Analysis of Abutments .

Text books

1. Essentials of Bridge Engineering by D. Jhonson Victor, Oxford University Press.

2. Design of Bridges by N.Krishna Raju, Oxford & IBH Publishing Co. Pvt. Ltd.

Reference Book

1. Design of bridge structures by T.R.Jagadeesh and M.A.Jayaram, Prentice Hall India.

 PE-VI: CE4205A : AIR POLLUTION AND CONTROL

Air Pollution and its Definition – Factors Influencing Air Pollution – Classification of Pollutants Particulates – Gases–Sources of Pollution – Air Qualities Standards – Effects – Location of Industries. Meteorology – Wind Roses – Lapses Rates – Mixing Depth Atmospheric Dispersion – Plume Behavior, Accumulation, Estimation of Pollutants – Effective Stack Height. Air Pollution Effects on Human Beings, Animals, Plants and Materials – Air Pollution Episodes in India and Abroad. Ambient Air Quality Monitoring and Stack Monitoring. Control of Air Pollution – Removal of Pollutants – Particulate and Gaseous – Air Pollution Control Equipments (Units) such as Settling Chamber, Cyclones, Wet Scrubbers/Collectors, Scrubbers, Centrifugal Scrubbers Spray Towers, Packed Beds, Electrostatic Precipitators, After Burners – Absorption – Adsorption – Diffusion.

Text Books

1. Environmental Engineering by H.S.Peavy, Rowe, Tchenobolus. McGraw-Hill Pub.

2. Air Pollution Control Engineering by N.D. Nevers, McGraw-Hill Publication.

3. Air Pollution by H. V. N Rao and M. N. Rao, Tata McGraw-Hill Co.

Reference Books

1. Air Pollution and Control by K.V.S.G.Murali Krishna. Kaushal and Company, Kakinada.

2. An Introduction to Air Pollution by R.K.Trivedy and P.K.Goel, BSP Books Pvt. Ltd.

3. Environmental Pollution Control Engineering by C.S.Rao, New Age Publications.

PE-VI: CE4205B : DESIGN AND DRAWING OF REINFORCED
CONCRETE AND STEEL STRUCTURES

Design and Detailing of Combined Footing with Strap Beam, Retaining Wall, Solid & T-beam Girder Bridge Design and Detailing of Built-up Beams, Built-up Columns (laced and battened), Spliced Columns, Column Bases and Plate Girders

PE-VI: CE4205C WATERSHED MANAGEMENT

Principles of Watershed Management: Basics Concepts, Hydrology and Water Availability, Surface Water, Groundwater, Conjunctive Use, Human Influences in the Water Resources System, Water Demand, Integrated Water Resources System River Basins Watershed Management Practices in Arid and Semi-Arid Regions, Watershed Management through Wells, Management of Water Supply – Case Studies, Short Term and Long Term Strategic Planning Conservation of Water: Perspective on Recycle and Reuse, Waste Water Reclamation Social Aspects of Watershed Management: Community Participation, Private Sector Participation, Institutional Issues, Socio-Economy, Integrated Development, Water Legislation and Implementations, Case Studies Sustainable Watershed Approach: Sustainable Integrated Watershed Management, Natural Resources Management, Agricultural Practices, Integrated Farming, Soil Erosion and Conservation Water Harvesting: Rainwater Management – Conservation, Storage and Effective Utilisation of Rainwater, Structures for Rainwater Harvesting, Roof Catchment System, Check Dams, Aquifer Storage Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management

Text Book

1. Watershed Management in India by J.V.S.Murthy, Wiley Eastern.

Reference Books

1. Watershed Management by J.V.S.Murty, New Age Intl.

2. Decision Support System for Integrated Watershed Management by Allam, G.I.Y., Colorado State University.

3. Watershed Planning and Management by R.Vir Singh, Yash Publishing House.

4. Watershed Management, American Soc. of Civil Engineers, American Society of Civil Engineers, New York.

CE4206 : DESIGN AND DRAWING OF IRRIGATION STRUCTURES

1. Tank Surplus weir

2. Glacis type of canal drop

3. Notch fall

4. Siphon Aqueduct- type III

5. Cross regulator and head regulator

Text books

1. Water Resources Engineering, by C. Satyanarayana Murthy, New Age International Publishers.

2. Hydrology and Water Resources Engineering, by S.K. Garg, Khanna Publishers.

CE4207 : PROJECT WORK

The student shall submit a report based on project work and attend a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, Guide and the External Examiner. Civil Engineering

Civil Engineering

Scheme of Instruction & Syllabus for B.Tech. (Civil Engineering with Environmental Engineering Elective)

(Effective from 2019-20 Admitted Batch)

II Year – I Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE2101 BSC Mathematics-IV 2 1 - 3 30 70 100

 2 CE2102 ESC Engineering Geology 3 - - 3 30 70 100

 3 CE2103 PCC Mechanics of Materials 3 - - 3 30 70 100

 4 CE2104 PCC Surveying-I 3 - - 3 30 70 100

 5 CE2105 ESC Engineering Mechanics 3 2 - 3 30 70 100

 6 CE2106 PCC Building Material and Building
 Construction 3 - - 3 30 70 100

 7 CE2107 PCC Materials Testing and Evaluation Lab - - 3 1.5 50 50 100

 8 CE2108 PCC Surveying Field Work - 1 2 1.5 50 50 100

 Total 17 5 5 21.0 280 520 800

II Year - II Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE2101 PCC Surveying - II 3 1 - 3 30 70 100

 2 CE2202 PCC Fluid Mechanics - I 3 1 - 3 30 70 100

 3 CE2203 PCC Structural Analysis - I 4 1 - 3 30 70 100

 4 CE2204 PCC Environmental Engineering - I 3 1 - 3 30 70 100

 5 CE2205 PCC Geotechnical Engineering - I 3 - - 3 30 70 100

 6 CE2206 OEC Open Elective-I Managerial Economics 3 - - 2 30 70 100

 7 CE2207 PCC Building Planning and Design - 1 2 2 30 70 100

 8 CE2208 PCC Total Station and Geomatics Lab - - 3 1.5 50 50 100

 9 CE2209 PCC Fluid Mechanics Lab-I - - 3 1.5 50 50 100

 Total 19 4 8 22.0 310 590 900

III Year - I Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE3101 PCC Structural Analysis - II 3 1 - 3 30 70 100

 2 CE3102 PCC Environmental Engineering-II 3 1 - 3 30 70 100

 3 CE3103 PCC Reinforced Concrete Structures - I 4 1 - 3 30 70 100

 4 CE3104 PCC Steel Structures - I 4 1 - 3 30 70 100

 Professional Elective - I

 CE3105A PEC Concrete Technology

 5 CE3105B PEC Remote Sensing and
 GIS Applications 3 - - 3 30 70 100

 CE3105C PEC Geo-Environmental Engineering

 6 CE3106 OEC Open Elective - II Building Services
 and Maintenance 3 - - 2 30 70 100

 7 CE3107 PCC Geotechnical Engineering Lab - I - - 3 1.5 50 50 100

 8 CE3108 PCC Environmental Engineering Lab - - 3 1.5 50 50 100

 Total 20 4 6 20.0 280 520 800

III Year - II Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE3201 PCC Estimation, Specifications and Contracts 3 1 - 3 30 70 100

 2 CE3202 PCC Fluid Mechanics -II 4 1 - 3 30 70 100

 3 CE3203 PCC Reinforced Concrete Structures - II 3 1 - 3 30 70 100

 4 CE3204 PCC Transportation Engineering - I 3 1 - 3 30 70 100

 Professional Elective - II

 CE3205A PEC Steel Structures- II

 5 CE3205B PEC Ground Improvement Techniques 3 - - 3 30 70 100

 CE3205C PEC Irrigation Engineering

 6 CE3206 PCC Highway Material Lab - - 3 1.5 50 50 100

 7 CE3207 PCC Concrete Lab - - 3 1.5 50 50 100

 8 CE3208 PCC Computer Applications in Civil
 Engineering Lab - 1 2 1.5 50 50 100

 Total 16 5 8 19.5 300 500 800

IV Year - I Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE4101 PCC Geotechnical Engineering - II 3 1 - 3 30 70 100

 2 CE4102 PCC Fluid Mechanics - III 3 1 - 3 30 70 100

 3 CE4103 PCC Water Resources Engineering-I 3 1 - 3 30 70 100

 4 CE4104 PCC Construction Management 3 - - 3 30 70 100

 Professional Elective - III

 CE4105A PEC Prestressed Concrete Structures

 5 CE4105B PEC Elements of Coastal Engineering 3 - - 3 30 70 100

 CE4105C PEC Introduction to Rock Mechanics

 CE4105D PEC Solid Waste Management

 Professional Elective - IV

 CE4106A PEC Environmental Impact Assessment

 6 CE4106B PEC Earth Retaining Structures 3 - - 3 30 70 100

 CE4106C PEC Airport Planning and Design

 CE4106D PEC Finite Element Method of Analysis

 7 CE4107 PCC Geotechnical Engineering Lab - II - - 3 1.5 50 50 100

 8 CE4108 PCC Fluid Mechanics Lab-II - - 3 1.5 50 50 100

 Total 18 3 6 21.0 280 520 800

IV Year - II Semester

S.No. Sub Code Category Subject Name L T P C I E TM

 1 CE4201 PCC Water Resources Engineering-II 3 - - 3 30 70 100

 2 CE4202 PCC Transportation Engineering-II 3 - - 3 30 70 100

 3 CE4205 HSC Industrial Management and 3 - - 2 30 70 100 Entrepreneurship

 Professional Elective - V

 CE4204A PEC Industrial Waste Treatment

 4 CE4204B PEC Hydroulic Structures 3 - - 3 30 70 100

 CE4204C PEC Traffic Engineering and Management

 CE4204D PEC Bridge Engineering

 Professional Elective - VI

 CE4205A PEC Air Pollution and Control

 CE4205B PEC Design and Drawing of Reinforeced 3 - - 3 30 70 100 Concrete and Steel Structures

 CE4205C PEC Watershed Management

 6 CE4206 PCC Design and Drawing of Irrigation - - 3 1.5 50 50 100 Structures

 7 CE4207 PW Project Work - - 12 5 100 100 200

 Total 15 3 15 20.5 300 500 800

SUMMARY OF CREDITS SEMESTER WISE

I B. Tech I Semester 19.0

I B. Tech II Semester 20.0

II B. Tech I Semester 21.0

II B. Tech II Semester 22.0

III B. Tech I Semester 20.0

III B. Tech II Semester 19.5

IV B. Tech I Semester 21.0

IV B. Tech II Semester 20.5

TOTAL CREDITS 163

 Civil Engineering

Scheme of Instruction & Syllabus for B.Tech.
(Civil Engineering with Environmental Engineering Elective)

(Effective from 2019-20 Admitted Batch)

II Year – I Semester

CE2101 MATHEMATICS – IV

Vector Calculus-1: Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator  applied to scalar point functions– gradient,  applied to vector point functions– divergence and curl.

Physical interpretation of  applied twice to point functions, applied to products of two functions; Irrotational and Solenoidal fields.
Vector Calculus-2: Integration of vectors, line integral, circulation, work done, surface integralflux, Green’s theorem in the plane, Stoke’s theorem, volume integral, Gauss Divergence theorem. Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates Introduction Of Partial Differential Equations: Formation of partial differential equations, solutions of partial differential equations– equations solvable by direct integration, linear equations of first order: Lagrange’s Linear equation, non-linear equations of first order, Charpit’s method. Homogeneous linear equations with constant coefficients– rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations. Applications of Partial Differential Equations: Method of separation of variables, One dimensional wave equation–vibrations of a stretched string, one dimensional Heat equation, Two dimensional heat flow in steady state – solution of Laplace’s equation in Cartesian and polar coordinates (two dimensional).

Integral Transforms: Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms, Convolution theorem for Fourier transforms, Parseval’s identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

Text Books

1. Higher Engineering Mathematics by Dr. B.S.Grewal, Khanna Publishers.

Reference Books

1. A Text Book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.

2. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.

3. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley Publication .

4. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publishing Co. Ltd.

5. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

6. Higher Engineering Mathematics by Dr. M.K.Venkataraman, The National Publishing Company.

CE2102 ENGINEERING GEOLOGY

General geology: Importance of geology from Civil Engineering point of view. Weathering and soils: soil profile, erosion, and soil formation, types of Indian soils. Landforms produced by running water, glaciers, wind, sea waves and currents. Ground water: Origin and Occurrence of ground water. Porosity and permeability. Aquifers and ground water moment and water bearing properties of rocks. Petrology & Mineralogy:

Petrology: Definitions of rock. Rock classification, structure, texture and mineralogical composition. Types of rocks– ingenious rocks and structures-dykes and sills: granite, dolerite, basalt.

Sedimentary rocks: conglomerate, sandstone, shale, limestone. Metamorphic rocks: gneiss, khondalite, schist, marble, charnokite, engineering properties of rocks.

Mineralogy: Physical properties: form, colour. lustre, cleavage, fracture, hardness and specific gravity. Study of important rock forming minerals: feldspar, micas and clays Stratigraphy and Structural Geology: Stratigraphy: major geological formations of India. Archaeans. Cuddapahs, vindyana, gondwanas and deccan traps. Mineral resources of Andhra Pradesh. Structural geology: elements of structural geology–strike and dip, plunge. Clinometers compass and Brunton compass. Classification of folds, faults and joints.

Geological methods of investigation: geological formations, preparations of geological maps, structural features and groundwater parameters. Natural hazards: earthquake origin and distribution. Volcanoes, landslides and mass moment. Tsunamis.

Remote Sensing and Geo Physical Methods: Remote sensing: Introduction, electromagnetic spectrum, aerial photo, types of aerial photos and flight planning aerial mosaics. Elements of photo interpretation. Satellite, remote sensing, Satellite, sensors and data products, principles of GIS. RS and GIS applications to Civil Engineering–town planning, dams and reservoirs, Geophysical Methods: Principles of geophysical methods, electrical methods, seismic methods. Principles of resistivity method and configurations. Applications of resistivity method in prediction of soil profile, hard rock and ground water table. principles of seismic refraction and reflections methods and their applications to Civil Engineering problems. Geological applications to Civil Engineering structures: Role of engineering geologists in planning, design and construction stages in Civil Engineering works. Geological investigations for dams and reservoir; geological investigations for bridges and multi-storied structures.

geological investigation for highways. Geological investigations for tunnels and coastal structures. (sea walls, groins and bulkheads). Environmental geology.

Text Books

1. Principles of Engineering Geology by K.V.G.K.Gokhale. B.S. Publications-2005.

2. Engineering Geology by N.Chennakesavalu, Mc-Millan, Indian Ltd-2005

3. A Text Book of Geology by P.K.Mukherjee, World Press

4. Engineering and General Geology by Parbin Singh, Katson Publishing House

5. Fundamentals of Remote Sensing by George Jospeh, University Press (India) Private Ltd.

CE2103: MECHANICS OF MATERIALS

Duties/Obligations Accountability of Structural Engineer for the Design of a Structure: a) Economy b) Safety: (i) Strength Consideration (ii) Stiffness Consideration. Need for Assessment of Strength of a Material – Analysis for Strength Requirement for Design Purposes – Review of IS Code Provisions.

Effects of Force: Tension, Compression and Shear. Stress as Internally Elastic Resistance of a Material – Strain – Property of Elasticity – Hooke’s Law – Stress-Strain Diagrams. Characteristic Strengths, Factors of Safety and Working Stresses for Materials and Various Types of Application of Load. Elastic Strain – Energy, Stress due to Gradually Applied Load, Sudden Load, Impact Load and Shock Load. Lateral Strain, Poisson’s Ratio. Complementary Shear Stress, Shear Strain, Shear Modulus. Relation Between Modulus of Elasticity, Modulus of Rigidity and Bulk Modulus. Stresses in Composite Assemblies due to Axial Load and Temperature Change.

Effect of Transverse Force, Shear Force, Bending Moment and Axial Thrust Diagrams for

A) Cantilever B) Simply Supported and C) Over Hanging Beams for various patterns of Loading. Relation between (i) Intensity of Loading (ii) Shear Force and (iii) Bending Moment at

a Section. Theory of Simple Bending: Flexural Normal Stress Distribution; Flexural Shear Stress Distribution for Various Shapes of Cross Section. Deflections of Beams: (i) Cantilever (ii) Simply Supported and (iii) Over Hanging Beams, using (a) Double Integration and (b) Macaulay’s Method. Stresses on Oblique Plane – Resultant Stress – Principal Stress and Maximum Shear Stress and Location of their Planes. Mohr’s Circle for Various Cases of Stresses; Theory of Pure Torsion for Solid and Hollow Circular Sections – Torsional Shear Stress Distribution, Effect of Combined Torsion, Bending and Axial Thrust – Equivalent B.M and T.M. Longitudinal and Hoop stresses in Thin Cylinders subjected to Internal Pressure. Wire Wound Thin Cylinders. Columns and Struts: Combined Bending and Direct Stresses – Kern of a Section – Euler’s Theory – End Conditions. Rankine-Gordon Formula – Eccentrically Loaded Columns. Open and Closed Coiled Helical Springs subjected to Axial Load.

Text books

1. Strength of materials by S.Ramamrutham and R.Narayana, Dhanpat Rai Publishing Company, New Delhi.

2. Mechanics of Materials by B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications.

3. Analysis of Structures, Vol. I, 1993 edition, by V.N.Vazirani and M.M.Ratwani, Khanna Publishers Books.

Reference Books

1. Strength of Materials (Elementary Theory and Problems) by S.Timoshenko and D.H.Young, CBS Publishers & Distributors Pvt. Ltd.

2. Introduction to Mechanics of Solids by Popov, Prentice-Hall.

3. Strength of Materials by Hyder, Universities Press.

4. Elementary Mechanics of Solids by P.N. Singer and P.K.Jha, New Age International Publishers.

CE2104 : SURVEYING – I

Introduction: Classification and Principles of Surveying, Triangulation and Trilateration – Earth as Spheroid, Datum, Geoid, Azimuth, Latitude, Longitude, Map Projections, Scales, Plans and Maps. Chain Surveying: Instrumentation for Chaining – Errors due to Incorrect Chain–Chaining on uneven and sloping Ground – Errors in Chaining –Tape Corrections – Problems: Base Line Measurement – Chain Triangulation – Check Lines, Tie Lines, Offsets. Basic Problems in Chaining – Obstacles in Chaining – Problems – Conventional Signs. Compass Survey: (a) Introduction to Compass Survey Definitions of Bearing. True bearing, True meridian, Magnetic Meridian, Magnetic Bearing – Arbitrary Meridian, R.B & B.B of Lines – Designation of Bearing – W.C.B. & R.B. – Conversion of Bearings from one system to the other – Related Problems – Calculation of Angles for Bearings, Calculation of Bearings for Angles, Related Problems – Theory of Magnetic Compass (i.e. Prismatic Compass) – Magnetic Dip – Description of Prismatic Compass. Temporary Adjustments of Compass – Magnetic Declination – Local Attraction – Related Problems – Errors in Compass Survey. (b) Traverse Surveying: Chain and Compass Traversing – Free or Loose Needle Method – Fast Needle Method – Checks in Closed and Open Traverse – Plotting Methods of Traverse Survey – Closing Error – Balancing the Traverse – Bowditch’s Method –Transit Method, Gale’s Traverse Table. Plane Table Surveying: Introduction – Advantages, Accessories – Working Operations such as Fixing the Table to Tripod, Leveling – Centering – Orientation by Back – Sighting. Methods of Plane Tabling – Plane Table Traversing – Three Point Problem – Mechanical Method – Graphical Method – Two Point Problem – Errors in Plane Tabling. Levelling: Definitions of Terms – Methods of Levelling – Uses and Adjustments of Dumpy Level – Temporary and Permanent Adjustments of Dumpy Level Levelling Staves – Differential Levelling, Profile Levelling – Cross Sections – Reciprocal levelling. Precise Levelling – Definition of BS, IS, FS, HI, TP – Booking and Reduction of Levels, H.I. Methods – Rise and Fall Method – Checks – Related Problems – Curvature and Refraction Related Problems – Correction – Reciprocal Levelling – Related Problems – L.S & C.S Leveling – Problems in Levelling – Errors in Levelling.

Minor Instruments: Uses and Adjustments of the following Minor Instruments: Line Ranger, Optical Square, Abney Level and Clinometer, Ceylon Ghat Tracer, Pentagraph, Sextant and Planimeter. Contouring: Definitions – Contour Intervals, Characteristics of Contours – Methods of Locating Contours – Direct and Indirect methods – Interpolation of Contours – Contour Gradient – Uses of Contour Maps. Contours Mapping using Computer Techniques (Surfer, CAD).

Text Books

1. Surveying Vol. I, II and III by B.C.Punmia, Standard Book House.

2. Surveying Vol. I, II and III by K.R. Arora, Standard Book House.

Reference Books

1. Surveying Vol. I and II by S.K. Duggal, Tata McGraw-Hill Publishing Co. Ltd.

2. Surveying: Theory & Practices by James M. Anderson and Edward M. Mikhail, Tata McGraw-Hill Publishing Co. Ltd.

3. Advanced Surveying by Satheesh Gopi, Sathikumar and Madhu, Pearson India.

4. Geomatics Engineering by M.K.Arora and R.C.Badjatia, Nemchand & Bros.

CE2105 : ENGINEERING MECHANICS

Basic Concepts: Introduction to Engineering Mechanics – Scalar and Vector quantities – Forces – Characteristics of a Force – Definitions and Examples of Various Types of Force Systems – Definition of Resultant – Composition and Resolution of Forces – Moment of a Force – Principles of Moments of Force – Couples – Characteristics of a Couple – Transformations of a Couple – Resolution of a Force into a Force and Couple. Resultants of Force Systems, Possible Resultants of Different Types of Force Systems – Resultant of a Concurrent, Coplanar Force System – Resultant of a Non-concurrent Coplanar Force System – Resultant of a Concurrent Non-coplanar Force System – Resultant of a Parallel, Non-coplanar Force System – Resultant of a System of Couples in Space – Resultant of Non-concurrent, Non-coplanar, Non-parallel Force System – Screw of Wrench.

Equilibrium: Free Body Diagrams – Equations of Equilibrium for a Concurrent Coplanar Force System – Equilibrium of Bodies Acted on by Two or Three Forces – Equilibrium of Bodies Acted on by Non-concurrent Coplanar Force System – Equilibrium of Bodies Acted on by Parallel, Non-coplanar Force System – Equilibrium of Non-concurrent, Non-coplanar NonParallel Force System. Analysis of Statically Determinate Trusses by (a) Method of Joints and (b) Method of Sections. Centroids and Centres of Gravity: Centre of Gravity of Parallel Forces in a Plane – Centre of Gravity of Parallel Forces in Space – Centroid and Centre of Gravity of Composite Bodies – Theorems of Pappus – Distributed Loads on Beams. Moments of Inertia, Definition – Parallel Axis Theorem for Areas – Second Moments of Areas by Integration – Radius of Gyration of Areas – Moments of Inertia of Composite Areas – Parallel Axis and Parallel Plane Theorems for Masses – Moments of Inertia of Masses by Integration – Radius of Gyration of Mass – Moments of Inertia of Composite Masses.

Friction: Nature of Friction – Laws of Friction – Coefficient of Friction – Angle of Friction – Cone of Friction – Problems Involving Frictional Forces Method of Virtual Work: Principle of Virtual Work – Equilibrium of Ideal System – Stability of Equilibrium. Kinematics: Absolute Motion: Introduction – Recapitulation of Basic Terminology of Mechanics – Newton’s Laws – Introduction to Kinematics of Absolute Motion – Rectilinear Motion of a Particle – Angular Motion – Curvilinear Motion of a Particle using Rectangular Components – Motion of Projectiles – Curvilinear Motion using Radial and Transverse Components – (Simple Problems only) – Basics of Simple Harmonic Motion (Simple Problems) – Motion of Rigid Bodies. Kinematics: Relative Motion: Introduction to Kinematics of Relative Motion – Relative Displacement – Relative Velocity – Instantaneous Centre – Relative Acceleration. Kinetics: Introduction to Kinetics – Newton’s Laws of Motion – Equation of Motion for a Particle. Motion of the Mass Centre of a System of Particles – D’Alembert’s Principle – Rectilinear Translation of a Rigid Body – Curvilinear Translation of a Rigid Body – Rotation of a Rigid Body – Plane Motion of a Rigid Body.

Kinetics: Work and Energy Approach – Work Done by a Force – Work Done by a Couple – Work Done by a Force System – Energy: Potential Energy – Kinetic Energy of a Particle – Kinetic Energy of a Rigid Body – Principle of Work – Energy and Application to Particle and Rigid Body in Planar Motion – Conservation of Energy Impulse – Momentum Approach – Linear Impulse – Linear Momentum – Principle of Linear Impulse and Linear Momentum – Conservation of Linear Momentum – Elastic Impact - Principle of Angular Momentum.

Text Books

1. Engineering Mechanics by Fredin and Leon Singer, B.S.Publications.

2. Applied Mechanics by I.B. Prasad, Khanna Publishers.

Reference Books

1. Engineering Mechanics by S.Timoshenko and D.H. Young, Tata McGraw-Hill Publishing Co. Ltd. India.

2. Engineering Mechanics Vol. I and Vol. II by J.L.Meriam and L.G.Kraige, Wiley Publications.

3. Mechanics for Engineers Statics and Dynamics by F.B. Beer and E.R. Johnston.

4. Engineering Mechanics by R.S.Kurmi, S.Chand Publishing.

CE 2106 : BUILDING MATERIALS AND BUILDING CONSTRUCTION

Masonry: Different Types of Stone Masonry – Plan, Elevation, Sections of Stone Masonry Works – Brick Masonry – Different Types of Bonds – Plan, Elevation and Section of Brick Bonds up to Two-Brick Wall Thickness – Partition walls – Different Types of Block Masonry – Hollow Concrete Blocks – FAL-G Blocks, Hollow Clay Blocks. Foundations: Types of Foundations: Strip, Isolated, Strap, Combined Footings, Raft – Mat – Slab and Beam Raft, Box Type Raft, Inverted Arch Foundations, Shell Foundations, Grillage Foundations – Minimum Depth of Foundation – Bearing Capacity of Soils.

Paints, Varnishes: Paints and Varnishes: Constituents and Characteristics of Paints, Types of Paint, their uses and preparation on Different Surfaces, Painting Defects, Causes and Remedies. Constituents of Varnishes, Uses of Varnishes, Different Kinds of Varnishes, Polishes. Painting of Interior Walls, Exterior Walls, Wooden Doors and Windows – Steel Windows – Various Types of Paints (Chemistry of Paints not included) Including Distempers; Emulsion Paints etc., Varnishes Wood Work Finishing Types. Asbestos, Asphalt Bitumen and Tar: Availability and uses of Asbestos, Properties of Asbestos, Various Types of Asbestos, Difference Between Asphalt and Bitumen, Types, Uses and Properties of Asphalt and Bitumen, Composition of Coal Tar, Wood Tar, Mineral Tar and Naphtha. Roofing: Mangalore Tiled Roof, RCC Roof, Madras Terrace, Hollow Tiled Roof, Asbestos Cement, Fibre Glass, Aluminium, G.I. Sheet Roofings. Trusses: King Post and Queen Post Trusses – Steel Roof Truss for 12m Span with details. Wooden Doors and Windows: Parallel – Glazed – Flush Shutters, Plywood, Particle Board Shutters – Aluminum, PVC, Steel Doors, Windows and Ventilators, various types of Windows, Glazing – Different Varieties. Stair Cases: Stair Cases or Stairway Design (Architectural Design or Planning only) various types such as, Straight Flight, Dog-legged, Quarter Landing, Open Spiral, Spiral Stairs etc. Concrete Technology and Mix Design: Polymer Concrete, Types of Cement Concretes, Ingredients and their Characteristics, Cement Concrete Properties and Relevant Tests, Storage, Batching, Mixing and Transporting, Placing, Vibrating and Curing. Concrete Grades and Mix Designs up to M30 as per IS Code. Introduction to Polymer Concrete and its applications.

Text Books

1. Engineering Materials [Material Science] by Rangwala, Charotar Publications.

2. Concrete Technology Theory & Practice by M.S. Shetty, S. Chand & Company Ltd.

3. Building Construction by B.C. Punmia,. Laxmi Publications.

4. Civil Engineering Construction Materials, S.K. Sharma, KBP House.

Reference Books

1. Concrete: Microstructure, Properties & Materials, PK Mehta, Tata McGra-Hill Publications.

2. Building Construction, Vol.II & III By W.B. Mckay, E.L.B.S. and Longman, UK.

3. Building Materials by S.K. Duggal, New Age International Publishers.

4. Construction Technology by R. Chudly Vols I & II, 2nd Edition, Longman, UK.

CE2107 : MATERIALS, TESTING AND EVALUATION LABORATORY

(1) Tension Test on Mild steel/HYSD bars (2) Compression Test on Wood (Parallel and Perpendicular to Grains) (3) Tests on Springs for the Determination of Rigidity Modulus and Spring Constant (4) Brinell’s and Rockwell Hardness Tests (5) Charpy and Izod Impact Tests (6) Double Shear Test on Mild Steel Specimen (7) Bending Test: Load Deflection Test for the Determination of Young’s Modulus on Simply Supported and Cantilever Beams of Wood and Steel (8) Buckling of Wooden Column

CE2108 : SURVEYING FIELD WORK

Chain Surveying: Introduction of Instruments used for Chain Survey, Folding and Unfolding of Chain – Line Ranging (Direct Method) – Pacing. Chain Traversing – Preparation of Plan of a Residential Building by making use of Chain, Ranging Rods, Oblique Off – Set Method, Introduction of Check Line. Preparation of Residential Building by Perpendicular Offset, Introduction of Tie Lines. Finding the Distance Between Inaccessible Points by making Use of Chain, Cross Staff, Tape, Ranging Rods; Arrows and Field Problems of Obstacles to Chaining. Compass Survey: Introduction to Prismatic Compass – Temporary Adjustments. Finding the Distance Between Inaccessible Points by Making use of Compass, Tape and Ranging Rods. Compass Traversing – Plotting of a Residential Building.

Plane Table Survey: Introduction to Plane Table – Use of its Accessories: Two and Three Point Problem. Finding the Distance between Inaccessible Points by Making use of Plane Table, Accessories – Ranging Rods and Tape. Levelling: Introduction to Dumpy Level, Levelling Staff. Reading of Level Staff, Temporary Adjustments of Dumpy Level. Introduction to Fly Levelling – Booking the Readings by Height of Collimation Method. Introduction to Fly Levelling–Booking the Readings by Rise and Fall Method – To Find Closing Error. Check Levelling – L.S. and C.S. of a Road Profile. Preparation of Contour Plan for an Open Area by taking Level of the Site.

Civil Engineering

SYLLABUS FOR B.Tech. (CIVIL ENGINEERING with
ENVIRONMENTAL ENGINEERING ELECTIVE)

(Effective from 2019-20 Admitted Batch)

II Year – II Semester

CE2201 : SURVEYING – II

Theodolite – Types of Theodolites – Temporary Adjustments, Measurements of Horizontal Angle – Method of Repetition, Method of Reiteration – Uses of Theodolites – Errors in Theodolite or Permanent Adjustments of a Theodolite – Identification – Rectifying the Errors. Theodolite Traversing – Open and Closed Traverse – Closing Errors, Balancing the Error – Bowditch Method – Transit Method, Omitted Measurements – Gale’s Traverse Table or Trigonometric Levelling – Elevation of Top of the Tower – Same Plane – Different Planes. Tacheometry – Principle of Tachometry – Stadia Methods – Fixed Hair Method – Movable Hair Method – Tangential Method – Subtense Bar – Beaman’s Stadia, Arc – Reduction Diagrams or Triangulation – Classification – Intervisibility of Station – Signals and Towers – Base Line Measurements – Corrections – Satellite Station and Reduction to Centre – Basenet. Curves – Sample Curves – Elements of Simple Curves – Methods of Setting Simple Curves – Rankine’s Method – Two Theodolite Method – Obstacles in Curve Setting – Compound Curves – Elements of Compound Curves or Reverse Curves – Elements of Reverse Curve – Determination of Various Elements – Transition Curves – Ideal Shape – Spiral Transition Curves – Length of Transition Curve – Setting Out Methods. Total Station Surveying: Electronic Theodolite, Electronic Distance Measurements, Total Station, Errors in Measurements, Advantages, Disadvantages, Applications; Contour Mapping, Determination of Height of Remote Point, Position of Hidden Point, Free Station, Area Measurement, Volume Measurement. Modern Surveying and Mapping: GPS Survey – Introduction, Errors in GPS, Positioning Methods, Classification of GPS Surveying, Applications, Advantages and Disadvantages, Photogrammetric Surveying; Sensors and Platforms, Aerial Photogrammetry, Satellite Images Resolution, Concept of Stereo Models, Photogrammetric Products, Rectified Images, Orthophotography, Topographic Map, Digital Maps, DEM, GIS, Advantages and Disadvantages of Photogrammetric Surveying.

Text Books

1. Surveying Vol. I, II and III by B.C.Punmia, Standard Book House.

2. Surveying by Dr. K.R. Arora, Standard Book House.

Reference Books

1. Surveying Vol. I and II by S.K. Duggal, Tata McGraw-Hill Publishing Co. Ltd.

2. Principles of GIS for Land Resource Assessment by P.A. Burrough, Clerendon Press, Oxford.

3. Surveying: Theory and Practices by James M. Anderson and Edward M. Mikhail, McGraw-Hill Education.

4. Advanced Surveying by Satheesh Gopi, Sathikumar and Madhu, Pearson India.

5. Geometric Engineering by Arora and Badjatia, Nemchand and Co.

CE2202 : FLUID MECHANICS – I

Fluid Properties and Fluid Statics: Introduction & Physical Properties of Fluids – Definition of Fluid, Fluid as Continuum; Mass Density, Specific Weight, Specific Gravity, Specific Volume, Bulk Modulus, Compressibility, Vapour Pressure, Cavitation, Viscosity – Newton’s Law of Viscosity, Rheological Diagram; Capillarity and Surface Tension. Fluid Statics, Pressure and its Measurement – Forces acting on a Fluid Element – Pascal’s law; Variation of Pressure in Static Fluid; Absolute, Gauge and Total Pressure; Pressure Measurement – Piezometers, Manometers, Micro-manometers, Mechanical Gauges and Pressure Transducers. Forces on Immersed Bodies in Static Fluids – Force on a Plane Surface – Centre of Pressure; Pressure Diagram; Forces on Curved Surfaces; Forces on Radial Crest Gates and Lock Gates. Buoyancy and Floatation – Archimedes Principle; Stability of Floating Bodies – Centre of Buoyancy, Metacentric Height and its determination. Fluid Kinematics and Conservation of Mass: Types of Fluid Flow & Methods of Fluid Flow Analysis – Methods of Describing Fluid Motion; Types of Flow – Steady and Unsteady Flows, Uniform and Non-uniform Flows, free and forced vortex motions, Laminar and Turbulent Flows; Streamline, Path line, Streak line; Stream Surface – Stream Tube. Fluid Kinematics – Translation, Deformation and Rotation of a Fluid Element in Motion; Local, Convective and Total Accelerations; One, Two and Three Dimensional Analysis of Flows. Ideal Fluid Flow – Stream Function, Velocity Potential; Rotational & Irrotational Flows – Vorticity and Circulation; Laplace Equation in terms of Stream Function and Velocity Potential; Flow Nets. Principle of Conservation of Mass – Concepts of System and Control Volume; Continuity Equation in three dimensional Cartesian coordinates; Continuity Equation for flow through a Stream tube. Fluid Dynamics: Principle of Conservation of Energy – Equation of Motion for Ideal Fluids, Euler’s Equation in Streamline Coordinates, Derivation of Energy Equation through integration of Euler’s Equation, Bernoulli’s Equation, Energy Correction Factor. Flow measuring devices – Flow Measurement in Pipes – Measurement of Static, Stagnation and Dynamic Pressures and Velocity – Pitot Tube, Prandtl Pitot Tube; Measurement of Discharge through a Pipe using Flow Meters – Venturimeter, Flow Nozzle meter and Orifice meter. Flow through Tanks and Reservoirs – Measurement of Discharge from Tanks and Reservoirs – Steady and Unsteady Flow through Orifices and Mouthpieces – Small & Large Orifices – Different types of Mouthpieces; Discharge from tanks through Drowned Orifices, Time of Emptying Tanks, Discharge from a Tank with Inflow. Flow Measurement in Channels – Flow Measurement in Open Channels, Flow Past Weirs and Notches, Sharp Crested and Broad Crested Weirs, Weirs with and without end contractions, Ventilation of Weirs, Triangular Notches, Cipolletti Weir. Principle of Conservation of Momentum – Momentum of Fluids in Motion, Impulse Momentum Equation, Momentum Correction Factor. Application of Momentum Principle – Forces on Pipe Bends and Reducers, Flow through a Nozzle; Angular Momentum of Fluid Flow – Sprinkler Problems. Laminar flow: Equation of Motion for Real Fluids – Modifications in Equation of Motion, Stress Strain Relationships, Tangential Stress Terms. Steady Flow between Parallel Plates, Couette's and Poiseuille's Flows; Axisymmetric Flows, Flow without and with Pressure Gradient – Hagen-Poiseuille Equation; Relationship between Friction factor and Reynolds Number for Laminar Flow through Pipes; Stokes’ law.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.

2. Fluid Mechanics by A.K.Jain, Khanna Publishers.

Reference Books

1. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co. Ltd.

2. Engineering Hydraulics, H.Rouse, John Wiley & Sons Inc.

3. Mechanics of Fluids, I.H.Shames,McGraw-Hill Professional.

CE2203 : STRUCTURAL ANALYSIS – I

Deflections of Beams Using (i) Moment Area Method, (ii) Conjugate Beam Method, (iii) Unit Load Method (iv) Castigliano’s Theorem – 1. Strain – Energy due to (i) Axial Load, (ii) Shear Force, (iii) Bending Moment and (iv) Torque; Deflections of Statically Determinate Structures: (A) Single Storey, Single Bay Rectangular Portal Frames using (i) Unit Load Method, (ii) Castigliano’s Theorem –1. (B) Trusses (Having 9 Members or less) using (i) Unit Load Method and (ii) Castigliano’s Theorem-1. Analysis of (A) Fixed Beams, (B) Three Span Continuous Beams using (i) Theorem of Three Moments, (ii) Slope Deflection Method and (iii) Moment Distribution Method Moving Loads: Maximum Shear Force and Bending Moment Diagrams for Different types of Loads. Maximum Bending Moment at a Section under a Wheel Load and Absolute Maximum Bending Moment in the case of several Wheel Loads. Equivalent Uniformly Distributed Live Load for Shear Force and Bending Moment. Reversal of Nature of Shear Force, Focal Length, Counter Bracing for Truss Panels, Influence Lines for (i) Beams and (ii) Members of Warren and Pratt Trusses. Thick Cylinders –Lamme’s Theory, Compound Tubes – Theory of Failure (i) Principal Stress Theory, (ii) Principal Strain Theory, (iii) Maximum Shear Stress Theory and (iv) Maximum Strain Energy Theory.

Text books

1. Theory of Structures, Vol- I, by G.S.Pundit, S.P.Gupta and R.Gupta, McGraw-Hill Education India.

2. Mechanics of structures Vol- I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House.

3. Strength of Materials by S.Ramamrutham and R.Narayanan, Dhanpat Rai Publishing House.

Reference Books

(1) Elementary Strength of Materials by S.Timoshenko and D.H.Young, Affiliated East-West Press.

(2) Analysis and Design of Structures Vol-I by V.N.Vazirani and M.M.Ratwani, Khanna Publishers.

(3) Intermediate Structural Analysis by C.K.Wang, McGraw-Hill.

(4) Strength of Materials by B.C.Punmia, Laxmi Publications.

CE2204 : ENVIRONMENTAL ENGINEERING – I

Introduction: Importance and Necessity of Protected Water Supply systems, Objectives of Protected Water Supply System, Flow Chart of Public Water Supply System, Role of Environmental Engineer, Agency Activities. Water Demand and Quantity Studies: Estimation of Water Demand for a town or city, Types of Water Demands, Per Capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design Period, Population Studies, Population Forecasting Studies. Hydrological Concepts: Hydrological Cycle, Types of Precipitation, Measurement of Rainfall. Surface Sources of Water: Lakes, Rivers, Impounding Reservoirs, Capacity of Storage Reservoirs, Mass Curve Analysis. Groundwater Sources of Water: Types of Water bearing formations, Springs, Wells and Infiltration Galleries, Yields from Wells and Infiltration Galleries. Collection of Water: Factors Governing the Selection of the Intake Structure, Types of Intakes. Conveyance of Water: Gravity and Pressure Conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of Pipe Lines, Laying of Pipe Lines. Quality and Analysis of Water: Characteristics of water – Physical, Chemical and Biological. Analysis of Water: Physical, Chemical and Biological. Impurities in Water, Water Borne Diseases. Drinking Water Quality Standards. Treatment of Water: Flowchart of Water Treatment Plant, Treatment Methods (Theory and Design) – Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration, Chlorination and other Disinfection methods, Softening of Water, Defluoridation, Removal of Odours. Distribution of Water: Methods of Distribution System, Components of Distribution System, Layouts of Distribution Networks, Pressures in the Distribution Layouts, Analysis of Distribution Networks, Water Connection to the Houses.

Text Books

1. Environmental Engineering by Peavy, Rowe, Tchenobolus. McGraw-hill Pub.

2. Elements of Environmental Engineering by K.N. Duggal, S.Chand & Company Pvt. Ltd.

Reference Books

1. Environmental Engineering Vol. I: Water Supply Engineering by S.K. Garg, Khanna Publishers.

2. Water Supply and Sanitary Engineering by G.S.Birdie and J.S.Birdie, Dhanpat Rai Publishing Company.

3. Water Supply Engineering by P.N.Modi, Standard Book House.

4. Water Supply Engineering by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd.

CE2205 : GEOTECHNICAL ENGINEERING – I

Introduction: Soil Formation, Minerals in Clays and Sand, Soil Structure, Physical properties of Soil: Void ratio, Porosity, Degree of Saturation, Water Content, Unit Weights, Specific Gravity, Weight – Volume Relationships, Relative density, Consistency Limits and Consistency Indices, Activity. Mechanical Analysis and Soil Classification: Sieve Analysis, Stoke’s Law, Hydrometer and Pipette Analysis, Textural Classification, Classification based on Size, Unified Soil Classification and Indian Standard Soil Classification Systems, Field Identification of Soils Soil Hydraulics: Types of Soil Water, Capillary Rise and Surface Tension, Darcy’s Law and its Limitations, Constant Head and Variable Head Permeability Tests, Factors Effecting Coefficient of Permeability, Permeability of Stratified Soils. Total, Neutral and Effective Stresses, Effective Stress Principle, Upward Flow Conditions, Quick Sand Conditions, Critical Hydraulic Gradient. Stress Distribution in Soils: Boussinesq’s Theory for Determination of Vertical Stress, Assumptions and Validity, Extension to Line, Strip, Rectangular and Circular Loaded Areas, Pressure Bulb and Influence Diagrams, Newmark’s Influence Chart – Construction and Use, Westergaard’s Theory, 2:1 Load Dispersion Method, Contact Pressure Distribution beneath Footings.

Compaction: Mechanism of Compaction, Factors Effecting Compaction, Laboratory Compaction Tests, Effect of Compaction on Soil Properties, Field Compaction: Compaction Equipment and Evaluation of Field Compaction. Consolidation: Basic Definitions: Compression Index, Coefficient of Compressibility and Coefficient of Volume Decrease; Spring Analogy for Primary Consolidation; Initial Compression, Primary Compression and Secondary Compression, Generation of Effective Stress-Void Ratio Relationship from Consolidation Test: Height of Solids Method and Change in Void Ratio Method; Determination of Preconsolidation Pressure, Normally Consolidated, Over Consolidated and Under Consolidated Clays, Terzaghi’s One Dimensional Consolidation Theory – Assumptions, Derivation of Differential Equation and Solution, Laboratory Determination of Coefficient of Consolidation by Time Fitting Methods. Shear Strength of Soils: Stress at a Point, Mohr Circle of Stress, Mohr-Coulomb Failure Theory, Shear Parameters, Laboratory Shear Tests – Shear Box, Triaxial and Unconfined Compression Tests, Laboratory and Field Vane Shear Tests, Sensitivity of Clays, Types of Shear Tests based on Drainage Conditions, Total Stress Analysis and Effective Stress Analysis, Shear Strength of Sands, Critical Void Ratio and Dilatancy, Liquefaction of Soils, Factors affecting Shear Strength of Clays and Sands,

Text Books

1. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers

2. Basic and Applied Soil Mechanics by Gopal Rajan and A.S.R. Rao, New Age International Publishers.

3. Geotechnical Engineering by P. Purushothama Raj, Pearson Publishers

OP-I: CE2206 MANAGERIAL ECONOMICS

Unit -I Significance of Economics and Managerial Economics: Economics: Definitions of Economics– Wealth, Welfare and Scarcity definition Classification of Economics– Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines. Demand Analysis: Demand – Definition, Meaning, Nature and types of demand, Demand function, Law of demand – Assumptions and limitations. Exceptional demand curve. Elasticity of demand – Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand. Demand Forecasting – Need for Demand forecasting, Factors governing demand forecasting, Methods of demand forecasting: Survey methods– Experts' opinion survey method and consumers Survey methods. Utility Analysis: Utility– Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, the law of Diminishing Marginal Utility and its Limitations.

Unit -II Theory of Production and Cost analysis: Production – Meaning, Production function and its assumptions, use of production function in decision making; Law of Variable Proportions: three stages of the law. Cost analysis – Nature of cost, Classification of costs – Fixed vs. Variable costs, Marginal cost, Controllable vs. Non – Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale.

Unit -III Market Structures: Definition of Market, Classification of markets; Salient features or conditions of different markets – Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve; Monopolistic Competition.

Unit -IV Pricing Analysis: Pricing – Significance: Different Pricing methods– Cost plus pricing, Target pricing, Marginal cost pricing, Going-rate pricing, Average cost pricing, Peak load pricing, Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark-down pricing of retailers.

Unit -V Business cycles, Inflation and Deflation: Business cycles – Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles Inflation –Meaning, Types, Demand-pull and Cost push inflation, Effects of Inflation, Anti- inflationary measures Deflation– Meaning, Effects of Deflation, Control of Deflation, Choice between Inflation and Deflation

Text Books

1. Managerial Economic by Sankaran,S., Marghan Publications.

2.Managerial Economics and Financial Analysis by Aryasri, A.R., MC Graw-Hill Education.

Reference Books

1. Managerial Economics by Dwivedi, D.N., Vikhas Publishing House Pvt. Ltd. 6th Edition.

2. Modern Economic Theory by Dewett, K.K., Chand & Company Ltd.

CE2207 : BUILDING PLANNING AND DESIGN

Residential Buildings: Different types of Residential Buildings, Selection of Site for Residential Building. Brief Information of Housing Colonies for Different Income Groups in India–Sizes of Plots – Public Spaces, Evolutionary Housing Concept. Climatology: Elements of Climate: Sun, Wind, Relative Humidity, Temperature effects, Comfort Conditions for House, various types of Macro Climatic Zones. Design of Houses and Layouts with Reference to Climatic Conditions. Orientation of Buildings. Solar Charts, Ventilation. Principles of Planning Anthropometric Data Preliminary Drawings: (a) Conventional Signs of Materials various Equipment used in a Residential Building (copying exercise) (b) Plan, Section and Elevation of a Small House (one room and verandah) (copying exercise) (c) Plan, Section and Elevation of Two Bed Room House (copying exercise) (d) (e) (f) Plan, Section and Elevation of Three Bed Room House in Hot and Humid Zone, Hot and Arid Zone, Cold Zone (copying exercises)

(a) Design of Individual Rooms with Particular Attention to Functional and Furniture Requirements. Building Regulations and Bye-laws of Residential Buildings; (b) AUTOCAD Drawing of Residential Building (only for internal assessment) Drawing the Plan, Section and Elevation of Houses with given Functional Requirements and Climatic Data. (emphasis may be given to Hot and Humid zones.)

Text Books

1. Building Planning and Drawing by N. Kumara Swamy and A.Kameswara Rao, Charotar Publishing House.

2. Building Planning Drawing and Scheduling by Gurucharansingh and Jagadish Singh, Standard Publishers Distributors

Reference Books

1. Civil Engineering Drawing by Sharma and Gurucharan Singh, Standard Publishers.

2. Civil Engineering Drawing Series ‘B’ by R.Trimurty, M/S Premier Publishing House.

3. Building Drawing with an Integrated Approach to Built Environment by M.G.Shah, C.M.Kale and S.Y.Patki, McGraw-Hill Publishing Company Limited.

CE2208 : TOTAL STATION AND GEOMATICS LABORATORY

1. Measurement of Horizontal Angles by Repetition & Reiteration, Measurement of Vertical Angles, Heights and Distances

2. Distance between two In-accessible Points using Theodolite

3. Tachometry

4. Setting Out Curve by Deflection Angle Method using two Theodolites

5. Point Positioning using GPS

6. Contour Mapping using Total Station

7. Height of Remote Point using Total Station

8. Position of Hidden Point using Total Station

9. Area and Volume Measurement using Total Station

10. GIS related Surveying Applications

CE2209 : FLUID MECHANICS LABORATORY – I

1. Study of Small Orifice by Constant Head Method and Time of Emptying a Tank through a Small Orifice.

2. Study of Cylindrical Mouthpiece by Constant Head Method and Time of Emptying a Tank through a Cylindrical Mouthpiece.

3. Determination of Metacentric Height of Floating Body.

4. Study of Surface Profiles in Free and Forced Vortex Motions.

5. Study of Venturimeter.

6. Study of Orifice meter.

7. Study of Flow Nozzle Meter.

8. Study of Sharp-crested Full Width and Contracted Weirs.

9. Study of V-Notch and Trapezoidal Notch.

10. Study of Broad-crested Weir.

III Year – I Semester

CE3101 : STRUCTURAL ANALYSIS – II

Analysis of Statically Indeterminate Trusses (having not more than 7 members and 3 supports) containing (a) External Redundant Supports (b) Internal Redundant Members using (i) Method of Consistent Deformation of Unit Load Method (ii) Castigliano’s Theorem – II.

Analysis of Three Span Continuous Beams using Kani’s Method, Analysis of Statically Indeterminate Frames (Single Storey, Single Bay Portal Frames only) using (i) Slope-deflection method (ii) Moment Distribution Method
(iii) Kani’s Method. Arches: Normal Thrust, Radial Shear and Bending Moment in Three Hinged and Two Hinged Parabolic and Segmental Arches. Effects of Rib-shortening and Temperature Change. Suspension Bridges: Stresses in Loaded Cables with Supports at the Same and Different Levels. Length of Cable; Two and Three Hinged Stiffening Girders. Introduction to Matrix Methods of Structural Analysis (Very elementary treatment only), Static Indeterminacy, Kinematic Indeterminacy, Stiffness and Flexibility Method for Two Span Continuous Beams only– Truss with 3 supports and 7 members.

Text books

1. Theory of Structures by S.Ramamrutham, R.Narayan, Dhanpat Rai, Publishing Company.

2. Theory of Structures by B.C.Punmia, Ashok K Jain,Arun K Jain, Laxmi Publications.

3. Mechanics of Structures Vol II by S.B.Junnarkar, H.J.Shah, Charotar Publishing House.

Reference Books

1. Statically Indeterminate Structures by C.K. Wang, Mcgraw-Hill.

2. Structural Analysis – A Matrix Approach by G.S. Pandit and S.P. Gupta, McGraw-Hill Education.

3. Indeterminate Structures by R.l. Jindal, S. Chand Publishers.

CE3102 : ENVIRONMENTAL ENGINEERING – II

Introduction to Sanitation – Systems of Sanitation – Relative Merits and Demerits – Collection and Conveyance of Wastewater – Sewerage – Classification of Sewerage Systems– Estimation of Sewage Flow and Storm Water Drainage – Fluctuations – Types of Sewers – Hydraulics of Sewers and Storm Drains – Design of Sewers – Materials for Sewers – Appurtenances in Sewerage – Cleaning and Ventilation of Sewers – Safety of Sewer Workers.

Storm Sewers – Design: Pumping of Wastewater – Pumping Stations – Location – Components Parts – Types of Pumps and their Suitability with regard to Wastewaters. House Plumbing: Plumbing Systems of Drainage – Sanitary Fittings and other Accessories – Single Stack System – One Pipe and Two Pipe Systems – Design of Building Drainage. Bacteriology of Sewage: Sewage Characteristics – Physical, Chemical and Biological Examination – Decomposition – Cycles of Decomposition – Sampling and Analysis of Wastewater – BOD-COD –Treatment of Sewage – Primary Treatment: Screens–grit Chambers – Grease Traps – Floatation – Sedimentation – Design of Primary and Pretreatment Units. Secondary Treatment: Aerobic and Anaerobic Treatment Process B – Comparison. Suspended Growth Process: Activated Sludge Process, Principles, Designs and Operational Problems, Modifications of Activated Sludge Processes, Miscellaneous Methods, Oxidation Ponds, Oxidation Ditches, Aerated Lagoons. Attached Growth Process: Trickling Filters – Mechanism of Impurities Removal – Classification – Filter Problems, Design and Recirculation. RBCs, Fluidized Bed Reactors, Sewage Disposal Methods. Anaerobic Processes: Septic Tanks and Imhoff tanks – Principles and Design – Sludge Treatment and Disposal-Fundamentals of UASB. Biosolids (Sludge): Characteristics – Thickening – Digestion, Drying and Sludge Disposal.

Text Books

1. Wastewater Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill edition.

2. Environmental Engineering by Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. McGraw-Hill international edition

3. Environmental Engineering II: Sewage Disposal and Air Pollution Engineering, Khanna Publishers.

Reference Books

1. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, by S.K.Garg, Khanna Publishers.

2. Water Supply and Sanitary Engineering by G.S.Birdie and J.S.Birdie, Dhanpat Rai Publishing Company.

3. Water Supply Engineering by P.N.Modi, Standard Book House.

4. Water Supply Engineering by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd.

CE3103 : REINFORCED CONCRETE STRUCTURES - I

(IS-456 code book is allowed for examination)

General: Loading Standards as per IS 875, Grades of Steel and Cement, Stress-Strain Characteristics of Concrete and Steel, Introduction to Working Stress Method and Limit State Method (L.S.D.) of Design.

Limit State of Collapse of in Flexure: Central Value measures, Measures of Distribution, Normal Distribution Curve. Introduction and Principles of L.S.D., Characteristic Load and Strengths, Design Values, Partial Safety Factors, Factored Loads.

Limit State of Collapse: Flexure of R.C.C. Beams of Rectangular section. Under Reinforced, Balanced and Over Reinforced Sections. Compression Stress Block, Estimation of Ultimate Moment by Strain Compatibility. Guide Lines for choosing Width, Depth and Percentage of Reinforcements in Beams. Analysis and Design of Singly Reinforced Rectangular Beams and Doubly Reinforced Beams, Design of Flanged Beams (T and L), Effective Flange Width, Basis of Analysis and Design, Minimum and Maximum Steel in Flanged Beams. Design of One way and Two way Slabs: Simply Supported Slabs on all Four Sides, Moment in Two way Slabs with Corners held down. Choosing Slab Thickness. Design of Restrained Slabs (with Torsion at corners) I.S. Code Provisions. Detailing of Reinforcement. Shear, Torsion and Bond: Limit State of Collapse in Shear, Types of Shear Failures. Truss Analogy, Shear Span/Depth Ratio. Calculation of Shear Stress, Types of Shear Reinforcement. General Procedure for Design of Beams for Shear. Enhanced Shear near Supports. Shear in Slabs, Steel detailing. Analysis for Torsional Moment in a Member. Torsional Shear Stress in Rectangular and Flanged Sections. Reinforcement for Torsion in RC Beams. Principles of Design for Combined Bending Shear and Torsion. Detailing of Torsion Reinforcement – Concept of Bond, Development Length, Anchorage, Bond, Flexural Bond. Columns: Short and Long Columns, Minimum Eccentricity, Short Column under Axial Compression, Column with Helical and Tie Reinforcement. Footings: Analysis and Design of Isolated Square and Rectangular Footings.

Text Books

1. Limit State of Design of Reinforced Concrete by P. C. Vergheese, Prentice Hall India Learning.

2. Reinforced Concrete Limit state Design by A.K. Jain, Nem Chand & Brothers.

3. R.C.C Design by Unnikrishna Pillai and Devadas Menon, McGraw-Hill

Reference Books

1. Limit State Design of Reinforced Concrete Structures by P. Dayaratnam, P.Sarah, Oxford and IBH Publishers.

2. Reinforced Concrete Structures by R.Park and T.Paulay, Wiley Publishers.

 CE3104 : STEEL STRUCTURES – I

Note : All the designs should be taught in the limit state design method as per IS 800-2007 Fundamental Concepts of Limit State Design of Structures, Different types of Rolled Steel Sections available to be used in Steel Structures. Stress – Strain relationship for Mild Steel Bolted Connections: Behavior of Bolted Joints, Design Strength of Ordinary Black Bolts, High Strength Friction Grip Bolts, Simple Connections, Moment Resistant Connections

Welded Connections: Advantages of Welding, Types and Properties of Welds, Types of Joints, Weld Specifications Design of Welded Joints subjected to Axial Load, Eccentric Welded Connections Tension Members: Types of Tension Members, Design of Strands, Slenderness Ratio, Displacement of Tension Members, Behavior of Tension Members, Modes of Failure, Factors affecting Strength of Tension Members, Angles under Tension, Design of Tension Members, Lug Angles, Splices

Compression Members: Possible Failure Modes, Classification of Cross-section, Behavior of Compression Members, Effective Length, Radius of Gyration and Slenderness of Compression Members, Allowable Stresses in Compression, Design of Axially Loaded Compression Members, Built up Compression Members, Laced and Battened Columns, Eccentrically Loaded Columns, Column Splices.

Beams: Beam Types, Section Classifications, Lateral Stability of Beams, Allowable Stress in Bending, Shear and Bearing Stresses, Effective Length of Compression Flange, Laterally Supported and Unsupported beams, Design of Built up Beams. Roof Trusses: Types of Trusses, Economical Spacing of Roof Trusses, Loads on Roof Trusses, Estimation of Wind Load on Roof Trusses as per IS: 875. Design of Members of Roof Truss and Joints, Design of Purlins.

Column Bases and Foundations: Allowable Stress in Bearing, Slab Base, Gusset Base and Grillage Foundations. Introduction to Pre-engineered Structures, Concepts, Advantages and Disadvantages.

Text Books

1. Limit State Design of steel structures by S.K.Duggal, McGraw-Hill Education Private Ltd.

2. Design of steel structures by K.S.Sai Ram, Pearson Education India.

3. Limit State Design of steel structures by Ramchandra and Virendra Gehlot, Scientific Publishers (India).

Reference Books

1. Design of Steel structures by N. Subramanian, Oxford University Press.

2. Design of steel structures by Limit State Method as per IS: 800-2007 – S.S. Bhavikatti, IK International Publishing House.

PE - I: CE3105A : CONCRETE TECHNOLOGY

Chemical and Mineral Admixtures: Water Reducers, Air Entrainers, Set Controllers, Special Admixtures – Structure, Properties and effects on Concrete Properties. Introduction to Supplementary Cementing Materials and Pozzolans – Fly ash, Blast Furnace Slag, Silica Fume, and Metakaolin – their Production, Properties, and Effects on Concrete Properties; Other Mineral Additives – Reactive and Inert.

Dimensional Stability and Durability: Creep and Relaxation – Parameters Affecting; Shrinkage of Concrete – Types and Significance. Parameters affecting Shrinkage; Measurement of Creep and Shrinkage. Durability of Concrete: Introduction to Durability; Relation between Durability and Permeability – Chemical Attack of Concrete; Corrosion of Steel Rebars; other Durability Issues.

Mix Design: Review of Methods and Philosophies of IS, BS and ACI Methods, Mix Design for Special Purposes. Acceptance Criteria for Compressive Strength of Concrete

Special Concretes: Properties and Applications of High Strength – High Performance Concrete, Reactive Powder Concrete, Lightweight, Heavyweight and Mass Concrete; Fibre Reinforced Concrete; Self-compacting Concrete; Shotcrete.

Text Book

1. Concrete Technology Theory and Practice by M.S.Shetty, S.Chand & Company Ltd, New Delhi.

Reference Books

1. Properties of Concrete by A.M.Neville, Longman 1995.

2. Concrete micro-structure, Properties and Materials by P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw-Hill, USA.

PE I: CE3105B : REMOTE SENSING AND GIS APPLICATIONS

Remote Sensing: Introduction, Basic Components of Remote Sensing, Electromagnetic Radiation, Electromagnetic Spectrum, Interaction with Atmosphere, Energy Interaction with the Earth Surfaces, Sensors – Types and Characteristics, Passive Sensor, Active Sensor, Platforms – Airborne Remote Sensing, Space Borne Remote Sensing, Data Pre-processing, Important Remote Sensing Programmes.

Geographic Information System: Introduction, Key Components, Spatial Data, Raster Data Models, Vector Data Models, Raster Versus Vector, Data Input Methods and Editing, NonSpatial Data, Map Projections.

Image Analysis: Introduction, Elements of Visual Interpretations, Digital Image Processing – Digital Image Data Formats – Band Interleaved by pixel, Band Interleaved by line, Band Sequential, Image Preprocessing, Image Rectification, Image Enhancement, Image Classification, Supervised Classification, Unsupervised Classification.

GIS Analysis: Introduction, Digital Elevation Models, RS and GIS Data Integration, Overlay Function – Vector Overlay Operations, Raster Overlay Operations, Arithmetic Operators, Comparison and Logical Operators, Conditional Expressions, Overlay using a Decision Table, Some Neighbourhood Operations. RS and GIS Applications in Civil Engineering: Land Cover and Land Use, Urban Applications, Hydrological Studies, Runoff Modeling, Flood Zone Delineation and Mapping, Groundwater Prospects and Recharge, Reservoir Storage Estimation, Water Management, Irrigation Planning, Drought Monitoring, Environmental Impact Assessment and other Watershed Studies.

Text Books

1. Remote Sensing and Image Interpretation by Thomas M. Lilles and Ralph W. Kiefer, John Wiley and Sons Inc.

2. Introduction to Geographical Information Systems by Kang-tsung Chang, TMH Publications & Co.

Reference Books

1. Fundamentals of Remote Sensing and its Applications by Dr George Joseph, Universities Press.

2. Concepts & Techniques of GIS by C.P. Lo Albert, K.W.Young, Prentice Hall (India) Publications.

3. Principles of Geographical Information Systems by Peter A. Burragh and Rachael A. Mc Donnell, Oxford Publishers.

PE-I: CE3105C GEO-ENVIRONMENTAL ENGINEERING

Wastes: Source, Production and Classification of Wastes, Soil Pollution Processes, Waste Characterization, Physical Characterization, Problems due to Improper Disposal of Wastes, Waste Management Strategies.

Soil Pollution, Sources of Soil Pollution, Control of Soil Pollution. Waste Disposal Facilities such as Landfills, Configuration or Types of Landfill, Components of Landfill, Layout of a Landfill Site, Stages of Decomposition of Waste in a Landfill, Landfill Planning and Design. Barrier Systems – Active Systems, Passive Systems, Vertical Barriers and their Types, Bottom Barriers, Reuse of Waste Materials, Contaminated Site Remediation.

Text Book

1. Geoenvironmental Engineering – Principles and Applications by Reddi, L. N., and Inyang, H. F., Marcel Dekker.

Reference Books

1. Geotechnical Practice for Waste Disposal by Daniel, D. E., Chapman and Hall, London.

2. Clay Barrier Systems for Waste Disposal Facilities by Rowe, R. K., Quigley, R. M. and Booker, J.R., E & FN Spon, London.

OP II: CE3106 BUILDING SERVICES AND MAINTENANCE

Ventilation and Air conditioning: Ventilation–Necessity of Ventilation – Functional Requirements– Systems of Ventilation – Types – Natural Ventilation – Artificial Ventilation – Air Conditioning – Systems of Air Conditioning – Essentials of Air Conditioning systems – Protection against fire caused by Air Conditioning Systems.

Thermal Insulation: Heat Transfer – Thermal Insulating Materials – General Methods of Thermal Insulation – Economics of Thermal Insulation – Thermal Insulation of Exposed Walls, Doors, Windows and Roofs.

Fire Safety: Fire Hazards, Causes of Fire in Buildings, Fire Load – Safety Regulations – Characteristics of Fire Resisting Materials – General Fire Safety Requirements for Buildings – NBC – Planning Considerations in Buildings like Non–combustible Materials, Fire Resistant Construction, Staircases and Lift Lobbies, Fire Escapes and A.C. Systems – Building Types – Heat and Smoke Detectors – Fire Alarms, Snorkel Ladder – Fire Fighting Pump and Water Storage –Dry and Wet Rises – Automatic Sprinklers.

Plumbing Services: Water Supply System –Fixing the Pipe in Building – Maintenance of Building Pipe Line – Water Meters – Sanitary Fittings – Principles Governing Design of Building Drainage – Gas Supply Systems.

Machineries in Buildings: Lifts – Definitions – Essential Requirements – Design Considerations – Maintenance Escalators – Essential Requirements, Pumps – Types of Pumps, Pumps for Household, Flats and Pumps for Dewatering

Electrical Installation in Buildings: Lighting for Office Buildings – School Buildings – Residential Buildings – Fannage – Air Conditioning/Heating – Reception and Distribution of Main Supply – Fittings and Accessories – Method of Internal Wiring – Earthing – Planning of Electrical Installations – Lightening Arrestors – Earthing

Anti–termite Treatment: Types of Termites, Internal and External Anti-termite Treatments – Preconstruction Treatment – Post-construction Treatment – Preventive Measures.

 Text Books

1. Building Construction by B.C.Punmia, Er. Ashok K Jain, Arun K Jain, Laxmi Publications (P) Ltd., New Delhi.

2. Building Construction by Janardhan Jha, S K Sinha, Khanna Publishers.

3. Building construction by Rangwala, Charotar Publishibg House.

Reference Books

1. National Building Code, Bureau of Indian Standards.

2. Building Services Engineering by David V.Chadderton, Routledge

3. Building Construction by P.C.Varghese, Prentice Hall India Learning.

CE3107 GEOTECHNICAL ENGINEERING LABORATORY – I

1. Determination of Specific Gravity of Coarse Grained and Fine Grained Soils.

2. Determination of Atterberg Limits of Clay.

3. Determination of Field Density by Core Cutter and Sand Replacement Methods.

4. Determination of Grain Size Distribution of Coarse Grained Soil by Sieve Analysis.

5. Determination of Grain Size Distribution of Fines Fraction of Soil by Hydrometer/pipette Analysis.

6. Determination of Coefficient Permeability of Coarse Grained Soil by Constant Head Permeability Test.

7. Determination of Coefficient Permeability of Fine Grained Soil by Variable (Falling) Head Permeability Test.

8. Determination of Compaction Characteristics of Soil by IS Light / Heavy Compaction Test.

Demonstration Experiments:

1. Rapid Moisture Meter Test for Quick Determination of Water Content

2. Determination of Water Content of Compacted Soil in Field by Proctor’s Plasticity Needle

Reference Books

1. Relevant IS Codes of Practice

CE3108: ENVIRONMENTAL ENGINEERING LABORATORY

1. Determination of pH and Conductivity of a given water and wastewater sample

2. Measurement of Turbidity using Nephelometric Turbid meter and Determination of optimum coagulant dosage (Jar Test).

3. Determination of Hardness in a given water sample.

4. Estimation of Acidity of a water sample.

5. Estimation of Alkalinity of a waste and wastewater sample.

6. Determination of Available Chlorine in a given Bleaching powder sample and residual Chlorine in a water sample.

7. Estimation of Fluorides in a given water sample.

8. Estimation Iron in a water sample.

9. Estimation of Total Solids: Settleable Solids: Suspended solids, dissolved solids.

10. Measurement of D.O. by volumetric analysis

11. Estimate the B. O. D. of a wastewater sample.

12. Estimate the C. O. D. of a wastewater sample.

13. Estimation of Chlorides in a water sample.

14. Estimation of Nitrates in a given sample.

Text Books

1. Environmental Engineering Laboratory Manual by Kotaiah, B. and Kumara Swamy, N. Charotar Pub. House.

2. Chemical Analysis of Water and Soil: A laboratory Manual by Muralikrishan K.V.S.G.., Envir. Prot. Society.

III Year – II Semester

CE3201: ESTIMATION, SPECIFICATIONS AND CONTRACTS

Introduction: Standard Units, Units of Measurement of Different items of Work. Meaning of Estimate, Tender, Contract, Price Escalation. Errors in Estimation, Different types of Estimates. Contingencies and Related Terms in the Estimate, Different types of Approvals. Plinth Area and Related Terms used in the Estimation of various Structures, Rules and Methods of Measurements of different Works.

Specifications: Meaning, Purpose, types of Specifications, Method of preparation of Specification, General Specification, Detailed Specifications of different items of Buildings and other Structures – Rate Analysis – Data Sheet for Materials and various items of work in Buildings and other Structures, Schedule of Rates, Abstract Estimate of Buildings.

Detailed Estimate of Buildings. Different items of work in Building; Principles of taking out Quantities, Detailed Measurement Form; Long Walls and Short Walls method of Building Estimate, Centre Line Method of Building Estimate. Estimate of RCC Building, Slope Roof Buildings; G.I. and A.C. Sheet, Detailed Estimate of different types of Doors and Windows, Electricity and Water Supply, Sanitation Works etc.

Estimate of Earthwork; Different Formulae for Calculations, Estimate of Metalled Road, Tar Road, Concrete Road, Railway Track, Estimate of Culverts and Bridges etc. Valuation of Buildings; Purpose, Different Method of Building Valuation; Different Terms used in Valuation and their Meaning.

Text Books

1. Estimating and Costing in Civil Engineering by B.N. Dutta, Sangam Books.

2. Textbook of estimating and costing by G.S. Birdie, Dhanpat Rai Publishing Company Private Limited.

Reference Books

1. Estimation, Costing, Specifications and Valuation in Civil Engineering by M.Chakraborti.

2. Textbook on Estimating, Costing and Accounts by D.D. Kohli and R.C. Kohli, S Chand & Company Pvt. Ltd.

CE3202 FLUID MECHANICS – II

Navier-Stokes Equations (No Derivation), Boundary Layer Theory: Theory of Boundary Layer – Characteristics of Laminar Boundary Layer – Boundary Layer growth over a Flat Plate (without pressure gradient) – Boundary Layer Thickness and its Characteristics – Displacement, Momentum and Energy Thicknesses; Stability Parameter; Laminar and Turbulent boundary layers.

Boundary Layer Separation – Mechanism of Separation, Control of B.L. Separation; Boundary Layer on Rough Surfaces – Laminar Sublayer, Shear Friction Velocity; Friction Drag.

Turbulent Flow: Critical Reynolds Number – Characteristics of Turbulent Flow – Mean and Fluctuating Components of Velocity. Analysis of Turbulent Flows – Shear Stress due to Turbulence –Velocity distribution for Hydrodynamically Smooth and Rough Pipes; Variation of Friction Factor in Turbulent Flow; Friction Factor for Commercial Pipes – Moody diagram.

Flow through Pipes: Introduction to Pipe Flow and Laws of Friction – Reynolds Experiment; Steady Turbulent Flow through Pipes; Laws of Friction; Darcy-Weisbach Equation. Total Energy and Hydraulic Gradient – Energy and Hydraulic Gradient Lines; Minor Losses in Pipes; Pipes in Series and Parallel – Equivalent Length of Pipe. Flow Between Two Reservoirs; Three Reservoir Problems; Distribution Mains; Working Pressures, Design Pressure And Test Procedures; Choice Of Pipe Material; Siphon; Pipe Network Analysis By Hardy–Cross Method; Hydraulic Power Transmission Through Pipes And Nozzles, Water Hammer (Only Concept). Drag, Lift & Propulsion: Concepts of Drag and Pressure Distribution over Immersed Bodies – Drag and Lift – Deformation Drag, Friction Drag, Form Drag – Drag coefficient. Distribution of Fluid Pressure on Immersed Bodies – Pressure Distribution for Flow Past a Circular Disk, Sphere; Effects of Eddy Pattern in Two Dimensional Flow –Distribution of Pressure for Two Dimensional Flow Past a Cylinder – von Kármán Vortex Trail, Eddy Shedding; Drag of Immersed Bodies – Variation of Drag Coefficient with Reynolds Number – Drag on Cylinder – Resistance Diagram for Bodies of Revolution; Drag Coefficient of Practical Bodies. Lift and Propulsion – Effect of Circulation in Irrotational Flow, Generation of Lift around a Cylinder, Magnus Effect.

Open Channel Flows: Basic Concepts – Introduction, Classification of Open Channels – Classification of Flow; Channel Geometry – Geometric Elements of a Channel Section; Velocity Distribution in a Channel Section; Wide Open Channel; Measurement of Velocity; Velocity Distribution Coefficients; Pressure Distribution in a Channel Section – Effect of Slope on Pressure Distribution; Basic Equations – Chezy’s Equation, Manning’s Equation. Uniform Flow Computation; Conveyance of a Channel Section – Section Factor and Hydraulic Exponent. Flow Characteristics in a Closed Conduit with Open Channel Flow; Determination of Normal Depth and Velocity; Design of Channels for Uniform Flow; Design of Non-erodible Channels; Best Hydraulic Section; Determination of Section Dimensions for Uniform Flow; Most Economical Channel Sections – Rectangular, Trapezoidal, Circular and Triangular Channel Sections; Critical Flow – Computation of Critical Flow, Section Factor for Critical Flow. Application of Energy Principle in Open channels – Definition of Specific Energy, Specific Energy Diagram, Critical depth, Critical Velocity, Conjugate or Alternate Depths, Sub-critical, Critical and Super-critical Flows, Froude Number, Relationship between Critical depth and Specific Energy for Rectangular, Trapezoidal Sections; Application of Momentum Principle in Open channels – Specific Force; Canal Transitions – Change of Depth in Channels with Change in Cross-section and Hump in the Bed; Control Sections; Venturi Flume and Parshall Flume. Varied Flow in Open Channels: Analysis & computation of G.V.F: Definition of G.V.F. and Derivation of Governing Equation – Mild, Steep, Critical, Horizontal and Adverse Slopes – Backwater and Drawdown Curves – G.V.F. Profiles for Channels with Changing Slopes; Computation of G.V.F. Profiles – Method of Direct Integration (Procedures only), Direct Step Method – Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple Slope cases only). Rapidly Varied Flow – Hydraulic Jump, Types of Jumps, Hydraulic Jump in Horizontal Rectangular Channels; Surges.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.

2. Flow in Open Channels by K.Subramanya, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Fluid Mechanics by A.K.Jain, Khanna Publishers.

2. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co. Ltd.

3. Flow through Open Channels by K.G.Ranga Raju, Tata McGraw-Hill Publishing Co. Ltd.

4. Open Channel Hydraulics by V.T.Chow, McGraw-Hill Ltd.

CE3203 : REINFORCED CONCRETE STRUCTURES – II

Retaining Walls: Types of Retaining Walls, Forces on Retaining Walls, Rankine and Coloumb Earth Pressure Theories (c and  soils). Passive Earth Pressure, Drainage of Retaining Walls. Stability Requirements. Preliminary Proportioning of Cantilever Retaining Walls. Design of Cantilever and Counterfort Retaining Walls.

Water Tanks: Stress in Concrete and Steel in Water Tanks, Modular Ratio, Impermeability Requirements, Tanks resting on Ground and below Ground of Circular and Rectangular shapes; Elevated Circular and Rectangular Tanks resting on Maximum of 8 Columns; Design of Staging of Rectangular tanks.

Bridges: Components of a Bridge in Sub Structure and Super Structure. Classification of Bridges. Highway Loading Standards, Kerbs, Footpaths, Railings, Parapet Loadings, Impact, Wind, Longitudinal Forces.

Design of Solid Slabs, Design of T-beam Bridge Deck Slab, Longitudinal and Cross Beams (Design any one component for exam), Courbon’s Theory. Piles and Pile Caps: Design of Bored Cast-in-situ Piles (Bearing and Friction types), Under Reamed Piles. Pile Caps Design; Bending and Truss Methods.

Prestresed Concrete – Reinforced Concrete versus Prestressed Concrete – Prestressing Systems (Freyssinet, Gifford Udal, Magnel-Blatten) – Prestressing Losses – Steel and Concrete for Prestressing – Homogeneous Beam Concept, Limiting Eccentricities, Pressure Line, Elastic Stress Distribution across the Depth due to D.L., Eccentric Prestress and L.L.

Text Books

1. Reinforced Concrete structures Limit State by B. C. Punmia, Laxmi Publications.

2. Design of Reinforced Concrete Structures by M.L.Gambhir, PHI Publications

3. R.C.C Design by Unnikrishna Pillai and Devadas Menon, McGraw-Hill

Reference Books

1. Limit State of Design of Reinforced Concrete by P. C. Vergheese, Prentice Hall India Learning.

2. Reinforced Concrete Limit state Design by P. Dayaratnam and P.Sarah, Oxford and IBH Publishers.

3. Reinforced Concrete Structures by N.Subramanyan, Oxford University Press.

 CE 3204 : TRANSPORTATION ENGINEERING – I

Highway Engineering-1: Highway Development and Planning, Classification of Roads, Highway Alignment, Highway Geometrics – Design of Cross Sectional Elements, Sight Distance, Horizontal and Vertical Alignment.

Highway Engineering-2: Traffic Engineering – Traffic Characteristics, Traffic Studies (Surveys), Traffic Control Devices – Design of Intersections. Design of Pavements – Design Factors, Design of Flexible Pavements – Group Index Method, CBR Methods, Design of Rigid Pavements – Westergaard Equations, I.R.C. Recommendations for Design of Concrete Roads.

Highway Engineering-3: Construction of Roads – Earthen Roads – W.B.M. Roads – Bitumen Roads – Cement Concrete Roads – Highway Materials and their Properties and Tests. Maintenance of all types of Roads – Highway Drainage – Arborical Culture – Street lighting.

Airport Engineering: Layout of Airports – Components Functions – Aircraft Characteristics – Airport Site Selection – Airport Obstructions – Runway Design – Visual Aids – Air Traffic Control.

Text Books

1. Highway Engineering by S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand

2. Airport Planning and Design by S.K.Khanna, S.G.Arora and S.S.Jain, Nem Chand and Bros.

Reference Books

1. Principle and Practice of Highway Engineering by R.C.Sharma and S.K.Sharma, Asia Publishing House.

2. Transportation Engineering by L.R. Kadiyali, Khanna Publications.

3. Principles of Transportation Engineering by Partha Chakraborty, PHI Learning.

4. Airport Engineering by Rangwala, Charotar Publications.

PE-II: CE3205A STEEL STRUCTURES – II

Note: All the designs should be taught in the limit state design method as per IS 800-2007. Plate Girders (Bolted and Welded): Components of a Plate Girder, Economical Depth, Proportioning of Web and Flanges, Shear Buckling resistance of Web by Simple Post Critical and Tension Field Methods, Curtailment of Flange Plates, Connection of Flange Angles to Web and Flange Angles to Flange Plates.

Web Stiffeners: Design of Bearing Stiffeners. End Panel Design, Design of Intermediate Stiffeners, Connections.

Bridges: Classification, Loadings, Deck type Plate Girder Bridges. Bearings: Types of Bearings, Plate Bearing, Rocker Bearing, Roller Bearing, Knuckle Pin Bearing. Water Tanks: Introduction, Design of Elevated Circular and Rectangular Water Tanks. Plastic Analysis: Introduction, Upper and Lower Bound Theorems, Uniqueness Theorem, Shape Factor, Load Factor; Beams: Collapse Load for Fixed and Continuous Beams, Design of Beams; Frames: Collapse Load for a Frame of Single Bay Single Storey Frame.

Text Books

1. Limit State Design of steel structures by S.K.Duggal, McGraw-Hill Education Private Ltd.

2. Design of steel structures by K.S.Sai Ram, Pearson Education India.

3. Limit State Design of steel structures by Ramchandra and Virendra Gehlot, Scientific Publishers (India)

Reference Books

1. Design of Steel structures by N. Subramanian, Oxford University Press.

PE II: CE3205B GROUND IMPROVEMENT TECHNIQUES

In-situ Densification Methods in Granular Soils: Introduction of Vibration at the Ground Surface, Impact at the Ground Surface, Vibration at Depth, Impact at Depth. In-situ Densification Methods in Cohesive Soils: Introduction, Preconsolidation Preloading using Sand Drains, Sand Wicks, Geodrains/Band drains, Forced Vacuum Preconsolidation, Stone and Lime Columns, Thermal Methods.

Grouting: Objectives, Suspension, Emulsion and Solution Grouts, Categories of Grouting, Grouting Equipment, Stage Grouting in Soils by Tube-a-Manchettee, Ascending and Descending Stage Grouting, Hydrofracture, Grout Control

Reinforced Earth: Principles, Components of Reinforced Earth – Fill, Reinforcing Material and Facing, Evaluation of Interfacial Friction of Fill and Reinforcing Material, Applications of Reinforced Earth, Design Principles of Reinforced Earth Walls

Geotextiles: Introduction, Types of Geotextiles; Functions and their Application, Tests for Geotextiles Soil Stabilization: Objectives, Methods of Stabilisation, Mechanical Stabilization: Proportioning of Materials by Rothfutch’s Method, Factors affecting Mechanical Stabilization, Cement and Lime Stabilization: Mechanisms, Engineering Benefits, Factors affecting Cement and Lime Stabilization, Construction Techniques, Bituminous Stabilization: Types of Soil – Bitumen, Factors affecting Bituminous Stabilization of Soils, Construction Methods.

Deep Mixing of Soils with Lime/Cement: Lime-soil Columns, Soil-Cement Columns, Construction Methods, Applications. Stone Columns: Introduction, Construction Methods – Vibroflotation Technique and Rammed Stone Column, Functions and limitations.

Text Book

1. Ground Improvement Techniques, P.Purushothama Raj, Lakshmi Publications (P) Ltd.

Reference Books

1. Engineering Principles of Ground Modification, Monfred R Hausmann,Mc Graw-Hill Publishing Co.

2. Highway Engineering, Khanna S.K. and Justo C.E., Nem chand Publications.

PE II: CE3205C IRRIGATION ENGINEERING

Development of Irrigation: Water Resources of India – Importance of Irrigation in Agriculture – Historical Evolution of Irrigation In India – Irrigation Development During Pre-Colonization – Colonization and Post-Colonization – National Water Policy – Inadequacy of Irrigation Management – Criteria for Good Irrigation Management.

Soil Water Plant Relationship: Soil Physical Properties Influencing Soil – Water Relationship– Forms and Occurrence of Soil Water – Classification of Soil Water – Soil Water Constants – Energy Concept of Soil Water – Forces acting on Soil Water – Soil Water Potential Concept – Soil Water Retention – Soil Moisture Measurement.

Crop Water Requirement: Water Requirement of Crops– Evapotranspiration and Consumptive Use – Methods of Estimating Evapotranspiration – Effective Rainfall – Irrigation Requirement– Duty of Water – Irrigation Efficiencies – Irrigation Scheduling – Irrigation Measurement.

Surface Irrigation Methods: Canal Network and Canal Design – Surface Irrigation Methods – Types – Border Irrigation, Furrow Irrigation and Strip Irrigation– Specifications, Hydraulics and Design. Drip and Sprinkler Irrigation Method: Sprinkler and Drip – History and Development, Types, Components, Design and Layout, Performance Evaluation, Operation and Maintenance.

Drainage Principles and Criteria: Factors to be considered in Land Drainage – Combined Irrigation and Drainage Systems – Water Balance – Equations for Water Balance – Drainage Surveys – Agricultural Drainage Criteria – Effect of Field Drainage Systems on Agriculture. Irrigation Water Quality: Water Quality for Irrigation – Salinity and Permeability Problem – Root Zone Salinity – Irrigation Practices for Poor Quality Water – Saline Water Irrigation – Future Strategies

Text Books

1. Irrigation Engineering by G.L.Asawa, New Age International Publishers.

2. Irrigation and Water Power Engineering by B.C.Punmia and Pande B.B. Lal, Laxmi Publishing.

3. Irrigation Theory and Practices by A.M.Michael, A.M, Vikas Publishing Pvt Ltd,

4. Irrigation Engineering by Gupta, B.L, and Amir Gupta, Satya Praheshan.

Reference Books

1. Irrigation Water Management (Principles & Practices) by Dilip Kumar Majumdar, Prentice Hall of India (P), Ltd

2. Irrigation Engineering by N,N,Basak,Tata McGraw-Hill Publishing Co. Ltd.

3. Irrigation Engineering by R.K.Sharma, S. Chand & Company Pvt. Ltd.

CE3206 : HIGHWAY MATERIAL LABORATORY

Testing of Aggregates: Specific gravity – Sieve Analysis – Shape test – Flakiness Index – Elongation Index – Angularity Number – Aggregate Crushing value – Impact Value – Abrasion value – Stripping Value and Soundness.

Testing of Bituminous Material: Specific Gravity – Penetration Value – Viscosity Value – Softening Point – Ductility Value – Flash and Fire Point. Testing on Soils: C.B.R. Test (IS 2720 – Part-XVI) – N.D.C. Penetration Test (IS 2720 PartXXXII) – Group Index. Testing on Bituminous Mixes: Bitumen Extraction Test, Marshal Stability Test (Demonstration)

Reference Book

1. Highway material testing by S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand & Brothers

CE3207 : CONCRETE LABORATORY

1) Determination of Specific Gravity and Unit Weight of Cement

2) Determination of Specific Gravity and Unit Weight of Coarse and Fine Aggregates

3) Determination of Normal Consistency of Cement

4) Determination of Initial and Final Setting Time

5) Determination of Fineness of Cement.

6) Determination of Compressive Strength of Cement (for different grades of cement).

7) Determination of Bulking Characteristics of Sand.

8) Sieve Analysis of Coarse and Fine Aggregates and Classification as per IS 383.

9) Workability Tests on Green Concrete by using: Slump Cone, Compaction Factor Apparatus, Flow Table, Vee-Bee Consistometer.

10) Tests on Hardened Concrete. a. Determination of Compressive Strength b. Determination of Split tensile strength c. Determination of Modulus of rupture.

11) Design of Concrete Mix by using IS Code Method (for class work only)

CE3208: COMPUTER APPLICATIONS IN CIVIL ENGINEERING LABORATORY

Determination of Shear Force, Bending Moment, Deflection for Different Loading Conditions for a Simply Supported Beam and Cantilever Beam. Determination of Fixed End Moments for Different Loading Conditions of a Fixed Beam. Analysis and Design of Singly and Doubly Reinforced Beams. Analysis and Design of Columns, Footings. Estimation of Runoff for a Catchment.

Estimation of Friction Factor for Laminar and Turbulent Flows, Minor Losses in Pipe Flow. Conversion of Angles from WCB to RB.

Classification of Soils Determination of Coefficient of Permeability, Degree of Consolidation and Shear Strength.

Computation of Water Surface Profiles in Open Channel Flows. Estimation of Settlement of Foundations in Cohesive soil, Stability Analysis of Slopes. Estimation of Earth Pressure in Cohesive and Cohesionless Soils.

Basic AUTO CAD Commands Application of Drafting Tools and Modifying Tools Creation of 3 Dimensional Solids. Application of STAAD Pro/ETABS for the Analysis and Design of various Structural Components of Civil Engineering and Building Frames. .

Text Books

1. Computer aided design-Software and Analytical tools by C.S. Krishnamoorthy and S. Rajesh, Alpha Science

2. Computer Aided Design in Reinforced Concrete, V.L.Shah, Standard publishers distributors

 IV Year – I Semester

CE4101 : GEOTECHNICAL ENGINEERING – II

Subsoil Exploration: Objectives, Methods of Subsoil Exploration Direct, Semi direct and Indirect Methods, Soundings by Standard, Dynamic Cone and Static Cone Penetration Tests, Types of Boring, Types of Samples, Criteria for Undisturbed Samples, Transport and Preservation of Samples, Borelogs, Planning of Exploration Programmes, Report Writing.

Bearing Capacity: Safe Bearing Capacity and Allowable Bearing Pressure, General and Local Shear Failures, Terzaghi’s Bearing Capacity Equations its modifications for Square, Rectangular and Circular Foundations, Factors affecting Bearing Capacity of Soil, Effect of Water Table on Bearing Capacity, IS Code Method for Bearing Capacity of Footings, Allowable Bearing Pressure based on N-values. Bearing Capacity from Plate Load Tests.

Shallow Foundations: Factors effecting locations of Foundation and Design considerations of Shallow Foundations, Types of Shallow Foundations and Choice of Type of Foundations, Foundations on Expansive Soils.

Settlement Analysis: Types of Settlement, Causes of Settlement, Computation of Settlement of Footings in Saturated Clay and Granular Soils, Allowable Settlement. Measures to Reduce Settlement.

Pile Foundations: Classification, Load carrying capacity of Pile – Dynamic Formula, Static Formula, Pile Load Tests; Efficiency of Pile Group, Load Carrying Capacity and Settlement of Pile Groups in Cohesive and Cohesionless soils, Negative Skin Friction, Under Reamed Pile.

Caissons: Types of Caissons, Pneumatic Caissons, Different Shapes of Well Foundations, Relative Advantages and Disadvantages, Different Components of Well and their Functions, Bearing Capacity of Well Foundation, Grip Length, Problems in Well Sinking and Remedial Measures.

Stability Analysis of Slopes: Infinite and Finite Slopes, Stability Analysis of Infinite Slopes, Different Factors of Safety, Types of Slope Failures – Toe, Slope and Base Failure, Stability Analysis of Finite slopes – Swedish Circle Method, Friction Circle Method, Fellineous Method for Location of Critical Slip Circle, Taylor’s Stability Number.

Earth Pressure: Types of Earth Pressure, Rankine’s Active and Passive Earth Pressure on Smooth Vertical Wall with Horizontal and Inclined Backfills. Coloumb’s Wedge Theory, Culmann’s and Rebhann’s Graphical Methods for Active Earth Pressure of Cohesionless Backfills, Stability Analysis of Retaining Walls. Bulkheads: Classification, Analysis of Cantilever Sheet Piles in Sand and Saturated Clay, Analysis of Anchored Bulkhead by Free Earth Support Method in Granular Soil.

Text Books

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publishers

2. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers.

Reference Books

1. Foundation Engineering by P.C. Varghese, Prentice Hall of India

2. Foundation Analysis and Design by J. E. Bowles, Mc Graw-Hill Publishing Co. .

CE4102 : FLUID MECHANICS – III

Dimensional Analysis and Similitude: Fundamental Concepts of Dimensional Analysis – Importance of Dimensional Analysis & Model Study; Units and Dimensional Formulae for Various Engineering Quantities; Fourier Concept of Dimensional Homogeneity.

Methods of Arriving at Dimensionless Groups – Non-dimensional Parameters; Rayleigh’s Method; Buckingham  method – Buckingham modified method; Omitted and Superfluous variables. Examples in Dimensional Analysis – Capillary Rise, Drag on Cylinder, Resistance of a Ship, Discharge over a Sharp Crested Weir, Fall Velocity of a Sphere, Head Characteristics of a Pump, Thrust on a Propeller,

Similarity and Similarity Laws – Concepts of Similarity – Geometric, Kinematic and Dynamic Similarities; Modeling Criteria; Similarity Laws – Important Dimensionless Numbers – Reynolds Number, Froude Number, Mach Number, Euler Number, Weber Number. Application of Similarity Laws to Practical Problems – Bodies Completely Submerged in Fluids, Bodies Subjected to Gravity and Viscous Forces, River Models – Manning’s Law; Distorted Models – Depth Distortion and Slope Distortion; Problems Related to Modeling of Spillways, Ships, Pumps and Turbines. Impact of Jets: Force Exerted by Fluid Jet on Stationary and Moving Flat and Curved Vanes, Torque and Work Done by Series of Moving Vanes. Hydraulic Machines– Turbines: Introduction and Classification of Turbines – Function of Prime Movers and Pumps, Hydraulic Turbines, Classification Based on Head, Discharge, Hydraulic Action – Impulse and Reaction Turbines, Differences Between Impulse and Reaction Turbines; Choice of Type of Turbine – Specific Speed.

Working of Impulse Turbines and Design Principles – Components and Working Principles of A Pelton Turbine – Work Done; Hydraulic and overall Efficiencies; Design of Pelton Turbine – Working Proportions; Governing Mechanism for a Pelton Turbine. Working of Reaction Turbines and Design Principles – Components and Working Principles of a Francis Turbine – Work Done; Hydraulic and overall Efficiencies; Design of Francis Turbine – Working Proportions; Governing Mechanism for a Francis Turbine. Draft Tube Theory – Functions and Types of Draft Tubes in Reaction Turbines, Efficiency of Draft Tube; Kaplan Turbine and Working Proportions of Kaplan Turbine.

Performance and Characteristics of Turbines: Unit Quantities, Specific Speed and its Importance; Model Relationships; Operating Characteristic Curves; Cavitation Problem in Turbines – Thoma’s Cavitation Factor. Hydraulic Machines – Centrifugal Pumps Functions of a Pump – Types of Pumps – Selection Criterion – Rotodynamic and Positive Displacement Pumps – Comparison between Centrifugal & Reciprocating Pumps. Centrifugal Pumps – Components & Working principles of Centrifugal Pumps; Classification of Centrifugal Pumps – Impellers based on Shape and Type of Casing, Pump with Volute Casing, Pump with Vortex Chamber & Pump with Guide vanes, Closed, Semi-closed & Open Impellers, Axial, Radial & Mixed Flow Impellers; Working Head and Number of Stages, Single & Double Suction. Work done by Centrifugal Pumps – Pressure Change in a Pump, Manometric and Static Head – Velocity triangles – Effect of Vane Shape; Pump Losses and Efficiency – Pressure Rise in the Impeller – Minimum Starting Speed of pump – Multistage Pumps; Pumps in Parallel and Series; Cavitation – Limitation of Suction Lift, NPSH and its importance in Selection of Pumps. Performance Characteristics of Pumps – Similarity Relations and Specific speed of Pumps – Dimensionless characteristics – Constant Efficiency Curves of Centrifugal Pumps. Hydraulic Machines – Reciprocating Pump & Hydraulic Ram: Reciprocating Pumps – Fundamental concepts, Component Parts and Working principle of Single Acting and Double Acting Reciprocating Pumps – Discharge Coefficient, Volumetric Efficiency and Slip; Work done by Reciprocating pumps – Work Done and Power Input – Indicator Diagram – Effect of Acceleration and Friction on Indicator Diagram – Maximum Speed of Rotation of Crank; Air Vessels and their principles – Modified Indicator Diagram in the presence of Air Vessels, Work Saved due to Presence of Air Vessel, Flow into and from Air Vessel.

Hydraulic Ram – Working Principle of Hydraulic Ram.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.

2. Fluid Mechanics by Jain, A.K., Khanna Publishers.

Reference Books

1. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co. Ltd.

2. Hydraulic Machines by Jagadish Lal, Metropoliton Book Company.

CE4103 : WATER RESOURCES ENGINEERING – I

Introduction to Hydrological Aspects: Water Resources in India, Hydrology in Water Resources Planning – Hydrologic Planning –Water Budget Equation; Climate and Weather – Importance of Monsoon Rains, Clouds, Storms and Precipitation – Precipitation – Types, Measurement of Rainfall; Influence and Feedbacks of Hydrological Changes Due to Climate Change; Average Depth of Rainfall over an Area, Mean Annual Rainfall, Analysis of Rainfall Data – Consistency of Rainfall Record, Double Mass Curve, Depth –Intensity, Depth-Area-Duration Curves, Frequency of Point Rainfall – Intensity-DurationFrequency (IDF) Curves, Probable Maximum Precipitation (PMP) Curves; Infiltration – Factors affecting and its Determination, Infiltrometers; Evaporation and Evapo-Transpiration – Pan Evaporation; Runoff – Factors Affecting Runoff, Methods of Determination of Runoff, Hydrograph Analysis, Base Flow Separation, Unit Hydrographs, Hydrograph of Different Durations, Applications of Unit Hydrograph; S-Hydrograph, Synthetic Unit Hydrograph; Stream Flow Measurement – Gauge Discharge Curves. Groundwater Flow: Mechanics of Interstitial Flow, Definitions, Subsurface Distribution of Water, Ground Water Movement; Darcy’s Law; Permeability – Intrinsic Permeability; Well Hydraulics – Steady Flow in Different Types of Aquifers and Wells; Determination of Hydraulic

Properties of Aquifer; Well Losses; Specific Capacity of Well; Well Efficiency – Pumping Tests – Recuperation Test Method for Determination of Well Yield. Rain Water Harvesting and Recharging of Underground Storage – Methods of Recharging – Infiltration Galleries, Infiltration Wells, Springs. Methods of Construction of Open Well–Yield of an Open Well – Methods of Construction of Tube Wells, Well Shrouding and Well Development, Spacing of Tube Wells, Design of Tube Well; Pumping Requirements, Centrifugal and Bore Hole Type Pumps; Collector Wells. Reservoir Planning and Flood Routing: Types of Reservoir – Investigations for Reservoir Planning, Selection of Site for a Reservoir, Zones of Storage in a Reservoir; Purpose of Reservoir, Design Studies, Reservoir Regulation, Reservoir Yield, Mass Curve and Demand Curve, Determination of Reservoir Capacity, Yield From a Reservoir of given Capacity; Operating Schedules – Rule Curve for Reservoir Operation; Economics of Water Resources Projects – Apportionment of Total Cost of a Multi Purpose Project, Benefit – Cost Ratio; Reservoir Losses – Measures To Reduce Evaporation Loss in Reservoirs Sedimentation, Control of Reservoir Sedimentation. Flood Routing – Hydrologic Reservoir Routing by Puls Method of Routing, Channel Routing by Muskingum Method. Irrigation: Definition of Irrigation, Types of Irrigation Systems – Direct and Indirect, Lift and Inundation Irrigation Systems, Methods of Irrigation – Surface and Sprinkler Methods, Trickle or Drip Irrigation, Soil Moisture Constants, Depth of Water Held By Soil In Different Zones, Water Extraction – Quality of Irrigation Water, Irrigation Efficiencies – Soil Moisture – Irrigation Relationship – Estimating Depth and Frequency of Irrigation on the Basis of Soil Moisture Regime Concept; Water Requirements of Crops, Duty, Delta and Base Period – Their Relationship, Crops – Seasons, Factors Affecting Duty and Methods of Improving Duty, Consumptive Use of Water –Determination of Evapotranspiration – Blaney-Criddle and Penman Equations and Hargreaves Method; Determination of Canal Capacities for Cropping Patterns, Size of Reservoir, Assessment of Irrigation Water Charges. Canal Systems: Classification of Irrigation Canals – Canal Alignment, Design of Unlined Canals, Regime Theories – Kennedy’s and Lacey’s Theories, Critical Tractive Force Method, Design Problems – Balancing Depth – L.S. of a Channel – Design According to I.S: 7112, 1975; Schedule of Area Statistics, Cross Section of an Irrigation Channel – Maintenance of Irrigation

Channel. Regulation of Channel System – Canal Outlets, Requirements of a Good Outlet – Types of Outlets; Water Logging – Causes and Control – Land Drainage; Canal Lining – Methods, Design of Lined Canals, Canal Navigation – Requirements, Methods to make Navigability Feasible.

Text Books

1. Irrigation and Water Power Engineering by B.C.Punmia and P.B.B. Lal, Laxmi Publications Pvt. Ltd.

2. Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House.

Reference Books

1. Irrigation and Hydraulic Structures by S.K.Garg, Khanna Publishers.

2. Engineering Hydrology by K.Subramanya, Tata McGraw-Hill Education Private Limited.

3. Hand Book of Applied Hydrology by V.T.Chow, McGraw-Hill Book Co.

4. Impacts of Climate Change and Climate Variability on Hydrological Regimes by Jan C. van Dam, Cambridge University Press.

5. Hydrology: Principles, Analysis and Design by H.M.Raghunath, New Age International.

6. Ground Water by H.M.Raghunath, New Age International.

CE4104 : CONSTRUCTION MANAGEMENT

Bar Charts, Milestone Charts, Weaknesses in Bar Charts

PERT and CPM: Introduction, Event, Activity, Dummy Activities, Rules for Drawing Networks, Numbering the Events (Fulkerson’s Law)

Time Estimates and Evaluation of Critical Path – Optimistic Time, Most Likely Time, Pessimistic Time, Expected Time, Earliest Allowable Occurrence Time, Latest Allowable Occurrence Time, Slack, Project Duration, Probability of Completion, Start and Finish Time Estimates, Floats, Project Scheduling, Critical and Sub-Critical Paths.

Cost-Time Optimization: Direct and Indirect Costs, Normal and Crash Costs and Times, Crashing of The Activity, Optimization of Project Cost. Updating and Resource Allocation – Process of Updating, Updating Cycle, Updated Networks, Resource Histograms, Resource Smoothening, Resource Leveling.

Works Management and Contracts – Department Execution of Works, Master Roll Form 21, Piece Work Agreement Form, Work Order, Definition of Contract, Element of Contract, Valid Contract, Notice Inviting Tender, Tender Forms, Bidding Process, Earnest Money, Security Deposit, Award of Contract, Types of Contracts – Lumpsum Contract, Item Rate Contract, Cost Plus Percentage Contract, Special Contracts, Disputes, Claim Settlement Through Arbitration.

Management – Significance of Construction Management, Concept of Scientific Management, Qualities of Manager, Organization – Authority, Policy, Recruitment Process and Training Development of Personnel. Labour Problems, Labour Legislation in India, Workmen Compensation Act 1923, and Subsequent Amendments, Minimum Wages Act 1948.

Text books

1. PERT and CPM Principles and Applications by L. S. Srinath, Affiliated East-West press Pvt. Ltd.

2. Estimating and Costing in Civil Engineering (Theory & Practice) by B.N.Dutta UBS Publishers Distributors Pvt. Ltd; 28th Revised Edition.

Reference Books

1. Project Planning and Control with PERT and CPM by B.C. Punmia, Laxmi Publications.

2. Construction Management and Planning by H.Guha and Sen Gupta, Tata McGraw – Hill Publishing Co. Ltd.

PE-III: CE4105 A : PRESTRESSED CONCRETE STRUCTURES

Introduction, Basic Concepts of Prestressing, Need for High Strength Steel and Concrete, Advantages of Prestressed Concrete; Materials for Prestressed Concrete, High Strength Concrete and High Strength Steel. Prestressing Systems (1) Freyssinet System (2) Gifford Udall (3) Magnel-Blatan System, Tensioning Devices, Anchoring Devices. (D) Pretensioning and Post Tensioning

Prestressing Losses, Elastic Shortening, Loss due to Shrinkage, Loss due to Creep, Loss due to Friction, Loss due to Curvature etc.; I.S. Code Provisions Analysis of Prestressed Members, Assumptions, Pressure or Thrust Line; Concept of Load Balancing, Cable Profile, Kern Distance, Stress in Tendons as Per IS 1343, Cracking Moment. Deflection of Prestressed Concrete Beams

Limit State Design of Flexural Members, Stresses, I.S. Code Provisions, Design of Symmetrical Beams, Design of Prestressed Concrete Poles, Design for Shear, I.S. Code Provisions. Transfer of Prestress (Pretensioned Members), Transmission Length, Bond Stress, Transverse Tensile Stress, End Zone Reinforcement, Flexural Bond Stress, I.S. Code Provisions. Anchorage Zone in Post Tensioned Members, Stress Distribution in End Block, Guyon’s Method of Approach of Analysis of End Block (not more than 2 Cables).

Text Book

1. Prestressed Concrete by N.Krishna Raju., Tata McGraw-Hill Education

Reference Books

1. Prestressed Concrete by N.Rajagopalan, Alpha Science International.

2. Prestressed Concrete by P. Dayaratnam, Oxford and IBH Publishers.

3. Design of Prestressed Concrete Structures by T.Y. Lin and Ned. H. Burns, Wiley India.

PE III: CE4105B : ELEMENTS OF COASTAL ENGINEERING

Introduction, General Design Considerations for Coastal Engineering. Long Period Waves: Tides, Seiches, Tsunamis, Storm Surge and Wind Set Up. Solutions of Linear Wave Equation for Progressive and Standing Waves – Pressure Velocity Fields – Surface Profile and Dispersion Relationship – Principle of Super Position – Wave Energy, Energy Flux and Energy Principle – Group Velocity. Wave Mechanics. Celerity and Group Velocity. Wind Generated Waves. Wave Statistics. Wave Transformation: Shoaling, Refraction, Diffraction and Reflection. Wave Breaking Criteria. Wave Forecasting for Deepwater Waves. Beach Profiles and Surf Zone Wave Breaking. Sediment Transport.

Impacts of Coastal Structures on Shoreline Changes. Seawalls, Breakwaters, Groins, Jetties, Wharves. Wave Forces on Walls. Design of Breakwaters: Rubble Mound-Type, Wall-Type, Structural Cross-Section. Wave Forces on Piles – Basic Assumptions – Values of the Inertia and Drag Coefficients and Their Dependence on the Wave Theory used.

Text Books

1. Water Wave Mechanics for Engineers and Scientists by R.G.Dean and R.A.Darlymple, World Scientific Publishers.

2. Coastal Hydrodynamics by J.S.Mani. PHI Publishers 2nd Edition.

Reference Books

1. Basic Coastal Engineering by R.M.Sorense, 3rd Edition, Springer.

2. Coastal Engineering Manual (CEM). US Army Coastal Engineering Research Center, 2002-2006. (Download from CECIL or USACE website).

PE III: CE4105C : INTRODUCTION TO ROCK MECHANICS

Introduction: Geological Formation of Rocks, Structural Geology, Classification of Rocks, Defects in Rock, Physical, Mechanical Properties of Rocks, Exploration Techniques – RQD and RMR, Laboratory Tests for Shear Strength, Tensile Strength, Flexural Strength, Elastic Constants, Field Tests – Test for Deformability, Shear Tests and Strength Tests Improvement Techniques for Rock: Grouting, Rock Bolting, Rock Reinforcement - Mechanism, Types of Reinforcement, Steps Involved in Installation, Foundations on Rock, Rock Blasting– Explosives, Selection Criteria for Explosives, Steps Involved in Blasting

Text book

1. Rock Mechanics for Engineers by B.P.Verma, Khanna Publishers

Reference Books

1. Rock Characterization, Testing and Monitoring by E.T.Brown, Pergamon Press, London, U.K

2. Rock Mechanics on the Design of Structures in Rock by Oberti and Duvalk, W. L. John Wiley & Sons.

3. Rock Mass Classification Systems – A Practical Approach in Civil Engineering by B.Singh and R.K.Goel, Elsevier Publisher.

 PE III: CE4105D : SOLID WASTE MANAGEMENT

Introduction: Definition of Solid Waste, Garbage, Rubbish–Sources and Types of Solid Wastes. Characteristics of Solid Wastes: Physical, Chemical and Biological Characteristics– Problems due to Improper Disposal of Solid Waste.

Solid Waste Management: Definition– Reduction, Reuse, Recycling and Recovery Principles of Waste Management – Functional Elements of Solid Waste Management – Waste Generation and Handling at Source – Collection of Solid Wastes – Collection Methods and Services– Guidelines for Collection Route Layout.

Transfer and Transport of Wastes: Transfer Station – Processing and Segregation of the Solid Waste – Various Methods of Material Segregation.

Processing and Transformation of Solid Wastes: Composting: Definition–Methods of Composting – Advantages of Composting – Incineration: Definition – Methods of Incineration– Advantages and Disadvantages of Incineration. Disposal of Solid Waste: Volume Reduction, Open Dumping, Land Filling Techniques. Landfills: Classification–Design and Operation of Landfills, Land Farming, Deep Well Injection.

Text Books

1. Integrated Solid Waste Management: Engineering Principles and Management Issues by George Tchobanoglous, Hilary Theisen, Samuel A Vigil. McGraw-Hill Series in Water Resources and Environmental Engineering.

2. Environmental Engineering by Howard S.Peavy, Donald R.Rowe and George Techobanoglous.

PE-IV: CE4106A : ENVIRONMENTAL IMPACT ASSESMENT

Concept of Environment – Definition of EIA and EIS – Elements of EIA – Guidelines for the Preparation of EIS – Governmental Policies for Environmental Protection.

Environmental Setting – Environmental Attributes – Air, Water, Soil, Noise, Ecological, Social, Economical, Cultural, Human and Aesthetic Aspects – Environmental Indices. Methodology for the Identification of Impacts – Criteria for the Selection of Methods – Methodologies – Adhoc, Checklist, Overlaying, Matrix and Network Methods.

Prediction and Assessment of Impacts on – Air, Water, Soil, Noise, Ecological, Social, Economical, Cultural, Human Environments and Aesthetic Aspects. Review of Environmental Impact Statement – Cost Benefit Analysis – Measures for Environmental Impact Mitigation and Control – Case Studies.

Text Books

1. Environmental Impact Assessment by Larry W. Canter. McGraw-Hill Co.

2. Environmental Impact Assessment Methodologies by Y Anjaneyulu, and Valli Manikkam,, BSP Books PVT Ltd.

Reference Book

1. Environmental Impact Assessment by R.K.Jain, L.V.Urban, G.S.Stacey and H.E. Balbach, McGraw-Hill Co.

PE-IV: CE4106B : EARTH RETAINING STRUCTURES

Earth Pressure: Basic Concepts, Rankine and Coulomb Earth Pressure Theories, Determination of Active and Passive Pressures: Culmann’s Graphical Method, Logarithmic Spiral Methods, Friction Circle Method. Consideration of Surcharge, Seepage, Earthquake, Wave Effect, Stratification, Type of Backfill, Wall Friction and Adhesion.

Retaining Structures: Uses, Types, Stability and Design Principles of Retaining Walls, Backfill Drainage, Settlement and Tilting. Sheet Pile Walls: Types, Design of Cantilever Sheet Pile Walls in Granular and Cohesive Soils; Design of Anchored Sheet Pile Walls by Free and Fixed Earth Support Methods, Rowe’s Theory of Moment Reduction, Design of Anchors. Braced Excavations: Types of Sheeting and Bracing Systems, Lateral Earth Pressure on Sheeting in Sand and Clay, Design Components of Braced Cuts. Cellular Cofferdams: Types – Diaphragm and Circular Type, Design by TVA Method. Stability of Cellular Cofferdams, Cellular Cofferdams in Rocks and Soils.

Text Book

1. Foundation design by W. C. Teng, Prentice Hall

Reference Books

1. Basic and Applied Soil Mechanics by Gopal Rajan and A.S.R. Rao, New Age International Publishers.

2. Soil Mechanics in Engineering Practice by K.Terzaghi and R.B.Peck, John Wiley & Sons.

3. Foundation Analysis and Design by J. E. Bowles, Mc Graw-Hill Publishing Co.

PE - IV : CE4106C : AIRPORT PLANNING AND DESIGN

Air Transport: History of Air Transport, Structure and Organisation of Air Transport, National Airports Authority, Airports Authority of India, International Civil Aviation Organisation. Airport Characteristics: Requirements of Aircraft Types, Weight Components, Aeroplane Component Parts, Classification of Flying Activity, Aircraft Characteristics.

Airport Planning: Airport Master Plan, Regional Planning, Airport Site Selection, Estimation of Future Air-Traffic Needs. Airport Obstructions: Zoning Laws, Classification Of Obstructions. Runway Design: Runway Orientation, Basic Runway Length, Corrections, Airport Classification, Runway Geometry Design. Airport Capacity and Configuration, Runway Intersection Design, Taxiway Design: Geometric Design Standards, Exit Taxiways, Holding Aprons. Terminal Area and Airport Layout: Building Area, Terminal Area, Apron, Hangar, Typical Airport Layouts. Visual Aids: Airport Marking, Airport Lighting Air Traffic Control: Need of Air Traffic Control Air Traffic Control Network, Air Traffic Control Aids – Enroute Aids and Landing Aids, Instrumental Landing System.

Text Book

1. Airport Planning and Design by S.K. Khanna, M.G. Arora, S.S. Jain, Nem-Chand and Bro.

Reference Book

1. Airport Engineering by Rangwala, Charotar Publications.

PE IV: CE4106D : FINITE ELEMENT METHOD OF ANALYSIS

Matrix Methods of Analysis – Introduction, Analysis of Beams and Portal Frames (One Bay, One Storey Two Bay, Two Storey) by Stiffness Method and Flexibility Method.

Introduction: A Brief History of F.E.M, Need of the Method, Applications of FEM, Review of Basic Principles of Solid Mechanics, Basic Equation in Elasticity Equations of Equilibrium, Constitutive Relationship, Concept of Plane Stress, Plain Strain, Concept of Axi-Symmetric Elements. Concept of Energy Principles and Methods.

Basic Theory Relating to the Formulation of the Finite Element Method, Element Shapes, Nodes, Nodal Degree of Freedom, Node Numbering, Coordinate System (Local and Global), Convergence Requirements, Compatibility Requirement, Geometric Invariance.

Finite Element Analysis of Single Bar Element (One-Dimensional Problem) – Shape Functions, Derivation of Stiffness Matrix, Stress-Strain Relations – All with Reference to Bar Element and Trusses under Axial Forces.

Text Books

1. Structural Analysis – A Matrix Approach by G.S.Pandit and S.P.Gupta, Tata McGrawHill Publishing Co. Ltd.

2. Introduction to the Finite Element Method by C.S.Desai and J.F.Abel, Van Nostrand.

3. Finite Element Analysis by C.S.Krishnamoorthy, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla, Ashok D.Belegundu, Prentice-Hall of India Private Limited.

2. Finite Element Analysis by S.S.Bhavikatti, New Age International Publishers.

3. Basic Structural Analysis by C.S. Reddy, Tata McGraw-Hill, New Delhi.

4. Finite Element Methods for Engineers by Reger, T. Fenuer, The Macmillan Ltd., London.

CE4107 GEOTECHNICAL ENGINEERING LABORATORY – II

1. Field identification and Classification of Soils.

2. Determination of Relative Density of Sand.

3. Determination of Unconfined Compressive Strength of Clay.

4. Determination of Shear Parameters of Soil by Direct Shear Test.

5. Determination of Undrained Shear Parameters of Soil by Triaxial Compression Test.

6. Determination of Undrained Shear Strength and Cohesion of Soft Clay by Vane Shear Test.

7. Determination of Differential Free Swell and Swell Pressure of Clay.

8. Determination of Coefficient of Consolidation of Clay by Taylor and Casagrande Methods of Time Fitting.

Demonstration experiments

1. Standard Penetration Test

2. Determination of Compression Index of Clay by Oedometer Test

Reference Books

1. Relevant IS Codes of Practice

CE4108 : FLUID MECHANICS LABORATORY– II

1) Study of Characteristics of a hydraulic jump – To measure and draw (E1-E2)/E1 vs F1 and Lj / y2 vs F1, and compare with theoretical results wherever possible.

2) Study of Rugosity Coefficients in an Open Channel Flow.

3) Study of Major Losses in Pipes – Pipe Friction – To Compute Darcy-Weisbach Friction Factor.

4) Study of Drag Characteristics of a Circular Cylinder with its Axis Normal to the Direction of Flow.

To measure the Pressure Distribution on the Surface of a Cylinder and Plot the Dimensionless Pressure Variation around the Cylinder and Compute the Pressure Drag. To measure the Velocity Variation in the Wake of the Cylinder, Velocity of Approach, and Compute the Total Drag by Momentum Principle. 5) Study of Performance Characteristics of a Centrifugal Pump – To Measure the Discharge, Head Developed and Power Input at Various Discharges for Centrifugal Pump and Draw the Performance Characteristics.

6) Study of Performance Characteristics of a Reciprocating Pump – To Measure the Discharge, Head Developed and Power Input at Various Discharges for Reciprocating Pump and Calculate Percentage Slip and Efficiency.

7) Study of Performance Characteristics of a Pelton Turbine – To Measure the Discharge, Head Difference across the Turbine, the Brake load, Speed of Turbine for Various Discharges and Draw the Performance Characteristics.

8) Study of Performance Characteristics of a Francis Turbine – To Measure the Discharge, Head difference across the Turbine, the Brake Load, Speed of Turbine for Various Discharges and Draw the Performance Characteristics. 9) Study of Impact of a Jet on Flat and Curved Vanes.

IV Year – II Semester

CE4201 : WATER RESOURCES ENGINEERING – II

Storage Works: Classification of Dams, Factors Governing Selection of Types of Dam, Selection of Site, Preliminary Investigation. Gravity Dams: Forces acting on a Gravity Dam, Stability Criteria, Modes of Failure – Elementary and Practical Profiles, Stability Analysis, Principal and Shear Stress – Construction Joints, Openings in Dams – Galleries, Foundation Treatment of Gravity Dam.

Earth Dams: Types, Foundation for Earth Dams, Design of Earth Dams, Causes for Failure of Earth Dams, Criteria for Safe Design, Phreatic Line, Seepage Analysis – Seepage Control Through Body and Foundation.

Spillways: Essential Requirements, Spillway Capacity, Components, Types of Spillways and Their Working, Design of Ogee Spillway, Energy Dissipation Below Spill Way, Scour Protection, Use of Hydraulic Jump as Energy Dissipater – Design of Stilling Basins – USBR and IS Standard Basins; Spillway Crest Gates – Different Types.

Diversion Head Works: Types, Location and Components, Effects of Construction of Weirs on Permeable Foundation, Bligh’s, Lanes and Khosla’s Theories, Method of Independent Variables, Design Principles of Weirs and Barrages, Design of Weirs on Permeable Foundations, Design of Vertical Drop Weir, Silt Control Devices. Regulation Works: Canal Falls – Definition, Necessity and Location, Classification of Falls, Design Principles of Syphon Well Drop, Notch Fall, Sarada Fall, Straight Glacis Fall; Offtake Alignment; Cross Regulator and Distributary Head Regulator – Design of Cross Regulator and Distributor Head Regulator.

Cross Drainage Works: Types, Factors Affecting the Suitability of Each Types, Classification of Aqueducts, Design Principles of Different Types of Aqueducts.

River Training Works: River Training and its Objectives, Classification of River Training Works, Marginal Embankment, Guide Banks, Groynes, Cutoffs, Bank Pitching, Launching Aprons, Miscellaneous Types of River Training Works.

Water Power Engineering: Development of Hydro Power in India, Assessment of Available Power, Utilisation Factor, Load Factor, Diversity Factor, Storage and Pondage; Types of Hydro Power Schemes; Components of Hydel Schemes – Fore Bay, Intake Structure, Trash Racks, Surge Tanks; Water Hammer Pressure, Substructure and Superstructure of Power House.

Text Books

1. Irrigation and Water Power Engineering by Punmia, B.C. and P.B.B. Lal, Laxmi Publications Pvt. Ltd.

2. Irrigation Water Resources and Water Power Engineering by Modi, P.N., Standard Book House.

3. Irrigation and Hydraulic Structures by Garg, S.K., Khanna Publishers.

Reference Book

1. Hand book of Applied Hydrology, Chow, V.T., McGraw-Hill Book Co.

CE4202 : TRANSPORTATION ENGINEERING– II

Railway Engineering-1: Historical Development of Railways in India – Advantages of Railways – Classification of Indian Railways – Permanent Way – Components and their Functions – Rail Joints – Welding of Rails – Creep of Rails – Rail Fixtures and Fastenings.

Railway Engineering-2: Track Geometric Design – Points and Crossings – Track Drainage – Layout of Railway Stations and Yards – Signals – Interlocking – Track Circuiting – Track Maintenance.

Dock and Harbour Engineering: Layout of Port Components – Functions – Classification of Ports – Site Selection – Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – Navigational Aids. Tunnel Engineering: Alignment of Tunnels – Cross-Section of Tunnels – Construction Methods of Tunnels – Tunnel Lining – Ventilation – Drainage – Muck Disposal.

Text Books

1. Railway Engineering by S.C. Saxena and S. Arora, Dhanpat Rai Publications Pvt. Ltd.

2. Roads Railways Bridges Tunnel Engineering by T.D.Ahuja and G.S.Birdie, Standard Book House.

3. Dock and Harbour Engineering by P. Hasmukh, Oza and H.Gautam Oza, Charotar Publishing House Pvt. Ltd.

Reference Books

1. Harbour, Dock and Tunnel Engineering by R.Srinivasan, Charotar Publications.

2. Railway Engineering by S.C.Rangwala, Charotar Publishing House.

3. Railway Bridge and Tunnel Engineering by Rangwala, Charotar Publishing House.

CE4203 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Unit-I Basic Concepts of Management Management:- Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Unit-II Forms of Business Organizations: Introduction, Types of Business Organizations: Private Sector – Individual Ownership, Partnership, Joint Stock Companies and Co-Operative Organizations; Public Sector– Departmental Organizations, Public Corporations and Government Companies; The Joint Sector Management.

Unit-III Production and Operations Management: Plant Location– Factors to be considered in the Selection of Plant Location; Break-even Analysis– Significance and Managerial Applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Unit-IV Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Unit-V Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea Generation: Sources and Techniques; Stages in Project formulation; Steps for starting a Small Enterprise – Incentives for Small Scale Industries by Government.

Text Books

1. Industrial Organization and Engineering Economics by T.R.Banga and S.C.Sharma, Khanna Publishers.

2. The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth) by Vasant Desai, HImalayan Publishing House.

Reference Books

1. Management Science by A.R.Aryasri, McGraw Hill Education (India Private Limited.

2. Entrepreneurship, P.Sheela and K. Jagadeswara Rao, Shree Publishing House.

PE-V: CE4204A : INDUSTRIAL WASTE TREATMENT

Characteristics of Waste Water of Specific Industries, Characteristics of Treatment Plant Effluents, Effect of Waste Water on Self Purification Capacity of Streams, Primary Treatment of Waste Water.

Principles of Biological Waste Treatment; Microbiological Growth Rate Kinetic Equations, Sludge Production, Oxygen Requirements, Continuous Flow Treatment Models. Aerobic Treatment Studies in Continuous and Semi-Continuous Reactors. Anaerobic Treatment, Studies, Nitrogen and Phosphorus Removal.

Biological Treatment Facilities: Process Designs of the following Units W.R.T. Industrial Wastes; Activated Sludge Process; Trickling Filter; Sludge Digestion Units; Aerated Lagoons; Stabilization Ponds (Oxidation Ponds); Oxidation Ditches (Paveer Ditches); Rotating Biological Contactor; Anaerobic Filter.

Principles of Industrial Waste Treatment: Waste Reduction Pretreatment of Wastes, Collection and Segregation of Wastes, Reduction in Volume and Strength Neutralisation, Equalisation, Proportioning, Manufacturing Processes,

Flow sheets; Characteristics and Treatment of Wastes and Disposal Methods of the following Industries – Sugar, Dairy, Distillery, Paper, Tannery, Textile, Sheet, Fertiliser, Oil Refinery and Petrochemicals.

Text Books

1. Industrial Wastewater Treatment by A.K. Patwardhan. PHI.

2. Waste Water Treatment by M.N. Rao and A. K. Datta.3rd Ed. Oxford & IBH Publishing Co Pvt. Ltd.

Reference Book

1. Industrial Pollution Control by Eckenfelder Jr., McGraw-Hill Co.

PE-V: CEE4204B : OCCUPATIONAL HEALTH AND

INDUSTRIAL HYGIENE

Occupational Health – Definition, Occupational Hazards – Types, Physical Hazards: – Heat, Noise, Vibration, Radiation, Pressure. Occupational Health Hazards – in Construction Industry, in Mining, in Quarrying.

First Aid-Definition, First Aid for Wounds, Burns, Shocks, Fractures and Artificial Respiration

Chemical Hazards- Dusts and Gases, Industrial Poisons; Modes of Exposure, Biological Hazards, Ergonomic Hazards, Mechanical Hazards

Industrial Hygiene, Ventilation, Illumination, Air Conditioning, Housekeeping, Personal Protective Equipment

Text Book

1. Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L.Graffia, William Andrew Inc.

PE-VI: CE4205A : AIR POLLUTION AND CONTROL

Air Pollution and its Definition – Factors Influencing Air Pollution – Classification of Pollutants Particulates – Gases–Sources of Pollution – Air Qualities Standards – Effects – Location of Industries. Meteorology – Wind Roses – Lapses Rates – Mixing Depth Atmospheric Dispersion – Plume Behavior, Accumulation, Estimation of Pollutants – Effective Stack Height. Air Pollution Effects on Human Beings, Animals, Plants and Materials – Air Pollution Episodes in India and Abroad. Ambient Air Quality Monitoring and Stack Monitoring. Control of Air Pollution – Removal of Pollutants – Particulate and Gaseous – Air Pollution Control Equipments (Units) such as Settling Chamber, Cyclones, Wet Scrubbers/Collectors, Scrubbers, Centrifugal Scrubbers Spray Towers, Packed Beds, Electrostatic Precipitators, After Burners – Absorption – Adsorption – Diffusion.

Text Books

1. Environmental Engineering by H.S.Peavy, Rowe, Tchenobolus. McGraw-Hill Pub.

2. Air Pollution Control Engineering by N.D. Nevers, McGraw-Hill Publication.

3. Air Pollution by H. V. N Rao and M. N. Rao, Tata McGraw-Hill Co.

Reference Books

1. Air Pollution and Control by K.V.S.G.Murali Krishna. Kaushal and Company, Kakinada.

2. An Introduction to Air Pollution by R.K.Trivedy and P.K.Goel, BSP Books Pvt. Ltd.

3. Environmental Pollution Control Engineering by C.S.Rao, New Age Publications.

PE-VI- CEE4205B : PLUMBING SERVICES AND MAINTENANCE

Introduction to Plumbing Systems: Definition – Classification of Plumbing Systems – Plumbing Appliance – Plumbing Appurtenance – Plumbing Fixture– Single–Multi Family Buildings, Restaurants, Handicap Fixtures: Toilets, Sinks And Lavatories, Sink and Lavatory Faucets, Bathing Units, Drinking Units. Standard Fixture Installation Regulations. Sewers– Building Sewers- Faucet- Self-Closing Faucet- Interceptor. Water Safety Plans in Operation and Managements of Water Systems- The Role of Plumber in Risk Assessment and Risk Management-Codes of Practice For Plumbing.

Water Supply And Distribution: The Main Water Pipe: Supplies, Pressure-Reducing Valves, Water Hammer, Tanks, Pressurized Water Tanks. Pipe Support: Water Conservation, Antiscale Precautions, Valve Regulations, Cutoffs. Backflow Prevention. Hot-Water Installations-Water Heaters. Water Supplies – Fixture. Minimum Pipe Size.

Sanitary Drainage Systems: Sizing Building Drains and Sewers – Horizontal Branches - Stack Sizing – Installation: Pipe Joints, Fittings – Offsets In Horizontal Piping – Horizontal to Vertical Changes in Direction – Vertical to Horizontal Changes in Direction Vents, Traps, Clean–Outs and Interceptors: Sewer Gas –Trap Seals, Plumbing Vents –Individual Vents – Relief Vents – Circuit Vents – Developed Length – Branch Vents – Vent Stacks –Stack Vents – Common Vents – Island Vents – Wet Vents – Crown Vents – Vent–Installation Requirements. Clean–Outs – Types of Clean–Outs – Traps: P-Traps – S-Traps – House Traps – Crown–Vented Traps – Other Traps –Trap Sizes –Tailpiece Length –Standpipe Height –Proper Trap Installation – Grease Traps – Backwater Valves.

Storm Drainage and Special Piping and Storage Systems: Sizing – Sizing Drain Leaders and Gutters – Roof Drains – More Sizing Information, Sump Pumps – Variations. Special Piping and Storage Systems: General Requirements – Sterilizers – Aspirators – Medical Gases – Oxygen Systems.

Text Books

1. Handbook on Plumbing Installation for Buildings. HKSARG, Water Supplies Department

2. Plumbing Engineering Design Hand Book. Vol.2, Plumbing Systems. American Systems Plumbing Engineers. ISBN 1-891255-24-X

Reference

1. Health Aspects of Plumbing. WHO & World Plumbing Services.

CE4206: DESIGN AND DRAWING OF IRRIGATION STRUCTURES

1. Tank Surplus weir

2. Glacis type of canal drop

3. Notch fall

4. Siphon Aqueduct- type III

5. Cross regulator and head regulator

Text books

1. Water Resources Engineering, by C. Satyanarayana Murthy, New Age International Publishers.

2. Hydrology and Water Resources Engineering, by S.K. Garg, Khanna Publishers.

 CE4207 : PROJECT WORK

The student shall submit a report based on project work and attend a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, Guide and the External Examiner.

Civil Engineering

SCHEME OF INSTRUCTION & SYLLABUS FOR

M.Tech. (STRUCTURAL ENGINEERING)

(with effect from 2019-20 Admitted Batch)

I – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

ST1.1 Theory of Elasticity 4 -- 4 3 70 30 100 3

ST1.2 Advanced Reinforced 4 -- 4 3 70 30 100 3 Concrete Design

ST1.3 Matrix Methods of Structural 4 -- 4 3 70 30 100 3 Analysis

**Program Elective –I**

ST1.4 (a) Advanced Foundation
 Engineering

 (b) Experimental Stress 4 -- 4 3 70 30 100 3
 Analysis

 (c) Wind Analysis and
 Design of Tall Structures

ST1.5 (a) Advanced Concrete
 Technology

 (b) Structural Dynamics 4 -- 4 3 70 30 100 3

ST1.6 Computer Applications in
 Structural Engineering - 3 3 Viva 50 50 100 1.5

ST1.7 Design of Structures - 3 3 Viva 50 50 100 1.5

 Total 20 6 26 450 250 700 18

 II – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

ST2.1 Theory of Plates and Shells 4 -- 4 3 70 30 100 3

ST2.2 Finite Element Method of
 Analysis 4 -- 4 3 70 30 100 3

ST2.3 Earthquake Engineering 4 -- 4 3 70 30 100 3

**Program Elective –III**

ST2.4 (a) Optimization Techniques
 (b) Ground Improvement
 Techniques 4 -- 4 3 70 30 100 3
 (c) Reliability Analysis and
 Design

 **Program Elective –IV**

ST2.5 (a) Prestressed Concrete
 (b) Design of Steel Bridges 4 -- 4 3 70 30 100 3
 (c) Inelastic Design of Slabs

ST2.6 Repair and Rehabilitation of
 Structures -- 3 3 Viva 50 50 100 1.5

ST2.7 Advanced Design of
 Structures -- 3 3 Viva 50 50 100 1.5

ST2.8 Seminar -- 3 3 Viva 50 50 100 2

 Total 20 9 29 500 300 800 20

III SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

**Program
Elective –V**

ST3.1 (a) Industrial Structures 4 -- 4 3 70 30 100 3

 (b) Design of Concrete Bridges

**Program
Elective–VI**

ST3.2 (a) Structural Stability 4 -- 4 3 70 30 100 3

 (b) Numerical Methods for
 Structural Engineering

ST3.3 Dissertation (Preliminary) -- -- -- Viva -- 100 100 8

 Total 8 -- 8 140 160 300 14

IV SEMESTER

Code No. Course Title Scheme of Examination Total Credits

 Exam (hrs) Ext. Sess.

ST4.1 Dissertation (Final) Viva 100 -- 100 16

 Total 16

Civil Engineering

M. Tech. (STRUCTURAL ENGINEERING) Syllabus

(with effect from 2019-2020 Admitted Batch)

I – SEMESTER

ST1.1 : THEORY OF ELASTICITY

Plane Stress and Plane Strain: Components of stress, Strain, Hooke’s law, Stress and strain at a point. Plane stress, Plane strain, Equations of equilibrium, Boundary conditions, Compatibility equations stress foundation.

Two Dimensional Problems in Rectangular Coordinates: Solution by polynomials, St. Venant’s principle determination of displacements, Bending of cantilever loaded at the end, Bending of a beam by uniform load.

Two Dimensional Problem in Polar Coordinates: General equations of equilibrium, Stress function and equation of compatibility with zero body forces. Analysis of thick cylindrical shells with symmetrical loading about the axis, Pure bending of curved bars, Strain components in polar coordinates, Rotating disks.

Three Dimensional State of Stress: Differential equations of equilibrium – Boundary conditions for compatibility – Displacements – Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution.

Torsion: Torsion of straight bars – St.Venant solution – Stress function, Warp function – Elliptic cross section – Membrane analogy torsion of bar of narrow rectangular cross section. Analysis of Stress and Strain in Three Dimensions: Introduction – Principal stresses- Determination of principal stress – Stress invariants – Maximum shearing stress strain at point.

Text Book

1. Theory of Elasticity by Timoshenko and Goodier, McGraw Hill Company.

Reference Books

1. Theory of Elasticity by Sadhu Singh, Khanna publishers

2. Applied Elasticity by C.T. Wang. Mcgraw Hill

3. Advanced Strength of Materials by Den Hartog, Dover Publications, Inc.

ST1.2 ADVANCED REINFORCED CONCRETE DESIGN

Deflection of Reinforced Concrete Beams and Slabs: Introduction, Short-term deflection of beams and slabs, Deflection due to imposed loads, Short-term deflection of beams due to applied loads, Calculation of deflection by IS 456, Deflection of continuous beams by IS 456, Deflection of slabs.

 Estimation of Crack width in Reinforced Concrete Members: Introduction, Factors affecting crack width in beams, Mechanisms of flexural cracking, Calculation of crack width, Simple empirical method, Estimation of crack width in beams by IS 456, Shrinkage and thermal cracking.

Redistribution of Moments in Reinforced Concrete Beams: Introduction, Redistribution of moments in fixed beam, Positions of points of contra flexure, Conditions for moment redistribution, Final shape of redistributed bending moment diagram, Moment redistribution for a two-span continuous beam, Advantages and disadvantages of moment redistribution, Modification of clear distance between bars in beams (for limiting crack width) with redistribution, Moment-curvature (M - ), Relation of reinforced concrete sections.

Approximation Analysis of Grid Floors: Introduction, Analysis of flat grid floors, Analysis of rectangular grid floors by Timoshenko’s plate theory. Analysis of grid by stiffness matrix method, Analysis of grid floors by equating joint deflections, Comparison of methods of analysis, Detailing of steel in flat grids.

Design of Flat Slabs: Introduction, Proportioning of Flat Slabs, Determination of Bending moment and Shear Force, Direct Design method, Equivalent Frame method, Slab Reinforcement. Design and Detailing of Reinforced Concrete Deep Beams.

Design of Reinforced Concrete Members for Fire Resistance: Introduction, ISO 834 standard heating conditions, Grading or classifications, Effect of high temperature on steel and concrete, Effect of high temperatures on different types of structural members, Fire resistance by structural detailing from tabulated data, Analytical determination of the ultimate bending moment, Capacity of reinforced concrete beams under fire, Other considerations.

Text Book Advanced Reinforced Concrete Design by P.C. Varghese. PHI Learning Private Limited.

Reference Book Reinforced Concrete by Park and Paulay, John Wiley & Sons.

ST1.3 : MATRIX METHODS OF STRUCTURAL ANALYSIS

Introduction to Matrix methods: Introduction, coordinate systems, displacement and force transformation matrices, element and structure stiffness matrices, Element and structure flexibility matrices, equivalent joint loads, stiffness and flexibility approaches.

Matrix methods for beams: Analysis of beams, fixed and continuous beams by flexibility method. Analysis of beams, fixed and continuous beams by stiffness method.

Matrix methods for Plane truss problems: Analysis of 2-D trusses by flexibility method. Analysis of 2-D trusses by stiffness method

Matrix methods for Plane Frames: Analysis of 2-D frames by Flexibility matrix methods. Analysis of 2-D frames by Stiffness matrix methods.

Text Books

1. Matrix methods of Structural Analysis by G.S.Pandit and S.P.Gupta, Tata McGraw Hill Co..

2. Matrix Analysis of framed Structures by W Weaver and Gere, Van Nostrand Reinhold.

Reference Books

1. Advanced Structural Analysis by Devdas Menon, Narosa Publishing House, 2009.

2. Matrix Analysis of Structures by Asslam Kassimali, Brooks/Cole Publishing Co., USA, 1999.

3. Analysis of Indeterminate Structures by C.K Wang, McGraw-Hill.

ST1.4 (a) ADVANCED FOUNDATION ENGINEERING

Common Syllabus for SMFE1.2, CTPM1.4(a), TE1.4(a) and ST1.4(a)

Introduction -Principles of Design of Foundations, Types of shear failures in foundation soils, Types of foundations, Design Loads, Basic Concepts of safe and allowable bearing capacity. Shallow Foundations

Bearing Capacity Analysis: Bearing capacity theories – Terzaghi, Meyerhof, Skempton, Hansen, Vesic and IS Methods, Bearing capacity evaluation from Standard Penetration test and Plate load test.

Settlement Analysis: Uniform and Differential Settlements, Elastic and Consolidation Settlements, Settlement analysis in cohesionless soils by Schemartmann and Hartman method, Penetration tests; Permissible settlements as per IS 1904-1978, causes of settlement, settlement Control.

Proportioning of footings: Isolated column footings, Strip, combined Footings and Strap Footing. Raft Foundations: Bearing capacity of raft foundation, floating raft, Types of rafts, Beam on Elastic foundation and Conventional methods of Design, determination of modulus of subgrade reaction.

Deep Foundations - Pile Foundations: Types, load capacity- dynamic formulae, static formula; pile load tests- Vertical load test, lateral load test, Cyclic load test; settlement of piles and pile groups, negative skin friction on single pile and pile groups; laterally loaded piles - Broom’s Analysis, IS Code method; Under reamed piles – Load capacity, design and construction.

Well Foundations: Types, Bearing Capacity of well foundations, Construction of pneumatic caissons, Tilts and Shifts: precautions, Remedial measures; Lateral stability analysis by Terzaghi’s Method, Design aspects of Components of well foundation.

Foundations in Expansive Soils: Introduction, Identification of expansive soils, Swell potential and swelling pressure, Active depth, Foundation Problems, Foundation practices in expansive soils, Soil Replacement and ‘CNS’ concepts.

Foundations of Transmission Line Towers - Introduction, Necessary information, Forces on tower foundations, General design criteria, Choice and type of foundation, Design procedure.

Text Books

1. Analysis and Design of Substructures by Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.

2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publications.

Reference Books

1. Foundation Analysis and Design by J.E. Bowles, Mc Graw Hill Publishing Co.

2. Foundation Design by W.C. Teng, John Wiley, New York.

3. Analysis and Design of Substructures by Swami Saran, Oxford &IBH Publishing Co.

4. Foundation Engineering by P.C. Vargheese, Prentice Hall of India.

ST1.4(b) EXPERIMENTAL STRESS ANALYSIS

Analysis of Stress, strain, Stress- Strain relation and theories of failure. Electrical Resistance Strain Gauges: Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity.

Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

Photoelasticity: Two dimensional photo elasticity, Concept of light – photoelastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

Brittle Coating And Moire Methods : Introduction to Moire techniques, brittle coating methods and holography.

Text Books

1. Experimental Stress Analysis by Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., Tata McGraw-Hill, New Delhi, 1984.

2. Experimental Stress Analysis by Dally, J.W., and Riley, W.F., McGraw-Hill Inc.

ST1.4(c) WIND ANALYSIS AND DESIGN OF TALL STRUCTURES

Introduction: Basic wind speed, Design wind speed, Design wind pressure, offshore wind velocity, wind pressures and forces in buildings/structures, External pressure coefficients for various roofs, dynamic effects.

Lateral load Analysis of Multistory Building Frames: Analysis of Multistory Building Frames for lateral loads, Cantilever method, Portal method and Factor method.

Design of Shear Wall: Introduction, Types of shear walls, Behaviour of cantilever wall with rectangular cross-section, flange cantilever shear walls, Moment-Axial load interaction for shear wall section, Interaction of shear walls and rigid joined frames, Shear walls with openings, Coupled shear walls.

Design of Chimneys (RCC): Introduction, Wind pressure, Stress in chimney shaft due to self weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference, Design of RC chimney.

Bunkers and Silos: Introduction, Differences between bunker and silo, Design of square or rectangular bunkers, Design of circular bunkers, Design of silos, Silos for storage of cement.

Multistory Building Frames: Analysis of multistory frames, Method of substitute frames, Bending moments in beams and columns.

Text Books

1. Advanced Reinforced Concrete Design ,by N.Krishna Raju, CBS

2. Reinforced Concrete Structures by Punmia, Jain & Jain, Laxmi Publications (P) Ltd.

3. Tall Chimneys by Manohar, S.N., Mcgraw-Hill Book Comp.

Reference Books

4. Reinforced Concrete Structures by Park, R. & Paulay, T., John Wiley & Sons.

5. Design of Steel Structures by N.Subramanian, OUP India.

ST1.5(a) ADVANCED CONCRETE TECHNOLOGY

Common Syllabus for ST1.5(a), CTPM1.5(a) and SMFE1.5(a)

Durability of concrete and concrete construction: Durability concept, pore structure and transport processes, reinforcement corrosion, fire resistance, frost damage, sulphate attack, alkali silica reaction, delayed ettringite formation, methods of providing durable concrete, short-term tests to assess long-term behavior.

Mix design: Review of methods and philosophies of IS, BS and ACI methods, mix design for special purposes, Acceptance criteria for compressive strength of concrete.

Special concretes: Lightweight concrete, autoclaved aerated concrete, no-fines concrete, lightweight aggregate concrete and foamed concrete, High strength concrete, refractory concrete, high density and radiation-shielding concrete, polymer concrete, fibre-reinforced concrete, mortars, renders, recycled concrete, Ferro Cement, Self Compacting Concrete.

Special processes and technology for particular types of structure: Sprayed concrete, underwater concrete, grouts, grouting and grouted concrete, mass concrete, slip form construction, pumped concrete, concrete for liquid retaining structures, vacuum process, concrete coatings and surface treatments.

Test methods: Analysis of fresh concrete, Accelerated testing methods, Tests on hardened concrete, Core cutting and testing, partially destructive testing, Non-destructive testing of concrete structures

Text Book

1. Properties of Concrete, A.M.Neville, Longman 1995.

2. Concrete Technology Theory and Practice, M.S.Shetty, S.Chand & Company Ltd, New Delhi.

Reference

1. Concrete micro-structure, Properties and Materials, P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw Hill, USA.

ST1.5(b) STRUCTURAL DYNAMICS

Common Syllabus for ST1.5(b) and HCH1.5(b)

One Degree Systems: Undamped systems, Various forcing functions damped systems, Response to pulsating force, Support motion.

Lumped Mass Multidegree System: Direct determination of natural frequencies, Characteristic shapes, Stodola-Vianelle method, Modified Rayleigh-Ritz method, Lagrange’s equation, Model analysis of multi degree systems, Multistorey rigid frames subjected to lateral loads, Damping in multi degree systems. Structures with distributed mass and load, Single span beams, Normal modes of vibration, Forced vibrations of beams, Beams with variable cross-section and mass.

Approximate design methods, Idealized system, Transformation factors, Dynamic reactions response calculations, Design example (RC beam, Steel beam and RC slab), and approximate design of multi degree systems.

Matrix Approach: Coordinates and lumped masses, Consistent mass matrix, Undamped force vibration of a system with one degree freedom, Response of single degree freedom undamped system, Viscous damped vibration of a single degree freedom system, Undamped vibration of multi degree freedom system, Orthogonality of natural nodes, Normal coordinates.

Text Books

1. Structural Dynamics by John M. Biggs. McGraw-Hill

2. Dynamics of Structures, Theory and Applications to Earthquake Engineering by Anil K. Chopra, Prentice Hall of India.

Reference Books

1. Structural Analysis by A. Ghali & A.M. Neville, CRC Press.

 ST1.6 COMPUTER APPLICATIONS IN

STRUCTURAL ENGINEERING

Application of software’s in Structural Engineering (by using STAAD Pro, ETABS, STRAP, STRUDS etc) for the following problems.

1. Analysis and Design of Beams.

2. Analysis and Design of Footings.

3. Analysis and Design of Trusses.

4. Analysis and Design of Two Dimensional Frames.

5. Analysis and Design of Three Dimensional Frames.

6. Analysis and Design of Water Tanks.

7. Analysis and Design of Steel Members.

8. Implementation of Concepts of FEM using a Computer Language.

 ST1.7 DESIGN OF STRUCTURES (VIVA-VOCE)

Any THREE of the following:

1. Design of Folded Plates

2. Elevated Service Reservoirs

3. Retaining walls

4. Grid floor

5. Flat slab

6. Pressed steel tank

7. Buried pipes

Civil Engineering M.Tech. (STRUCTURAL ENGINEERING) Syllabus

(with effect from 2019-2020 Admitted Batch)

II – SEMESTER

ST2.1 THEORY OF PLATES AND SHELLS

Bending of Long Rectangular Plates to a Cylindrical Surface: Differential equation for cylindrical bending of plates – Uniformly loaded rectangular plates with simple supported edges and with built in edges. Pure bending of plates slopes – Curvatures of bent plates – Relations between bending moments and curvature – Particular cases – Strain energy in pure bending – Limitations.

Symmetrical Bending of Circular Plates: Differential equation – Boundary conditions. Simply supported rectangular plates under sinusoidal loading – Navier’s solution and its application to concentrated load – Levy’s solution for uniformly distributed load or hydrostatic pressure – Bending of rectangular plates by moments distributed along the edges – Differential equation of rectangular plate within plane and lateral forces.

Membrane analysis: a) Shells of revolution (axi-symmetrical loading), Spherical shells, Conical shells, Elliptical shell of revolution, Torus, Hyperboloid of revolution of one sheet, Shells of uniform strength membrane deformation. b) Membrane analysis of shells of translation, Circular cylinder, Diretrix, Parabola, Cycloid, Catenary and Membrane deformations. c) Membrane analysis of shells of general shape: Anticlastic, Synclastic shells, Hyperbolic paraboloid, Candella shells, Conoid, Elliptic paraboloid, Rotational paraboloid.

Bending analysis of cylindrical shell: Beam method, Schorer method, Finsterwalder method. Classification analysis.

Text Books

1. Theory of Plates and Shells by Timoshenko, S. and Wernewsky, Kriegar.

Reference Books

1. Design of Reinforced Concrete Shells and Folded Plates by P.C.Varghese, PHI

2. Stresses in Shells by Flugge, Springer.

3. Design and Construction of Shells by Ramaswamy, G.S, McGraw-Hill.

ST2.2 : FINITE ELEMENT METHOD OF ANALYSIS

Common Syllabus for ST2.2, SMFE2.5(b), WRE2.5(b), HCH2.5(b) and TE2.5(b)

Introduction: A brief history of F.E.M. Need of the method, Review of basic principles of solid mechanics- Equations of equilibrium, Boundary conditions, Compatibility, Strain displacement relations, Constitutive relationship in matrix form, plane stress & plane strain and axisymmetric bodies of revolution with axi-symmetric loading, Energy principles - Rayeigh - Ritz method of functional approximation.

Theory relating to the formulation of the finite element method, Coordinate system (local and global), generalized coordinates, Concept of the element, Various element shapes, Discretisation of a structure, Mesh refinement Vs. Higher order element, Interconnections at nodes of displacement models, inter element compatibility, -shape functions.

Basic component – One dimensional FEM single bar element, Beam element : Derivation of stiffness matrix, Assembly of stiffness, Matrix boundary conditions, shape functions for 1 D elements, Initial strain and temperature effects, and trusses under axial forces.

Two dimensional FEM: Different types of elements for plane stress and plane strain analysis – Displacement models Generation of element stiffness and nodal load matrices –static condensation.

Isoparametric representation and its formulation for 2d analysis. Formulation of 4-noded and 8-noded isoparametric quadrilateral elements – Lagrangian elements-serendipity elements.

Text Books

1. Finite Element Analysis by C.S.Krishnamoorthy, (2002), Tata McGraw Hill Publishing Co. Ltd.

2. Introduction to Finite Element Method by Desai,C.S.and Abel, J.F.,Van Nostrand, 1972.

Reference Books

1. Introduction to Finite element Method by Tirupathi chandra Patla and Belugundu

2. The Finite Element Method in Engineering Science” by Zienkiewicz, P., McGraw Hill, 1971.

ST2.3 EARTHQUAKE ENGINEERING

One Degree Systems: Undamped systems, Various forcing functions damped systems, Response to pulsating force, Support motion. Lumped Mass Multidegree System: Direct determination of natural frequencies, Characteristic shapes, Stodola-Vianelle method, Modified Rayleigh-Ritz method, Lagrange’s equation, Model analysis of multi degree systems, Multistorey rigid frames subjected to lateral loads, Damping in multi degree systems.

Matrix Approach: Coordinates and lumped masses, Consistent mass matrix, Undamped force vibration of a system with one degree freedom, Response of single degree freedom undamped system, Viscous damped vibration of a single degree freedom system, Undamped vibration of multi degree freedom system, Orthogonality of natural nodes, Normal coordinates.

Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic regions, Intensity and Isoseismals of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zoning.

Earthquake Response of Linear Systems: Earthquake excitation, Equation of motion, Response quantities, Response history, Response spectrum concept, Deformation, Pseudo-velocity, and Pseudo-acceleration, Response spectra, Peak structural response from the response spectrum, Response spectrum characteristics, Elastic design spectrum, Comparison of design and response spectra, Distinction between design and response spectra.

Earthquake analysis of Multistorey buildings: By seismic coefficient method and Response spectrum method, Base shear, Fundamental period of buildings, Distribution of forces along the height. Earthquake analysis of Water towers: Introduction, Behaviour under earthquake loads, Design features, Water tower as a rigid jointed space frame, Hydrodynamic pressures in tanks.

Earthquake analysis of Stack like structures: Introduction, Fundamental period of vibration, Dynamic bending moment, Shear diagram

Earthquake analysis of dams: Hydrodynamic pressures on dams, Zanger’s method, Vertical component of reservoir load, Concrete or masonry gravity dams

Text Books

1. Dynamics of Structures, Theory and Applications to Earthquake Engineering by Anil K. Chopra, Prentice Hall of India.

2. Structural Dynamics by John M. Biggs.

3. Elements of Earthquake Engineering by Jaikrishna and Chandrasekharan, Saritha Prakasham, Meerut.

Reference Books

1. Earthquake resistant design of structures by S.K.Duggal, Oxford University Press.

2. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.

ST2.4(a) OPTIMIZATION TECHNIQUES

Introduction: Need and scope of optimization, Historical development, Statement of an optimization problems, Objective function and its surface, design variables, constraints and constraint surface. Classification of optimization problems, various functions (continuous, discontinuous, and discrete) and Function behaviour (Monotonic, Non-Monotonic and Unimodal)

Classical Optimization Techniques: Differential calculus method, Multivariable optimization by method of constrained variation and Lagrange multipliers (generalized problem). Kuhn-Tucker conditions for optimality.

Fully stressed design and optimally criterion based algorithms, Introduction, Characteristics of fully stressed design theoretical basis – Examples.

Non-linear Programming: Unconstrained minimization – Fibonacci, Golden section, Quadratic and Cubic interpolation methods for a one-dimensional minimization and Univariate Method, Powel’s method, Newton’s method and Davidon Fletcher Powell’s method for multivariable optimization. Constrained minimization – Cutting plane method, Zoutendijk’s method and penalty function methods.

Linear programming – Definitions and theorems – Simplex method – Duality in linear programming. Plastic analysis and minimum weight design and rigid frame. Introduction to quadratic programming, Geometric programming and Dynamic programming. Design of beams and frame using dynamic programming technique.

Text Books

1. Optimization Theory and Applications by Rao, S.S., Wiley Eastern Ltd., New Delhi, 1978.

2. Optimum Design of Structures by Majid, K.I., Newnes-Butter Worths, London, 1974.

Reference Books

1. Mathematical Foundations for Design: Civil Engineering Systems by Robert, M. Stark and Robert L. Nicholls, McGraw Hill Book Company, New York, 1972.

2. Optimum Structural Design, Theory and Applications by Gallegher, R.H. and Zienkiewiez, O.C., John Wiley and Sons, New York, 1973.

ST2.4(b) GROUND IMPROVEMENT TECHNIQUES

Common Syllabus for SMFE2.4(b), CTPM2.4(b), ST2.4(b) and TE2.4(a)

Compaction: Theory of compaction, Shallow Surface Compaction - Equipment, Placement water content, factors affecting shallow compaction; Deep compaction: Methods - Vibrofloatation, Terra probe method, Pounding, Blasting, Compaction piles; Compaction Control.

Vertical Drains: Sand drains, Sand wicks, Rope drains, Design of vertical drains, Stone columns, application of the techniques to Marine clays.

Stabilization: Introduction, objectives, Methods of stabilization – Mechanical, Cement, Lime, Bituminous, Calcium chloride; construction methods, factors affecting stabilization of soils; Deep Mixing methods – Soil lime Columns and Cement Lime Columns, applications.

Dewatering: Definition, necessity, Methods of dewatering – Interceptor ditch, Single, Multistage and Vacuum well points, Horizontal wells, Electro-osmosis. Permanent drainage by Foundation drains and Blanket drains.

Grouting: Definition, Objectives of grouting, Grouts and their properties, Categories of Grouting, Grouting methods: Ascending, Descending and Stage Grouting in Soils, Hydrofracture, Grouting Equipment, Post grouting tests.

In-situ Reinforcement: Ground Anchors, Tiebacks and Soil Nailing, Micropiles.

Text Book

1. Ground Improvement Techniques by P. Purushothama Raj, Laksmi Publications, New Delhi.

Reference Books

1. Engineering Principles of Ground Modification by Monfred R Hausmann, Mc Graw Hill Publishing Co.

2. Reinforced Soil and Its Engineering Applications by Swami Saran, I.K. International Pvt. Ltd.

ST2.4(c) RELIABILITY ANALYSIS AND DESIGN

Common Syllabus for ST2.4(c) and SMFE2.4(c)

Concepts of Structural Safety: General, Design methods.

Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation.

Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, Common probability distribution, Extremal distribution.

Resistance Distributions and Parameters: Introduction, Statistics of properties of concrete, Statistics of properties of steel, Statistics of strength of bricks and mortar, Dimensional variations, Characterization of variables, Allowable stresses based on specified reliability.

Probabilistic Analysis of Loads: Gravity loads, Wind load.

Basic Structural Reliability: Introduction, Computation of structural reliability. Monte Carlo Study of Structural Safety: General, Monte Carlo method, Applications.

Level 2 Reliability Methods: Introduction, Basic variables and failure surface, First-order second-moment methods (FOSM).

Reliability Based Design: Introduction, Determination of partial safety factors, Safety checking formats, Development of reliability based design criteria, Optimal safety factors, Summary of results of study for Indian standard – RCC design. Reliability of Structural Systems: Preliminary concepts as applied to simple structures.

Text Book

1. Structural Reliability Analysis and Design by R.Ranganatham, Jaico Publishing House.

Reference Book

1. Structural Reliability by R.EMelchers, John Wiley and Sons Ltd.

ST2.5(a) PRESTRESSED CONCRETE
Common Syllabus for ST2.5(a) and CTPM2.5(a)

Introduction: Basic concepts of prestressing need for high strength steel and concrete, advantages of prestressed concrete. Materials for prestressed concrete, high strength concrete and high strength steel.

Prestressing systems and losses of prestress: (1) Freyssinet Anchorage System (2) Gifford Udall System (3) Magnel-Blaton System, Tensioning devices, anchoring devices. (4) Pretensioning and Post tensioning. Prestressing losses, Elastic shortening, loss due to shrinkage, loss due to creep, loss due to friction, loss due to slip etc. I.S.code provisions. Analysis of prestressed Concrete Beams: Assumptions, Analysis of prestress, Resultant stresses at a section, pressure or thrust line, concept of load balancing, cable profile, kern distance, stress in tendons as per IS 1343, cracking moment.

Shear and Torsional Resistance of Prestressed Concrete Members: Shear and Principal Stresses, Ultimate Shear Resistance of Prestressed Concrete Members, Design of Shear Reinforcements, Prestressed Concrete members In Torsion, Design of Reinforcements for Torsion, Shear and Bending. Transfer of prestress in Pretensioned members: Transmission length, bond stress, Transverse tensile stress, End Zone reinforcement, flexural bond stress, I.S. Code Provisions.

Anchorage zone in post tensioned members: Introduction, stress distribution in End block, Investigation on Anchorage Zone Stresses- Magnel’s method, Guyon’s method of approach of analysis of end block (Not more than 2 cables).

Deflection of Prestressed Concrete Members: Importance of Control of Deflections, Factors Influencing Deflections, Short-Term Deflection of Uncracked members, Prediction of Long Time Deflections, Deflection of Cracked Members, Requirements of various Codes of Practice.

Text Book 1. Prestressed Concrete by N.Krishna Raju, Tata McGraw-HillPublishing Company Limited.

Reference Books

1. Prestressed Concrete by N.Rajagopalan, Alpha Science.

2. Prestressed Concrete Structures by P. Dayaratnam, Oxford & Ibh

3. Design of Prestressed Concrete Structures by T.Y. Lin and Ned. H. Burns, John Wiley and Sons.

ST2.5(b) DESIGN OF STEEL BRIDGES

Steel Bridges: Introduction, classification of steel bridges, economical span, clearance requirements, dimensions of rolling stock, width of roadway and footway.

Loads: Live load for Railway, Highway and combined rail cum road bridges, Impact effect, wind load, lateral force (racking force), longitudinal forces, centrifugal forces, seismic forces, temperature effects.

Plate girder bridges: Introduction, types, general arrangement, wind load effects, analysis and design of Deck type plate girder bridge for railways, analysis and design of Half-through plate girder bridge for railways, analysis and design of Through type plate girder bridge for railways.

Truss girder bridges: Introduction, general arrangement of components of truss girder bridge, self-weight of Truss girder bridge, wind load and wind effects, analysis of portal bracing, analysis and design of through type truss girder bridge.

Bearings : Introduction, IS code requirements for bearings, Types of bearings, plate bearing, Rocker bearing, Roller bearing, Knuckle pin bearing, Railway board roller bearing.

Text Books

1. Comprehensive design of steel structures-B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications (P) Ltd.

Reference Books

1. Design of Steel structures by N. Subramanian, Oxford University Press.

2. Limit State Design of steel structures – Ramchandra and Virendra Gehlot, Scientific Publishers (India)

ST2.5(c) INELASTIC DESIGN OF SLABS

Basic elastic theory Analysis: Classical plate theory, Lagrange’s equation, moment-deformation, shear-deformation relationships. Examples on square and rectangular plates carrying uniformly distributed load for different edge conditions.

Principles of yield line theory: slab reinforcement, section behavior and conditions at ultimate load. Yield lines as axes of rotation and basic rules for the determination of the pattern of yield lines. Different yield line patterns for rectangular and non rectangular slabs supported on three and four sides with different edge conditions.

Analysis by principle of virtual work: Derivation of virtual work equations for Isotropic and Orthotropic two-way Square/ Rectangular slabs supported on four sides for different edge conditions.

Analysis of rectangular/Square slabs supported on three sides with different edge conditions and one edge is free (Balcony slabs) using virtual work principle.

Analysis of rectangular/Square slabs supported on three (Balcony slabs) and four sides with different edge conditions using equilibrium method.

Design of rectangular/Square slabs supported on three (Balcony slabs) and four sides for different edge conditions.

Derivation of virtual work equations only, for two-way slabs supported on four sides with different edge conditions having openings at centre, central eccentric, corner, central short side and central long side.

Text Books

1. Reinforced Concrete Slabs, Robert Park, William L Gamble, John Wiley & Sons.

2. Ultimate Strength Design for Structural Concrete. V.Ramakrishnan, P.D.Arthur. Wheeler books.

Reference Books

1. R H Wood and LL Jones “Yield line Analysis of Slabs. Thames and Hudson, Chatto & Windus, London,1967

ST2.6 REPAIR AND REHABILITATION OF STRUCTURES

Materials: Construction chemicals, Mineral admixtures, Composites, Fibre reinforced concrete, High performance concrete, Polymer-impregnated concrete.

Techniques to Test the Existing Strengths: Destructive and non-destructive tests on concrete.

Repairs of Multi-storey Structures: Cracks in concrete, Possible damages to the structural element beams, Slab, Column, Footing, etc., Repairing techniques like Jack Chu, Grouting, External pre-stressing, Use of chemical admixtures, Repairs to the fire damaged structure.

Repairs to Masonry Structures & Temples: Damages to masonry structures – Repairing techniques, Damages to temples – Repairing techniques.

Foundation Problems: Settlement of soils – Repairs, Sinking of piles – Repairs.

Corrosion of Reinforcement: Preventive measures – Coatings – Use of SBR modified cementitious mortar, Epoxy resin mortar, Acrylic modified cementitious mortar, Flowing concrete.

Temporary Structures: Need for temporary structures under any Hazard, Various temporary structures, Case-studies.

Case Studies: At least 2 case studies per each student.

Text Book

1. Deterioration, Maintenance and Repair of Structures by Johnson, McGraw Hill.

ST2.7 ADVANCED DESIGN OF STRUCTURES (VIVA-VOCE)

Any THREE of the following: 1. Design of blast resistant structures 2. Design of berth structures 3. Design of Quay Walls 4. Pre-engineered buildings 5. Bow string girder bridge 6. Balanced cantilever bridge 7. Raft design 8. Design of Piles and pile caps

ST2.8 SEMINAR

Each student has to select a topic and collect about 10 papers with at least 5 journal papers and prepare a report and give a seminar at the end of the semester

III SEMESTER

ST3.1(a) INDUSTRIAL STRUCTURES

Plastic Analysis: Introduction, Limit analysis of steel structures, Mechanical properties of structural steel, Plastic hinge, Moment curvature relations, Limit load, Coplanar load, Upper lower bound theorems. Redistribution of moments continuous beams: Relevant or irrelevant mechanisms, Types of mechanisms method for performing moment check. Portal frame, Mechanisms, Combination of mechanisms, Moment check, Partial complete and over complete collapse.

Light gauge steel structures: Local buckling of thin sections, Post packing of thin elements, Light gauge steel columns and compression members, Form factor for columns and compression members, Stiffened compression elements, Multiple stiffened compression elements, Unstiffened compression elements effective length of light gauge steel compression members, Basic design stress, Allowable design stress, Light gauge steel beams, Laterally supported light gauge steel beams web crippling. Allowable design stress in beams, Beams subjected to combined axial end bending stress, connections.

Analysis of Communication Towers: Analysis of Transmission line Towers: Loads on towers, Sag (dip) and Tension in uniformly loaded conductors, Analysis of towers (analysis as coplanar assembly), Design of members in towers, Design of foundation of towers. Design of Steel Chimneys for wind and gravity loads.Design of gantry girder

Text Book

1. Comprehensive Design of Steel Structures by B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd

Reference Books

1. Plastic Design of Steel Frames by Beedle, Wiley.

2. Design of Steel Structures by Arya & Ajmani, Nem Chand Publishers.

ST 3.1(b) DESIGN OF CONCRETE BRIDGES

Introduction to bridge engineering. Historical background of bridges and types. Bridge aesthetics and proportioning. Design process. Review of applicable design codes. Loads on bridges and force distribution. Bridge geometry. Analysis and design of Slab Bridge, Skew slab bridge.

Analysis and design of T-beam bridge: Deck slab considering IRC loads, longitudinal girders(Interior, Exterior), Cross girder. Analysis and design of prestressed concrete girder and box girder bridges considering only primary torsion, Design of end block.

Bridge Bearing: Types of bearings, Rocker bearing, Elastomeric bearing.

Text book

1. Essentials of Bridge Engineering, D. Jhonson Victor, Oxford University Press.

Reference Book

1. Design of Bridges, N.Krishna Raju, Oxford & IBH Publishing Co.Pvt.Ltd, New Delhi

ST3.2(a) STRUCTURAL STABILITY

Buckling of Columns: Method of neutral equilibrium, Critical load of the Euler column, Linear column theory – An eigen value problem, Effective length concept, Higher order differential equation for columns initially bent columns, Effect of shear stress on buckling, eccentrically loaded columns, beam columns (Beam columns with concentrated lateral load, distributed load, end moment), Inelastic buckling of columns, Double modulus theory, Tangent modulus theory, Shanley theory of inelastic column behaviour.

Approximate Methods of Analysis: Conservation of energy principles, Calculation of critical loads using approximate deflection curve, Principle of stationary potential energy, Raleigh-Ritz method, Buckling load of column with variable cross-section, Galerkin’s method, Calculation of critical load by finite differences, Unevenly spaced pivot points, Matrix stiffness method, Effect of axial load on bending stiffness-slope deflection equations, Buckling of column loaded along the length using energy methods.

Buckling of Frames: Modes of buckling, Critical load of a simple frame using neutral equilibrium, Slope deflection equations and matrix analysis. Lateral buckling of cantilever and simply supported beams of rectangular and I-sections and use of energy method and finite differences.

Buckling of Plates: Differential equation, Strain energy of bending, Critical load, Finite difference approach inelastic buckling of plates.

Matrix approach for Frames: Criterion for determination of critical loads, Stiffness influence coefficients for members without axial load, Derivation of stability functions, Problem involving Non-sways, Modified stiffness of beams, Frames with sway, Multi-bar frames.

 Text Book

1. Principles of Structural Stability Theory by Alexander Chajes, Waveland Pr Inc

Reference Book

1. Theory of Elasticity Stability by Timoshenko and Gere. Dover Publications

ST3.2(b) NUMERICAL METHODS FOR STRUCTURAL
ENGINEERING

Solutions of linear equations: Direct method – Cramer’s rule, Gauss – Elimination method- Gauss – Jordan elimination method– Triangulation (LU Decomposition) method – Iterative methods - Jacobi – Iteration method –Gauss – Siedel iteration, Successive over –relaxation method.

Eigen values and Eigen vectors: Jacobi method for symmetric matrices- Given’s method for symmetric matrices-Householder’s method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method.

Interpolation: Linear Interpolation - Higher order Interpolation - Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas –Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series-Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson’s extrapolation- Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas-Numerical solution to spatial differential equations – Application to Simply Supported Beams, Columns & rectangular Plates.

Numerical Differentiation: Different methods based on undetermined coefficients- optimum choice of step length– Partial differentiation.

Numerical Integration: Newton-Cotes integration formulas- Double integration using Trapezoidal Rule – Romberg Integration -Simpson’s method Gaussian quadrature- Errors in integration formulas- Multiple integration with variable limits.

Ordinary Differential Equation: Euler’s method – Backward Euler method – Midpoint method – single step method, Taylor’s series method- Boundary value problems and characteristics- Shooting method- Solution through a set of equations.

Text books

1. Numerical Methods For Scientific and Engineering Computations. M.K.Jain- S.R.K.Iyengar – R.K.Jain Willey Eastern Limited. New Age International (p) Ltd., Publishers.

2. Numerical Methods for Engineers StevanC.Chopra, Raymond P.Canal Mc. Graw Hill Book Company.

3. Numerical Methods for Engineering Problems by N. Krishna Raju and K.U. Muthu, M.C. Millan Publishers, New Delhi.

Reference Books

1. C Language and Numerical methods by C.Xavier – New Age International Publisher. Reprint March 2012 ISBN:978-81-224-1174-4.

2. Computer based numerical analysis by Dr. M.Shanta Kumar, Khanna Book publishers

ST3.3 DISSERTATION (Preliminary)

The student shall submit a brief report on the selected topic of his/her dissertation work and attend for a formal viva-voce examination before a committee comprising the Chairman, BOS, Head of the Department and the Guide.

Department of Civil Engineering M.Tech. (STRUCTURAL ENGINEERING) Scheme of Instruction and Examination (with effect from 2019-20 Admitted Batch)

IV – SEMESTER ST4.1 DISSERTATION (Final)

The student shall submit his/her dissertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, the Guide and the External Examiner

Civil Engineering

M.Tech. (SOIL MECHANICS AND FOUNDATION ENGINEERING)

Scheme of Instruction and Examination

(with effect from 2019-20 Admitted Batch)

I – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

SMFE1.1 Advanced Soil Mechanics 4 -- 4 3 70 30 100 3

SMFE1.2 Advanced Foundation
 Engineering 4 -- 4 3 70 30 100 3

SMFE1.3 Geosynthetics and
 Reinforced Soil Structures 4 -- 4 3 70 30 100 3

**Program Elective –I**

SMFE1.4 (a) Analysis and Design of
 Pavements
 (b) Rock Mechanics `4 -- 4 3 70 30 100 3
 (c) Remote Sensing and
 GIS Applications

**Program Elective–II**

SMFE1.5 (a) Advanced Concrete
 Technology 4 -- 4 3 70 30 100 3
 (b) Subsurface Exploration

SMFE1.6 Soil and Rock - 3 3 Viva 50 50 100 1.5
 Engineering Lab.

SMFE1.7 Geosynthetics Lab. - 3 3 Viva 50 50 100 1.5

 Total 20 6 26 450 250 700 18

II – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

SMFE2.1 Soil Dynamics and
 Machine Foundations 4 -- 4 3 70 30 100 3

SMFE2.2 Earth and Earth Retaining
 Structures 4 -- 4 3 70 30 100 3

SMFE2.3 Geotechnical Earthquake
 Engineering 4 -- 4 3 70 30 100 3

**Program Elective –III**

SMFE2.4

 (a) Disaster Management
 (b) Ground Improvement 4 -- 4 3 70 30 100 3 Techniques
 (c) Reliability Analysis and
 Design

**Program Elective –IV**

SMFE2.5 (a) Geotechnics of 4 -- 4 3 70 30 100 3
 Underground Structures
 (b) Finite Element Method
 of Analysis

SMFE2.6 Design Project - 3 3 Viva 50 50 100 1.5

 SMFE2.7 Case Studies - 3 3 Viva 50 50 100 1.5

 SMFE2.8 Seminar -- 3 3 Viva 50 50 100 2

 Total 20 9 29 500 300 800 20

 III SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

**Program
Elective –V**

SMFE3.1(a) Problematic Soils 4 -- 4 3 70 30 100 3

 (b) Geotechnics of Industrial
 Wastes

**Program
Elective–VI** SMFE 3.2 (a) Forensic 4 -- 4 3 70 30 100 3 Geotechnical Engineering

 (b) Geoenvironmental
 Engineering

SMFE3.3 Dissertation (Preliminary) -- -- -- Viva -- 100 100 8

 Total 8 -- 8 140 160 300 14

IV SEMESTER

Code No. Course Title Scheme of Examination Total Credits

 Exam (hrs) Ext. Sess.

SMFE4.1 Dissertation (Final) Viva 100 -- 100 16

 Total 16

Civil Engineering

M.Tech. (SOIL MECHANICS AND FOUNDATION ENGINEERING)

(with effect from 2019-20 Admitted Batch)

I – SEMESTER

SMFE1.1 ADVANCED SOIL MECHANICS

Elements of elasticity: State of stress at a point, stress function, equilibrium equation, compatibility equation, boundary conditions, Hooke’s law, two dimensional problems, principal stress and strain, octahedral stresses, stress invariants, Mohr’s representation.

Elements of plasticity : Ideal plastic substance, strain hardening, yield criteria – Tresca, Hises and Mohr, Coulomb theories of failure and failure envelops in cohesionless and cohesive soils.

Rheological models–Hookean, Newtonian, rigid plastic, Elasto–plastic, Kelvin–Voigt and Maxwell models.

Soil strength: Effective stress law for saturated and partially saturated soil, pore pressure measurements in partially saturated soils, effective stress concept, effect of intermediate principal stress, effect of rate of stress, stress dilatancy theory, plane strain and stress path Hvorslev shear strength parameters

Clay Minerals: Classification, Structure, properties; Identification of clay minerals - X ray Diffraction, Electron Microscope and Differential Thermal Analysis.

Text book

1. Soil Behaviour by James K Mitchell, John Wiley & Sons Inc

Reference books

1. Foundation of theoretical soil mechanics by M. E. Harr, Mc Graw Hill book co.

2. Selected topics in soil mechanics by I. K. Lee, Butler Warth

3. Rheological aspect of Soil Behaviour by Suklje, Thomas Telford Publishing

SMFE 1.2 ADVANCED FOUNDATION ENGINEERING

Common Syllabus for SMFE1.2, CTPM1.4(a), TE1.4(a) and ST1.4(a)

Introduction

Principles of Design of Foundations, Types of shear failures in foundation soils, Types of foundations, Design Loads, Basic Concepts of safe and allowable bearing capacity.

Shallow Foundations

Bearing Capacity Analysis: Bearing capacity theories – Terzaghi, Meyerhof, Skempton, Hansen, Vesic and IS Methods, Bearing capacity evaluation from Standard Penetration test and Plate load test.

Settlement Analysis: Uniform and Differential Settlements, Elastic and Consolidation Settlements, Settlement analysis in cohesionless soils by Schemartmann and Hartman method, Penetration tests; Permissible settlements as per IS 1904-1978, causes of settlement, settlement Control.

Proportioning of footings: Isolated column footings, Strip, combined Footings and Strap Footing.

Raft Foundations: Bearing capacity of raft foundation, floating raft, Types of rafts, Beam on Elastic foundation and Conventional methods of Design, determination of modulus of subgrade reaction.

Deep Foundations

Pile Foundations: Types, load capacity- dynamic formulae, static formula; pile load tests- Vertical load test, lateral load test, Cyclic load test; settlement of piles and pile groups, negative skin friction on single pile and pile groups; laterally loaded piles - Broom’s Analysis, IS Code method; Under reamed piles – Load capacity, design and construction.

Well Foundations: Types, Bearing Capacity of well foundations, Construction of pneumatic caissons, Tilts and Shifts: precautions, Remedial measures; Lateral stability analysis by Terzaghi’s Method, Design aspects of Components of well foundation.

Foundations in Expansive Solis

Introduction, Identification of expansive soils, Swell potential and swelling pressure, Active depth, Foundation Problems, Foundation practices in expansive soils, Soil Replacement and ‘CNS’ concepts.

Foundations of Transmission Line Towers

Introduction, Necessary information, Forces on tower foundations, General design criteria, Choice and type of foundation, Design procedure.

Text Books

1. Analysis and Design of Substructures by Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.

2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publications

Reference Books

1. Foundation Analysis and Design by J.E. Bowles, Mc Graw Hill Publishing Co.

2. Foundation Design by W.C. Teng, John Wiley, New York.

3. Analysis and Design of Substructures by Swami Saran, Oxford &IBH Publishing Co.

4. Foundation Engineering by P.C. Vargheese, Prentice Hall of India

SMFE1.3 : GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES

Reinforced Earth: Concept, Effects of Reinforcement on soils – Equal Confining and Psuedo Cohesion Concepts, Materials, Friction Coefficient – Definition, Laboratory determination, Factors affecting fiction coefficient; Application of Reinforced Earth

Geosynthetics: Types, Functions, Tests on Geosynthetics, Durability aspects, Applications

Reinforced Earth Retaining Walls: Introduction, Stability Mechanisms, Design of Reinforced Earth Retaining Wall, Advantages over conventional Retaining Walls

Reinforced Embankments: Introduction, Design of Reinforced Embankment, Foundation mattress below the embankment, Design of Reinforced Mattress

Reinforced Soil Beds: Introduction, Factors affecting the Behaviour of Reinforced Soil Beds, Analysis and Design

Reinforced Pavements: Benefitsof placing reinforcement in flexible pavement layers, design of reinforced pavements by Giroud and Noiray approach and modified CBR Method.

 Text Book 1. An Introduction to Soil Reinforcement and Geosynthetics” By G.L. Siva Kumar Babu, University Press

 Reference Books 1. Designing with Geosynthetics by Robert M Koerner, 2. Advances in Geosynthetics by G. Venkatapparao, Sai Master Geoenvironmental Services Pvt. Ltd. Publications

 SMFE1.4(a) ANALYSIS AND DESIGN OF PAVEMENTS

 Pavement Types, Design Factors: Definition, Comparison of pavements. Types of pavements based on structural behavior – Flexible and Rigid Pavements, Comparison, components and their functions, Soil subgrade, sub-base, Base course and wearing course. Design wheel loads – Equivalent Single Wheel Load (ESWL), Repetitions of loads. Strength characteristics of pavement materials – subgrade modulus, Elastic moduli of base course and sub-base materials, Traffic and Loading, Environment, Materials, Failure criteria. Climatic Variations

 Stresses in Flexible Pavements: Layered System Concepts: One Layer System - Boussinesq Theory. Two Layer Theory - Burmister’s Theory. Three Layer System.

 Stresses in Rigid Pavements: Relative Stiffness of Slabs, Modulus of Subgrade Reaction, Stresses due to Warping, Stresses due to Friction, Stresses due to Wheel Load, Stresses due to temperature variation (temperature differential).

 Pavement Design: Design of Flexible pavements – Group-Index method, California Bearing Ratio(CBR) method, Mc leod method, Burmister Method, IRC Method of Flexible Pavement Design as per IRC 37 –2001, AASHTO Method of Flexible Pavement. Design of Air field Pavements – Corps of Engineers method

 Design of Rigid pavements – Design of Joints, Expansion Joints, Contraction Joints, Design of Dowel and Tie bars. IRC recommendations for Rigid pavements as per IRC 581988. Design of Airfield Rigid pavements– LCN System of Pavement design.

Pavement Failures: Flexible pavements – Alligator cracking, Longitudinal cracking, Frost heaving, lack of binder to lower course, formation of waveson corrugation, Reflection cracking.

Pavement Inventories: Serviceability Concepts, pavement serviceability index, Roughness for measuring unevenness, Profilograph, profilometer, road roughometer, Benkelman beam deflection method, Skid resistance measurement.

Pavement Evaluation: Structural Evaluation of Benkelman beam. Evaluationof Pavement surface measurement condition using instruments (Profilograph, bump Integrator)

Overlays: Types of overlays – Flexible overlay over Flexible Pavements, Rigid overlay over Flexible Pavements, Flexible overlay over Rigid Pavements, Rigid overlay over Rigid Pavements. Design of overlay using Benkelman beam using IRC 81-1997. Concrete Block Pavements – Types and shapes, Construction and maintenance.

Text Books:

1. PrinciplesofPavementDesign by Yoder and Witzorack,, John Willey and Sons.

2. Highway Engineering, S.K. Khanna and C.E.G Justo and A. Veeraragavan, Nemchand Brothers publications.

3. Airport Planning and Design by S.K. Khanna and S. Arora, Nemchand and brothers publications.

Reference Books

1. Yang, H. Huang, “Pavement Analysis and Design”, Prentice Hall Publication, Englewood Cliffs, NewJersy.

2. Sargious, M.A. Pavements and Surfacings for Highways andAirports– Applied science Publishers limited

3. Ralps Hass and Hudson, W.R. “Pavement Management System” Mc-Graw Hill Book Company.

4. Guidelines for the use of Interlocking concrete block Pavement, IRC:SP:63-2004

5. IRC codes ofpractice.

6. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das, PHI Learning.

SMFE1.4(b) ROCK MECHANICS

Introduction :Geological formation of rocks, Structural Geology, classification of rocks, Defects in rock, Physical, mechanical properties of rocks, Exploration techniques – RQD and RMR, Laboratory tests for shear strength, tensile strength, flexural strength, elastic constants, Field tests – test for deformability, shear tests and strength tests

Engineering classification of Rock mass, Stress-strain behaviour, Failure criteria for rock masses - Yield criteria for failure theories: maximum stress theories, maximum elastic strain theories etc, and Griffith’s theory of fracture initiation, stresses around open flaw and equation defining fracture

Tunnelling in rocks - different phases and methods of tunnelling, Instrumentation in tunnels, Rock freezing, Rock fall, Improvement techniques for rock – Grouting, Rock bolting

Rock reinforcement - Mechanism, types of reinforcement, steps involved in installation, Foundations on rock, Rock blasting- explosives, Selection criteria for explosives, steps involved in blasting

Text book

1. Singh, B. and Goel, R. K. “Rock Mass Classification Systems – A Practical Approach in Civil Engineering “Elsevier Publisher

Reference Books

1.Verma, B. P., “Rock Mechanics for Engineers” Khanna Publishers

2.Brown, E.T., “Rock Characterisation, Testing and Monitoring”, Pergamon Press, London, U.K

3. Rock mechanics on the design of structures in rock by Oberti and Duvalk, W. L. John Wiley.

SMFE1.4(c) REMOTE SENSING AND GIS APPLICATIONS

Common Syllabus for HCH1.4(c), SMFE1.4(c) and EEM1.4(c)

Introduction - Definition- Principle of Remote Sensing- History of Development of Remote Sensing- Stages in Remote Sensing- Electromagnetic Radiation and the Electromagnetic Spectrum- Interactions With the Atmosphere- Atmospheric Scattering- Atmospheric Absorption- Atmospheric Windows- Refraction- Interaction of EMR with the Earth's Surface- Reflection- Transmission- Spectral Signature.

Platforms & Sensors- Remote Sensing Systems- Remote Sensing From Space- Remote Sensing Sensors- Resolution- Imaging Sensors- Optical Infrared (OIR) Imagers- Optical Sensors- Thermal Sensors- Microwave Sensors- Active Microwave Sensors- Data Preprocessing- Remote Sensing in India.

Introduction to Image Interpretation- Basic Principles of Image Interpretation- Elements of Image Interpretation- Techniques of Image Interpretation- Interpretation Keys- Introduction to Digital Image Processing- Digital Image- Image Rectification and Registration- Geometric Correction- Image Enhancement Techniques (Only Concepts)- Image Classification -

Unsupervised Classification and Supervised Classification- Digital Photogrammetry - Stereo Images from Satellites - Data Merging .

Geographic Information Systems (GIS)- Definitions and Related Technology- GIS Operations- GIS Elements- GIS Concepts and Practice- Map Projection and Coordinate System.

Vector Data Model- Introduction- Vector Data Representation- Geometric Objects- Topology. Vector Data Analysis- Introduction- Buffering- Applications of Buffering- Map Overlay- Feature Type and Map Overlay- Map Overlay Methods- Slivers- Error Propagation in Map - Overlay- Distance Measurement- Map Manipulation-

Raster Data Analysis- Introduction- Analysis Environment- Local Operations- Local Operations With a Single Grid- Local Operations With Multiple Grids- Neighborhood Operations- Zonal Operations.

Terrain Mapping and Analysis- Introduction- Data for Terrain Mapping and Analysis- Surface Models-DEM- TIN.

GIS Models and Modeling- Introduction- GIS Modeling- Binary Models- Index Models Remote Sensing & GIS Application in Civil Engineering – Some Case Studies from Literature.

Text Books

1. Fundamentals of Remote Sensing 2nd Ed by George Joseph- University Press- New Delhi.

2. Introduction to Geographic Information Systems by Kang Tsung Chang- Tata Mc.G.H. Publications- New Delhi.

3. Remote Sensing and Image Interpretation by Lillesand- T.M. and Kieffer- Joh Wiley and Sons- New York- 1987.

Reference Books

1. Remote Sensing of the Environment – An Earth Resource Prespective by John R. Jensen- Pearson Education- New Delhi.

2. Geographic Information Systems: A Management Perspective by Aronoff- S. Ottawa: Wdl Publications- 1989.

3. Geographic Information Systems For Geoscientists: Modeling with GIS by Bonham Carter- G-F.- New York: Pergamon Press- 1994.

4. Principles Of Geographical Information Systems by Burrough- P.A And R.A. Mcdonnell.. Oxford: Oxford University Press- 1998.

5. Concepts and Technologies of Geographic Information Systems by Lo- C.P.- and Albert K.W. Young- Prentice Hall Of India (Pvt) Ltd- New Delhi.

6. Introductory Digital Image Processing by John R Jensen- Prentice Hall- New Jersey.

7. Application of Remote Sensing to Hydrology Including Groundwater by Farsworth- R.K.- Bawetl- E.C. & Dhanju- M.S.-- IHP- UNESCO- 1984.

SMFE1.5(a) ADVANCED CONCRETE TECHNOLOGY

Common Syllabus for ST1.5(a), CTPM1.5(a) and SMFE1.5(a)

Durability of concrete and concrete construction: Durability concept, pore structure and transport processes, reinforcement corrosion, fire resistance, frost damage, sulphate attack, alkali silica reaction, delayed ettringite formation, methods of providing durable concrete, short-term tests to assess long-term behavior.

Mix design: Review of methods and philosophies of IS, BS and ACI methods, mix design for special purposes. Acceptance criteria for compressive strength of concrete

Special concretes: Lightweight concrete, autoclaved aerated concrete, no-fines concrete, lightweight aggregate concrete and foamed concrete, High strength concrete, refractory concrete, high density and radiation-shielding concrete, polymer concrete, fibre-reinforced concrete, mortars, renders, recycled concrete, Ferro Cement, Self Compacting Concrete.

Special processes and technology for particular types of structure: Sprayed concrete, underwater concrete, grouts, grouting and grouted concrete, mass concrete, slip form construction, pumped concrete, concrete for liquid retaining structures, vacuum process, concrete coatings and surface treatments.

Test methods: Analysis of fresh concrete, Accelerated testing methods, Tests on hardened concrete, Core cutting and testing, partially destructive testing, Non-destructive testing of concrete structures

Text Book

1. Properties of Concrete, A.M.Neville, Longman 1995.

2. Concrete Technology Theory and Practice, M.S.Shetty, S.Chand & Company Ltd, New Delhi.

Reference Book

1. Concrete micro-structure, Properties and Materials, P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw Hill, USA.

SMFE1.5(b) : SUBSURFACE EXPLORATION

Objectives of Soil Exploration, Methods of Soil Exploration, Depth and Extent of Soil Exploration in Different Civil Engineering Projects

Problems and phases of foundation investigations. Geophysical, sounding, drilling and accessible explorations. Sample requirements, sampling methods and equipment. Handling, preservation and transportation of samples.

Sample preparation, laboratory tests – Triaxial (UU/CU), Consolidation, Swelling pressure. Analysis of results and interpretation, importance of in-situ testing. Performing various in situ tests – File Vane Shear Test, Plate load test, Pile load test, SPT, SCPT, DCPT. Precautions and interpretation. Site evaluation and reporting.

Exploration in Rock and Marine Soil Exploration

Text Book

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publications

Reference books

1. Head, K. H., Manual of Soil Laboratory Testing, volume 1 to 3, 1981

2. Compendium of Indian Standards on Soil Engineering Parts I and II, 1987 – 1988

SMFE1.6. : SOIL AND ROCK ENGINEERING LAB

Experiments on Soil

1. Index and Engineering Properties Of soils

2. Quick Determination of Water content – Rapid Moisture Meter, Proctor’s Needle.

3. Determination of Compression Index, Coefficient of consolidation of clays

4. Determination of Swell Parameters – Differential Free Swell, Swell Pressure Tests.

5. Determination of Shear Parameters – Tri-axial Test, Direct Shear Test, Vane Shear test, Unconfined Compression Test.

6. Determination of Relative Density of granular soils.

Experiments on Rock

1. Determination of Specific Gravity.

2. Determination of Unconfined Compression Strength.

3. Determination of Porosity.

4. Determination of Water absorption.

5. Determination of point load Index of Rocks.

Demonstration Tests:

1. Plate Load Test.

2. Pile Load Test.

3. Standard Penetration Test.

Reference Book: Relevant IS Codes of Practice

SMFE1.7 GEOSYNTHETICS LAB

1. Determination of physical properties of Geotextiles, Geogrids and Geomembranes

2. Determination of Grab and wide width tensile strengths of geotextiles

3. Determination of Tensile strength of Geogrids and Geomembranes

4. Determination of Interfacial frictional characteristics of Geotexiles with Fill material

5. Determination of in plane and cross plane permeability of geotextiles

6. Determination of Puncture Resistance of geotextiles

7. Determination of A.O.S of geotextiles

8. Evaluation of long term flow ability of geotextiles by Gradient ratio test

9. Cone Drop Test on geotextiles

Reference Books: Relevant ASTM Standards

II – SEMESTER

SMFE 2.1 SOIL DYNAMICS AND MACHINE FOUNDATIONS

Theory of Vibration: Free and forced vibrations with and without damping for single mass system with single degree freedom, Logarithmic Decrement and Damping Ratio, Principles of Design of Vibration measuring Devices, Transmissibility of force, vibrations of Two degree freedom system, vibrations of Systems under transient loads.

Natural frequency of foundation soil system- Barkan’s Method, Pressure Bulb Concept, Pauw’s Analogy, Tschebetorioff’s concept of reduced natural Frequency.

Dynamic Soil Properties: Tests for determination of dynamic soil properties - Cyclic Plate load test, Block vibration test, Up Hole, down Hole and Cross Hole wave Propagation tests, Hammer Test, Resonant Column Test, Seismic Reflection and Refraction tests.

Design of Machine Foundation: Types of Machine Foundations, design criteria, Degrees of Freedom of Block foundation, Analysis of Block foundations under sliding, rocking, yawing and Coupled motions, Design Aspects and Construction details of foundations for reciprocating and Impact, vibration isolation: active and passive isolation, vibration isolation materials.

Text Book

1. Soil Dynamics by Shamsher Prakash, Shamsher Prakash Foundation

Reference books

1. Hand Book of Machine Foundations by P. Srinivasulu and C.V. Vaidyanathan, Tata Mc Graw Hill Book Co.

2. Dynamics of Bases and Foundation by Barken, Mc Graw Hill Book Co.

3. Vibration of soil and Foundation by Richart F.E., Hall J.A., Woodes R.E., Prentice Hall

SMFE2.2 EARTH AND EARTH RETAINING STRUCTURES

Earth Pressure:

Basic concepts, Rankine and Coulomb earth pressure theories, Determination of active and passive pressures: Culmann’s Graphical method, logarithmic spiral methods, friction circle method. Consideration of surcharge, seepage, earth quack, wave effect, stratification, type of backfill, wall friction and adhesion.

Retaining structures:

a. Uses, types, stability and design principles of retaining walls, backfill drainage, settlement and tilting. b. Sheet Pile Walls: Types, Design of cantilever sheet pile walls in granular and Cohesive soils; Design of anchored sheet pile walls by free and fixed earth support methods, Rowe’s theory of moment Reduction, Design of anchors. c. Braced excavations: Types of sheeting and Bracing systems, lateral earth pressure on sheeting in sand and clay, Design components of braced cuts. d. Cellular cofferdams: Types – Diaphragm and Circular type, Design by TVA method. Stability of cellular cofferdams, cellular cofferdams in rocks and soils.

Text Books

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publications

2. Foundation design by W. C. Teng, Prentice Hall

Reference books

1. Theoretical soil mechanics by Karl Terzaghi, John Willey 1965

2. Soil mechanics in engineering and practice by K. Terzaghi. And R.B. Peck 2nd edition, John Wiley 1968.

3. Analysis and design of foundations by J.E. Bowles, McGraw Hill, 4th edition 1955.

SMFE2.3 : GEOTECHNICAL EARTHQUAKE ENGINEERING

Seismology and Earth Quakes: Introduction, Seismic Hazards, seismic waves, internal structure of earth, Continental Drift and plate tectonics, faults, elastic rebound theory, geometric notations, location of earthquakes, size of earthquakes. Strong Ground Motion: Strong ground motion measurement, Ground motion parameters, Estimation of ground motion parameters. Seismic Hazard Analysis: Identification and evaluation of earthquake sources, Deterministic Seismic Hazard Analysis, Probabilistic seismic Hazard analysis. Wave Propagation: Waves in Rods, one dimensional wave equation, Effect of end condition on wave propagation, Mode vibrations of rods of finite length, Wave propagation through elastic infinite medium, Waves in Semi infinite elastic medium. Dynamic Soil Properties: Measurement of Dynamic Soil Properties using field and laboratory tests (overview), Strength and Stress-strain behavior of cyclically loaded soils. Ground Response Analysis: One dimensional ground response analysis – Linear and Non-linear approaches. Local Site Effects: Effect of local site conditions on ground motion, Design parameters, Development of design parameters. Liquefaction: Flow liquefaction, cyclic mobility, liquefaction hazards, liquefaction susceptibility, Initiation of liquefaction, Effects of liquefaction, liquefaction Control measures

Text Book

1. Geotechnical Earthquake Engineering by Steven L. Kramer, Prentice Hall

Reference Book

1. Geotechnical Earthquake Engineering Handbook by Robert W. Day, McGraw-Hill Publishing Co., New York

SMFE2.4(a) DISASTER MANAGEMENT

Types of Disasters:

Disaster - concept and definitions of disaster, causes of disasters, types – natural disasters – floods, droughts, cyclones, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold wave, global warming, sea level rise, ozone depletion. Man-made disasters: Sociological – political – industrial and human disasters.

Risk Assessment and Analysis

Concept and elements of Hazards, Risks and Vulnerability – Policies of Disaster Management, Identification of Crisis Situation, strategic developments, roles and responsibilities of recovery team, importance of team building in disaster management.

Disaster Preparedness:

Prevention and Preparedness – Plan, Action and Accountability, Concept and Nature of Disaster Preparedness, Plan of Disaster Preparedness for People with Special Needs/Vulnerable Groups, with Relevance to Housing, Infrastructure and Livestock, Community Based Disaster Preparedness Plan, Role of Information technology, Education, Communication and training. Medical and health preparedness plan.

Disaster Damage Assessment and Response:

Needs and Damage Assessment– Control process and measurement – modern and traditional methods of response, Disaster Response Plan – roles of response teams and forces. Epidemiological Study of Disasters - Medical and Health Response to Different Disasters - Role of Information and Communication Technology in Health Response

Disaster Mitigation and Recovery:

Disaster Mitigation – meaning and concept – structural mitigation and non-structural mitigation – mitigation strategies and emerging trends. Reconstruction and rehabilitation for development, Medium and long-term recovery aspects, Participative Rehabilitation Process: Community involvement and development of infrastructure.

Reference Books:

1. Disaster Management by Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.

2. Natural Hazards & Disaster Management by R.B.Singh

3. Disaster Management: Future Challenges and opportunities by Jagbir Singh4

4. Natural Disaster Management, Jon Ingleton

5. Disaster Management, Rajib Shaw and RR Krishnamurthy, Universities Press, Hyderabad.

SMFE2.4(b) GROUND IMPROVEMENT TECHNIQUES

Common Syllabus for SMFE2.4(b), CTPM2.4(b), ST2.4(b) and TE2.4(a)

Compaction: Theory of compaction, Shallow Surface Compaction - Equipment, Placement water content, factors affecting shallow compaction; Deep compaction: Methods - Vibrofloatation, Terra probe method, Pounding, Blasting, Compaction piles; Compaction Control.

Vertical Drains: Sand drains, Sand wicks, Rope drains, Design of vertical drains, Stone columns, application of the techniques to Marine clays.

Stabilization: Introduction, objectives, Methods of stabilization – Mechanical, Cement, Lime, Bituminous, Calcium chloride; construction methods, factors affecting stabilization of soils; Deep Mixing methods – Soil lime Columns and Cement Lime Columns, applications

Dewatering: Definition, necessity, Methods of dewatering – Interceptor ditch, Single, Multistage and Vacuum well points, Horizontal wells, Electro-osmosis. Permanent drainage by Foundation drains and Blanket drains.

Grouting: Definition, Objectives of grouting, Grouts and their properties, Categories of Grouting, Grouting methods: Asending, Descending and Stage Grouting in Soils, Hydrofracture, Grouting Equipment, Post grouting tests.

In-situ Reinforcement: Ground Anchors, Tiebacks and Soil Nailing, Micropiles.

Text Book

1. Ground Improvement Techniques by P. Purushothama Raj, Laksmi Publications, New Delhi.

Reference Books

1. Engineering Principles of Ground Modification by Monfred R Hausmann, Mc Graw Hill Publishing Co.

2. Reinforced Soil and Its Engineering Applications by Swami Saran, I.K. International Pvt. Ltd.

SMFE2.4(c) RELIABILITY ANALYSIS AND DESIGN

Common Syllabus for ST2.4(c) and SMFE2.4(c)

Concepts of Structural Safety: General, Design methods.

Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation.

Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, Common probability distribution, Extremal distribution.

Resistance Distributions and Parameters: Introduction, Statistics of properties of concrete, Statistics of properties of steel, Statistics of strength of bricks and mortar, Dimensional variations, Characterization of variables, Allowable stresses based on specified reliability.

Probabilistic Analysis of Loads: Gravity loads, Wind load.

Basic Structural Reliability: Introduction, Computation of structural reliability. Monte Carlo Study of Structural Safety: General, Monte Carlo method, Applications.

Level 2 Reliability Methods: Introduction, Basic variables and failure surface, First-order second-moment methods (FOSM).

Reliability Based Design: Introduction, Determination of partial safety factors, Safety checking formats, Development of reliability based design criteria, Optimal safety factors, Summary of results of study for Indian standard – RCC design. Reliability of Structural Systems: Preliminary concepts as applied to simple structures.

Text Book

1. Structural Reliability Analysis and Design by R.Ranganatham, Jaico Publishing House.

Reference Book

1. Structural Reliability by R.EMelchers, John Wiley and Sons Ltd.

SMFE2.5(a) GEOTECHNICS OF UNDERGROUND STRUCTURES

Arching in soils, prerequisites and features of arching, Theory of arching in soils, Application of arching in cohesive frictional and cohesive-frictional soils. Soil pressures on conduits- Loads on ditch, negative and positive projecting conduits, Bedding conditions for conduits and types of conduits, Pressures in silos, Janssen’s theory for pressures in silos Stresses in Vicinity of Vertical Shafts, Tunnels, Construction of Erath Tunnels Retaining Systems for Underground Excavations Braced Cuts: Lateral Earth pressure on Sheeting, Types of Sheeting and Bracing Systems, Design of Braced Cuts Tie Backs: Components, advantages over Braced Cuts, Design concepts Soil Nailing: Components of nailing system, Driven and Grouted Nails, Design of nailing system, anchored Spider Netting Types of Anchorage Systems for anchored Sheet pile walls, Design of anchorages, considerations in positioning of anchorages

Text Book

1. Shamsher Prakash, Gopal Ranjan and Swami Saran (1987) “Analysis and Design of Foundations and Retaining Structures”, Sarita prakasha.

Reference books

1. Leonards, G.A (1962) “Foundation Engineering”, Mc Graw Hill Co.

2. Design of Foundation Systems by Nainan P Kurian, Narosa Publishing House.

SMFE2.2 FINITE ELEMENT METHOD OF ANALYSIS

Common Syllabus for ST2.2, SMFE2.5(b), WRE2.5
(b), HCH2.5(b) and TE2.5(b)

Introduction: A brief history of F.E.M. Need of the method, Review of basic principles of solid mechanics- Equations of equilibrium, Boundary conditions, Compatibility, Strain displacement relations, Constitutive relationship in matrix form, plane stress & plane strain and axisymmetric bodies of revolution with axi-symmetric loading, Energy principles - Rayeigh - Ritz method of functional approximation.

Theory relating to the formulation of the finite element method, Coordinate system (local and global), generalized coordinates, Concept of the element, Various element shapes, Discretisation of a structure, Mesh refinement Vs. Higher order element, Interconnections at nodes of displacement models, inter element compatibility, -shape functions.

Basic component – One dimensional FEM single bar element, Beam element : Derivation of stiffness matrix, Assembly of stiffness, Matrix boundary conditions, shape functions for 1 D elements, Initial strain and temperature effects, and trusses under axial forces.

Two dimensional FEM: Different types of elements for plane stress and plane strain analysis – Displacement models Generation of element stiffness and nodal load matrices –static condensation.

Isoparametric representation and its formulation for 2d analysis. Formulation of 4-noded and 8noded isoparametric quadrilateral elements – Lagrangian elements-serendipity elements.

Text Books

1. Finite Element Analysis by C.S.Krishnamoorthy, (2002), Tata McGraw Hill Publishing Co. Ltd.

2. Introduction to Finite Element Method by Desai,C.S.and Abel, J.F.,Van Nostrand, 1972.

Reference Books

1. Introduction to Finite element Method by Tirupathi chandra Patla and Belugundu

2. The Finite Element Method in Engineering Science” by Zienkiewicz, P., McGraw Hill, 1971.

SMFE2.6 DESIGN PROJECT

The students should carry out typical foundation design under varying soil conditions or revision of IS codes & IRC guidelines or any project suggested by course instructor. The design project may consist of

1. Soil and Structural Design of Combined footings, rafts

2. Design of Pile Groups

3. Design of Laterally loaded Piles

4. Design of well Foundations

5. Landfill Design

6. Reinforced Soil Structures

7. Design of Bulk heads

8. Case studies.

SMFE2.7 CASE STUDIES

Students should select a case study in any of the following areas and prepare a comprehensive report and present the case study

1. Foundation design

2. site characterization

3. ground improvement

4. Slope Instability

5. Soil Contamination and remediation

6. Foundation failures

7. Embankment construction on weak subgrades.

SMFE2.8 SEMINAR

Each student has to select a topic and collect about 10 papers with at least 5 journal papers and prepare a report and give a seminar at the end of the semester

III – SEMESTER

SMFE3.1(a) PROBLEMATIC SOILS

Expansive Soils:Geology, engineering properties, swelling, swelling pressure, strength and compressibility, permeability stabilization methods, foundation types.

Soft Clays:Geology of soft marine clays, mineralogy, physical properties, shear strength and compressibility, foundation types.

Organic and Peaty Soils, Collapsible soils:Geotechnical properties, foundation types

Liquefiable Soils: Identification, Factors affecting Liquefaction, Methods for improving resistance of soils to Liquefaction

Filled up Soils: Characterization, Methods for Strengthening Filled up material for supporting structures, Foundation practices in Filled up areas.

Soil Stabilization:Principles of soil stabilization; Role of admixtures; Purpose based classification of soils; Methods of stabilization – Lime, cement, bitumen and special chemicals – Mechanisms, uses and limitation; use of fly ash and other waste materials

Text Book:

1. Ground Improvement Techniques by P. Purushothama Raj, Lakshmi Publications

Reference Books

1. Tropical soils in engineering practice by S. A. Ola, Balkema publications, Holland

2. Soil stabilization principles and practice by Ingles, O. G. and Metcalf, J. B., Butterworth,1972

SMFE3.1(b) GEOTECHNICS OF INDUSTRIAL WASTES

Wastes from Thermal Power Plants: Fly ash, bottom ash and Pond Ash, availability, Properties, classification, scope for use in civil engineering projects, Present applications

Agriculture Waste: Rice Husk Ash, Physical, Chemical and Engineering Properties, Potential uses based on its properties.

Wastes from Steel Plants: Blast Furnace Slag, Granulated Blast Furnace Slag and Ground Granulated Blast Furnace Slag, Material properties, potential applications.

Quarry Dust: Production, Properties, comparison with sand, potential uses.

Potential for use of Industrial wastes in stabilization of soils.

Underground Pollution Risk of using Industrial wastes as construction materials and Mitigation. Evaluation methods for studying the leaching effect of industrial wastes on underground.

Text Book

1. Ground Improvement Techniques by P. Purushothama Raj, Lakshmi Publications, New Delhi. Reference Book

1. A. Sridharan and K. Prakash (2009), “Geotechnical Engineering Characterization of Coal Ashes”, CBS Publishers

SMFE3.2(a) : FORENSIC GEOTECHNICAL ENGINEERING

Concept of Forensic Investigation, Necessity, Objectives of Forensic Geotechnical Investigation, Methods of Forensic Investigation. Project reconnaissance and characterization of the distress, including document search such as plans, codes, and other technical specifications followed in the original design. Diagnostic tests – Analysis of field data – selection of laboratory tests based on actual field parameters to evaluate the behaviour of soil/ground. Scope and extent of application of Forensic Engineering techniques in geotechnical and foundation failure investigations, settlement of structures, expansive soils, lateral movement, other geotechnical and foundation problems, groundwater and moisture problems. Back analysis: Selection of theoretical model - methods of analysis, Instrumentation and Monitoring Development of the most probable failure hypothesis - cross-check with original design. Performing reliability checks, Legal issues involving jurisprudence system, insurance, repairs, reducing potential liability, responsibility of geotechnical engineers and contractors.

Text Book

1. Forensic Geotechnical and Foundation Engineering by Robert W. Day, Mc Graw Hill

Reference Book

1. Malcolm D. Bolton, “A Guide to Soil Mechanics “Universities Press.

2. Saxena, D.S., "Technical, Ethical, and Legal Issues with Forensic Geotechnical Engineering - A Case History", Proceedings, 13th Asian Regional Conference on Soil Mechanics and Geotechnical Engineering, Kolkata, India, 11 December 2007.

SMFE3.2(b) GEOENVIRONMENTAL ENGINEERING

Common Syllabus for SMFE3.2(b) and TE3.2(b)

Wastes: source, production and classification of wastes, soil pollution processes, waste characterization.

Waste disposal facilities: Landfills and impoundments, Slurry walls, Types of landfills, Landfill planning and design; Barrier systems – Basic concepts, Design and construction; Stability, compatibility and performance contaminant transformation and transport in subsurface, Monitoring surface contamination, Stabilization and modification of wastes. Reuse of waste materials, contaminated site remediation, Case studies in waste handling.

Soil erosion and conservation: Causes of soil erosions, Factors contributing to erosion – climatic factors, Topographical factors, Vegetation factors. Erosion control – Cropping systems, Gullies,

Check dams, Contouring, Wind striping, Ridging, Bank protection, Erosion control with vegetation mats and Silt fences.

Note:

1. Student is expected to give at least one seminar on the subject from journal. 2. Preparation of paper involving case studies where the topics covered were incorporated in practice.

Text Book

1. Geoenvironmental Engineering – principles and applications by L.N. Reddiand H.F. Inyang, Marcel Dekker, 2000

Reference books

1. Geotechnical practice for waste disposal by D.E. Daniel, Chapman and Hall, London 1993

2. Clay barrier systems for waste disposal facilities by R.K. Rowe, R.M. Quigleyand J.R. Booker,E & FN Spon, London, 1995

3. Design, construction and monitoring of landfillsby Bagchi, A, John Wiley & Sons, New York 1994

4. Waste containment systems, Waste stabilization and landfillsDesign and evaluation by H.D. Sharma, H. D. and S.P. Lewis,John Wiley & Sons, New York 1994

SMFE3.3 : DISSERTATION (Preliminary)

The student shall submit a brief report on the selected topic of his/her dissertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department and the Guide.

IV – SEMESTER

SMFE 4.1 DISSERTATION (Final)

The student shall submit his/her dissertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, the Guide and the External Examiner.

Civil Engineering

M.Tech. (HYDRAULICS, COASTAL AND HABOUR ENGINEERING)

Scheme of Instruction and Examination

(with effect from 2019-20 Admitted Batch)

I – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

HCH1.1 Advanced Fluid Mechanics 4 -- 4 3 70 30 100 3

HCH1.2 Wave Hydrodynamics 4 -- 4 3 70 30 100 3

HCH1.3 Hydrology and Water
 Resources Engineering 4 -- 4 3 70 30 100 3

**Program Elective –I**

HCH1.4 (a) Flood Modeling and
 Drought Assessment
 (b) Watershed Management 4 -- 4 3 70 30 100 3
 (c) Remote Sensing and
 GIS Applications

Program Elective –II

HCH1.5 (a) Climate Change and
 Water Resources
 Engineering
 (b) Structural Dynamics 4 -- 4 3 70 30 100 3
 (c) Basic Coastal
 Engineering

HCH1.6 Computer Programming of - 3 3 Viva 50 50 100 1.5 Numerical Methods

HCH1.7 GIS lab - 3 3 Viva 50 50 100 1.5

 Total 20 6 26 450 250 700 18

II – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

HCH2.1 Free Surface Flow 4 -- 4 3 70 30 100 3 HCH2.2 Marine and Offshore
 Structures 4 -- 4 3 70 30 100 3 HCH2.3 Siting and Planning of Port
 and Harbour Installations 4 -- 4 3 70 30 100 3 **Program Elective –III**

HCH2.4 (a) Estuarine Hydrodyna-
 mics and Salinity Transport 4 -- 4 3 70 30 100 3
 (b) Groundwater Hydraulics
 (c) Design of Offshore Structures

**Program Elective –IV**

HCH2.5 (a) Seismic Design of
 Port Structures
 (b) Finite Element Method 4 -- 4 3 70 30 100 3
 of Analysis
 (c) Water Resources
 Systems Analysis

HCH2.6 Hydraulics and Coastal
 Engineering Lab. - 3 3 Viva 50 50 100 1.5

 HCH2.7 Sediment Transport and
 Dredging - 3 3 Viva 50 50 100 1.5

 HCH2.8 Seminar -- 3 3 Viva 50 50 100 2

 Total 20 9 29 500 300 800 20

 III SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

**Program Elective –V**

HCH3.1 (a) Environmental 4 -- 4 3 70 30 100 3
 Hydraulics
 (b) Urban Storm
 Water Drainage

**Program Elective –VI**

HCH3.2 (a) Hydraulic Structures 4 -- 4 3 70 30 100 3
 (b) Irrigation Water Systems
 and Analysis

HCH3.3 Dissertation (Preliminary) -- -- -- Viva -- 100 100 8

 Total 8 -- 8 140 160 300 14

IV SEMESTER

Code No. Course Title Scheme of Examination Total Credits

 Exam (hrs) Ext. Sess.

HCH4.1 Dissertation (Final) Viva 100 -- 100 16

 Total 16

Civil Engineering

M.Tech. (HYDRAULICS, COASTAL AND HABOUR ENGINEERING)

(with effect from 2019-20 Admitted Batch)

I – SEMESTER

HCH 1.1 ADVANCED FLUID MECHANICS

Two dimensional Irrotational Flow- Standard Pattern of Two Dimensional Flows – Uniform flow- Source- Sink- Vortex and Doublet – Spiral Vortex – Flow Past a Half Body – Flow Past a Cylinder with and without Circulation – Flow Past a Rankine Body.

Laminar Flow- Introduction – Transformation – Relationship among Stresses – Relationship between Stresses and Deformations- Navier Stokes equations – Simple Examples of Exact Solution – Poiseuille Flow – Couette Flow – Combination of Poiseuille and Couette Flow – Establishment of Simple Flows – Non linear Exact Solutions – Flow between Convergent and Divergent Plates – Flow against a Normal Wall – Approximate Solutions – Flow past a sphere – Laminar stability Parameter – Analysis of laminar stability – Experimental investigation on laminar stability.

Laminar Boundary Layer- Introduction to the boundary layer – Thickness – Displacement- momentum and energy thickness – Boundary layer equations – Boundary layer along a Flat Plate with Zero Pressure Gradient (Blassius Solution) – Boundary layer Integral Momentum Equation – Transition of Turbulence.

Turbulent Flow- Definitions – Wall Turbulence and Free Turbulence – Isotropic and homogeneous Turbulence – Turbulence intensity and scale and their measures – micro scale and integral scale – Correlations – Lagrangian and Eulerian description of the flow field – Reynolds Equations – Energy and Momentum Equations and Illustration of their Application by the example of Hydraulic Jump – Phenomenological theories – Turbulent Boundary Layer Along a Flat Plate – Momentum Equation – Turbulent flow in pipes – Pipe Resistance Factor – Boundary Layer Separation – Wake Behind Cylinder – Simple Example of Free Turbulence Shear Flows.

Text Books / Reference Books

1. Applied Hydrodynamics by Valentine- H.R., - Butterworth’s Scientific Publications.

2. Engineering Fluid Mechanics Vols. I and II by Narasimhan,S- Orient Longman.

3. Boundary layer theory by H. Schlichting.

4. Elementary Mechanics of Fluid by Hunter Rouse.

5. Hydraulic Machines by P. Kumar, BSP Books PVT Ltd

HCH 1.2 WAVE HYDRODYNAMICS

The Basics for the application of Potential Theory to Water Wave Problems – General Governing Equations – Bernoulli’s Generalized Equation and General Boundary Conditions.

Approximating the Governing Equations Based on Physical Reasoning – Solutions of Linear Equation for Progressive and Standing Waves – Pressure Velocity Fields – Surface Profile and Dispersion Relationship – Principle of Super Position – Wave Energy- Energy Flux And Energy Principle – Group Velocity.

Various Perturbation Schemes for Solving Water Wave Problems – Stokes’ Wave – Derivation of Second Order Governing Equations and Outline of Their Solution – Mass Transport and the Momentum Principle (Radiation Stresses) – Limitations of The Stokes’ Solution – Cnoidal Waves And Solitary Waves – Wave Breaking Criteria.

 Wave Refraction – Graphical Techniques – Wave Diffraction Around Breakwater and Through Breakwater Gaps. Wind Generated Wave – Some Statistical Aspects- Rayleigh Distribution Wave Heights- The Wave Spectrum and Mathematical Spectrum Models – PM- JANSWOP Etc. – Wave Forecasting Using SMB’s Significant Wave Height Method and PNJ Wave Spectrum Method.

Wave Forces on Piles – Basic Assumptions – Values of the Inertia and Drag Coefficients and their Dependence on the Wave Theory Used.

Beach and Shoreline Development – Deltas- Head Lands and Estuaries – Water Movement in Near Shore area Sources and Characteristics of Materials – Littoral Transport – Contribution by Streams – Contribution by Erosion or Coastal Formation – Modes of Littoral Transport – Depths at which Material Moves – Determination of Direction and Direction Variability – Rates of Littoral Transport – Losses of Littoral Material.

Text Books/Reference Books

1. Shore Protection Manual (CEM), U.S. Army Coastal Engineering Research Centre.

2. Estuary and Coastline Hydrodynamics by Ippen, A.T., Iowa State University Press.

3. Coastal Engineering Vols. I & II by Silvester, R., Elsevier Scientific Publishing Co.

4. Oceanographical Engineering by Wiegel- R.R.- Prentice Hall Inc.

5. Wind Waves and Maritime Structures by Minikin, R.R.,Charles Griffin & Co.

6. Coastal Hydraulics by Muir Wood, A.M. and C.A. Fleming, John Wiley and Sons.

7. Coastal Processes with Engineering Applications by Robert, A.D., Cambridge University Press.

8. Coastal Hydrodynamics by Mani, J.S., PHI Learning Pvt. Ltd

HCH1.3 HYDROLOGY AND WATER RESOURCES ENGINEERING

Part A: Hydrology Runoff-Runoff Process – Unit Hydrograph – Derivation and Analysis – S-Hydrograph – Synthetic Unit Hydrograph-Instantaneous Unit Hydrograph – Methods of Determining IUH – Conceptual Models of IUH – Formulation of Models – Concept of Linear Reservoir- Models of Nash and Dooge and Kulandaiswamy- Nonlinearity of Runoff-Distribution – Overland Flow Steam Flow – Flow Duration and Mass Curves and Time Series Analysis.

Floods: Importance of Flood Studies – Definition- Causes of Floods- Seasonal Distribution of Floods- Design Flood- Factors Affecting Flood Flow; Magnitude and Frequency of Floods – Empirical- Probability and Unit Hydrograph Methods; Flood Control Measures: Flood Control Reservoirs – Types- Location- Size – Levees and Flood Walls – Stage Reduction and Reduction in Peak Discharge Flood Routing Through Reservoirs.

Part B : Water Resources Engineering Introduction to Water Resources- Hydrological Cycle – Characteristics – Surface and Ground Water Resources – Quality Conservation and Flood Control; Water Resources Planning – Purpose of Water Resources Development- Classification of Water Resources Development Projects- Functional Requirements of Multipurpose Projects- Process of Project Formulation- Project Evaluation- Strategies for the Future- Planning Strategies- Management Strategies.

Climate Change on Water Resources - Climate and Weather- the Vital Importance of Monsoon Rains- Clouds- Storms and Precipitation- Influences and Feedbacks of Hydrological Changes on Climate- Observed Climate Change Impacts- Future Changes in Water Availability and Demand Due to Climate Change- Climate Related Drivers of Freshwater Systems in the Future- Impacts of Climate Change on Water Stress in the Future- Freshwater Areas and Sectors Highly Vulnerable to Climate Change- Potential Water Resource Conflicts Between Adaptation and Mitigation.

Site Investigations and Design Aspects of Water Resources - Surface Water Resources –Minor Tanks- Reservoirs- Diversion Head Works; Ground Water Resources – Tube Wells- Open Wells. Rainwater Harvesting- Artificial Recharge of Ground Water.

Application of Remote Sensing (RS) and Geographical Information System (GIS) in Water Resource - A Brief History of RS- Sensor Systems Used in RS- RS Satellites- Landsat- and IRS. Remote Sensing Applications in Civil Engineering Projects GIS Over View- GIS Components- Raster Data Models and Vector Data Model- Application of RS and GIS in Water Resources Engineering.

Reference Books

1. Hydrology by Wisler- C.O. and E.F. Brater- John Wiley and Sons.

2. Geo-Hydrology by De Wiest- R.J.M.- John Wiley and Sons.

3. Hydrology for Engineers by Linsley, R.K., M.A. Kohler and J.L.H. Paulus McGraw-Hill.

4. Water Resources Engineering by Linsely, R.K.- J.B.Franzini,
D.L. Freyberg and G. Tchobanoglous- McGraw- Hill Publishing Co.; 4th edition.

5. Irrigation Engineering and Hydraulic Structures by Garg S.K. Khanna Publishers.

 6. Principles of Geographical Information Systems for land resource assessment by Burrough, P.A., Clarendon Press, Oxford.

7. Remote Sensing in Civil Engineering by Kennie, J.M. and M.C. Matthews McGraw-Hill.

8. Remote Sensing: Principles and Interpretation by Sabins F.F.,Waveland Pr Inc- 3rd Edition.

9. Impacts of climate change and climate variability on hydrological regimes by Jan C. van Dam- Cambridge University Press.

10. IPCC fourth assessment report- The AR4 synthesis report

11. IPCC fourth assessment report- Working Group I report- The physical Science Basis.

12. IPCC fourth assessment report- Working Group II report- Impacts- Adaptation and vulnerability.

13. IPCC fourth assessment report- Working Group III report- Mitigation of Climate Change.

HCH1.4(a) FLOOD MODELLING AND DROUGHT ASSESSMENT

Flood Estimation : Hydrologic extremes – Flood – Types of Flood – Effects of Flood – Design Flood - SPF/MPF - Estimation of design flood – Physical Indicators - Envelope curves - Empirical methods – Rational method - Statistical methods – Frequency analysis – Unit hydrograph method.

Flood Modeling And Management : Hydrologic and Hydraulic Routing – Reservoir and Channel Routing - Flood Inundation Modeling – HEC HMS and HEC RAS software's - Flood control methods – Structural and non structural measures - Flood Plain Zoning – Flood forecasting – Flood Mitigation - Remote Sensing and GIS for Flood modeling and management.

Drought And Impacts : Definition – Definitions based on rainfall- stream flow- vegetation and comprehensive aspects - Characterization of Drought/water shortage/aridity/desertification - Types of Drought – NCA classification – Impacts of Drought – Environmental- Social and Economical aspects

Drought Assessment: Drought Severity Assessment – Meteorological Hydrological and Agricultural methods – Drought Indices – GIS based Drought Information system – Drought Vulnerability Assessment and Mapping Using GIS.

Drought Monitoring And Management: DPAP Programme - Drought Monitoring – Application of Remote sensing – Drought Mitigation –Proactive and Reactive Approach – Supply and Demand Oriented Measures – Long term and Short term Measures – Water Scarcity Management in Urban- Industrial and Agricultural sectors

Reference Books

1. Applied Hydrology by Chow V.T.- Maidment D.R.- Mays L.W.- McGraw Hill Publications- New York- 1995.

2. Elementary Hydrology by Vijay P.Singh.- Prentice Hall of India- New Delhi- 1994.

3. Drought Research Needs by Yevjevich V.- Water Resources Publications- Colorado State University- USA- 1977.

4. Flood Routing Methods as Applied to Indian Rivers by Rangapathy V.- Karmegam M.- and Sakthivadivel R.- Monograph in- Anna University Publications

HCH1.4(b) WATERSHED MANAGEMENT

Common Syllabus for HCH1.4(b) and EEM1.4(b)

Watershed Management Concept - Introduction- Concept of Watershed Management- History of Watershed Management and its Relevance to India- Watershed Characteristics; Climatic Characteristics- Physiographic Characteristics- Causes of Watershed Deterioration- Effect of Watershed on the Community- Water Resources Region of India

Principles of Watershed Management- Integrated Watershed Management Approach (IWMA)- Objectives of IWMA- Envisaged Results- Success Criteria- Selection of Watershed Village- Equity Issues for Watershed Policies- Factors Causing The Inequality- Benchmark Survey- Remote Sensing Survey in Watershed Management- Land Capability Classification.

Soil Erosion: Introduction- Soil Erosion- Factors Affecting Soil Erosion- Different Types and Causes of Erosion- Geologic Erosion- Accelerated Erosion- Estimation of Loss of Soil from Erosion- Soil Loss Models- Sediment Models- Bed Load Models- Control of Soil Erosion Management of Natural Drainages- Introduction- Check Dam- Structures for Gully Stabilization and Storage of Water- Rivers or Stream Bank Management Measures in Watershed- River Training Works- Methods of River Training Works.

Wasteland and Land Drainage Management- Introduction- Causes of Wasteland – Water Logging- Salinity- Soil Erosion- Overgrazing- Mining Operation- Industrial Effluent- Brickfields- Inadequate Surface and Subsurface Drainages- Remedial Measures in Wasteland Management- Land Drainage Management- Surface or Overland Drains- Subsurface or Underground Drains- Discharge and Spacing of tile Drain.

Flood Damage Mitigation Management- Introduction- Mitigation Measures- Structural Mitigation Measures- Non-Structural Mitigation Measures- Flood Plain Zoning- Flood Forecasting.

Water Harvesting- Introduction- Techniques of Water Harvesting- Indigenous Water Harvesting Methods in India- Engineering Methods of Water Harvesting.

Watershed Modeling- Introduction- Data of Watershed for Modeling- Application of Watershed Models- Model Calibration and Validation.

 Text Book

1. Watershed management by Madan mohan das- Mimi das Saikia- PHI learning pvt. Ltd.

Reference Books

1) Watershed Management by Murty- J.V.S.-- New Age Intl.- New Delhi 1998.

2) Decision Support System for Integrated Watershed Management by Allam- G.I.Y.-- Colorado State University- 1994.

3) Watershed Planning and Management by Vir Singh- R.-- Yash Publishing House- Bikaner-

4) Watershed Management- American Soc. of Civil Engineers- New York- 1975.

HCH1.4(c) REMOTE SENSING AND GIS APPLICATIONS

Common Syllabus for HCH1.4(c), SMFE1.4(c) and EEM1.4(c)

Introduction - Definition- Principle of Remote Sensing- History of Development of Remote Sensing- Stages in Remote Sensing- Electromagnetic Radiation and the Electromagnetic Spectrum- Interactions With the Atmosphere- Atmospheric Scattering- Atmospheric Absorption- Atmospheric Windows- Refraction- Interaction of EMR with the Earth's Surface- Reflection- Transmission- Spectral Signature.

Platforms & Sensors- Remote Sensing Systems- Remote Sensing From Space- Remote Sensing Sensors- Resolution- Imaging Sensors- Optical Infrared (OIR) Imagers- Optical Sensors- Thermal Sensors- Microwave Sensors- Active Microwave Sensors- Data Preprocessing- Remote Sensing in India.

 Introduction to Image Interpretation- Basic Principles of Image Interpretation- Elements of Image Interpretation- Techniques of Image Interpretation- Interpretation Keys- Introduction to Digital Image Processing- Digital Image- Image Rectification and Registration- Geometric Correction- Image Enhancement Techniques (Only Concepts)- Image Classification - Unsupervised Classification and Supervised Classification- Digital Photogrammetry - Stereo Images from Satellites - Data Merging .

Geographic Information Systems (GIS)- Definitions and Related Technology- GIS Operations- GIS Elements- GIS Concepts and Practice- Map Projection and Coordinate System. Vector Data Model- Introduction- Vector Data Representation- Geometric Objects- Topology. Vector Data Analysis- Introduction- Buffering- Applications of Buffering- Map Overlay- Feature Type and Map Overlay- Map Overlay Methods- Slivers- Error Propagation in Map - Overlay- Distance Measurement- Map Manipulation.Raster Data Analysis- Introduction- Analysis Environment- Local Operations- Local Operations With a Single Grid- Local Operations With Multiple Grids- Neighborhood Operations- Zonal Operations.

Terrain Mapping and Analysis- Introduction- Data for Terrain Mapping and Analysis- Surface Models-DEM- TIN. GIS Models and Modeling- Introduction- GIS Modeling- Binary Models- Index Models Remote Sensing & GIS Application in Civil Engineering – Some Case Studies from Literature.

Text Books

1. Fundamentals of Remote Sensing 2nd Ed by George Joseph- University Press- New Delhi.

2. Introduction to Geographic Information Systems by Kang Tsung Chang- Tata Mc.G.H. Publications- New Delhi.

3. Remote Sensing and Image Interpretation by Lillesand- T.M. and Kieffer- Joh Wiley and Sons- New York- 1987.

Reference Books

1. Remote Sensing of the Environment – An Earth Resource Prespective by John R. Jensen- Pearson Education- New Delhi.

2. Geographic Information Systems: A Management Perspective by Aronoff- S. Ottawa: Wdl Publications- 1989.

3. Geographic Information Systems For Geoscientists: Modeling with GIS by Bonham Carter- G-F.- New York: Pergamon Press- 1994.

4. Principles of Geographical Information Systems by Burrough- P.A And R.A. Mcdonnell.. Oxford: Oxford University Press- 1998.

5. Concepts and Technologies of Geographic Information Systems by Lo- C.P.- and Albert K.W. Young- Prentice Hall of India (Pvt) Ltd- New Delhi.

6. Introductory Digital Image Processing by John R Jensen- Prentice Hall- New Jersey.

7. Application of Remote Sensing to Hydrology Including Groundwater by Farsworth- R.K.- Bawetl- E.C. & Dhanju- M.S.-- IHP- UNESCO- 1984.

HCH1.5(a) CLIMATE CHANGE AND WATRE RESOURCES
ENGINEERING

Definitions- Climate- Climate System- Climate Change – Drivers of Climate Change – Characteristics of Climate System Components - Green House Effect – Carbon Cycle – Wind Systems - Trade Winds and The Hadley Cell – Ozone Hole in The Stratosphere - El Nino- La Nino. Global Scenario – Indian Scenario – Observed Changes and Projected Changes of IPCC - Impacts on Water Resources – NATCOM Report –Impacts on Sectoral Vulnerabilities – SRES – Different Scenarios

Need for Vulnerability Assessment – Steps for Assessment –Approaches for Assessment – Models – Quantitative Models- Economic Model- Impact Matrix Approach - Box Models - Zero-Dimensional Models - Radioactive-Convective Models - Higher-Dimension Models - Emics (Earth-System Models of Intermediate Complexity) - GCMS (Global Climate Models or General Circulation Models) – Sectoral Models. Water-Related Adaptation to Climate Change in the Fields of Ecosystems and Biodiversity- - Agriculture and Food Security- Land Use and Forestry- Human Health- Water Supply and Sanitation- Infrastructure and Economy (Insurance- Tourism- Industry And Transportation) - Adaptation- Vulnerability and Sustainable Development Sector-Specific Mitigation - Carbon Dioxide Capture and Storage (CCS) - Bio-Energy Crops- Biomass Electricity- Hydropower- Geothermal Energy- Energy use in Buildings- Land-Use Change and Management- Cropland Management- Afforestation and Reforestation - Potential Water Resource Conflicts Between Adaptation and Mitigation - Implications for Policy and Sustainable Development.

Case Studies: Water Resources Assessment Case Studies – Ganga Damodar Project - Himalayan Glacier Studies- Ganga Valley Project - Adaptation Strategies in Assessment of Water Resources- Hydrological Design Practices and Dam Safety- Operation Policies for Water Resources Projects - Flood Management Strategies - Drought Management Strategies - Temporal & Spatial Assessment of Water For Irrigation -Land Use & Cropping Pattern - Coastal Zone Management Strategies.

Reference Books

1. Climate change and water- IPCC Report Technical Paper VI- 2008.

2. UNFCC Technologies for Adaptation to climate change- 2006.

3. Climate Change and India: Vulnerability assessment and adaptation by P R Shukla- Subobh K Sarma- NH Ravindranath- Amit Garg and Sumana Bhattacharya-- University Press (India) Pvt Ltd- Hyderabad.

4. Preliminary consolidated Report on Effect of climate change on Water Resources- GOI- CWC- MOWR- 2008.

HCH1.5(b) STRUCTURAL DYNAMICS

Common Syllabus for ST1.5(b) and HCH1.5(b)

One Degree Systems: Undamped systems, Various forcing functions damped systems, Response to pulsating force, Support motion.

Lumped Mass Multidegree System: Direct determination of natural frequencies, Characteristic shapes, Stodola-Vianelle method, Modified Rayleigh-Ritz method, Lagrange’s equation, Model analysis of multi degree systems, Multistorey rigid frames subjected to lateral loads, Damping in multi degree systems.

Structures with distributed mass and load, Single span beams, Normal modes of vibration, Forced vibrations of beams, Beams with variable cross-section and mass. Approximate design methods, Idealized system, Transformation factors, Dynamic reactions response calculations, Design example (RC beam, Steel beam and RC slab), Approximate design of multi degree systems.

Matrix Approach: Coordinates and lumped masses, Consistent mass matrix, Undamped force vibration of a system with one degree freedom, Response of single degree freedom undamped system, Viscous damped vibration of a single degree freedom system, Undamped vibration of multi degree freedom system, Orthogonality of natural nodes, Normal coordinates.

Text Books

1. Structural Dynamics by John M. Biggs. McGraw-Hill

2. Dynamics of Structures, Theory and Applications to Earthquake Engineering by Anil K. Chopra, Prentice Hall of India.

Reference Books

1. Structural Analysis by A. Ghali & A.M. Neville, CRC Press.

HCH1.5(c) BASIC COASTAL ENGINEERING

Introduction- General Design Considerations for Coastal Engineering- Long Period Waves- Tides- Tsunamis- Storm Surge and Wind Set Up. Pressure Velocity Fields – Surface Profile and Dispersion Relationship – Wave Energy- Energy Flux And Energy Principle – Group Velocity. Wave Mechanics- Celerity and Group Velocity-Wind Generated Waves.

Wave Transformation- Shoaling- Refraction- Diffraction and Reflection-Wave Breaking Criteria- Wave Forecasting for Deepwater Waves.

Coastal Sediments-Coastal Sediment Characteristics- Initiation of Sediment Motion Under Waves- Radiation Stress-Wave Set-Up and Wave Set- Down- Mechanics of Coastal Sediment Transport – Limits for Littoral Drift – Suspended and Bed Load – Alongshore Sediment Transport Rate – Distribution of Alongshore Currents and Sediment Transport Rates in Surf Zone.

Onshore- Offshore Sediment Transport – Coastal Features – Beach Features – Beach Cycles – Beach Stability – Beach Profiles -Coastal Erosion- Planning And Methods of Coast Protection Works.

Design of Shore Defense Structures – Non-Breaking and Breaking Wave Forces on Coastal Structures –Wall Types Structures and Breakwaters- Classification- Design and Application in Coastal Protection and Harbor Planning- Case Studies on Coastal Erosion and Protection. Impacts of Coastal Structures on Shoreline Changes. Seawalls- Breakwaters- Groins- Jetties.

Text Books

1. Basic Coastal Engineering by Sorenson- R.M.-- A Wiley-Inter science Publication- New York- 1978

2. Water wave mechanics for engineers and scientists by Dean and Darlymple.

3. Coastal Hydrodynamics by J.S. Mani- PHI Learning

4. Coastal Engineering by Horikawa- K.-- University of Tokyo press- 1978

5. Introduction to coastal Engineering and Management by Kamphius- J.W.

6. Advances on Ocean Engineering-Volume 16- World Scientific-2002.

Reference Books

1. Coastal Engineering-Processes theory and design practice by Reeve-D.- Chadwick- A. and Fleming- C- Spon Press- Taylor & Francis Group- London & Paris-2004

2. Coastal Stabilisation- Advances on Ocean Engineering-Volume 14 by Silvester- R. and Hsu- J.R.C. World Scientific- 1997.

3. Coastal Engineering Manual- U. S. Army Corps of Engineers- Washington- DC 203141000- Vol. 1 to 3- July 2003.

HCH1.6 COMPUTER PROGRAMMING OF NUMERICAL METHODS

Introduction to Programming and Flow Charts- Digital and Analog Computers Functional Organization of a Digital Computer – Counting – Techniques Binary – Binary – Numbers Storage and Retrieval of Information – Programming Language – Applicability of Fortran – Flow Chart Concept – Few Examples.

Arithmetic Expressions and Statements- Arithmetic Expressions – Fortran Constants – Integer- Real and Complex Constants – Fortran Variables – Integer and Real Variables – Rules Regarding the Meaning of Variables and use of Operation of Symbols – Hierarchy of Arithmetic Operations – use of Parenthesis and Rules Regarding Parenthesis – Arithmetic Statements Builtin Functions.

Input Output and Format Statements- Input Output Devices – Rules Punching a Card – The Data Card – Read Statement Data Initialization Statement – Specification Statement Varieties – F E I and a Formats – Blank Field Specification – Carriage Control – Punching of Format Statements – Use of Coding Sheets.

Control Statements- Unconditional and Conditional Control Statements – Small Programmes. Subscripted Variables- Subscripted Variables – Rules Regarding Subscripted Variables – Dimension Statement – General Form – Do Statement – General Form – Continue Statement – Rules Regarding Do Statements and Nested Do Loops – Equivalence Statements – Small Programmes.

Sub-Programming- Subroutines Sub-Programme Statements – Rules Regarding Subroutine SubProgrammes – Call Statements – Common Statement – Rules Regarding Common Statement – Examples with Small Programmes.

Some Aspects of Fortran 90: Declaration Statements – Logical Constants and Variables – Relational Operators and Expressions – Logical Operators and Expressions – Logical Assignments – Statements – Logical IF Statement – Complex Variable and Expressions – Library Functions – Control Cards – Examples with Programmes.

Programming of Numerical Methods: Calculation of Mean- Variance and Correlation Coefficient – Linear Regression – Simple Linear Programming – Matrix Inversion by Partitioning Method Linear Interpolation – Taylor’s Series – Real Roots by Iteration – Newton-Raphson Method – Von Mises Method – Chord Method – Bisection Method. Numerical Differentiation and Integration – Simpson’s 1/3 Rule- Trapezoidal Rule – Milne’s Predictor Corrector Method to Solve First and Second Order Differential Equations – Runge Kutta Method.

Programming of Some Hydraulics and Coastal Engineering Problems: Hydrograph Analysis- Stress Analysis of Gravity and Earth Dams- Wave Reflection Analysis (Two Probe and Three Probe Methods)- Computation of Wave Force on a Cylinder and a Wall- Best Hydraulic Section- GVF Surface Profile Computations- Bed and Suspended Sediment Load Computations.

Reference Boks

1. Computer Programming in FORTRAN 90 & 95 by Rajaraman-V., PHI Learning Pvt. Ltd.

2. Numerical Methods and FORTRAN Programming: with applications in engineering and science by Daniel- D.M. and S.D. William- Wiley.

3. Numerical methods in Fortran by McCormick- J. M. and M. G. Salvadori Prentice Hall.

HCH1.7 G.I.S. LABORATORY

Students are Supposed to Work on Various Problems Involving the Following Applications Using any GIS Package.

1. Creation of Vector Maps and Raster Maps Through Digitization and Rasterisation

2. Image Processing of Digital Images (Geometric Correction- Image Enhancement- Image Classification)

3. Preparation of Thematic Maps (Land Use/ Land Cover- Road Maps- Drainage Network Map Etc.) From Satellite Image of any Region.

4. Watershed Delineation from Drainage Map and Contour Map of any Region.

5. Development of Digital Elevation Model (DEM) using any Technique.

6. Any simple case study of RS & GIS Application in WRE.

 II – SEMESTER

HCH2.1 FREE SURFACE FLOW

Introduction- Classification of Flows- Velocity Distribution- Pressure Distribution- Derivation of the General One-Dimensional Equations of Continuity- Energy and Momentum used in Open Channel Flow Analysis.

Steady Uniform Flow and Non-Uniform Flows - Chezy’s Equation- Manning’s Formulae- Uniform Flow Computations – Hydraulically Efficient Channel Section- Design of Irrigation Channels- Specific Energy- Specific Force- Critical Depth- Calculation of Critical Depth- Applications of Specific Energy- Channel Transitions and Controls- Hydraulic Jumps- Surges.

Gradually Varied Flow: Surface Profile for Gradually Varied Flow.Unsteady Flow in Open Channels: Method of Characteristics- Surge Formation. Kinematics of Waves- Flood Routing and Overhead Flow.

Inland Navigation- Introduction- Various Requirements of Navigable Waterways- Various Measures adopted for achieving Navigability- India’s Navigable Waterways.

River Engineering- Classification of Rivers- Causes of Meandering- the Aggrading type of River- Degrading type of River- Cutoffs- River Training- Types of Training Works.

Reference Books

1. Flow in Open Channels by Subramanya- K.- Tata McGraw-Hill Publishing Co. Ltd.

2. Flow through Open Channels by K.G. Ranga Raju- Tata McGraw-Hill Publishing

3. Open Channel Flow by Henderson- F.M.- Macmillan series in Civil Engineering.

4. Open Channel Hydraulics by Chow- V.T.- McGraw-Hill Ltd.

5. Engineering Hydraulics by Rouse- H.- John Wiley & Sons Inc.

6. Open-Channel Flow by Hanif Choudhury- M.- Prentice Hall of India.

7. Irrigation and Hydraulic structures by Garg- S.K.- Khanna Publishers.

8. Irrigation and Water Power Engineering by Punmia- B.C. and P.B.B. Lal- Laxmi Publications Pvt. Ltd.

HCH2.2 MARINE AND OFFSHORE STRUCTURES

Introduction- Coastal Protection Works – Seawall – Groins – Structural Aspects – Sand Dunes – Vegetation – Beach Nourishment.

 Break Waters – Types – Selection of Site and Type – Effects on the Beach – Design Principles of Rubble Mound- Vertical Wall and Composite Breakwaters – Stability of Rubble Structures.

 Wharves and Jetties – Types – Materials of Construction – Design Principles – Deck for Fenders Types – Design- Dolphins – Mooring Accessories.

Submarine Pipelines – Route Selection and Diameter / Wall Thickness Calculations; Pipeline Stability- Free Span Calculations; Concrete Coated Pipelines and Pipe-In-Pipe Insulated Pipelines; Design using DNV 81 Code.

Introduction- Offshore Definition- Purpose of Offshore Structures- Classification and Examples- Various Types of Offshore Structures – Jacket Platforms- Semi Submersibles- Tension Leg Platforms- Gravity Platforms Guyed Towers- Articulated Towers.Load Calculations: Environmental Loads on Offshore Structures due to A)Wind B) Wave C) Current D) Ice E) Earth Quake- Functional Loads- Buoyant Forces.

 Installation Forces- Soil Structure Interaction. Wave Force Calculation on A Jacket Platform And Semi Submersible. Preliminary Design Aspects of Offshore Structures- Construction- Towing and Installation Procedure of Jacket Platforms and Gravity Platforms.

Text Books/Reference Books

1. Hydrodynamics of Offshore structures by Chakrabarthi- S.K.- WIT Press / Computational Mechanics.

2. Mechanics of Wave Forces on Offshore structures by Turgut Sarpkaya & M. Issacson- Van Nostrand Reinhold Co.

3. Structural Engineering by Dawson- T.H.-Offshore Prentice Hall Inc Englewood Cliffs- N.J.

4. Dynamic Analysis of Offshore Structures by Brebia- C.A and S. Walker- New Butterworths- U.K.

5. Recommended Practice for Planning- Designing and Constructing Fixed Offshore Platforms- API- American Petroleum Institute Publication.

HCH2.3 SITING AND PLANNING OF PORT AND HARBOUR INSTALLATIONS

History of Port Growth – Factors affecting Growth of Port.

Classification of Harbours – Planning of A Port – Ship Characteristics as they Relate to Port Planning – Need and Economic Justification of a Port – Volume and Type of Commerce – Hinterland Studies and Growth.

Meteorological- Hydrographic and Oceanographic Data Required for Port Design – Determination of Best Location of a Harbour to Afford Maximum Protection- Minimum Maintenance and Facilities for Expansion.

Size and Shape of Harbour and Turning Basin – Type- Location and Height of Breakwaters – Location and Width of Entrance to Harbour – Depth of Harbour and Navigational Channel – Number- Location and Type of Docks or Berths or Jetties.

Shore Facilities for Marine Terminals and Fishing Harbours.

Reference Books

1. Dock and Harbour Engineering Vols. I- II & III by Cornick- H.F.- Charles Griffin & Co.

2. Design & Construction of ports and Marine structures by Quinn- A.D.F.- McGraw-Hill.

3. Port Engineering by Brunn- P.- Gulf Publishing Co.

HCH2.4(a) ESTUARINE HYDRODYNAMICS AND SALINITY
TRANSPORT

Common Syllabus for HCH2.4(a) and WRE2.4(a)

Tidal Dynamics in Estuaries- Estuaries of Rectangular Section: General Review of Engineering Problems in Tidal Estuaries- General Characteristics of Estuaries- Mathematic Description of Tides Without Friction- Mathematic Description of Tides With Friction- Experimental Results on Cooscillating Tides.

Real Estuaries- Introduction- Methods of Analysis- Numerical Integration Methods- and Harmonic Method- Damped Cooscillating Tide.

The Mechanism of An Arrested Saline Wedge- Introduction- Form Characteristics of Arrested saline Wedges- The Pattern of Velocities- Mixing in Arrested Saline Wedge- Hydrodynamics of Layers- Estimation of the Length of Arrested Saline Wedges in Wide Channels.

Diffusion Processes in Stratified Flow- Introduction- Convective-Diffusion Equation for Turbulent Flow- One-Dimensional Turbulent Diffusion in Constant-Density Flow- OneDimensional Turbulent Diffusion in Stratified Flow.

Salinity Intrusion in Estuaries- Basics Factors Governing Salinity Distribution in Estuaries- Effects of Salinity and Fresh-Water Flow on Tidal Conditions- Internal Flow Processes- OneDimensional Analysis of Mixed Estuaries- Experimental Results for WES Tidal Flume.

Reference Book

1. Estuary and Coastline Hydrodynamics by A.T. Ippen (Author)- Publisher: McGraw-Hill Inc.

HCH2.4(b) GROUNDWATER HYDRAULICS

Introduction- Hydrologic Cycle- Movement & Occurrence of Groundwater- Properties of Groundwater- General Flow Equations- Dupuit Equation.

Fundamentals of Groundwater Flow- Occurrence of Ground Water- Vertical Distribution of G.W. Flow- Darcy’s Law- Permeability- Porosity- Anisotropic Aquifers- Differential Equations of G.W. Flow.

Potential Flow- Flow nets- Boundary Conditions- Flow-Net Construction for Confined & Unconfined Flow Systems.

Mechanics of Well Flow- Steady & Unsteady Flow in Confined & Unconfined Aquifers- Leaky Aquifers- Partial Penetration of Wells- Multiple Well Systems- Boundary Effects & Method of Images- Well Loses.

Groundwater Modeling- Sand Tank-Heleshaw- Electrical Analogous Models- Finite Element/Difference Models.

Groundwater Development and Management- Design of Wells- Construction of Wells- Well Development- Artificial Recharge- Conjunctive Use- Salinity of G.W. Groundwater Pollution. Sources & Type of Groundwater Contamination- Contaminant Transport Mechanisms: Advection- Diffusion & Dispersion- Mass Transport Equations- One & TwoDimensional Modeling.

Sorption & Other Chemical Reactions: Factors affecting Sorption- Sorption Isotherms- Sorption Effect on Fate & Transport of Pollutants- Estimation of Sorption.

Biodegradation Reactions & Kinetics- Biological Transformations- Microbial Dynamics- Kinetics of Biodegradation Nonaqueous-Phase Liquids- Types of NAPL- General Processes- NAPL Transport Computational Methods.

Groundwater Remediation and Design- Remedial Alternatives- Source Control- Hydraulic Controls- Bioremediation- Soil Vapor Extraction Systems- Remediating NAPL Sites- Emerging Technologies

Text Books

1. Ground Water Contamination Transport and Remediation by Bedient- Rifai & Newell - PTR Prentice Hall

2. Groundwater hydrology- D.K. Todd- john wiley & sons

3. Groundwater and Seepage by M.E. Harr.

HCH2.4(c) DESIGN OF OFFSHORE STRUCTURES

Introduction- Offshore Definition- Purpose of Offshore Structures- Classification and Examples- Various Types of Offshore Structures – Jacket Platforms- Semi Submersibles- Tension Leg Platforms- Gravity Platforms Guyed Towers- Articulated Towers. Materials used in Offshore Structures; Elements of Hydrodynamics and Wave Theory-Fluid Structure Interaction.

Load Calculations- I.Environmental Loads on Offshore Structures Due to (A) Wind- Wave- Current- Ice and Earth Quake- II. Functional Loads - III. Buoyant Forces - IV. Installation Forces. Design Wave Heights and Spectral Definition; Hydrodynamic Coefficients and Marine Growth; Fatigue Load. Wave Forces on Vertical and Inclined Cylinders- Wave Force Calculation on Jacket Platforms.

Analysis of Offshore Structural Member Using Matrix Methods- Plane Truss- Plane Frame and Space Frame. Static Method of Analysis and Dynamics of Offshore Structures. Use of Approximate Methods - Design of Structural Elements. Principles of Static and Dynamic Analyses of Fixed Platforms- Analysis of Jacket Plat form under Wave Loading.

 Dynamic Analysis-Introduction to Dynamic Analysis and Calculation of Responses of Semisubmersible and TLP’s Under Wave Loading.

Preliminary Design Aspects of Offshore Structures- Construction- Towing and Installation Procedure of Jacket Platforms and Gravity Platforms.

Steel Tubular Member Design- Introduction to Tubular Joints - Possible Modes of Failure - Eccentric Connections and Offset Connections Principles of ASD and LRFD- Allowable Stresses and Partial Safety Factors; Tubular Members- Slenderness Effects; Column Buckling- Design for Hydrostatic Pressure; Design for Combined Axial and Bending Stresses (API RP 2A Guidelines)- Simple Tubular Joints Design using Allowable Loads; Stress Concentration Factors- Fatigue of Tubular Joints - Fatigue Behavior- S-N Curves and Fatigue Damage Calculations.

Text Books/Reference Books

1. Hydrodynamics of Offshore structures by Chakrabarthi- S.K.- WIT Press / Computational Mechanics.

2. Mechanics of Wave Forces on Offshore structures by Turgut Sarpkaya & M. Issacson- Van Nostrand Reinhold Co.

3. Structural Engineering by Dawson- T.H.-Offshore Prentice Hall Inc Englewood Cliffs- N.J.

HCH2.5(a) SEISMIC DESIGN OF PORT STRUCTURES

Earthquake and Port Structures- Introduction- Earthquake Motion- Liquefaction- Tsunamis- Port Structures- Some Examples of Seismic Damages.

Design Philosophy- Performance Based Designs- Reference Levels of Earthquake Motions- Performance Evaluation.

Damage Criteria- Gravity Quay Walls- Sheet Pile Quay Walls- Pile Supported Wharves- Cellular Quay Walls- Quay Walls with Cranes- Breakwaters.

Seismic Analysis - Types of Analyses- Site Response/ Liquefaction Analysis- Analysis of Port Structures- Input and Output of Analysis. Existing Codes and Guidelines.

Reference Books

1. Foundation Analysis and Design by Bowles- J.E. (1997); Fifth Edition 2012; McGrawHill Companies Inc N.Y. USA.

2. Design Standard for Port and Harbour Facilities and Commentaries- Japan Port and Harbour Association (in Japanese). ; English edition (2001) by the Overseas Coastal Area Development Institute of Japan.

3. Seismic Design Guidelines for Port Structures- Working Group No. 34 of the Maritime Navigation Commission- International Navigation Association- A.A. Balkema- Rotterdam- The Netherlands- PIANC (2011).

HCH2.5(b) FINITE ELEMENT METHOD OF ANALYSIS

Common Syllabus for ST2.2, SMFE2.5(b), WRE2.5(b),

HCH2.5(b) and TE2.5(b)

Introduction: A brief history of F.E.M. Need of the method, Review of basic principles of solid mechanics- Equations of equilibrium, Boundary conditions, Compatibility, Strain displacement relations, Constitutive relationship in matrix form, plane stress & plane strain and axisymmetric bodies of revolution with axi-symmetric loading, Energy principles - Rayeigh - Ritz method of functional approximation.

Theory relating to the formulation of the finite element method, Coordinate system (local and global), generalized coordinates, Concept of the element, Various element shapes, Discretisation of a structure, Mesh refinement Vs. Higher order element, Interconnections at nodes of displacement models, inter element compatibility, -shape functions.

Basic component – One dimensional FEM single bar element, Beam element : Derivation of stiffness matrix, Assembly of stiffness, Matrix boundary conditions, shape functions for 1 D elements, Initial strain and temperature effects, and trusses under axial forces.

Two dimensional FEM: Different types of elements for plane stress and plane strain analysis – Displacement models Generation of element stiffness and nodal load matrices –static condensation.

Isoparametric representation and its formulation for 2d analysis. Formulation of 4-noded and 8noded isoparametric quadrilateral elements – Lagrangian elements-serendipity elements.

Text Books

1. Finite Element Analysis by C.S.Krishnamoorthy, (2002), Tata McGraw Hill Publishing Co. Ltd.

2. Introduction to Finite Element Method by Desai,C.S.and Abel, J.F.,Van Nostrand, 1972.

Reference Books

1. Introduction to Finite Element Method by Tirupathi chandra Patla and Belugundu

2. The Finite Element Method in Engineering Science by Zienkiewicz, P., McGraw Hill, 1971.

HCH2.5(c) WATER RESOURCES SYSTEMS ANALYSIS

System Concepts- Definition- Classification and Characteristics of Systems - Scope and Steps in Systems Engineering - Need for Systems Approach to Water Resources and Irrigation. Linear Programming- Introduction to Operations Research - Linear Programming- Problem Formulation- Graphical Solution- Solution by Simplex Method - Sensitivity Analysis- Application to Design and Operation of Reservoir- Single and Multipurpose Development Plans - Case Studies.

Dynamic Programming- Bellman's Optimality Criteria- Problem Formulation and Solutions - Application to Design and Operation of Reservoirs- Single and Multipurpose Reservoir Development Plans - Case Studies.

Simulation- Basic Principles and Concepts - Random Variant and Random Process - Monte Carlo Techniques - Model Development - Inputs and Outputs - Single and Multipurpose Reservoir Simulation Models - Case Studies.

Advanced Optimization Techniques: Integer and Parametric Linear Programming - Goal Programming Models with Applications Discrete Differential Dynamic Programming and Incremental Dynamic Programming - Linear Decision Rule Models with Application - Stochastic Dynamic Programming Models.

Reference Books

1. Water Resources Systems Planning and Management- An Introduction to Methods- Models and Applications by Daniel P. Loucks and Eelco van Beek- United Nations Educational- Scientific and Cultural Organization- 7- place de Fontenoy F-75352 Paris 07 SP- 2005.

2. Problems in Operations Research (Methods and solutions) by Gupta P.K and Man Mohan- Sultan Chand and sons- New Delhi- 1995.

3. Operations Research by Hiller F.S and Liebermann G.J.-CBS Publications and distributions. New Delhi- 1992.

4. Water Resources Systems Planning and Management by Chaturvedi. M.C.- Tata McGraw Hill- New Delhi- 1997.

5. Hydro systems Engineering and Management by Mays L.W.- and Tung YK- McGraw Hill Inc.- New York- 1992.

6. Principles of Operations Research with Application to Management Decisions by Wagner H.M.- Prentice Hall- India- New Delhi- 1993.

HCH2.6 HYDRAULICS AND COASTAL ENGINEERING
LABORATORY

1. Study of Pressure Distribution and D/S Profiles over a Spillway.

2. Study of Measurement of Velocities using a Pitot Tube and Current Meter in Open Channel.

3. Study of a Venturiflume.

4. Study of Measurement of Regular And Random Waves - Calibration of Instruments for the Measurement of Waves.

5. Study of Measurement of Wave Height- Wave Length and Wave Period.

6. Study of Measurement of Wave Reflection from Beach and Transmission Through/Over the Structures.

7. Study of Measurement of Wave Force on a Cylindrical Member.

8. Study of Measurement of Displacement of a Floating Body under Waves.

HCH2.7 SEDIMENT TRANSPORT & DREDGING

1. Study of Basics of Sediment Transport Phenomenon.

2. Estimation of Bed Load & Suspended Load and Reservoir Siltation

3. Sediment Samplers and Sampling: Bed Load Sampling- Suspended Load Sampling and Computation of Total Load.

4. Dredging and Disposal of Dredged Materials.

5. Case Studies of Reservoir Siltation.

6. Case Studies of Dredging in Ports and Harbours.

Text Books

1. Mechanics of Sediment Transportation and Alluvial steam problems by Garde- R.J. and K.G. Ranga Raju- Second Edition- Wiley Eastern Limited.

2. Hydraulics of Sediment Transport by Graf- W.H.- McGraw-Hill Book Co.

Reference Books

1. Loose Boundary Hydraulics by Raudkivi- A.J.-Pergamon press.

2. Practical Dredging by Cooper- H.R.- Brown- Son & Ferguson- Glasgow.

3. Dock and Harbour Engineering Vols. I- II & III by Cornick- H.F.- Charles Griffin & Co.

4. Dock and Harbour Engineering by Seetharaman- S. Umesh Publication.

HCH2.8 SEMINAR

Each student has to select a topic and collect about 10 papers with at least 5 journal papers and prepare a report and give a seminar at the end of the semester

III – SEMESTER

HCH3.1(a) ENVIRONMENTAL HYDRAULICS

Common Syllabus for EEM3.1(a) and HCH3.1(a)

Hydrology: Statistical analysis of Hydrological Data -, Intensity–Duration frequency Curves. Hydraulics of groundwater flow: Non–equilibrium flow, Yield estimations, Interferences Infiltration galleries, ground water recharge.

Transportation and distribution of water: Storage capacity, Pumping of Water, Design and selection of economical diameter of pumping main. Distribution of Water - Pressure and capacity requirements of distribution system, Analysis of networks, Appurtenances in a distribution layout, detection and prevention of leakage mains.

Hydraulics of Sewers: Design of sewers in full and partial flow conditions, Flow at Sewer transitions, Sewage pumping. Open channel flow–design of open channel flow sections.

Transport phenomenon – diffusion – dispersion – advection – adsorption - conservative and nonconservative pollutants. Governing Equations for flow and transport in surface and subsurface waters-chemical and biological process models-simplified models for lakes, streams, and estuaries.

Modelling of the transport phenomenon: complexity - coupled and uncoupled models – linear and nonlinear models - Solution techniques – calibration. Numerical models: FDM, FEM and Finite volume techniques - explicit vs. implicit methods - numerical errors. Different types of Stream quality modeling and Groundwater transport modeling.

References

1. Water and waste water Engineering by Fair Gayer and Okun

2. Engineering Hydrology by K. Subramanya, Tata McGraw-Hill Education

3. Hydrodynamics of transport for water quality modeling by Martin, L.J. and McCucheon, S.C, Lewis Publishers.

4. Groundwater by Freeze, R.A. and Cherry. J.A. Prentice Hall,

5. Groundwater Hydrology by Todd, Wiley Publications

HCH3.1(b) URBAN STORM WATER DRAINAGE

Introduction to Drainage Problems in Different Climates- Urbanization- its Effects and Consequences for Drainage-Interaction Between Urban and Peri-Urban Areas Process of Urbanization and Influence on Hydrologic Cycle. Planning Concepts and System Planning- Objectives of Urban Drainage and Planning Criteria- Drainage and System Layout. Planning Tools and Data Requirement- Drainage Master Plan- Examples for Drainage Structures.

Review of Hydrologic and Hydraulic Principles- Urban Hydrologic Cycle- Hydrologic Principles- Rainfall analysis in Urban Environment and Design Storm- Hydraulic Principles- Hydrodynamic Principles.

Urban Runoff Computations - Empirical- Time-Area and Unit Hydrograph approaches Design of Drainage System Elements: Hydraulic Fundamentals- Infiltration and on-Site Detention of Storm water- Design of Sewerage And Drainage Channels- Design of Appurtenances- Road Drainage- Design of Pumping Stations.

Control of Storm water Pollution- Pollution Build-Up and Wash off Process with Reference to Urban Drainage Systems. Source Control in Commercial and Industrial Complexes- Storage Options - Dry and Wet Ponds- Biological Treatment of Wastewater- Chemical Treatment of Storm water.

Operation and Maintenance of Urban Drainage Systems- Maintenance Requirement for Different Structures- Maintenance Planning- Cleaning of Sewers and Drains- Inventory of Damages- Repair Options.

Urban Drainage - Kinematic Wave Theory Approach. Introduction to Urban Watershed Software's Hydrologic Cistern- Water Conservation and Ecological aspects Water Harvesting.

Text-Books

1. Handbook of Applied Hydrology : A Compendium of Water resources by Chow- V.T.

2. Hydrology and hydraulic systems by Gupta- R.S.-- Prentice Hall- Englewood cliffs.

3. Urban Hydrology by Hall- M.J. 4. Hydrology by Viesmann & Knapp

HCH3.2(a) HYDRAULIC STRUCTURES

Common Syllabus for HCH3.2(a) and WRE3.2(a)

Dams- Types- Choice of Type of Dam- Forces Acting on Dams- Requirements of Stability- Causes of Failure.

Gravity Dams- Non-Overflow and Overflow Types- Modes of Failure and Criteria For Structural Stability of Gravity Dams- Design of Gravity Dam- Single Step and Multistep Design- Cracks and Joints in a Gravity Dam- Foundation Treatment for Gravity Dams- Stress Concentration around Openings in Dams- Gravity Dams Subjected to Earthquakes.

Spillways-Different Types of Spillways and Their Design Principles- Energy Dissipation Below Spillways- use of Hydraulic Jump as Energy Dissipater and Design of Stilling Basins- Types of Spillway Gates.

Arch Dams- Types- Loads on Arch Dams- Cylinder Theory – Constant Radius- Constant Angle- Variable Radius types- and Principles of Elastic Theory and Trial Load method of analysis.

Buttress Dams- Components- Advantages and Disadvantages- Types- Forces- Theory of Buttress Design- Buttress Spacing and Buttress Construction Details.

Earth Dams- Types of Earth Dams- Methods of Construction- Causes of Failure of Earth Dam- Design Criteria For Earth Dams- Selecting a Suitable Section for an Earth Dam- Requirements of Safety- Seepage- Construction of Seepage Line for Different Conditions- Seepage Control Methods- Stability Analysis for Different Conditions- Factor of Safety against Foundation Shear- Details of Method of Construction of Earth Dams- Maintenance and Treatment of Common Troubles in Earth Dams.

Appurtenance Works- Design Principles of Various types of Crest Gates- Stilling Basins- and Drainage Galleries. What Hammer Analysis and Design of Surge Tanks- Penstocks- Draft Tubes and Scroll Casing.

Reference Books

1. Theory and Design of Irrigation Structures Vol. I & II by Varshney- R.S.- S.C. Gupta and Gupta- R.L.-Nem Chand & Brothers.

2. Irrigation: Practice and Design – Vols. II & III by Khushalani- K.B. and M Khushalani- Oxford of IBH Publishing Co

3. Irrigation and Hydraulic structures by Garg- S.K.- Khanna Publishers.

4. Engineering for Dams – Vols. I- II & III by Creager- W.P- J.D. Justin and J. Hinds-John Wiley & Sons.

5. Hand Book of Applied Hydraulics by Davis- C.V. and K.E.Sorensen- Third Edition- McGraw-Hill Book Co

HCH3.2(b) IRRIGATION WATER SYSTEMS AND MANAGEMENT

Irrigation Systems – Major- Mini- Minor Potential Surface- Lift and GW Systems- Methods of Irrigation- Relative Merits and Demerits- Modeling

Soil Physics and Soil Chemistry; Terminology; Soil-Water and Hydraulic Conductivity. Soil Chemical Properties- Impact of Soil and Water Chemical Concentrations on Yields – Management of Soil Chemical Concentrations.

Soil Physics and Soil Agriculture- Cropping Pattern- Irrigation- Sustainable Systems Planning Irrigation Systems – Crop Water Requirements- Irrigation Frequency- Yield – Methods of Estimation of Crop Water Requirements – Methods Based on Temperature and Pan Evaporation; Combined Method; Crop Coefficient Curves.

Surface System Design: Definitions –Furrow System Design – Level Basin System Design – Graded Border System Design

Sprinkler System Design: Uniformity and Adequacy of Water Application-Evaporation And Wind Drift- Components of System Design. Distribution System Design and Layout- Centre Pivot System- Linear Move System- Big Gun and Boom Sprinkler Systems.

Trickle (Drip) Irrigation System Design: Concept of Trickle System- Emitters – Flow Through Laterals – Filtration and Water Treatment Systems- Fertilizer Injection Systems.

Water Logging and Prevention and Efficiencies. Optimization Techniques in Planning as Applied to Irrigation.

Agricultural Hydrology- Subsurface- Unsaturated Flow- Hysteresis- Soil Moisture and Deep Percolation- Return Flows and Modeling Droughts and Mitigation of Droughts.

Text Books

1. Water Resources Systems Planning and Management by Chaturvedi- M.C. Tata McGraw Hill

2. Economics of Water Resources Planning by v James L.D and Lee R.R-- McGraw Hill

3. Irrigation Theory & Practise by Maiche 4. Irrigation System Design (An engineering approach) by Richard H. Cuenea- Prentice Hall

5. Water Resources Systems Planning and Analysis by Deniel P. Louchs- Jerry R. Stedinger and Danglass. A. Haith- Prentice Hall.

Reference Books

1. Irrigation – Principles and methods by Irstelsen and Hanesn.

2. Hydro Systems Engineering and Management by Mays L.W. and Tung Y.K.- McGraw Hill

3. Systems Analysis for Civil Engineer by Ossenburgen P.J.-John Wiley and Sons- Publication of NW- Roorkee

HCH3.3 DISSERTATION (Preliminary)

The student shall submit a brief report on the selected topic of his/her dissertation work and attend for a formal viva-voce examination before a committee comprising the Chairman, BOS, Head of the Department and the Guide.

IV – SEMESTER

HCH4.1 DISSERTATION (Final)

The student shall submit his/her dissertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, the Guide and the External Examiner.

Civil Engineering

M.Tech. (ENVIRONMENTAL ENGINEERING AND MANAGEMENT)

Scheme of Instruction and Examination

(with effect from 2019-20 Admitted Batch)

I – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

EEM1.1 Numerical Methods and 4 -- 4 3 70 30 100 3
 Statistical Analysis

EEM1.2 Environmental Chemistry 4 -- 4 3 70 30 100 3

EEM1.3 Environmental Microbiology
 and Sanitation 4 -- 4 3 70 30 100 3

**Program Elective –I**

EEM1.4 (a) Occupational Health, 4 -- 4 3 70 30 100 3
 Safety and Hygiene
 (b) Watershed Management
 (c) Remote Sensing and
 GIS Applications

**Program Elective –II**

EEM1.5 (a) Environmental Impact 4 -- 4 3 70 30 100 3
 Assessment
 (b) Ecological and Ecosystem
 Engineering

EEM1.6 Environmental - 3 3 Viva 50 50 100 1.5
 Engineering Lab

EEM1.7 Case Studies - 3 3 Viva 50 50 100 1.5

 Total 20 6 26 450 250 700 18

II – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

 EEM2.1 Advanced Water and 4 -- 4 3 70 30 100 3
 Wastewater Treatment

 EEM2.2 Air Pollution and Control 4 -- 4 3 70 30 100 3  EEM2.3 Industrial Wastewater
 Treatment 4 -- 4 3 70 30 100 3  **Program Elective –III**

EEM2.4 (a) Disaster Management
 (b) Agricultural Pollution 4 -- 4 3 70 30 100 3
 and Control
 (c) Environmental Legislation

**Program Elective –IV**

EEM2.5 (a) Energy, Environment
 and Sustainability 4 -- 4 3 70 30 100 3
 (b) Environmental
 Biotechnology

EEM2.6 Environmental Process
 Design and Drawing - 3 3 Viva 50 50 100 1.5

EEM2.7 Air and Noise
 Monitoring Lab - 3 3 Viva 50 50 100 1.5

EEM2.8 Seminar -- 3 3 Viva 50 50 100 2

 Total 20 9 29 500 300 800 20

III SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

**Program Elective –V**

EEM3.1 (a) Environmental Hydraulics
 (b) Surface and Groundwater
 Hydraulics 4 -- 4 3 70 30 100 3

**Program Elective –VI**

EEM3.2 (a) Solid and Hazardous 4 -- 4 3 70 30 100 3
 Waste Management
 (b) Climate Change and CDM

EEM3.3 Dissertation (Preliminary) -- -- -- Viva -- 100 100 8

 Total 8 -- 8 140 160 300 14

IV SEMESTER IV SEMESTER

Code No. Course Title Scheme of Examination Total Credits

 Exam (hrs) Ext. Sess.

EEM 4.1 Dissertation (Final) Viva 100 -- 100 16

 Total 16

Civil Engineering

M.Tech. (ENVIRONMENTAL ENGINEERING AND MANAGEMENT)

(with effect from 2019-20 Admitted Batch)

I – SEMESTER

EEM1.1 NUMERICAL METHODS AND STATISTICAL ANALYSIS

Linear system – Gaussian elimination and Gauss – Jordan methods – Matrix inversion – Gauss Seidel method – Non-linear equations – Regula-Falsi and Newton- Raphson methods –interpolation – Newton’s and Lagrange’s interpolation

Linear Programming – Graphical and Simplex methods – Measures of central tendency, dispersion, Skewness and Kurtosis – Probability – conditional probability – Bayes’ theorem

Numerical solutions of ordinary differential equations – Introduction to initial and boundary value problems – Numerical solutions of ordinary differential equations : Taylor’s series, Euler’s method, Modified Euler’s method, Runge- Kutta methods (second and fourth orders) – Predictor.

Random variable – two dimensional random variables – standard probability distributions – Binomial Poisson and normal distributions - moment generating function

Sampling distributions – confidence interval estimation of population parameters – testing of hypotheses – Large sample tests for mean and proportion – t-test, F-test and Chi-square test – curve fitting-method of least squares

Regression and correlation – rank correlation – multiple and partial correlation – analysis of variance-one way and two way classifications – experimental design – Latin square design – Time series analysis.

Reference Books

1. Probability and Statistics for Engineers by Richard A. Johnson, Prentice Hall of India Publications.

2. Numerical methods by S. Armugan, A. ThangapandiIssac, A. Someswaranadham, Scitech Publications (India) Pvt Lt.

EEM1.2 ENVIRONMENTAL CHEMISTRY

(Basic concepts of the following branches of the chemistry as applicable to the Environmental Engineering) Quantitative, Qualitative and physical chemistry : Basic concepts of physical chemistry, Gas laws, Laws of Mass action, Common Ion Effect, Solutions, Vapour pressures of liquids, Binary Mixtures, Solutions of solids in Liquids, Oxidation – Reduction potentials, Ionization, Solubility products, Basics of colloidal chemistry- adsorption and absorption – principles

Equilibrium Chemistry : Equilibrium constants and Calculations, Le-Chatelier Principle, Transport and transformation of chemicals – Photo catalysis - Soil chemistry - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation

Organic Chemistry: Properties of Organic Compounds, Sources of Organic Compounds, Isomerism, Types of Organic Compounds, Aliphatic, Aromatic and Heterocyclic. – Principles of green chemistry.

Biochemistry : Enzymes, factors affecting the action of Enzymes, (co-enzymes or cofactors, Temperature, pH, Micro and Macro mutants), Proteins, carbohydrates and fats.

UV visible spectroscopy: Basic principles – application – Flame Photometry - Atomic absorption spectroscopy – Principles – applications, Gas chromatograph and HPLC – Principles and applications.

Nuclear Chemistry : Atomic Structure, Electron orbits, Neutron, Proton, Nuclear structure, Nomenclature of Isotopes, stable and radioactive nucleoids, Nature of Radiation, Energy of Radiation, Units of Radioactivity, half life,  and neutron induced reaction, nuclear fission and fusion.

Text Books

1. Chemistry for Environmental Engineering and Science, C.N. Sawyer, P.L. McCarty and G.F. Parkin, Tata McGraw-Hill publication.

2. Environmental Chemistry by AK De, Wiley Publications

EEM1.3 ENVIRONMENTAL MICROBIOLOGY AND SANITATION

Introduction : Microorganisms - classification, prokaryotic and eukaryotic cells, structure, characteristics, nucleic acids, DNA and RNA, replication. Recombinant DNA - Genetic Engineering. Metabolism Of Microorganisms :Environmental factors, nutrition and metabolism, growth phases, enzymes, carbohydrate, protein, lipids metabolism, respiration, fermentation, Glycolysis, Kreb's cycle, Hexose monophosphate pathway, significance of energetic Microbiology Of Drinking Water : Distribution of microorganisms, indicator organisms, coliforms - fecal coliforms - E.coli, Streptococcus fecalis and Clostridium welchii, differentiation of coliforms - significance - MPN index, M.F. technique, standards. Virusconcentration techniques. Algae in water supplies - problems and control. Microbiology Of Wastewater Treatment : Biodegradation of toxic pollutants - alpha oxidation ,beta oxidation, electron transport system and oxidative phosphorylation mechanism, Microbiology of biological treatment process

Aquatic Microbiology : Ecotoxicology - toxicants and toxicity - factors influencing toxicity, effects, acute, chronic, concentration response relationships, test organisms, toxicity testing bioconcentration - bioaccumulation - bio-magnification - bioassay - biomonitoring.

Sanitation : Industrial sanitation : Schools, Public Buildings, Hospitals, Eating establishments, Swimming pools – Study of factors like Light, Heat, Ventilation, Plumbing fixtures, Cleanliness and maintenance and comfort.. Rural Sanitation : Population habits and environmental conditions, problems of water supply and sanitation aspects, low cost excreta disposal systems. Rural sanitation improvement schemes.

Reference Books

1. Microbiology for sanitary engineers by Mckinney, McGrawHill Publications.

2. Microbiology for Environmental Scientists and Engineers by A. Gaudy & E. Gaudy, McGrawHill Publications.

3. Microbiology by Pelzer, Ecschan& N R Kreig. Tata McGraw Hill Publishing Company Limited.

4. Municipal and Rural sanitation by Victor Ehalers& Earnest W Steel, McGrawHill Book Company.

EEM1.4(a) OCCUPATIONAL HEALTH, SAFETY AND HYGIENE

Introduction:Need for developing Environment, Health and Safety systems in work places. Regulations and Codes of Practice. Role of trade union safety representatives. International initiatives. Ergonomics and work place.

Occupational Health and Hygiene: Definitions. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances. Advantages and limitations of environmental monitoring and occupational exposure limits. Hierarchy of control measures for occupational health risks. Role of personal protective equipment and the selection criteria. Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress.

Workplace Safety and Safety Systems:Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision. Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment.

Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.

Techniques of Environmental Safety: Methods of effective implementation and review of health & safety policies. Functions and techniques of risk assessment, inspections and audits. Investigation of accidents- Principles of quality management systems in health and safety management. Industry specific EHS issues

Education and Training:Relationship between quality manuals, safety policies and written risk assessments. Records and other documentation required by an organisation for health and safety. Requirements for and benefits of the provision of information, instruction, training and supervision. Factors to be considered in the development of effective training programmes. Principles and methods of effective training. Feedback and evaluation mechanism.

Reference Books

1. Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995

2. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.

3. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005

EEM1.4(b) WATERSHED MANAGEMENT

Common Syllabus for HCH1.4(b) and EEM1.4(b)

Watershed Management Concept - Introduction- Concept of Watershed Management- History of Watershed Management and its Relevance to India- Watershed Characteristics; Climatic Characteristics- Physiographic Characteristics- Causes of Watershed Deterioration- Effect of Watershed on the Community- Water Resources Region of India .

Principles of Watershed Management- Integrated Watershed Management Approach (IWMA)- Objectives of IWMA- Envisaged Results- Success Criteria- Selection of Watershed Village- Equity Issues for Watershed Policies- Factors Causing The Inequality- Benchmark Survey- Remote Sensing Survey in Watershed Management- Land Capability Classification.

Soil Erosion: Introduction- Soil Erosion- Factors Affecting Soil Erosion- Different Types and Causes of Erosion- Geologic Erosion- Accelerated Erosion- Estimation of Loss of Soil from Erosion- Soil Loss Models- Sediment Models- Bed Load Models- Control of Soil Erosion.

Management of Natural Drainages- Introduction- Check Dam- Structures for Gully Stabilization and Storage of Water- Rivers or Stream Bank Management Measures in Watershed- River Training Works- Methods of River Training Works.

Wasteland and Land Drainage Management- Introduction- Causes of Wasteland – Water Logging- Salinity- Soil Erosion- Overgrazing- Mining Operation- Industrial Effluent- Brickfields- Inadequate Surface and Subsurface Drainages- Remedial Measures in Wasteland Management- Land Drainage Management- Surface or Overland Drains- Subsurface or Underground Drains- Discharge and Spacing of Tile Drains.

Flood Damage Mitigation Management- Introduction- Mitigation Measures- Structural Mitigation Measures- Non-Structural Mitigation Measures- Flood Plain Zoning- Flood Forecasting.

Water Harvesting- Introduction- Techniques of Water Harvesting- Indigenous Water Harvesting Methods In India- Engineering Methods of Water Harvesting.

Watershed Modeling- Introduction- Data of Watershed for Modeling- Application of Watershed Models- Model Calibration and Validation

Text Book

1. Watershed management by Madan mohan das- Mimi das Saikia- PHI learning pvt. Ltd.

Reference Books

1) Watershed Management by Murty- J.V.S., New Age Intl.- New Delhi 1998.

2) Decision Support System for Integrated Watershed Management by Allam- G.I.Y.- Colorado State University- 1994.

3) Watershed Planning and Management by Vir Singh- R.-- Yash Publishing House- Bikaner-

4) Watershed Management- American Soc. of Civil Engineers- New York- 1975.

EEM1.4(c) REMOTE SENSING AND GIS APPLICATIONS

Common Syllabus for HCH1.4(c), SMFE1.4(c) and EEM1.4(c)

Introduction - Definition- Principle of Remote Sensing- History of Development of Remote Sensing- Stages in Remote Sensing- Electromagnetic Radiation and the Electromagnetic Spectrum- Interactions With the Atmosphere- Atmospheric Scattering- Atmospheric Absorption- Atmospheric Windows- Refraction- Interaction of EMR with the Earth's Surface- Reflection- Transmission- Spectral Signature.

Platforms & Sensors- Remote Sensing Systems- Remote Sensing From Space- Remote Sensing Sensors- Resolution- Imaging Sensors- Optical Infrared (OIR) Imagers- Optical Sensors- Thermal Sensors- Microwave Sensors- Active Microwave Sensors- Data Preprocessing- Remote Sensing in India.

Introduction to Image Interpretation- Basic Principles of Image Interpretation- Elements of Image Interpretation- Techniques of Image Interpretation- Interpretation Keys- Introduction to Digital Image Processing- Digital Image- Image Rectification and Registration- Geometric Correction- Image Enhancement Techniques (Only Concepts)- Image Classification - Unsupervised Classification and Supervised Classification- Digital Photogrammetry - Stereo Images from Satellites - Data Merging .

Geographic Information Systems (GIS)- Definitions and Related Technology- GIS Operations- GIS Elements- GIS Concepts and Practice- Map Projection and Coordinate System.

Vector Data Model- Introduction- Vector Data Representation- Geometric Objects- Topology. Vector Data Analysis- Introduction- Buffering- Applications of Buffering- Map Overlay- Feature Type and Map Overlay- Map Overlay Methods- Slivers- Error Propagation in Map - Overlay- Distance Measurement- Map Manipulation.

Raster Data Analysis- Introduction- Analysis Environment- Local Operations- Local Operations With a Single Grid- Local Operations With Multiple Grids- Neighborhood Operations- Zonal Operations.

Terrain Mapping and Analysis- Introduction- Data for Terrain Mapping and Analysis- Surface Models-DEM- TIN. GIS Models and Modeling- Introduction- GIS Modeling- Binary Models- Index Models Remote Sensing & GIS Application in Civil Engineering – Some Case Studies from Literature.

Text Books

1. Fundamentals of Remote Sensing 2nd Ed by George Joseph- University Press- New Delhi.

2. Introduction to Geographic Information Systems by Kang Tsung Chang- Tata Mc.G.H. Publications- New Delhi.

3. Remote Sensing and Image Interpretation by Lillesand- T.M. and Kieffer- Joh Wiley and Sons- New York- 1987.

Reference Books

1. Remote Sensing of the Environment – An Earth Resource Prespective by John R. Jensen- Pearson Education- New Delhi.

2. Geographic Information Systems: A Management Perspective by Aronoff- S. Ottawa: Wdl Publications- 1989.

3. Geographic Information Systems For Geoscientists: Modeling with GIS by Bonham Carter- G-F.- New York: Pergamon Press- 1994.

4. Principles Of Geographical Information Systems by Burrough- P.A And R.A. Mcdonnell.. Oxford: Oxford University Press- 1998.

5. Concepts and Technologies of Geographic Information Systems by Lo- C.P.- and Albert K.W. Young- Prentice Hall of India (Pvt) Ltd- New Delhi.

6. Introductory Digital Image Processing by John R Jensen- Prentice Hall- New Jersey.

7. Application of Remote Sensing to Hydrology Including Groundwater by Farsworth- R.K.- Bawetl- E.C. & Dhanju- M.S.-- IHP- UNESCO- 1984.

EEM1.5(a) ENVIRONMENTAL IMPACT ASSESSMENT

Introduction to EIA: Definition, Concepts, Types, Limitations, components of EIA process, settings – public participation, public hearing. Methodologies: background information, interaction matrix methodologies, network methodologies etc, environmental setting- various factors, documentation and selection process, environmental indices and indicators for describing affected environment.

EIA notification by Ministry of Environment and Forest (Govt. of India):Provisions in the EIA notification, Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring. Case studies in EIA.

Prediction and assessment of impact for air and noise environment:Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigations.

Prediction and assessment of impact for water and soil environment:Basic information of water quality (Surface water and groundwater), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and groundwater standards, prediction and assessment of impact for groundwater and soil, mitigations.

Prediction and assessment of impact on cultural and socioeconomic environment:Basic information on cultural resources, rules and regulations for cultural resources like archaeological, historical structures, Cultural system, prediction and assessment of impact, mitigations. Basic information of socio-economic environment, description of existing socio-economic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.

Text Books

1. Environmental Impact Assessment by Larry W. Canter. Mc-Grawhill Co.

2. Environmental Impact Assessment Methodologies by Y Anjaneyulu, and Valli Manikkam, BSP Books PVT Ltd

Reference Books

1. Environmental Impact Analysis Handbook, John G. Rau and David C. Wooten (Ed), McGraw Hill Book

2. Environmental Impact Assessment– Urban and Jain.

EEM1.5(b) ECOLOGICAL AND ECOSYSTEM ENGINEERING

Development and evolution of ecosystems – Principles and concepts – Energy flow and material cycling – productivity – Classification of ecotechnology – ecological engineering.

Classification of systems – Structural and functional interactions of environmental systems –Mechanisms of steady-state maintenance in open and closed systems

Classification of ecotechnology - Principles and components of Systems and ModelingModeling and ecotechnology – Classification of ecological models – Applications- Ecological economics- Self-organizing design and processes – Multi seeded microcosms.

Self organizing processes - Multiple seeded microcosms- Interface coupling in ecological systems - Concept of energy - Adapting ecological engineering systems to potentially catastrophic events - Agro ecosystems - Determination of sustainable loading of ecosystems.

Ecosanitation – soil infiltration systems–Wetlands and ponds–Source separation systems– Aqua cultural systems – Agro ecosystems – Detritus based treatment for solid wastes – marine systems- Case studies. Reference Books 1. Kangas, P.C. and Kangas, P., Ecological Engineering: Principles and Practice, Lewis Publishers, 2. Etnier, C. and Guterstam, B., Ecological Engineering for Wastewater Treatment, Lewis Publishers, 3. Concepts of Ecology by Kormondy, PHI Publications

EEM1.6 ENVIRONMENTAL ENGINEERING LABORATORY

1. Sampling and characterization of water and wastewater by gravimetric, volumetric and colorimetric methods

2. Settling Column Analysis for type II settling,

3. Break point chlorination,

4. Determination of Dosage of lime-soda for removal of hardness 5. Media preparation and inoculation

6. Test for plate count

7. Coliforms – fecal coliforms – E.coli

8. M.P.N. and M.F. techniques.

9. Bioassay study

10. Sampling and analysis of ambient air for SPM, SO2, Oxides of nitrogen

11. Instrumental methods of analyses for particulates, HC, CO, NOx, SO2.

Reference Books

1. Chemistry for Environmental Engineers, by Sawyer, C.N. and McCarty, P.L. and Parkin, G.F. McGraw Hill,

2. Environmental Chemistry, by De.A.K. New Age International Ltd.

3. Standard Methods for the Examination of Water and Wastewater, 21th Edition, American Public Health Association, Washington. D.C. 2005.

EEM1.7 CASE STUDIES

Each student shall submit two case studies related to Environmental Studies and face viva-voce examination.

II – SEMESTER

EEM2.1 ADVANCED WATER AND WASTEWATER TREATMENT

Physical and Chemical Treatment: Screening, Grit removal, Aeration and gas transfer, Application of Membrane Processes, Reverse Osmosis, Micro-filtration, Nano-filtration, Ultrafiltration and Electrodyalisis Chemical precipitation, other solids removal operations, Control of odour, Control of volatile organic compounds. Theory of Sedimentation – flocculent particle settling – theory of coagulation and flocculation- zeta potential - Filtration - theory of granular media filtration – head loss cleaning of filter media - backwash hydraulics – Theory of chlorination – equilibrium constants.

Principles:Objectives of biological treatment significance - aerobic and anaerobic treatment kinetics of biological growth - factors affecting growth – attached, suspended and Hybrid growth systems. Determination of kinetic coefficients for organics removal – Biodegradability assessment – selection of process – reactors – batch & continuous type

Aerobic Treatment of Wastewater:Design and construction aspects and the relevant parameters of significance of the units: Activated Sludge Process, Trickling Filters, Aerated Lagoons, Rotating Biological Contactors, Sequential Batch Reactors (SBR), Stabilization ponds, Hybrid reactors for the treatment of wastewater :– IFAS, MBBR, MBR, Expanded / fluidized bed bio reactors

Anaerobic Treatment of Waste Water:Sludgehandling and treatment -Sludge digestion: theory and principles - Disposal of digested sludge, Anaerobic ponds, UASB reactors and various modifications in UASB process and anaerobic filters. Two stage /phase reactors – biogas generation.

Reference Books

1. Wastewater Engineering, Treatment and Reuse. Metcalf & Eddy, Inc. Tata McGraw-Hill Publications

2. Biological Processes Design for wastewaters, Benefield, L.D. and Randall C.W. Prentice-Hall, Inc.

3. Wastewater treatment for Pollution Control by Arceivala, Tata McGraw Hill Publication

4. Water and wastewater technology by Hammer and Hammer, PHI Publications

EEM2.2 AIR POLLUTION AND CONTROL

Introduction:Definition - Sources and classification of Air Pollutants - Photochemical smog - Effects of air pollution on health of Human & Animals, vegetation & materials, air quality, Global effects of air pollution.

Meteorology and Dispersion of air pollutants:Temperature lapse rates and Stability, Wind velocity and turbulence, Wind Rose, plume behaviour, Measurement of meteorological variables. Dispersion of Air pollutants: Theories on modeling of Air pollutants. Gaussian model, Equations for the estimation of pollutant concentrations of emissions. Plume Rise – Equations for estimation. Effective stack height and mixing depths

Sampling and Particulate Pollution Control Methods:Atmospheric sampling and stack sampling methods. Air quality standards.

Types of particulate pollution control methods – Settling chambers, Cyclone separators, Scrubbers, Filters and Electrostatic precipitators, design aspects and principle of these air pollution control units.

Gaseous pollution control methods and automobile pollution:Types of gaseous pollution control methods – absorption, adsorption and combustion processes. Automobile pollution, sources of pollution, composition of auto exhausts, Control methods. Planning for conducting Air pollution survey Noise Pollution- Definitions – Significance in general - sources, measurement - effects and control measures, noise legislations

Reference Books

1. Environmental Engineering, Peavy and Rowe, Mc-Graw Hill Publication.

2. Air Pollution Control Engineering,. N.D. Nevers, Mc-Graw Hill Publication.

3. Air Pollution, M. N. Rao and HVN Rao Tata Mc-Graw Hill Publication.

4. Air pollution and control, KVSG Murali Krishna. Kaushal and Company, Kakinada

5. An Introduction to Air Pollution by RK Trivedy and PK Goel, BSP Books PVT Ltd

6. Environmental Pollution Control Engineering by CS Rao, New Age Publications

7. Air pollution Control Technologies by Anjaneyulu, Allied Publishers

EEM2.3 INDUSTRIAL WASTEWATER TREATMENT

Introduction: Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling -generation rates, characterization and variables –Toxicity of industrial effluents.

Pollution Prevention & unit operations:Prevention and Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy – Source & reduction techniques – Strength & volume Reduction - Material balance - Evaluation of Pollution prevention options - Waste minimization Circles. Equalisation - Neutralisation – Oil separation – Flotation – Precipitation – Heavy metal Removal– Aerobic and anaerobic biological treatment – High Rate reactors - Chemical oxidation – Ozonization – carbon adsorption Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal.

Wastewater Reuse And Residual Management:Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse , Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Management of RO rejects.

Manufacturing process and sources of effluent from the process of industries like fertilizer, pulp and paper, sugar, distillery, tannery, food processing, dairy and Pharmaceuticals, Industrial manufacturing process description, wastewater characteristics, and source reduction options

Manufacturing process and sources of effluent from the process of industries like: Steel, Petroleum Refineries, Textiles, Atomic Energy Plants, Metal finishing and other Mineral Processing Industries. Industrial manufacturing process description, wastewater characteristics, and source reduction options

Reference Books

1. Industrial Waste Water Pollution Control, W. Wesley Eckenfelder Jr.,McGraw Hill Publishing Company.

2. Wastewater Treatment for Pollution Control, Arceivala, S.J., McGraw-Hill, 1998.

3. Industrial waste treatment Handbook, Frank Woodard, Butterworth Heinemann, New Delhi, 2001.

4. Waste water treatment, M.N.Rao & A.K. Datta, Oxford & IBH Publishing Co Pvt.Ltd.

5. Industrial waste treatment – contemporary practice and vision for the future, Nelson Leonard Nemerow, Elsevier, Singapore, 2007

EEM2.4(a) DISASTER MANAGEMENT

Common Syllabus for CTPM2.4(a) and EEM2.4(a)

Types of Disasters: Disaster - concept and definitions of disaster, causes of disasters, types – natural disasters – floods, droughts, cyclones, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold wave, global warming, sea level rise, ozone depletion. Man-made disasters: Sociological – political – industrial and human disasters. Risk Assessment and Analysis Concept and elements of Hazards, Risks and Vulnerability – Policies of Disaster Management, Identification of Crisis Situation, strategic developments, roles and responsibilities of recovery team, importance of team building in disaster management. Disaster Preparedness: Prevention and Preparedness – Plan, Action and Accountability, Concept and Nature of Disaster Preparedness, Plan of Disaster Preparedness for People with Special Needs/Vulnerable Groups, with Relevance to Housing, Infrastructure and Livestock, Community Based Disaster Preparedness Plan, Role of Information technology, Education, Communication and training. Medical and health preparedness plan. Disaster Damage Assessment and Response: Needs and Damage Assessment– Control process and measurement – modern and traditional methods of response, Disaster Response Plan – roles of response teams and forces. Epidemiological Study of Disasters - Medical and Health Response to Different Disasters - Role of Information and Communication Technology in Health Response Disaster Mitigation and Recovery: Disaster Mitigation – meaning and concept – structural mitigation and non-structural mitigation – mitigation strategies and emerging trends. Reconstruction and rehabilitation for development, Medium and long-term recovery aspects, Participative Rehabilitation Process: Community involvement and development of infrastructure.

Reference Books:

1. Disaster Management by Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.

2. Natural Hazards & Disaster Management by R.B.Singh, Rawat Publishers & Distributors.

3. Disaster Management: Future Challenges and opportunities by Jagbir Singh4, I.K. International Publishing House Pvt. Ltd

4. Natural Disaster Management , Jon Ingleton, Tudor Rose Holdings Ltd (1999).

5. Disaster Management, Rajib Shaw and RR Krishnamurthy, Universities Press, Hyderabad.

EEM2.4(b) AGRICULTURAL POLLUTION AND CONTROL

Environmental issues in agriculture:Types of farming systems, agro meteorology, waterand nutrients requirement.

Fertilizers, pesticides, herbicides:types of fertilizers, pesticides and other agrochemicals, soil and water conservation practices. Natural fertilizers, pesticides and herbicides- green practices in agriculture yield improvement

Water logging and salinity: causes and effects. Wastewater reuse in agriculture,management and control of agricultural waste, recycling and reuse. Biotechnology in reduction of CO2 emission, Bio-scrubbers, Bio-beds, Bio-trickling filters and their applications.

Novel methods of pollution control: Methane production, Root zone treatment, Membrane technology.

Reference Books

1. Microbial Biotechnology: A. N. Glazer and H. Nikaids, Cambridge University Press, 2007.

2. Molecular Biotechnology: Gleek and Pasternack.

3. Biotechnology: A Text Book of Industrial Microbilogy, T. D. Brock, Sinauer Associates Incorporated; 2nd ed edition (May 1990)

4. Industrial Microbiology: Presscott and Dunn, CBS Publishers

5. Biotechnology: B. D. Singh, Kalyani Publishers.

6. Soil & Ground Water Pollution from Agricultural activities, T.V.Ramachandra, TERI Press.

EEM2.4(c) ENVIRONMENTAL LEGISLATION

Introduction: Indian Constitution and Environmental Protection – National Environmental policies – Precautionary Principle and Polluter Pays Principle – Concept of absolute liability – National and International multilateral environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration etc – Institutional framework (SPCB/CPCB/MOEF) - Supreme Court Judgments in Landmark cases

Water (P & CP) Act, 1974: Power & functions of regulatory agencies - responsibilities of Occupier, Provision relating to prevention and control, Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

Air (P & CP) Act, 1981:Power & functions of regulatory agencies - responsibilities of Occupier, Provision relating to prevention and control, Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

Environment (Protection) Act 1986: Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Sitting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorization – Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards

Other Acts & Management Systems: Relevant Provisions of Indian Forest Act, Public Liability Insurance Act, CrPC, IPC -Public Interest Litigation - Fundamentals of Environmental Management and ISO 14000 series - principles and elements. The ISO 14001- Environmental management systems standards.

Reference Books

1. CPCB, Pollution Control acts, Rules and Notifications issued there under Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.

2. Environmental law and policy in India by Shyam Divan and Armin Roseneranz, Oxford University Press, New Delhi, 2001.

3. Environmental law and enforcement by Greger I. Megregor, Lewis Publishers, London1994.

4. Constitution of India [Referred articles from part-III, part-IV and part-IV A]

5. Handbook of environmental management and technology: Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.

6. The ISO 14000 Handbook: Joseph Cascio.

7. ISO 14004: Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004:1996 (E)).

8. ISO 14001: Environmental management systems.

EEM2.5(a) ENERGY, ENVIRONMENT AND SUSTAINABILITY

Introduction:Sustainable Development – Indicators of Sustainability – Sustainability Strategies- Barriers to Sustainability – Industrial activity and Environment – Industrialization and sustainable development. Cleaner Production (CP) in Achieving Sustainability –Principles Cleaner Production, Definition, Importance Historical evolution, Benefits, Promotion, Barriers, Role of Industry, Government and Institutions, Industrial Ecology, clean development mechanism, reuse, recovery, recycle, raw material substitution.

Cleaner Production Project Development and Implementation:Overview of Cleaner Production (CP) Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress – Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling

Green Technology - Definition of green building, benefits and challenges, public policies and market-driven initiatives, effective green specifications. Overview of the Building Energy System Design Process. Assessing human functional and physiological smart growth- needs, local climate and free energy resources. Design scenarios- Day lighting , Electric Lighting.

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy- process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and application.

Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Reference Books

1. Pollution Prevention: Fundamentals and Practice, Paul L Bishop (2000) McGraw Hill International.

2. Pollution Prevention and Abatement Handbook – Towards Cleaner Production, World Bank Group (1998) World Bank and UNEP, Washington D.C.

3. Cleaner Production Audit, Environmental System Reviews, No.38, Prasad Modak, C.Visvanathan and Mandar Parasnis (1995) Asian Institute of Technology, Bangkok

4. Handbook of Organic Waste Conversion, .Bewik M.W.M.

5. Industrial Ecology and Sustainable Engineering by Graedel Allenby, PHI Publications

EEM2.5(b) ENVIRONMENTAL BIOTECHNOLOGY

Environmental Biotechnology: Principles and concepts - usefulness to mankind. Degradation of high concentrated toxic pollutants- halogenated, non halogenated, petroleum hydrocarbons, metals - Mechanisms of detoxification – oxidation - dehalogenation - biotransformation of metals - biodegradation of solid wastes.

Biofilm Kinetics: Microbial aggregation-idealized biofilm-Steady state biofilm – soluble microbial products and inert biomass- non steady state biofilms.

Microbial cell/enzyme technology – adapted microorganisms – biological removal of nutrients – algal biotechnology– extra cellular polymers - Biogas technology. Concept of rDNA technology – expression vectors – mutation – construction of microbial strains - radioactive probes - protoplast fusion technology – applications.

Biotechnological remedies for environmental pollution - decontamination of groundwater –Bioremediation: Scope and characteristics of contaminants- contaminant availability for biodegradation- Engineering strategies for bioremediation – evaluation of bioremediation.

Environmental effects and ethics of microbial technology – genetically engineered organisms – Microbial containment-Risk assessment.

Text Books

1. Environmental Biotechnology: Principles and Applications by Rittmann., B.E. and McCarty, P.L ,Tata McGraw-Hill,

2. Biological degradation of wastes by Martin. A.M, Elsevier Applied Science.

3. Environmental Biotechnology by Scraqq, Oxford Publications

4. Environmental Biotechnology by Bhattacharya and Banerjee, Oxford Publications

EEM2.6 ENVIRONMENTAL PROCESS DESIGN AND DRAWING

Review of the Principles of design and drawing of water supply and treatment units from source to distribution system.

Review of Principles of design and drawing of wastewater treatment units.

Detailed design and drawings of various types of intake structures, conduits, pipes, ground level reservoirs and elevated service reservoirs.

Preparation of drawings for various house plumbing fixtures. Design and drawings of various types of distribution systems and various methods of analysis of distribution networks

Text Books

1. Elements of Public Health Engineering by Duggal, S.Chand Publishers.

2. Water Supply and Sanitary Engineering by Birdie, Dhanpat Rai Publishing Company (p) Ltd (2010)

3. Water Supply and Sanitary Engineering by Hussain, Oxford and IBH Publishers.

EEM2.7 AIR AND NOISE MONITORING LABORATORY

1. Particulate Sampling – Dust Fall, Pollution Suspended Particulates and Total Particulate Matters using High Volume Sampler / Respirable Dust Sampler.

2. Experiment on Respirable Dust – Estimating RPM.

3. Estimating Sulphur Dioxide, NOx in Ambient Air Using High Volume Air Sampler.

4. Stack Sampling Techniques and Demonstration of Stack Monitoring.

5. Exercises on Ambient Gas Monitoring including CO & VOC.

6. Demonstration / Exercises on Air Pollution Control Devices – Bag Filter, Scrubber, Cyclone and ESP.

7. Exercises on Auto Exhaust Analyser for Petrol Vehicle and Diesel Vehicle Smoke test for Diesel Vehicle.

8. Exercises on Noise Measuring Instruments.

9. Exercises on Luxmeter ( Light Intensity measuring Instrument)

10. Demonstration on Wind Monitoring and Analysis of Data for Wind rose Diagrams.

11. Demonstration of Rain Gauges.

Reference Books

1. Air pollution and Control by Henry C Perkins, Mc Graw Hill Pvt Ltd, New Delhi, 1974.

2. Air Pollution (vol. I), Air Pollution and its effects (vol. II), Analysis, Monitoring and Surveying (vol. III), Sources of Air Pollution and their control by Stern A. C., Academic press, New York, 1968. 53

EEM2.8 SEMINAR

Each student has to select a topic and collect about 10 papers with at least 5 journal papers and prepare a report and give a seminar at the end of the semester

III SEMESTER

EEM3.1(a) ENVIRONMENTAL HYDRAULICS

Common Syllabus for EEM3.1(a) and HCH3.1(a)

Hydrology: Statistical analysis of Hydrological Data -, Intensity–Duration frequency Curves. Hydraulics of groundwater flow: Non–equilibrium flow, Yield estimations, Interferences Infiltration galleries, ground water recharge

Transportation and distribution of water: Storage capacity, Pumping of Water, Design and selection of economical diameter of pumping main. Distribution of Water - Pressure and capacity requirements of distribution system, Analysis of networks, Appurtenances in a distribution layout, detection and prevention of leakage mains.

Hydraulics of Sewers: Design of sewers in full and partial flow conditions, Flow at Sewer transitions, Sewage pumping. Open channel flow–design of open channel flow sections.

Transport phenomenon – diffusion – dispersion – advection – adsorption - conservative and non-conservative pollutants. Governing Equations for flow and transport in surface and subsurface waters-chemical and biological process models-simplified models for lakes, streams, and estuaries.

Modelling of the transport phenomenon: complexity - coupled and uncoupled models – linear and nonlinear models - Solution techniques – calibration. Numerical models: FDM, FEM and Finite volume techniques - explicit vs. implicit methods - numerical errors. Different types of Stream quality modeling and Groundwater transport modeling.

Reference Books

1. Water and waste water Engineering by Fair Gayer and Okun, I. K. International Pvt. Ltd.

2. Engineering Hydrology by K. Subramanya, Tata McGraw-Hill Education

3. Hydrodynamics of transport for water quality modeling by Martin, L.J. and McCucheon, S.C, Lewis Publishers.

4. Groundwater by Freeze, R.A. and Cherry. J.A. Prentice Hall,

5. Groundwater Hydrology by Todd, Wiley Publications

EEM3.1(b) SURFACE AND GROUND WATER HYDRAULICS

Land Processes – Subsurface and Channel Processes- Precipitation – Rain gauge network, Abstractions, Infiltration, Evaporation, Transpiration, Process and models

Unit Hydrograph & S curve hydrograph, Dimensionless unit hydrograph, GUIH, Watershed Model and Conceptual Models.

Occurrence and Movement of Ground water, Properties of aquifer, Groundwater flow equations, Dupuit Forchheimer assumptions, Well hydraulics, Partial penetration of wells, Interference of wells, Collector wells and Infiltration galleries.

Pumping tests, Analysis for unconfined and non leaky and leaky confined aquifer and water table aquifer, Locating hydro geologic boundaries, Well design criteria.

Natural and Artificial Recharge of Ground water- Salt water intrusion, Application of Finite Difference in ground water.

Reference Books:

1. Applied Hydrology by Ven Te Chow, Mc GrawHill Science Publishers

2. Elementary Hydrology by Singh, Vijay, Prentice Hall 3. Ground Water by Raghunath, Mc Graw Hill.

4. Hydraulics of Groundwater by Bear, J., Mc Graw Hill.

5. Surface water quality modeling by Chapra,, McGraw Hill Publication

EEM3.2(a) SOLID AND HAZARDOUS WASTE MANAGEMENT

Introduction: Definition of solid waste – waste generation, sources and types of solid waste – sampling and characterization – Determination of composition of Municipal Solid Waste – Onsite storage and handling of solid waste.

Collection and Transport of Solid Waste:Type and methods of waste collection systems, analysis of collection system Optimization of collection routes– alternative techniques for collection system. Transfer and Transport: Need for transfer operation, transport means and methods, transfer station types and design requirements. Separation and Processing and Transformation of Solid Waste- Waste as a Resource Economics, Disposable Materials, Recycling Collection, Processing, Potential for Reuse

Processing and disposal: Unit operations used for separation and processing, Materials Recovery facilities, Source reduction and waste minimization, Metal Separation & Recovery Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators. Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

Hazardous Waste Management:Definition and identification of hazardous wastes-sources and characteristics – hazardous wastes in Municipal Waste – Hazardous waste regulations – minimization of Hazardous Waste-compatibility, handling and storage of hazardous waste-collection and transport, e-waste - sources, collection, treatment and reuse.

Hazardous waste treatment technologies - Design and operation of facilities for physical, chemical and thermal treatment of hazardous waste – Solidification, chemical fixation and encapsulation, incineration. Hazardous waste landfills: Site selection, design and operation – remediation of hazardous waste disposal sites.

Text Books

1. Integrated Solid Waste Management: Engineering Principles and Management Issues by George Tchobanoglous , Hilary Theisen, Samuel A Vigil. McGraw-Hill Series in Water Resources and Environmental Engineering

2. Environmental Engineering by Howard S.Peavy, Donald R.Rowe and George Tchobanognous, McGraw Hill Publishing Company.

Reference Books

1. Hazardous Waste Management, Charles A. Wentz; McGraw Hill Publication, 2. Solid and Hazardous Waste Management by MN Rao, Razia Sultana, BSP Books 3. Municipal Solid Waste Management by P Jayaramireddy, BSP Books PVT Ltd.

 EEM3.2(b) CLIMATE CHANGE AND CDM

 Introduction: Atmosphere – weather and Climate - Causes of global and regional climate change- climate parameters – Temperature, Rainfall, Humidity, Wind – Global ocean circulation – El Nino and its effect - Carbon cycle.

 Global Warming: Emission sources of green house gases, Green House effect as a natural phenomenon, and due to anthropogenic activities, Recent role of green house effect. Global warming potential, Past present and future scenario of global warming.

 Impacts of Climate Change: Effects of Climate Changes on living systems – health effects, agriculture and food security, forestry, human migration, socioeconomic impacts- coastal areas, tourism, industry and business, vulnerability assessment- infrastructure. Sea level rise, Coastal erosion and landslides, strategies to combat global warming.

Mitigating Climate Change IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment- reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies –Concept of carbon sequestration, Carbon sequestration modalities and procedures, Carbon capture and storage, Carbon trading, Montreal protocol, Kyoto protocol, Role and functions of IPCC, National and International action plan on climate change.

 Alternate Fuels and Renewable Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Clean Development Mechanism - Energy Audit.

Text Books

 1. Air Pollution, KL Dorean, CBS Publishers & Distributers Pvt. Ltd. New Delhi.

2. Principles and Practices of Air Pollution Control and Analysis, J.R. Mudakavi, I.K. International Publishing House Pvt. Ltd., New Delhi.

3. Carbon Capture: Sequestration and Storage (Issues in Environmental Science and

4. Technology), RE Hester and RM Harrison, Royal Society of Chemistry; 1 edition (January 20, 2010)

5. Climate Change: causes, Effects and Solutions, John T. Hardy. Willy Publication, USA.

6. Earth ? s Climate Past and Future by Ruddiman W.F, freeman W.H. and Company,

7. Global Warming and Climate Change. Vol I & II.by Velma. I. Grover, Science Publishers, 2005.

8. Climate Change – An Indian Perspective by Dash Sushil Kumar, Cambridge University Press India Pvt. Ltd, 2007

Reference Books

 1. IPCC Fourth Assessment Report, Cambridge University Press, Cambridge, UK, 2007

2. Climate Change and Biodiversity by Thomas E, Lovejoy and Lee Hannah, TERI Publishers, 2005

3. Impacts of Climate Change and Climate Variability on Hydrological Regimes by Jan C. van Dam, Cambridge University Press, 2003.

EEM3.4 DISSERTATION (Preliminary)

 The student shall submit a brief report on the selected topic of his/her dissertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department and the Guide.

IV – SEMESTER

EEM 4.1 DISSERTATION (Final)

 The student shall submit his/her dissertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, the Guide and the External Examiner.

Civil Engineering

M.Tech. (CONSTRUCTION TECHNOLOGY AND PROJECT
MANAGEMENT)

Scheme of Instruction and Examination

(with effect from 2019-20 Admitted Batch)

I - SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

CTPM1.1 Principles of Construction 4 -- 4 3 70 30 100 3  Management

CTPM1.2 Construction Planning and 4 -- 4 3 70 30 100 3  Scheduling

CTPM1.3 Construction Equipment 4 -- 4 3 70 30 100 3  and Methods

**Program Elective –I**
CTPM1.4 (a) Advanced Foundation
 Engineering 4 -- 4 3 70 30 100 3
 (b) Urban Transportation
 Planning

**Program Elective –II**
CTPM1.5 (a) Advanced Concrete 4 -- 4 3 70 30 100 3  Technology
 (b) Construction Economics

CTPM1.6 Computer Applications in - 3 3 Viva 50 50 100 1.5 Structural Engineering

CTPM1.7 Case Studies - 3 3 Viva 50 50 100 1.5

 Total 20 6 26 450 250 700 18

 II – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

CTPM2.1 Project Administration 4 -- 4 3 70 30 100 3

CTPM2.2 Contracts and Legal 4 -- 4 3 70 30 100 3
CTPM2.3 Safety Management 4 -- 4 3 70 30 100 3

Program Elective –III
CTPM2.4 (a) Disaster Management
 (b) Ground Improvement 4 -- 4 3 70 30 100 3 Techniques

Program Elective –IV
CTPM2.5 (a) Prestressed Concrete
 (b) Strategic Management 4 -- 4 3 70 30 100 3
 of Construction Projects

CTPM2.6 Repairs and Rehabilitation - 3 3 Viva 50 50 100 1.5 of Structures

CTPM2.7 Construction Engineering - 3 3 Viva 50 50 100 1.5 Laboratory

CTPM2.8 Seminar - 3 3 Viva 50 50 100 2

 Total 20 9 29 500 300 800 20

 III SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

**Program Elective –V**
 CTPM3.1 (a) Environmental Impact 4 -- 4 3 70 30 100 3  Assessment
 (b) Operations Research

**Program Elective– VI**
CTPM3.2 (a) Management Information 4 -- 4 3 70 30 100 3  Systems
 (b) Infrastructure Valuation

CTPM3.3 Dissertation (Preliminary) -- -- -- Viva -- 100 100 8

 Total 8 -- 8 140 160 300 14

 IV SEMESTER

Code No. Course Title Scheme of Examination Total Credits

 Exam (hrs) Ext. Sess.

CTPM4.1 Dissertation (Final) Viva 100 -- 100 16

 Total 16

Civil Engineering

M.Tech. (CONSTRUCTION TECHNOLOGY AND MANAGEMENT)

(with effect from 2019-20 Admitted Batch)

I – SEMESTER

 CTPM1.1 : PRINCIPLES OF CONSTRUCTION MANAGEMENT

Introduction, History of Construction Management, Functions and Responsibilities of Construction Manager, Future of Construction Management. Major problems in Construction Industry, Decision Making in Construction Industry – Benefit-Cost Analysis, Replacement Analysis, Break Even Analysis.

 Project Cost and Value Management – Cost Planning, Cost Budgeting, Cost Controlling. Fundamentals of Value Engineering, Application of Value Engineering to Construction Industry.

 Concept and importance of Safety in Construction Industry, Unsafe Conditions and Unsafe Acts, Safety Benefits to Employers, Employees and Customers, Construction Safety Problems, Approaches to improve Construction Safety.

 Project Monitoring and Control Systems, Communication Systems, Cost and Progress Control, Fundamentals and Significance of Management Information Systems, Application of Management Information Systems in Constuction Industry.

 Reference Books

1. Construction Management and Practice. Raina, C.M. Tata McGraw-Hill,

2. Construction Management by Williams, Cengage publishing Pvt Ltd

3. Construction Project Management, K N Jha, Pearson publications

 CTPM1.2 : CONSTRUCTION PLANNING AND SCHEDULING

Introduction to methods of planning and scheduling, Work Break Down Structures.

 Bar charts and Milestone Charts – Development of Bar charts – Shortcomings – Remedial measures – Milestone charts.

 PERT- Elements of Networks – Event, Activity, and Dummy Activity – Guidelines for the construction of the network – Development of PERT network – Numbering - Fulkerson’s rule - Skip numbering.

 Time estimates – Optimistic, Pessimistic and Most likely time estimates – Earliest Expected time and Latest Allowable Occurrence time. Critical Path – Slack – Identification of Critical Path – Probability of Completion of projects.

CPM – Construction of network – Earliest Possible Occurrence time and Latest Possible Occurrence time – Start and Finish times of activities – Floats – Identification of Critical Path using floats. Cost Time Optimization – Direct and Indirect project costs – Total costs – Cost Slopes – Crashing - Cost and Time Optimization.

Updating – Importance of updating – Process of updating – Updating Cycle and Updated networks. Resource allocation – Resources – Usage profiles – Histograms – Resource Smoothing – Resource leveling.

 Reference Books

1. PERT and CPM – BC Punmia and KK Khandelwal

2. PERT and CPM – LS Srinath.

3. A management guide to PERT/CPM by Wiest Levy, PHI Publications

 CTPM1.3 CONSTRUCTION EQUIPMENT AND METHODS

Construction Equipment: Introduction, significance of equipment in construction industry - laboratory setting including plan reading, specification reading, construction scheduling and estimating, Job layout and its importance.

Construction Equipment Management: Equipment Management- Introduction, Differences between men and manpower, Extent of Mechanisation, Equipment planning, Selection of equipment, Forward planning, Purchase of Equipment, Specifications for ordering equipment. Maintenance Management – Introduction, Objectives, Functions, Maintenance planning, Maintenance control, Types of maintenance. Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management

 Equipment for Earthwork: Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment –Excavation equipment- Power Shovels, Back Hoe, Drag line, Clamshell – Excavating and Earth Moving Equipment – Scrapers, Bull Dozers, Tractors, Hauling Equipment – Dump trucks, Dumpers Loaders, trucks, Earth Compaction Equipment-Tamping Rollers, Smooth Wheel Rollers, Sheepsfoot Roller, Pneumatic-tyred Roller, Vibrating Compactors, Vibrocompaction methods.

 Other Construction Equipment: Pile driving Equipment - Erection Equipment – Cranes, Derrick Cranes, Mobile cranes, Overhead cranes, Traveller cranes, Tower cranes - Types of pumps used in Construction - Grouting - Material Handling Conveyors –Industrial Trucks, Forklifts and related equipment .

Equipment for Concrete and Road laying: Aggregate production equipment- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Aggregate Mixing Equipment - Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment – Ready mix concrete equipment, Concrete mixers, Concrete batching and mixing plant, Transportation of concrete mix, Concrete pouring and pumps, concrete compaction equipment.

Text Books

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", McGraw Hill, Singapore, 2006.

2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, New Delhi, 1988.

Reference Books

1. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.

2. Dr.MaheshVarma, "Construction Equipment and its planning and Application", Metropolitan Book Company, New Delhi. 1983.

 CTPM1.4(a) ADVANCED FOUNDATION ENGINEERING

Common Syllabus for SMFE1.2, CTPM1.4(a), TE1.4(a) and ST1.4(a)

 Introduction Principles of Design of Foundations, Types of shear failures in foundation soils, Types of foundations, Design Loads, Basic Concepts of safe and allowable bearing capacity. Shallow Foundations Bearing Capacity Analysis: Bearing capacity theories – Terzaghi, Meyerhof, Skempton, Hansen, Vesic and IS Methods, Bearing capacity evaluation from Standard Penetration test and Plate load test. Settlement Analysis: Uniform and Differential Settlements, Elastic and Consolidation Settlements, Settlement analysis in cohesionless soils by Schemartmann and Hartman method, Penetration tests; Permissible settlements as per IS 1904-1978, causes of settlement, settlement Control.

Proportioning of footings: Isolated column footings, Strip, combined Footings and Strap Footing. Raft Foundations: Bearing capacity of raft foundation, floating raft, Types of rafts, Beam on Elastic foundation and Conventional methods of Design, determination of modulus of subgrade reaction.

Deep Foundations Pile Foundations: Types, load capacity- dynamic formulae, static formula; pile load tests- Vertical load test, lateral load test, Cyclic load test; settlement of piles and pile groups, negative skin friction on single pile and pile groups; laterally loaded piles - Broom’s Analysis, IS Code method; Under reamed piles – Load capacity, design and construction.

Well Foundations: Types, Bearing Capacity of well foundations, Construction of pneumatic caissons, Tilts and Shifts: precautions, Remedial measures; Lateral stability analysis by Terzaghi’s Method, Design aspects of Components of well foundation. Foundations in Expansive Solis Introduction, Identification of expansive soils, Swell potential and swelling pressure, Active depth, Foundation Problems, Foundation practices in expansive soils, Soil Replacement and ‘CNS’ concepts. Foundations of Transmission Line Towers Introduction, Necessary information, Forces on tower foundations, General design criteria, Choice and type of foundation, Design procedure.

Text Books

1. Analysis and Design of Substructures by Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.

 2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publications

Reference Books

1. Foundation Analysis and Design by J.E. Bowles, Mc Graw Hill Publishing Co.

2. Foundation Design by W.C. Teng, John Wiley, New York.

3. Analysis and Design of Substructures by Swami Saran, Oxford &IBH Publishing Co.

4. Foundation Engineering by P.C. Vargheese, Prentice Hall of India

CTPM1.4(b) URBAN TRANSPORTATION PLANNING

 Travel Demand Concept: Demand function: Independent variables: Travel attributes; Assumptions in Travel demand estimation; Sequential, Sequential recursive and Simultaneous process.

 Data Collection and Inventories: Study area definition; Zoning principles; Travel data collection - Road side interview, Home interview; IPT surveys; Sampling techniques; Expansion factors; Use of Secondary sources in data collection. Travel Demand Estimation: Four step Travel Demand Forecasting approach; Trip generation Analysis; Zonal models Category analysis; Household models; Trip attraction of work centres.

 Trip Distribution: Mode Factor methods; Gravity model; opportunity model.

 Mode Split Analysis: Mode choice behavior; computing modes; Diversion curves; Probabilistic approaches.

 Traffic Assignment: Traffic network and coding; Minimum path trees; All or nothing assignment; Capacity restraint assignment; Corridor Identification; Plan preparation and Evaluation; Deficiency analysis.

Reference Books

1. Introduction to Transportation Planning by M.J.Bruton; Hutchinson cf London Ltd.

 2. Introduction to Urban System Planning by B.G.Hutchinson; Mc Gra Hill.

3. Urban Transportation Planning Guide - Roads & Transportation AS~C(i<:tion of Canada; University of Toronto Press.

4. Traffic Engineering and Transport Planning by Kadiyali L.R. Khanna Publishers.

 CTPM1.5(a) ADVANCED CONCRETE TECHNOLOGY

 Common Syllabus for ST1.5(a), CTPM1.5(a) and SMFE1.5(a)

 Durability of concrete and concrete construction: Durability concept, pore structure and transport processes, reinforcement corrosion, fire resistance, frost damage, sulphate attack, alkali silica reaction, delayed ettringite formation, methods of providing durable concrete, short-term tests to assess long-term behaviour.

Mix design: Review of methods and philosophies of IS, BS and ACI methods, mix design for special purposes. Acceptance criteria for compressive strength of concrete

Special concretes: Lightweight concrete, autoclaved aerated concrete, no-fines concrete, lightweight aggregate concrete and foamed concrete, High strength concrete, refractory concrete, high density and radiation-shielding concrete, polymer concrete, fibre-reinforced concrete, mortars, renders, recycled concrete, Ferro Cement, Self Compacting Concrete.

 Special processes and technology for particular types of structure: Sprayed concrete, underwater concrete, grouts, grouting and grouted concrete, mass concrete, slip form construction, pumped concrete, concrete for liquid retaining structures, vacuum process, concrete coatings and surface treatments.

 Test methods: Analysis of fresh concrete, Accelerated testing methods, Tests on hardened concrete, Core cutting and testing, partially destructive testing, Non-destructive testing of concrete structures

Text Books

1. Properties of Concrete, A.M.Neville, Longman 1995.

2. Concrete Technology Theory and Practice, M.S.Shetty, S.Chand & Company Ltd, New Delhi.

Reference

1. Concrete micro-structure, Properties and Materials, P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw Hill, USA.

 CTPM1.5(b) CONSTRUCTION ECONOMICS

 Economic Decision Making – payback period, Rate of return on investment, Cash-flow diagrams, time, Value of money. Cost benefit analysis, Break-even analysis, assessment of time for arriving break even. Risks, Uncertainties and Management decision in capital budgeting, Uncertainties due to improper planning. Work pricing, Client’s estimation of project costs, Bidding price, Price Escalation, Revision. Construction accounting, income statement, depreciation and amortization, Taxation and inflation, effect of inflation on cash-flow. Working capital management, International finance and budgeting, Budgetary performance appraisal.

 Text Books 1. Construction Economics: A new Approach by Danny Myers, Taylor and Francis Publisher, 2004. 2. The Construction Industry Aspects of its Economics and Management, Singapore University Press, 1990.

 CTPM1.6 COMPUTER APPLICATIONS IN
STRUCTURAL ENGINEERING

 Application of software’s in Structural Engineering (by using STAAD Pro,ETABS, STRAP, STRUDS etc) for the following problems. 1. Analysis and Design of Beams. 2. Analysis and Design of Footings. 3. Analysis and Design of Trusses. 4. Analysis and Design of Two Dimensional Frames. 5. Analysis and Design of Three Dimensional Frames. 6. Analysis and Design of Water Tanks. 7. Analysis and Design of Steel Members. 8. Implementation of Concepts of FEM using a Computer Language

 CTPM1.7 CASE STUDIES

 Candidates have to submit TWO case studies of construction projects of considerable size with all details related to various aspects like planning, design, construction, safety, EIA of the project, labour management, legal and other aspects etc, in a report format.

II – SEMESTER

CTPM2.1 PROJECT ADMINISTRATION

Preconstruction Operations – Constructability Analysis, Issuance of Bidding Documents, Prequalification of Bidders, Bonds, Opening Acceptance and Documentation of Bids. Construction Administration, Organizational Structure, Lines of Authority on Construction Projects, Responsibility, Staffing Responsibilities, Design Build Contracts, Responsibility for Coordination of the trades. Familiarization with construction documents, Certainty, Risk and Uncertainty, Risk Management, Identification and Nature of Construction Risks, Contractual allocations of Risk, Types of Risks, Minimizing risks and mitigating losses, use of expected values, utility in investment decisions, decision trees, sensitivity analysis. Control of Quality in Construction

Reference Books

1. Construction Project Administration by E.R.Fisk, (2000) Prentice hall International, London.

2. Construction Project Administration by A.A.Kwakye, (1977) Adission Wesley Longman,

 CTPM2.2 CONTRACTS AND LEGAL ISSUES

Execution of Works – Direct execution by Department – Muster Roll (form 21) – Piece work agreement – Work Order. Execution through contractor – Definitions – Types of contracts – Lump sum contract, Item rate contract, Cost plus fixed fee contract, Cost plus percentage contract, Special contracts. Contract document – Conditions of Contract – Tender notice – Bidding procedure – Scrutiny and acceptance of tender, award of contract – Earnest money deposit and Security deposit - Termination of contract. Disputes – Settlement through arbitration – Indian Arbitration Act 1940 – Clauses and advantages of arbitration. Specifications – Importance, Design and Writing of Specifications – Types of Specifications – General, Detailed, Standard, Special, Restricted and Manufacturer’s specifications. Accounts – Advances, Earnest money and Security deposits, First and final bills, Fines, Recovery, Closing of accounts. Labour legislation – Factory Act 1948, Contract Labour Act 1970, Trade Union Act, Minimum Wages Act 1948, Workmen Compensation Act 1923, Industrial Disputes Act 1947. Labour Welfare – Labour welfare fund act 1965, Employees State Insurance act 1948, Incentives,

Labour welfare measures.

Reference Books

1. Construction Management and Accounts by B.L.Gupta and Amit Gupta

2. Construction Management and Projects by B.Sengupta and H Guha

3. Construction Planning and Management by P.S.Gelhot and BM Dhir.

 CTPM 2.3 SAFEY MANAGEMENT

Safety management function, line versus staff authority, safety responsibility and accountability in construction industry. Safety and its importance in construction industry, hazards in construction projects, causes of accidents, cost of an accident. Experience Modification Rating, Workers insurance, general safety programs in construction industry, construction safety problems. Case based reasoning, case indexing, retrieval, accident prevention and forecasting using CBR method. Systems safety analysis, faulty tree analysis, failure modes and effects analysis in construction industry.

Reference Books

 1. Safety Management by John V. Grimaldi, (1996). AITBS Publishers & Distributors, New Delhi, India.

2. Construction Project Administration by A.A.Kwakye, (1997), Adisson Wesley Longman, London.

 CTPM2.4(a) DISASTER MANAGEMENT

 Common Syllabus for CTPM2.4(a) and EEM2.4(a)

 Types of Disasters: Disaster - concept and definitions of disaster, causes of disasters, types – natural disasters – floods, droughts, cyclones, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold wave, global warming, sea level rise, ozone depletion. Man-made disasters: Sociological – political – industrial and human disasters. Risk Assessment and Analysis Concept and elements of Hazards, Risks and Vulnerability – Policies of Disaster Management, Identification of Crisis Situation, strategic developments, roles and responsibilities of recovery team, importance of team building in disaster management. Disaster Preparedness: Prevention and Preparedness – Plan, Action and Accountability, Concept and Nature of Disaster Preparedness, Plan of Disaster Preparedness for People with Special Needs/Vulnerable Groups, with Relevance to Housing, Infrastructure and Livestock, Community Based Disaster Preparedness Plan, Role of Information technology, Education, Communication and training. Medical and health preparedness plan. Disaster Damage Assessment and Response: Needs and Damage Assessment– Control process and measurement – modern and traditional methods of response, Disaster Response Plan – roles of response teams and forces. Epidemiological Study of Disasters - Medical and Health Response to Different Disasters - Role of Information and Communication Technology in Health Response Disaster Mitigation and Recovery: Disaster Mitigation – meaning and concept – structural mitigation and non-structural mitigation – mitigation strategies and emerging trends. Reconstruction and rehabilitation for development, Medium and long-term recovery aspects, Participative Rehabilitation Process: Community involvement and development of infrastructure.

References: 1. Disaster Management by Dr. Mrinalini Pandey, Wiley India Pvt. Ltd. 2. Natural Hazards & Disaster Management by R.B.Singh 3. Disaster Management: Future Challenges and opportunities by Jagbir Singh4 4. Natural Disaster Management ,Jon Ingleton 5. Disaster Management,Rajib Shaw and RR Krishnamurthy, Universities Press, Hyderabad.

 CTPM2.4(b) GROUND IMPROVEMENT TECHNIQUES

 Common Syllabus for SMFE2.4(b),
CTPM2.4(b), ST2.4(b) and TE2.4(a)

Compaction: Theory of compaction, Shallow Surface Compaction - Equipment, Placement water content, factors affecting shallow compaction; Deep compaction: Methods - Vibrofloatation, Terra probe method, Pounding, Blasting, Compaction piles; Compaction Control.

Vertical Drains: Sand drains, Sand wicks, Rope drains, Design of vertical drains, Stone columns, application of the techniques to Marine clays.

 Stabilization: Introduction, objectives, Methods of stabilization – Mechanical, Cement, Lime, Bituminous, Calcium chloride; construction methods, factors affecting stabilization of soils; Deep Mixing methods – Soil lime Columns and Cement Lime Columns, applications

 Dewatering: Definition, necessity, Methods of dewatering – Interceptor ditch, Single, Multistage and Vacuum well points, Horizontal wells, Electro-osmosis. Permanent drainage by Foundation drains and Blanket drains.

 Grouting: Definition, Objectives of grouting, Grouts and their properties, Categories of Grouting, Grouting methods: Asending, Descending and Stage Grouting in Soils, Hydrofracture, Grouting Equipment, Post grouting tests.

 In-situ Reinforcement: Ground Anchors, Tiebacks and Soil Nailing, Micropiles.

Text Book

 1. Ground Improvement Techniques by P. Purushothama Raj, Laksmi Publications, New Delhi.

Reference Books

1. Engineering Principles of Ground Modification by Monfred R Hausmann, Mc Graw Hill Publishing Co.

2. Reinforced Soil and Its Engineering Applications by Swami Saran, I.K. International Pvt. Ltd.

 CTPM2.5(a) PRESTRESSED CONCRETE

 Common Syllabus for ST2.5(a) and CTPM2.5(a)

 Introduction: Basic concepts of prestressing need for high strength steel and concrete, advantages of prestressed concrete. Materials for prestressed concrete, high strength concrete and high strength steel.

 Prestressing systems and losses of prestress: (1) Freyssinet Anchorage System (2) Gifford Udall System (3) Magnel-Blaton System, Tensioning devices, anchoring devices. (d) Pretensioning and Post tensioning. Prestressing losses, Elastic shortening, loss due to shrinkage, loss due to creep, loss due to friction, loss due to slip etc. I.S.code provisions. Analysis of prestressed Concrete Beams: Assumptions, Analysis of prestress, Resultant stresses at a section, pressure or thrust line, concept of load balancing, cable profile, kern distance, stress in tendons as per IS 1343, cracking moment. Shear and Torsional Resistance of Prestressed Concrete Members: Shear and Principal Stresses, Ultimate Shear Resistance of Prestressed Concrete Members, Design of Shear Reinforcements, Prestressed Concrete members In Torsion, Design of Reinforcements for Torsion, Shear and Bending Transfer of prestress in Pretensioned members: Transmission length, bond stress, Transverse tensile stress, End Zone reinforcement, flexural bond stress, I.S. Code Provisions. Anchorage zone in post tensioned members: Introduction, stress distribution in End block, Investigation on Anchorage Zone Stresses- Magnel’s method, Guyon’s method of approach of analysis of end block (Not more than 2 cables).

 Deflection of Prestressed Concrete Members: Importance of Control of Deflections, Factors Influencing Deflections, Short-Term Deflection of Uncracked members, Prediction of Long

Time Deflections, Deflection of Cracked Members, Requirements of various Codes of Practice.

Text Book

1. Prestressed Concrete by N.Krishna Raju, Tata McGraw-HillPublishing Company Limited.

Reference Books

1. Prestressed Concrete by N.Rajagopalan, Alpha Science.

2. Prestressed Concrete Structures by P. Dayaratnam, Oxford & Ibh

3. Design of Prestressed Concrete Structures by T.Y. Lin and Ned. H. Burns, John Wiley and Sons.

 CTPM2.5(b) STRATEGIC MANAGEMENT OF CONSTRUCTION PROJECTS

 Introduction to Strategic Management Concepts-necessity and significance of strategic management. Different approaches of Strategy Formation and Implementation-procedures- problems encountered. External and Internal Environment Analysis. Financial Strategies-budget allocation for different tasks -Decision and Analytical Tools. Corporate Strategic Events, Leadership and Decision-making, Corporate Social Responsibility.

Text Books

1. David Langford, Steven Male, Strategic Management in Construction, 2nd Edition, John Wiley and Sons, 2008

2. Richard Fellows, Construction Management in Practice, 2nd Edition, Blackwell Science

 CTPM2.6 : REPAIR AND REHABILITATION OF STRUCTURES

 Materials: Construction chemicals, Mineral admixtures, Composites, Fibre reinforced concrete, High performance concrete, Polymer-impregnated concrete.

 Techniques to Test the Existing Strengths: Destructive and non-destructive tests on concrete.

 Repairs of Multi-storey Structures: Cracks in concrete, Possible damages to the structural element beams, Slab, Column, Footing, etc., Repairing techniques like Jack Chu, Grouting, External pre-stressing, Use of chemical admixtures, Repairs to the fire damaged structure.

 Repairs to Masonry Structures & Temples: Damages to masonry structures – Repairing techniques, Damages to temples – Repairing techniques.

 Foundation Problems: Settlement of soils – Repairs, Sinking of piles – Repairs.

 Corrosion of Reinforcement: Preventive measures – Coatings – Use of SBR modified cementitious mortar, Epoxy resin mortar, Acrylic modified cementitious mortar, Flowing concrete.

 Temporary Structures: Need for temporary structures under any Hazard, Various temporary structures, Case-studies.

 Case Studies: At least 2 case studies per each student.

Text Books

1. Forensic Engineering by Raikar, R.N.

2. Deterioration, Maintenance and Repair of Structures by Johnson, McGraw Hill.

Reference Books

1. Renovation of Structures by Perkins. 2. Repairs of Fire Damaged Structures by Jagadish, R.

 CTPM 2.7 : CONSTRUCTION ENGINEERING LABORATORY

Concrete Mix Design – by BIS, ACI and BS method – proportioning, Batching, Mixing, Moulding of specimens for compression, Modulus of Elasticity and Modulus of Rupture – Testing of specimens as per relevant of practice (comparative study). Development of correlation between Non-Destructive and Destructive Tests using Rebound Hammer & UPV instruments. Influence of following parameters on NDT readings – experimental observations. Aggregate – Cement ratio, Water Cement Ratio, Excess / Deficient Cement, Excess / Deficient Water, Aggregate Type. Strain and deflection measurement for a structural member under single point / two point loading crack propagation observation, measurement and plotting.

 CTPM 2.8 : SEMINAR

 The student has to give series of oral presentations on a selected topic and submit a brief report and attend a formal viva-voce examination at the end of the semester.

 III – SEMESTER

 CTPM3.1(a) ENVIRONMENTAL IMPACT ASSESSMENT

Concept of Environment – Definition of EIA and EIS – Elements of EIA – Guidelines for the preparation of EIS – Governmental policies for environmental protection. Environmental setting – Environmental attributes – air, water, soil, noise, ecological, social, economical, cultural, human and aesthetic aspects – Environmental indices. Methodology for the identification of Impacts – Criteria for the selection of methods – Methodologies- Adhoc, checklist, Overlaying, Matrix and Network methods. Prediction and Assessment of Impacts on – air, water, soil, noise, ecological, social, economical, cultural, human environments and aesthetic aspects. Review of Environmental Impact Statement – Cost benefit analysis – Measures for environmental impact mitigation and control – Case Studies.

Reference Books

1. Environmental Impact Analysis by Urban and Jain.

2. Environmental Impact Analysis by Canter.

3. Environmental Impact Assessment Methodologies by Y Anjaneyulu, and Valli Manikkam, BSP Books PVT Ltd

4. Environmental Impact Assessment by Anji Reddy, BSP Books PVT Ltd

 CTPM3.1(b) OPERATIONS RESEARCH

 Common Syllabus for CTPM3.1(b) and TE3.1(b)

 Linear Programming – Problem Formation, graphical Solution methods

The Simplex Method – Two–Phase Simplex method, Formulation of L.P.P and its solutions by SIMPLEX Method.

 Duality in Linear Programming – Fundamental properties of Duality, Duality and Simplex method, Bounded variable simplex algorithm.

 The Transportation Problem – The North–West Corner rule, The Row minimum Method, The Column minima method, The Matrix minima method, Vogel’s Approximation method, The Transportation Algorithm, Unbalanced Transportation Problems.

 Assignment and Routing Problems –The Assignment Problem, Unbalanced Assignment Problem, Travelling Salesman Problem.

Queuing Theory – Characteristics of Queuing systems, Queue discipline, service channels, Poisson process and Exponential distribution, Distribution of Inter-travel times, Classification of Queues, The M/1/1 Queuing system (Model I to IV), The M/M/C Queuing System (Model I to IV), Non – Poisson Queuing Systems.

Text Books

1. Operation research by Kanti Swarup, Gupta and Manmohan.

2. Operation research and statistical analysis by S.D.Sharma

Reference Books

1. Operations Research by Ranganath, Yes Dee publishing Pvt Ltd

2. Introduction to Optimization: Operation Research by J.C. Pant, Jain Brothers. Delhi.

3. Operation Research by Pannerselvam, Prentice Hall of India

4. Operation Research by Iyer, TMH

 CTPM3.2(a) : MANAGEMENT INFORMATION SYSTEMS

 Importance of Management Information Systems (MIS), Manger’s View of Information systems, Functions of Management, managerial role in the Construction Organization. Decision Making in Construction Industry, role of Management Information Systems in decision making. Strategic Uses of Information Technology, Inter Organizational Systems, Strategic Information Systems related to Construction Industry, Process of Reengineering Work. Information Technology, Classification of Information Systems, Role of Information Technology in Construction Industry, Impact of Information Technology on the Individuals and Organization. File Structures and Processing methods in Construction Organizations, Data base Concepts, An Data Base management systems, Knowledge Based management systems.

 Reference Books

1. Management Information Systems - The Manager’s View. Robert Schultheis, Mary Sumner. (1999).Tate McGraw Hill Edition, New Delhi.

2. Construction Project Administration, Kwakye, A.A.(1997), Adisson Wesley Longman,

3. Management Information Systems by Sumner, Tata McGraw Hill Publication

CTPM3.2(b) : INFRASTRUCTURE VALUATION

 Function analysis; FAST diagramming; brain storming; criteria scoring matrices. An introduction to value theory; an introduction to value management. Value Engineering-Definition and concepts of the creative and structured phases of value engineering. The workshop approach to achieve value- procedures- merits and demerits-detailed analysis. Teambuilding theory; target setting; time management.

Text Books

1. Lawrence D. Miles, Techniques of Value Analysis and Engineering, McGraw-Hill Book Company, 2009.

2. M.R.S. Murthy, Cost Analysis for Management Decisions, Tata McGraw-Hill Publishing Company Ltd.,1988.

 CTPM3.3 : THESIS (PRELIMINARY)

 The student shall submit a brief report on the selected topic of his/her dissertation work and attend for a formal viva-voce examination before a committee comprising the Chairman, BOS, Head of the Department and the Guide.

 IV – SEMESTER

 CTPM 4.1 THESIS (FINAL)

 The student shall submit his/her dissertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, the Guide and the External Examiner.

Civil Engineering

M. Tech. (TRANSPORTATION ENGINEERING)

Scheme of Instruction and Examination

(With effect from 2019 – 20 Admitted Batch)

 I – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

TE1.1 Urban Transportation Planning 4 -- 4 3 70 30 100 3

TE1.2 Analysis and Design of 4 -- 4 3 70 30 100 3 Pavements

TE1.3 Traffic Engineering and 4 -- 4 3 70 30 100 3 Management

**Program Elective –I**
TE1.4 (a) Advanced Foundation
 Engineering 4 -- 4 3 70 30 100 3
 (b) Analysis of Transportation
 Systems
 (c) Pavement Management
 Systems

**Program Elective –II**
TE1.5 (a) Probability and Statistics
 (b) Bridge Engineering 4 -- 4 3 70 30 100 3

TE1.6 Computational Transportation - 3 3 Viva 50 50 100 1.5 Engineering Laboratory

TE1.7 Traffic Engineering Laboratory - 3 3 Viva 50 50 100 1.5

 Total 20 6 26 450 250 700 18

 II – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

TE2.1 Geometric Design of 4 -- 4 3 70 30 100 3 Highways

TE2.2 Traffic Flow Theory 4 -- 4 3 70 30 100 3

TE2.3 Transportation Economics 4 -- 4 3 70 30 100 3
 and Project Appraisal

Program Elective –III
TE2.4 (a) Ground Improvement
 Techniques 4 -- 4 3 70 30 100 3
 (b) Environmental Impact
 Assessment
 (c) Project Planning and
 Management

Program Elective –IV
TE2.5 (a) Design and Maintenance
 of Rural Roads 4 -- 4 3 70 30 100 3
 (b) Finite Element Method
 of Analysis

TE2.6 Pavement Material and - 3 3 Viva 50 50 100 1.5 Evaluation Lab.

TE2.7 Highway Construction Practice - 3 3 Viva 50 50 100 1.5

TE2.8 Seminar - 3 3 Viva 50 50 100 2

 Total 20 6 29 500 300 800 20

 III SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

Program Elective –V
TE3.1 (a) Disaster Management 4 -- 4 3 70 30 100 3
 (b) Operations Research

Program Elective–VI
TE3.2 (a) GIS Applications in 4 -- 4 3 70 30 100 3
 Transportation Engineering
 (b) Geoenvironmenta l
 Engineering

TE3.3 Dissertation (Preliminary) -- -- -- Viva -- 100 100 8

 Total 8 -- 8 140 160 300 14

 IV SEMESTERIV SEMESTER

Code No. Course Title Scheme of Examination Total Credits

 Exam (hrs) Ext. Sess.

TE4.1 Dissertation (Final) Viva 100 -- 100 16

 Total 16

Civil Engineering

M.Tech. (TRANSPORTATION ENGINEERING)

(With effect from 2019 – 20 Admitted Batch)

 I–SEMESTER

 TE1.1 URBAN TRANSPORTATION PLANNING

 Transport Planning: Introduction, Systems approach, Stages in transport planning, survey and analysis of existing conditions, forecast analysis of future conditions and plan synthesis and Evaluation. Transportation Survey: Definition of study area, Zoning and types of survey – Home interviews, taxi surveys etc., Inventory of transport facilities, expansion of data from samples. Trip generation: Trip purpose, Multiple Linear Regression Analysis, Category analysis.

 Trip Distribution: Uniform factor method, Average factor method, Fratar method, Furness method, Gravity model, Trannar's model, Opportunity model.

 Traffic Assignment: All or Nothing Assignment, Multiple Route Assignment, Capacity Restraint Assignment, Design Curves.

 Modal Spilt: General Considerations, Modal spilt in Transport planning process

 Economic Evaluation: Need, Basic principles, Costs and Benefits of Transport projects – Cost categories, Benefits –Types of benefits, Methods of economic evaluation – Benefit – Cost Ratio method, First Year Rate of Return method, Net present Value method, Internal Rate of Return method – Comparison between methods of economic evaluation.

Text Books:

 1. Introduction to Transportation Planning - M.J.Bruton; Hutchinson of LondonLtd.

2. Introduction to Urban System Planning - B.G. Hutchinson,Mc Graw Hill. 3. Traffic Engineering and Transport Planning - Kadiyali L.R. KhannaPublishers

Reference Books:

 1. Urban Transportation Planning Guide - Roads &Transportation Association of Canada; University of TorontoPress.

2. Lecture notes on UTP - Prof. S.Raghavachari, R.E.C.Warangal

3. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das, PHI Learning.

 TE1.2 ANALYSIS AND DESIGN OF PAVEMENTS

 Pavement Types, Design Factors: Definition, Comparison of pavements. Types of pavements based on structural behavior – Flexible and Rigid Pavements, Comparison, components and their functions, Soil subgrade, sub-base, Base course and wearing course. Design wheel loads – Equivalent Single Wheel Load (ESWL), Repetitions of loads. Strength characteristics of pavement materials – subgrade modulus, Elastic moduli of base course and sub-base materials, Traffic and Loading, Environment, Materials, Failure criteria. Climatic Variations

Stresses in Flexible Pavements: Layered System Concepts: One Layer System - Boussinesq Theory. Two Layer Theory - Burmister's Theory. Three Layer System.

 Stresses in Rigid Pavements: Relative Stiffness of Slabs, Modulus of Subgrade Reaction, Stresses due to Warping, Stresses due to Friction, Stresses due to Wheel Load, Stresses due to temperature variation (temperature differential).

 Pavement Design: Design of Flexible pavements – Group-Index method, California Bearing Ratio(CBR) method, Mc leod method, Burmister Method, IRC Method of Flexible Pavement Design as per IRC 37 –2001, AASHTO Method of Flexible Pavement. Design of Air field Pavements – Corps of Engineers method

 Design of Rigid pavements – Design of Joints, Expansion Joints, Contraction Joints, Design of Dowel and Tie bars. IRC recommendations for Rigid pavements as per IRC 58-1988. Design of Airfield Rigid pavements– LCN System of Pavement design.

 Pavement Failures: Flexible pavements – Alligator cracking, Longitudinal cracking, Frost heaving, lack of binder to lower course, formation of waves on corrugation, Reflection cracking.

 Pavement Inventories: Serviceability Concepts, pavement serviceability index, Roughness for measuring unevenness, Profilograph, profilometer, road roughometer, Benkelman beam deflection method, Skid resistance measurement.

 Pavement Evaluation: Structural Evaluation of Benkelman beam. Evaluation of Pavement surface measurement condition using instruments (Profilograph, bump Integrator)

 Overlays: Types of overlays – Flexible overlay over Flexible Pavements, Rigid overlay over Flexible Pavements, Flexible overlay over Rigid Pavements, Rigid overlay over Rigid Pavements. Design of overlay using Benkelman beam using IRC 81-1997. Concrete Block Pavements – Types and shapes, Construction and maintenance.

TextBooks:

1. Principles of Pavement Design by Yoder and Witzorack,, John Willey and Sons.

2. Highway Engineering, S.K. Khanna and C.E.G Justo and A. Veeraragavan, Nemchand Brothers publications.

3. Airport Planning and Design by S.K. Khanna and S. Arora, Nemchand and brothers publications.

 Reference Books:

1. Yang, H. Huang, “Pavement Analysis and Design”, Prentice Hall Publication, Englewood Cliffs, NewJersy.

2. Sargious, M.A. Pavements and Surfacings for Highways and Airports– Applied science Publishers limited

3. Ralps Hass and Hudson, W.R. “Pavement Management System” Mc-Graw Hill Book Company.

4. Guidelines for the use of Interlocking concrete block Pavement, IRC:SP:63-2004

5. IRC codes of practice.

6. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das, PHI Learning.

 TE1.3 TRAFFIC ENGINEERING AND MANAGEMENT

Traffic Characteristics: Basic traffic characteristics - Speed, volume and concentration – Relationship between Flow, Speed and Concentration

 Traffic Measurement and Analysis: Volume Studies - Objectives, Methods, Speed studies - Objectives: Definition of Spot Speed, time mean speed and space mean speed, Methods of conducting speed studies. Speed Studies: Methods of conducting speed studies, Presentation of speed study data; Headways and Gaps, Critical Gap, Gap acceptance studies.

 Highway Capacity And Level Of Service: Basic definitions related to capacity, Level of service concept, Factors affecting capacity and level of service, Computation of capacity and level of service for two lane highways Multilane highways and freeways.

 Parking Studies and Analysis: Types of parking facilities - on street parking and off street Parking facilities, Parking studies and analysis.

 Traffic Safety: Accident studies and analysis, Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents.

 Traffic Control And Regulation: Traffic Signals - Design of Isolated Traffic Signal by Webster method, Warrants for signalisation, Signal Co-ordination methods, Simultaneous, Alternate, Simple progression and Flexible progression Systems.

 At–grade intersections, sight distance considerations and principles of design, channelization, mini round-abouts, layout of round-abouts. Advantages and limitations of round-abouts.

 Rotary Intersections: Definitions – Diverging, Merging, Weaving, Weaving Length, Advantages and Disadvantages. Rotary Design Elements – Design Speed, Radius at Entry, Radius at Exit, Width of Rotary Carriage way, Entry and Exit angles, External kerb line, Super elevation and camber- Capacity of rotary.

 Interchanges – Advantages and Disadvantages, Major and minor interchanges, entrance and exit ramps, acceleration and deceleration lanes, bicycle and pedestrian facility design.

Traffic And Environment: Detrimental effects of Traffic on Environment; Air pollution; Noise Pollution; Measures to curtail environmental degradation due to traffic.

 Traffic Management – Transportation System Management – Travel Demand management – Traffic Management measures – Purpose, Measures – Types of traffic management measures – Restriction of Turning Movements – One - way streets – Tidal Flow operations – Closing Side Streets – Exclusive Bus Lanes.

Text Books

1. Traffic Engineering and Transportation Planning - L.R. Kadiyali, KhannaPublishers.

2. Highway Engineering, S.K. Khanna and C.E.G Justo and A. Veeraragavan, Nemchand Brothers publications.

3. Transportation Engineering - An introduction - C. Jotin Khistry, Prentice HallPublication.

4. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India

Reference Books

 1. Traffic Engineering - Theory &Practice - Louis J. Pignataro, Prentice HallPublication.

2. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter P. Kilareski, John Wiley & Sons Publication.

3. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das, PHI Learning.

TE1.4(a) ADVANCED FOUNDATION ENGINEERING

 Common Syllabus for SMFE1.2, CTPM1.4(a),
TE1.4(a) and ST1.4(a)

 Introduction Principles of Design of Foundations, Types of shear failures in foundation soils, Types of foundations, Design Loads, Basic Concepts of safe and allowable bearing capacity. Shallow Foundations Bearing Capacity Analysis: Bearing capacity theories – Terzaghi, Meyerhof, Skempton, Hansen, Vesic and IS Methods, Bearing capacity evaluation from Standard Penetration test and Plate load test. Settlement Analysis: Uniform and Differential Settlements, Elastic and Consolidation Settlements, Settlement analysis in cohesionless soils by Schemartmann and Hartman method, Penetration tests; Permissible settlements as per IS 1904-1978, causes of settlement, settlement Control. Proportioning of footings: Isolated column footings, Strip, combined Footings and Strap Footing. Raft Foundations: Bearing capacity of raft foundation, floating raft, Types of rafts, Beam on Elastic foundation and Conventional methods of Design, determination of modulus of subgrade reaction. Deep Foundations Pile Foundations: Types, load capacity- dynamic formulae, static formula; pile load tests- Vertical load test, lateral load test, Cyclic load test; settlement of piles and pile groups, negative skin friction on single pile and pile groups; laterally loaded piles - Broom?s Analysis, IS Code method; Under reamed piles – Load capacity, design and construction. Well Foundations: Types, Bearing Capacity of well foundations, Construction of pneumatic caissons, Tilts and Shifts: precautions, Remedial measures; Lateral stability analysis by Terzaghi's Method, Design aspects of Components of well foundation. Foundations in Expansive Solis Introduction, Identification of expansive soils, Swell potential and swelling pressure, Active depth, Foundation Problems, Foundation practices in expansive soils, Soil Replacement and, CNS concepts. Foundations of Transmission Line Towers Introduction, Necessary information, Forces on tower foundations, General design criteria, Choice and type of foundation, Design procedure.

Text Books

1. Analysis and Design of Substructures by Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.

2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publications

Reference Books

1. Foundation Analysis and Design by J.E. Bowles, Mc Graw Hill Publishing Co.

2. Foundation Design by W.C. Teng, John Wiley, New York.

3. Analysis and Design of Substructures by Swami Saran, Oxford &IBH Publishing Co.

4. Foundation Engineering by P.C. Vargheese, Prentice Hall of India

 TE1.4 (b) ANALYSIS OF TRANSPORTATION SYSTEMS

 Traffic Regulations: Purpose and Scope, One way streets; reversible lanes and road ways; Turn regulations, Transit and Carpool lanes, Bicycle lanes and Bikeways, Pedestrian only streets, Speed Regulations, Passing and No Passing Regulations; Stop and yield controls.

 Traffic Management: Need for Traffic Management, Basic Traffic Management Activities, Traffic Management Strategies and their Coordination; Access Management, Congestion Management, Traffic Calming, Evaluation of Traffic Management Systems.

 Transportation System Management: Objectives, Need for TSM Long – Range vs. TSM Planning; TSM Actions, Traffic Management Techniques for improving Vehicular Flows, Preferential Treatment for High Occupancy Modes; Promoting Non- Auto and High Occupancy Vehicles; Transit and Intermediate public Transport service improvements, Demand Management Techniques for Reduced Intermediate Public Transport service improvements, Demand Management Techniques for Reduced Traffic Demand, Staggered Working Hours, Vehicular Restrictions, Intersection management techniques- Signal Progression – Optimization.

Local Area Traffic Management: Pedestrian Facilities; Bicycle Facilities; Traffic Planning and Management at Local Level; Individual Sites, Residential Neighborhoods and local interests, Traffic Effects of Land Use Developments.

Traffic Administration: Legislative Authority; Functional Responsibilities; Organization UMTA- State Highway Department; Traffic Records; Research Bodies; Citizen Participation; Asset Management.

Text Book

 1. Khisty CJ and BK Lall, Transportation Engineering: An Introduction Prentice Hall International, Inc

Reference Books

 1. Institution of Transportation Engineers. Traffic Engineering Hand Book, 4th ed., Prentice Hall

2. Transportation System Management, State of theArt, UMTA, USDOT

3. Local Area Traffic Management, TRB SpecialPublications

 TE1.4 (c) PAVEMENT MANAGEMENT SYSTEMS

 Pavement Management System: Components of PMS and their Activities, Major Steps in Implementing PMS, Inputs, Design, Construction and Maintenance, Rehabilitation and Feedback Systems, Examples of HDM and RTIM Packages, Highway Financing, Fund Generation, Evaluating Alternate Strategies and Decision Criteria.

 Pavement Inventories and Evaluation: Serviceability Concepts, Visual Rating, Pavement Serviceability Index, Roughness Measurements, Distress Modes - Cracking, Rutting etc, Pavement Deflection – Different Methods, Skid Resistance, Roughness, Safety Aspects. Inventory System - Assessment of Deficiencies.

 Pavement Maintenance And Quality Control: Causes of Deterioration, Traffic and Environmental Factors, Pavement Performance Modelling Approaches and Methods, Methods of Maintaining WBM, Bitumen and Cement Concrete Roads, Quality Assurance / Quality Control - ISO 9000; Sampling Techniques Tolerances and Controls Related to Profile and Compaction.

 Pavement Life Cycle Cost Analysis: Cost Components, Methods of LCA - Brief Description - Items Considered – Case Studies

 Pavement Maintenance Management: Components of Maintenance Management and Related Activities - Network and Project Level Analysis - Budgeting - Prioritisation Techniques and Formulation of Maintenance Strategies.

Text Books

 1. Sargious, M.A. - Pavements and Surfacing for Highways and Airports -Applied Science Publishers Ltd.

Reference Books

 1. Haas and Hudson, W.R. Pavement Management Systems - McGrawHill

2. Bridge and Pavement Maintenance - Transportation Research Record No.BOO,TRB

3. Shahin MY,1994 - Pavement Management for Airports, Roads and parkingLots.

4. Bent Thagesan,1996 Highway and Traffic Engineering for Developing Countries.

5. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das, PHI Learning.

 TE1.5(a) PROBABILITY AND STATISTICS

 Fundamental concepts and role of probability and statistics in civil engineering, collection and presentation of data – design of experiment.

 Elementary probability theory: random variables, conditional probability, theorem of total probability and Baye?s theorem.

 Probability distributions: Gaussian and log normal, Binomial geometric, Poisson exponential, Gamma uniform, triangular, Hyper geometric, Beta, Student's 'T', square, Fischer's F.

 Extreme – value: Gamble distributions, Central limit theorem, Moments and Expectations, Covariance matrix and Covariance propagation, weights. Estimation of parameters: Method of least squares – observation equations, normal equations, linear and nonlinear models.

 Confidence interval estimation and statistical testing: Tests of hypothesis and significance for mean, variance and ratio of variances, statistical inference, multi variety analysis, error analysis, error elapses derived probability distributions, goodness–of–fit tests.

 Regression: Linear, Non-linear and Multiple–linear Correlation analysis, Applications in Civil engineering.

Reference Books

 1. Ang, H.S. and Tang, W.H., Probability Concepts in Engineering Planning and Design, Wiley, New York,1975.

2. Benjamin, J.R. and Cornell, C.A., Probability Statistics and Decision for Civil Engineers, McGraw Hill, New York,1975.

3. Statistical Techniques for Transportation Engineering by Kumar Molugarm and Shanker Rao, BSP Books PVT Ltd.

 TE1.5(b) : BRIDGE ENGINEERING

 Introduction to bridge engineering. Historical background of bridges and types. Bridge aesthetics and proportioning. Design process. Review of applicable design codes. Loads on bridges and force distribution. Bridge geometry. Analysis and design of Slab Bridge, Skew slab bridge.

 Analysis and design of T-beam bridge: Deck slab considering IRC loads, longitudinal girders (Interior, Exterior), Cross girder. Analysis and design of prestressed concrete girder and box girder bridges considering only primary torsion, Design of end block.

 Bridge Bearing: Types of bearings, Rocker bearing, Elastomeric bearing.

Text book

1. Essentials of Bridge Engineering, D. Jhonson Victor, Oxford University Press.

Reference Books

1. Design of Bridges, N.Krishna Raju, Oxford & IBH Publishing Co.Pvt.Ltd, New Delhi

 TE1.6 COMPUTATIONAL TRANSPORTATION ENGINEERING LABORATORY

 1. Programming in C language – functions, arrays, strings, structures, file operations

2. Data structures.

3. Applications in Transportation Engineering.

 TE1.7 TRAFFIC ENGINEERING LABORATORY

1. Traffic surveys like traffic volume count, speed study, parking study, intersectionturning movements, speed & delay study.

2. Moving observer survey.

3. Origin–destination surveys.

4. Road side and house hold interviews.

5. Road lighting.

6. Traffic noise measurement.

7. Measurement of road user characteristics.

8. Use of automatic traffic recording equipment

Civil Engineering

M.Tech. (TRANSPORTATION ENGINEERING)

(With effect from 2019 –20 Admitted Batch)

II –SEMESTER

TE2.1 GEOMETRIC DESIGN OF HIGHWAYS

 Objects of Geometric design: Design controls Elements of design: Cross sectional Elements pavement surface Characteristics, Camber, Width of pavements – carriage-way, kerbs, road margins, Formation width, Right of way, Building line, control line. Sight distances – Stopping Sight Distance (SSD), Intermediate Sight Distance (ISD), Headlight Sight Distance (HSD), Overtaking Sight Distance (OSD). (“Geometric Design Standards for Rural (Non – Urban) Highways” – IRC: 73 -1980) (“Geometric Design Standards for Rural (Urban) Highways” – IRC: 86 - 1983)

 Horizontal alignment– Super Elevation analysis and design, Extra widening and side friction. Transition curves – types, Calculation of length. (“Guidelines for Design of Horizontal Curves for Highways and design tables” – IRC: 38 – 1988)

 Vertical alignment – Gradient, Types – Ruling, Limiting, Exceptional and Minimum gradient. Grade compensation. Vertical curves – Types- Summit and valley curve – Lengths. (“Vertical Curves for Highways”, IRC SP 23: 1993)

 At-grade intersections – sight distance considerations and principles of design, channelization, mini round-abouts, layout of round-abouts. Advantages and limitations of round-abouts. (Guidelines for the design of at-grade Intersections in Rural and Urban Areas”, IRC SP41: 1994)

 Rotary Intersections: Definitions – Diverging, Merging, Weaving, Weaving Length, Advantages and Disadvantages. Rotary Design Elements – Design Speed, Radius at Entry, Radius at Exit, Width of Rotary Carriage way, Entry and Exit angles, External kerb line, Super elevation and camber. Capacity of rotary (“Recommended practice for Traffic Rotaries”, IRC: 65 – 1976).

 Interchanges – Advantages and Disadvantages, Major and minor interchanges, entrance and exit ramps, acceleration and deceleration lanes, bicycle and pedestrian facility design. (“Guidelines for the design of Interchanges in Urban area”, IRC 92:1985)

 Parking layout and design. Terminal layout and design. (“Tentative Recommendation on the Provision of Parking Space for Urban Areas”, IRC SP 12: 1973)

Text Books

 1. Highway Engineering, S.K. Khanna and C.E.G Justo and A. Veeraragavan, Nemchand Brothers publications.

2. Khisty, C. J., and Lall, B. K., Transportation Engineering: An Introduction, Prentice Hall International, Inc.,2002.

Reference Books

1. AASHTO Design Guide, A Policy on Geometric Design of Highways and Streets,2001.

2. Fruin, Pedestrian Planning and Design, McGraw Hill Publication,2003.

3. Institution of Transportation Engineers, Traffic Engineering Hand Book, 4th Edition, Prentice Hall,1999.

4. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das, PHI Learning.

 TE2.2 TRAFFIC FLOW THEORY

 Traffic Flow Description: Traffic Stream Characteristics and Description Using Distributions: Measurement, Microscopic and Macroscopic Study of Traffic Stream Characteristics - Flow, Speed and Concentration; Use of Counting, Interval and Translated Distributions for Describing Vehicle Arrivals, Headways, Speeds, Gaps and Lags; Fitting of Distributions, Goodness of Fit Tests.

 Traffic Stream Models: Fundamental Equation of Traffic Flow, Speed-Flow-Concentration Relationships, Normalised Relationship, Fluid Flow Analogy Approach, Shock Wave Theory - Flow-Density diagram use in Shockwave analysis; Use of Time-space diagram for shockwave description; Bottleneck situations and shockwaves; traffic signal and shockwave theory; numerical Examples for application of shockwave theory;, Platoon Diffusion and Boltzman Like Behavior of Traffic Flow, Car-Following Theory, Linear and Non-Linear Car Following Models, Acceleration Noise, Fuel consumption models

 Queuing Analysis: Fundamentals of Queuing Theory, Demand Service Characteristics, Deterministic Queuing Models, Stochastic Queuing Models, Multiple Service Channels, Analysis of M/M/1 system; Assumptions and Derivation of System State Equations; Application of M/M/1 analysis for parking Garages and Toll Plazas- numerical Examples; Analysis of D/D/1 system for delay characteristics; Traffic Signal analysis as D/D/1 system; Computation of delays and queue dissipation Time – NumericalExamples.

 Pedestrian Delays And Gaps: Pedestrian Gap acceptance and delays; Concept of Blocks, Anti- blocks, Gaps and Non-Gaps; Underwood's analysis for Pedestrian Delays; Warrants for Pedestrian Crossing Facilities – Minimum Vehicular Volume Warrant, Minimum Pedestrian Volume Warrant, Maximum Pedestrian Volume Warrant.

 Simulation Models: Philosophy of Simulation Modelling, Formulation of Simulation Model, Methodology of System Simulation, Simulation Languages, Generation of Random Numbers, Generation of Inputs – Vehicle Arrivals, Vehicle Characteristics, Road Geometrics, Design of Computer Simulation Experiments, Analysis of Simulation Data, Formulation of Simulation Problems in Traffic Engineering and Validation; Basic concepts of simulation modelling application for Signalised Intersections, Pedestrian Crossings and Transit scheduling.

Text Book

1. Fundamentals of Transportation Engineering – C.S.Papacost as,Prentice Hall India Publication

Reference Books

1. Traffic Flow Theory: A Monograph , TRB Special Report165

2. Principles of Highway Engineering and Traffic Analysis –F.L.Mannering & W.P.Kilareski, John Wiley Publishers.

3. Traffic Flow Fundamentals – A.D. May, Prentice Hall India Publication

4. Fundamentals of Traffic Engineering – McShane & Rogers

 TE2.3 TRANSPORTATION ECONOMICS AND PROJECT APPRAISAL

 Transport Economics and Analysis: Review of Engineering Economics and Microeconomics, Welfare Theory and Equilibrium Conditions, Goals and Objectives, Principles of Economic Analysis. Discounted Cash Flows: Analysis of User Costs and Benefits, RUCS Models for Costs and Benefits, Methods of Economic Analysis; Suitability, Analysis for Null Alternative

 Investment Policies and Pricing: Average Cost, Marginal Cost, Allocation of Resources within Transport Sectors, Financing of Transport Sectors, Transport Investment Policies - Pricing Policies. Issues in transport policy: Budgeting, Non-user Impact Analysis, Analysis of Related Endeavour, Monitoring and Continuous Evaluation Strategies, Case Studies.

 System Selection, Evaluation And Cost Analysis: Framework of Evaluation, Transport Planning Evaluation at Urban andRegional levels, Other Evaluation Procedures - Traditional Economic Analysis, Achievement Matrices, Factor Profiles, Plan Ranking, Introduction to Mathematical Programming, Case Studies.

 Life cycle cost analysis: Factors consider for Life Cycle Cost Analysis; Data requirements for highway project feasibility analysis, establishment of Technical/ Economic/ Financial feasibility of a highway project, Social Benefits, Role of HDM in feasibility studies.

 Project Appraisal - Private Sector Participation: BOT, BOOT, BOLT Projects - Case history - Project Planning - Project System Management - Project Implementation - Funds Planning – Budgetary and Control - Tendering and Contract - Value Analysis, Information System - Impact assessment, Project Report Preparation.

 TQM in Highway Projects: Need for TQM, TQM Principles, Phases in TQM - Conceptual stage to Operations stage, TQM in Traffic & Transportation projects, Case Studies.

Text Book

 1. Lan Heggie, Transport Engineering Economics, McGrawHill

Reference Books

1. Highway investment in Developing countries - Thomas Telford Ltd.,Institute of CivilEngineers

2. Winfrey R, Economic Analysis for Highways - International Text Book Co.,Pennsylvania

3. Road User Cost Study - Final Report - Central Road Research Institute, NewDelhi

4. Dickey, J.W. - Road Project Appraisal for Developing countries, JohnWiley andSons.

 TE2.4(a) GROUND IMPROVEMENT TECHNIQUES

 Common Syllabus for SMFE2.4(b), CTPM2.4(b), ST2.4(b) and TE2.4(a)

 Compaction: Theory of compaction, Shallow Surface Compaction - Equipment, Placement water content, factors affecting shallow compaction; Deep compaction: Methods – Vibro floatation, Terra probe method, Pounding, Blasting, Compaction piles; Compaction Control.

 Vertical Drains: Sand drains, Sand wicks, Rope drains, Design of vertical drains, Stone columns, application of the techniques to Marine clays.

 Stabilization: Introduction, objectives, Methods of stabilization – Mechanical, Cement, Lime, Bituminous, Calcium chloride; construction methods, factors affecting stabilization of soils; Deep Mixing methods – Soil lime Columns and Cement Lime Columns, applications

 Dewatering: Definition, necessity, Methods of dewatering – Interceptor ditch, Single, Multistage and Vacuum well points, Horizontal wells, Electro-osmosis. Permanent drainage by Foundation drains and Blanket drains.

 Grouting: Definition, Objectives of grouting, Grouts and their properties, Categories of Grouting, Grouting methods: Ascending, Descending and Stage Grouting in Soils, Hydro fracture, Grouting Equipment, Post grouting tests. In-situ Reinforcement: Ground Anchors, Tiebacks and Soil Nailing, Micropiles.

Text Book

1. Ground Improvement Techniques by P. Purushothama Raj, Laksmi Publications, New Delhi.

Reference Books

1. Engineering Principles of Ground Modification by Monfred R Hausmann, Mc Graw Hill Publishing Co.

2. Reinforced Soil and Its Engineering Applications by Swami Saran, I.K. International Pvt. Ltd.

TE2.4(b) ENVIRONMENTAL IMPACT ASSESSMENT

 Concept of Environment – Definition of EIA and EIS – Elements of EIA – Guidelines for the preparation of EIS – Governmental policies for environmental protection.

 Environmental setting – Environmental attributes – air, water, soil, noise, ecological, social, economical, cultural, human and aesthetic aspects – Environmental indices.

 Methdology for the identification of Impacts – Criteria for the selection of methods – Methodologies- Adhoc, checklist, Overlaying, Matrix and Network methods. Prediction and Assessment of Impacts on – air, water, soil, noise, ecological, social, economical, cultural, human environments and aesthetic aspects. Review of Environmental Impact Statement – Cost benefit analysis – Measures for environmental impact mitigation and control – Case Studies.

Reference Books

1. Environmental Impact Analysis by Urban and Jain.

2. Environmental Impact Analysis by Canter.

3. Environmental Impact Assessment Methodologies by Y Anjaneyulu, and Valli Manikkam, BSP Books PVT Ltd

4. Environmental Impact Assessment by Anji Reddy, BSP Books PVT Ltd

TE2.4(c) : PROJECT PLANNING AND MANAGEMENT

 Introduction to Project Management: Systems Approach, Systems Theory and Concepts, Organization, Management Functions, Overview of Management Objectives, Tools and Techniques, Project Management - Processes and organizational Structures – Team Management - Project Manager as a Team Leader - Leadership Qualities, PMIS

 Construction Cost and Value Engineering: Types of Estimates, Implementation of Cost Controls, Project Cost Forecasting, Cost Optimization and Resources Planning - Value Engineering, Techniques for Project Selection, Break-Even Analysis, Cost Modeling, Energy Modeling, Life Cycle Cost Approach.

 Contract Management: Tendering and Contracting, Laws of Contracts, subcontracts, Potential Problems, Post Contract Problems, Documents, Conditions, Arbitration, Special Features of International Contracts.

 Quality Management and Safety in Construction Industry: Quality control by statistical methods, sampling plan, control charts, ISO 14000, Safety Measures, Safety Programmes, Safety Awareness and Implementation of Safety Plan – Compensation.

 Human Resource Management: Man Power Planning - Training - Motivation – Industrial Relations– Welfare Measures - MIS - Components and Structure - Personal Management.

 Resource Management and Inventory: Basic concepts, labour requirements and productivity, non-productive activities, site productivity, equipment and material management, inventory control.

 Construction Management Practices: Implementation of Procedures and Practices - International Experiences - Case Studies - Examples.

Text Books

 1. Herold Kerzner - Project Management - A systems approach to Planning, Scheduling and Controlling., CBS Publishers and Distributors.

2. Sengupta B and Guha H, Construction Management and Planning, Tata Mc Graw-Hil Publishing Company Limited, NewDelhi

Reference Books

1. K.Waker A Teraih and Jose M.Grevarn; Fundamentals of Construction Management and Organizations.

2. Anghel Patterson - Construction Cost Engineering Handbook - Marcel Dekken Inc.

3. Dell Isola - Value Engineering in Construction Industry, Van Nostrand ReinholdCo.,

4. Choudhary, S. Project Management, Tata McGraw Hill Publishing Co. Ltd.,

5. Raina UK, Construction management Practices, Tata Mc Graw hill Publishing Company Ltd.

6. A Guide to the Project Management Body of knowledge (PMBOK), Draft Copy, 1994. A Publication of the Project management Institute,USA.

 TE2.5(a) : DESIGN AND MAINTENANCE OF RURAL ROADS

 Introduction: Importance of Rural roads, Classification of rural roads, Terrain classification, Socio-economic impact of rural roads.

 Planning and Alignment: Data base for master plan, Concept of network planning, Rural Roads plan, Road alignment, Governing factors for route selection, Factors controlling alignment, Special considerations while aligning hill roads, Surveys, Detailed project report, Environmental issues

 Geometric Design: Introduction, Design speed, Basic principles of geometric design, Elements, Horizontal and vertical alignment, Alignment compatibility, Lateral and vertical clearances

 Road Materials: General, Soil and material surveys, Soil as road construction material, Stabilized soils, Aggregates for pavement courses, New materials and stabilizers, Materials for bituminous construction, Materials for semi-rigid and rigid pavement, Materials for special pavements Climatic suitability of concrete materials

 Pavement Design: Introduction, Design parameters, Pavement components, Design of flexible pavement, Design of semi-rigid pavement, Design of rigid pavement, Design of special pavements, Drainage and Shoulders

 Specifications and Construction: General, Selection of construction materials and methodology, Earthwork, Sub-base, Base course, Bituminous constructions, Semi-rigid pavement construction, Concrete pavements, Construction of special pavements, Equipment required for different operations.

 Green Road Concept and Use of Waste Materials: Introduction, Significance of green roads, Fly ash for road construction, Iron & steel and copper slags, Lime-rice husk ash concrete, Recycled concrete aggregate, Other waste materials.

 Quality Control in Construction: General, Pre-requisite, Specifications and codes of practice, Quality control tests during construction.

 Maintenance: General, Distresses/defects in pavements, Definitions of maintenance activities, Inventory of road and inspection, Types of maintenance, Classification of maintenance activities, Maintenance norms of maintenance cost.

Text Books

 1. Highway Engineering, S.K. Khanna and C.E.G Justo and A. Veeraragavan, Nemchand Brothers publications.

Reference Books

1. IRC: SP 20-2002, "Rural Roads Manual"

2. IRC: SP 72-2007, "Guidelines for the Design of Flexible Pavements for Low Volume Rural Roads."

3. IRC: SP 62-2004 „Guidelines for the Design and Construction of Cement Concrete Pavements for Rural Roads?

4. IRC, "Specifications for Rural Roads", MoRD, 2004

5. CRRI, "Various Reports on Use of Waste Materials".

 TE2.5(b) FINITE ELEMENT METHOD OF ANALYSIS

 Common Syllabus for ST2.2, SMFE2.5(b), WRE2.5(b), HCH2.5(b) and TE2.5(b)

 Introduction: A brief history of F.E.M. Need of the method, Review of basic principles of solid mechanics- Equations of equilibrium, Boundary conditions, Compatibility, Strain displacement relations, Constitutive relationship in matrix form, plane stress & plane strain and axisymmetric bodies of revolution with axi-symmetric loading, Energy principles - Raleigh - Ritz method of functional approximation.

 Theory relating to the formulation of the finite element method, Coordinate system (local and global), generalized coordinates, Concept of the element, Various element shapes, Discretisation of a structure, Mesh refinement Vs. Higher order element, Interconnections at nodes of displacement models, inter element compatibility, -shape functions.

 Basic component – One dimensional FEM single bar element, Beam element : Derivation of stiffness matrix, Assembly of stiffness, Matrix boundary conditions, shape functions for 1 D elements, Initial strain and temperature effects, and trusses under axial forces.

 Two dimensional FEM: Different types of elements for plane stress and plane strain analysis – Displacement models Generation of element stiffness and nodal load matrices –static condensation. Isoparametric representation and its formulation for 2d analysis. Formulation of 4-noded and 8-noded isoparametric quadrilateral elements – Lagrangian elements-serendipity elements.

Text Books

1. Finite Element Analysis by C.S.Krishnamoorthy, (2002), Tata McGraw Hill Publishing Co. Ltd.

2. Introduction to Finite Element Method by Desai,C.S.and Abel, J.F.,Van Nostrand, 1972.

Reference Books

 1. Introduction to Finite element Method by Tirupathi chandra Patla and Belugundu

2. The Finite Element Method in Engineering Science” by Zienkiewicz, P., McGraw Hill, 1971.

 TE2.6 : PAVEMENT MATERIALS AND EVALUATION LABORATORY

 1. Tests on aggregates – Specific gravity , Sieve Analysis , Shape test , Flakiness Index – Elongation Index –Angularity Number , Aggregate Crushing value, Impact value , Abrasion value, Attrition value, C.B.R Test

2. Tests on bitumen – Specific gravity, Penetration value, Viscosity value, Softening point, Ductility value, Flash and Fire point.

3. Tests on sub grade soil – C.B.R. test (IS 2720 – Part-XVI), N.D.C. Penetration test (IS 2720 Part-XXXII), Group Index.

4. Bitumen Extraction Test, Marshal Stability Test

5. Pavement Evaluation – Benkelman Beam Test

6. Marshal Mix design of bitumen and aggregates for different construction techniques.

 TE2.7 HIGHWAY CONSTRUCTION PRACTICE

 Embankment Construction: Formation cutting in Soil and hard rock, Preparation of Sub grade, Ground improvement – Methods – Rocks: Prefabricated vertical drain with surcharge, Rammed stone column using non-displacement method, Stone column using vibroreplacement (vibroflot) method. Soil: Lime treated soil for improved Subgrade/ Sub base, Cement treated soil and cement - fly ash subgrade/ sub base, Granular and Stabilized, Sub - bases / bases, Water Bound Macadam (WBM), Wet Mix Macadam (WMM), Cement treated bases, Dry Lean Concrete (DLC).

 Bituminous Constructions: Types of Bituminous Constructions - Interface Treatments,Prime Coat and Tack Coat, Bituminous Surface dressing, Seal coat, Penetration Macadam, Built up. Spray Grout, Premix methods , Bituminous macadam, Bituminous Premix carpet, Bituminous concrete or Asphalt Concrete ¬ Sheet Asphalt, Mastic Asphalt, Bituminous Surfacing and wearing Courses for roads, Selection of wearing Course under different Climatic and Traffic conditions, IRCspecifications, Construction methods – Surface dressing, penetration (grouted) macadam, Built up spray grout, premixed bituminous carpet and Quality Control. Concrete Road Construction: Test on Concrete mixes – Workability Tests – Slump cone, Veebee Consistometer test, Split - Tensile Strength test. Construction equipment, Method of construction of joints in concrete pavements, Quality Control in Construction of Concrete pavements, Construction of Pre-stressed, IRC, MORT&H, ACI Specifications, AASHTO Specifications, Recycled pavements, Non - Conventional Pavement materials.

 Hill Roads Construction: Retaining walls, Breast walls, Type of pavements for hill roads – reason for avoiding rigid pavements. Hill Road Drainage – Surface water flowing, side drains, Cross drainage, sub surface drainage. Maintenance of drainage structures.Slope Stability and Erosion Control – Causes for slope movements, and Control of Erosion of hill slopes. Landslides – types and preventions, Snow clearance, control of Avalanches.

(“Hill Roads Manual” – IRC: SP – 48)

 Overlays: Types of overlays – Flexible overlay over Flexible Pavements, Rigid overlay over Flexible Pavements, Flexible overlay over Rigid Pavements, Rigid overlay over Rigid Pavements.Design of overlay using Benkelman beam using IRC 81-1997.

Text Book

 1. Highway engineering by S.K Khanna,C.E.G. Justo and A. Veeraragavan, Nemchand brothers Publications

Reference Books

1. IRC and MORT & H ACI specifications,

2. AASHTO specifications

3. Specifications for Road and Bridge Works, MORTH, 5th Edition.

 TE2.8 SEMINAR

 The student has to do a mini project in the area of Transportation Engineering either from Experimental analysis or Fieldwork. He/she should present the work in the form of a report along with a power-point presentation.

 III – SEMESTER

TE3.1(a) DISASTER MANAGEMENT

 Types of Disasters-Disaster - concept and definitions of disaster, causes of disasters, types – natural disasters – floods, droughts, cyclones, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold wave, global warming, sea level rise, ozone depletion. Man-made disasters: Sociological – political – industrial and human disasters.

 Risk Assessment and Analysis-Concept and elements of Hazards, Risks and Vulnerability – Policies of Disaster Management, Identification of Crisis Situation, strategic developments, roles and responsibilities of recovery team, importance of team building in disaster management.

 Disaster Preparedness-Prevention and Preparedness – Plan, Action and Accountability, Concept and Nature of Disaster Preparedness, Plan of Disaster Preparedness for People with Special Needs/Vulnerable Groups, with Relevance to Housing, Infrastructure and Livestock, Community Based Disaster Preparedness Plan, Role of Information technology, Education, Communication and training. Medical and health preparedness plan.

 Disaster Damage Assessment and Response-Needs and Damage Assessment– Control process and measurement – modern and traditional methods of response, Disaster Response Plan – roles of response teams and forces. Epidemiological Study of Disasters - Medical and Health Response to Different Disasters - Role of Information and Communication Technology in Health Response

 Disaster Mitigation and Recovery-Disaster Mitigation – meaning and concept – structural mitigation and non-structural mitigation – mitigation strategies and emerging trends. Reconstruction and rehabilitation for development, Medium and long-term recovery aspects, Participative Rehabilitation Process: Community involvement and development of infrastructure.

Reference Books

1. Disaster Management by Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.

2. Natural Hazards & Disaster Management by R.B.Singh

3. Disaster Management: Future Challenges and opportunities by Jagbir Singh 4

4. Natural Disaster Management ,Jon Ingleton

5. Disaster Management, Rajib Shaw and RR Krishnamurthy, Universities Press, Hyderabad.

TE3.1(b) OPERATIONS RESEARCH

 Common Syllabus for CTPM3.1(b) and TE3.1(b)

 Linear Programming – Problem Formation, graphical Solution methods The Simplex Method – Two–Phase Simplex method, Formulation of L.P.P and its solutions by SIMPLEX Method.

 Duality in Linear Programming – Fundamental properties of Duality, Duality and Simplex method, Bounded variable simplex algorithm.

 The Transportation Problem – The North–West Corner rule, The Row minimum Method, The Column minima method, The Matrix minima method, Vogel's Approximation method, The Transportation Algorithm, Unbalanced Transportation Problems.

 Assignment and Routing Problems –The Assignment Problem, Unbalanced Assignment Problem, Travelling Salesman Problem.

 Queuing Theory – Characteristics of Queuing systems, Queue discipline, service channels, Poisson process and Exponential distribution, Distribution of Inter-travel times, Classification of Queues, The M/1/1 Queuing system (Model I to IV), The M/M/C Queuing System (Model I to IV), Non – Poisson Queuing Systems.

Text Books

1. Operation research by Kanti Swarup, Gupta and Manmohan.

2. Operation research and statistical analysis by S.D.Sharma

Reference Books

1. Operations Research by Ranganath, Yes Dee publishing Pvt Ltd

2. Introduction to Optimization: Operation Research by J.C. Pant, Jain Brothers. Delhi.

3. Operation Research by Pannerselvam, Prentice Hall of India

4. Operation Research by Iyer, TMH

TE3.2(a) GIS APPLICATIONS IN TRANSPORTATION ENGINEERING

 Introduction to GIS: Introduction, GIS over view, use of GIS in decision-making, Data processing, Components of GIS, The GIS and the organization. Data input - Key board entry, Manual digitizing, Scanning, Remotely and sensed data, existing digital data, census related data sets, Data output - Hard copy and soft, copy devices.

 Data Quality: Components of data quality-Microlevel, Macrolevel components, Sources of error, A note about data accuracy. Data Management .The data base approach, 3 classic data models, Nature of geographic data, Spatial data models, Databases for GIS.

 GIS Analysis and Functions: Organizing geographic data for analysis, Maintenance and analysis of thespatialdataandnon-spatialattributedata and its integration output formatting. Implementing a GIS Awareness, Developing system requirements, Evaluation of alternative systems, System justification and Development of an implementation plan, System acquisition and start up, Operation of the system.

 Application of GIS in Transportation Engineering - I : Intelligent information system for road accessibility study, GIS data base design for physical facility planning, Decision support systems for land use planning

 Application of GIS in Transportation Engineering - II: GIS applications in environment impact assessment, GIS based Highway alignment, GIS based road network planning, GIS based traffic congestion analysis and accident investigation.

Text Books

1. GIS A Management, Perspenfi Stan Aronoff, WDLPublisher.

2. Remote Sensing and GIS, S.K. Ghosh and A.M Chandra, Narosa Publications House

Reference Books

 1. GIS by Lo Yeng, PHI Publications

2. Basics of Remote Sensing and GIS, S Kumar, University Sc. Press

 TE3.2(b) GEO-ENVIRONMENTAL ENGINEERING

Common Syllabus for SMFE3.2(b) and TE3.2(b)

 Wastes: source, production and classification of wastes, soil pollution processes, waste characterization. Waste disposal facilities: Landfills and impoundments, Slurry walls, Types of landfills, Landfill planning and design; Barrier systems – Basic concepts, Design and construction; Stability, compatibility and performance contaminant transformation and transport in subsurface, Monitoring surface contamination, Stabilization and modification of wastes. Reuse of waste materials, contaminated site remediation, Case studies in waste handling.

Soil erosion and conservation: Causes of soil erosions, Factors contributing to erosion – climatic factors, Topographical factors, Vegetation factors. Erosion control – Cropping systems, Gullies, Check dams, Contouring, Wind striping, Ridging, Bank protection, Erosion control with vegetation mats and Silt fences. Note: 1. Student is expected to give at least one seminar on the subject from journal. 2. Preparation of paper involving case studies where the topics covered were incorporated in practice.

Text Book

 1. Geoenvironmental Engineering – principles and applications by L.N. Reddiand H.F. Inyang, Marcel Dekker, 2000

Reference books

 1. Geotechnical practice for waste disposal by D.E. Daniel, Chapman and Hall, London 1993

2. Clay barrier systems for waste disposal facilities by R.K. Rowe, R.M. Quigleyand J.R. Booker,E & FN Spon, London, 1995

3. Design, construction and monitoring of landfillsby Bagchi, A, John Wiley & Sons, New York 1994

4. Waste containment systems, Waste stabilization and landfillsDesign and evaluation by H.D. Sharma, H. D. and S.P. Lewis, John Wiley & Sons, New York 1994

 TE3.3 THESIS (PRELIMINARY)

 The student shall submit a brief report on the selected topic of his/her dessertation work and attend for a formal viva-voce examination before a committee comprising the Chairman, BOS, Head of the Department and the Guide.

IV – SEMESTER

 TE 4.1 THESIS (FINAL)

 The student shall submit his/her dessertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, the Guide and the External Examiner.

Civil Engineering

M.Tech. (Water Resources Engineering)

Scheme of Instruction and Examination

(with effect from 2019-20 Admitted Batch)

 I – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

WRE1.1 Computational Hydraulics 4 -- 4 3 70 30 100 3

WRE1.2 Applied Hydrology 4 -- 4 3 70 30 100 3

WRE1.3 Remote Sensing and GIS 4 -- 4 3 70 30 100 3 Applications for Water
 Resources Engineering

**Program Elective –I**

 WRE1.4 (a) Water Quality Modeling
 (b) Subsurface Investigations4 -- 4 3 70 30 100 3
 (c) Flood Modeling and
 Drought Assessment

**Program Elective –II**
WRE1.5 (a) Climate Change and
 Water Resources
 Engineering 4 -- 4 3 70 30 100 3
 (b) Planning, Management
 and Economics of Water
 Resources Projects

WRE1.6 Computational Fluid
 Mechanics Laboratory - 3 3 Viva 50 50 100 1.5

WRE1.7 GIS lab - 3 3 Viva 50 50 100 1.5

 Total 20 6 26 450 250 700 18

 II – SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

WRE2.1 Channel and Fluvial 4 -- 4 3 70 30 100 3  Hydraulics

WRE2.2 Environmental Impact 4 -- 4 3 70 30 100 3  Assessment of Water
 Resource Projects

WRE2.3 Watershed Behavior and 4 -- 4 3 70 30 100 3
 its Conservation

**Program Elective –III**
WRE2.4 (a) Estuarine Hydrodynamics 4 -- 4 3 70 30 100 3
 and Salinity Transport
 (b) Conjunctive Water
 Resources Planning

**Program Elective –IV**
WRE2.5 (a) Irrigation Water Systems 4 -- 4 3 70 30 100 3
 and Management
 (b) Finite Element Method
 of Analysis

WRE2.6 Hydraulics and Environmental
 Engineering Lab. -- 3 3 Viva 50 50 100 1.5

WRE2.7 Sediment Transport and
 Dredging -- 3 3 Viva 50 50 100 1.5 WRE2.8 Seminar -- 3 3 Viva 50 50 100 2

 Total 20 9 29 500 300 800 20

 III SEMESTER

Code No. Course Title Scheme of Instruction Scheme of Examination Total Credits

 Lec. Tut. Total Exam (hrs) Ext. Sess.

Program Elective –V
WRE3.1 (a) Hydroinformatics
 (b) Urban Storm Water 4 -- 4 3 70 30 100 3
 Drainage
 (c) Ground Water Flow and
 Contaminant Transport

Program Elective-VI
WRE3.2 (a) Hydraulic Structures 4 -- 4 3 70 30 100 3
 (b) Flood forecasting

WRE3.3 Dissertation (Preliminary) -- -- -- Viva -- 100 100 8

 Total 8 -- 8 140 160 300 14

 IV SEMESTER IV SEMESTER

Code No. Course Title Scheme of Examination Total Credits

 Exam (hrs) Ext. Sess.

WRE 4.1 Dissertation (Final) Viva 100 -- 100 16

 Total 16

Civil Engineering

M.Tech. (Water Resources Engineering)

Syllabus (with effect from 2019-20 Admitted Batch)

I – SEMESTER

WRE1.1 : COMPUTATIONAL HYDRAULICS

PART – A

 Statistical Methods in Hydraulics-Importance of Statistical and Probability Analysis, Statistical Variables, Frequency, Probability and Statistical Distributions for Discrete Random Variables and Continuous Random Variables.

 Statistical Parameters –Measures of Central Tendency, Measures of Variability and Measures of Skewness-Statistical Moments, Statistical Homogeneity–Time Homogeneity And Space Homogeneity.

 Probability And Distributions – Basic Definitions of Probability – Random Variable- Discrete Probability Distributions – Continuous - Distribution Functions – Expectation – Repeated Traits – Binomial Distribution – Poisson Distribution – Normal Distribution.

 Reliability Analysis-Sampling Reliability And Prediction of Reliability; Theoretical Justifications- Type-I External Distribution, Lognormal Distribution, Exponential Distribution and Log extrenal Distribution.

 Correlation and Rank Correlation – Linear Regression – Multiple Linear Regression – Curvilinear Regression.

 PART – B

 Introduction to programming language C-Overview of C Language- Contracts- Variables and Data Types. Operators and Expressions-Arithmetic Operators- Relational Operators- Logical Operators- Assignment Operators- Increments and Decrements Operators- Conditional Operators- Special Operators- Bitwise Operators- Managing Input and Output Operations.

 Decision Making and Branching- If Statements- Switch Statement- Conditional Operator Statement. Division Making And Looping. While Loop- Do Loop- For Loop- Nested Loops.

 Arrays- Single Dimensional Arrays. Handling Character String Functions. Various Built In String Functions. user Defined Functions- all Kinds of Functions. Structures and

Unions. Pointers and Pointer Operators. Files- File Handling Function Sequential Files- Random Access Files.

Text Books

1. Handbook of Applied Hydrology by Ven Te Chow, McGH Publishers.

2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, Nai Sarak, Delhi.

3. Programming in ANSI C by E. Balaguru Samy.

Reference Books

1. Handbook of Applied Hydrology by Ven Te Chow, McGH Publishers.

2. Stochastic Hydrology by Dr. P. Jayarami Reddy, Laxmi Publications, New Delhi.

3. Engineering Hydrology by R.S. Varshney, Nem Chand & Bros., Roorkee.

4. Programming with C by Vimala and Venugopal.

 WRE1.2 : APPLIED HYDROLOGY

 Introduction- Hydrologic Cycle - The Global Phenomenon- the Hydrologic Model on a Watershed Scale- Water Balance- Water Resources And Availability; History and Scope of Hydrology.

 Precipitation-Earth's Revolution- Seasons- And Atmospheric Circulation; Formulation- Types And Distribution- Presentation And Processing of Data – Consistency and Missing Data- Depth- Area and Duration- Mean Rainfall – Isohyetal and Trend Surface Methods- Confidence Limits and Comparison of Averages- Frequency Analysis – Normal and Lognormal Distributions- Frequency Plotting- Goodness of Fit- Climate Classification- Rain Gauge Network .

 Evaporation- Methods of Calculation – Energy Balance- Aerodynamic Methods; EvapoTraspiration Potential; Consumptive Use- Water Requirement of Crops; Soil Water Balance and Climate.

 Subsurface Water- Unsaturated Flow- Moisture Flux- Infiltration - Rates- Capacity.- Measurement- Horton's and Philiph's Equations; Green-Ampt Method- Ponding Time- Surface Runoff and Infiltration Indices.

 Runoff Hydrology- Watershed Processes- New Concepts- Surface Runoff- Honton’s Flow- Variable Source Area Theory – Subsurface Flow – Flow Through Matrix and Pipes; Stream Flow Components Hydrographs And Separation- Flow Recession; Unit Hydro-Graph Theory- Derivation- S-Curve and Applications- Travel Time. Catchment Response- Factors Influencing Run Off..

 Groundwater Hydrology-Occurrence of Groundwater. Vertical Distribution of Groundwater- Zone Of Aeration- Zone of Saturation- Types of Aquifers- Storage Coefficient- Groundwater Movement- Darcy’s Law- Permeability- Hydraulic Conductivity- Anisotropic Aquifers- Groundwater Flow Direction. Application of GIS For Hydrological Studies (Introduction Only)

Text Books

1. Hydrology for Engineering by Linsely R.K- McGraw Hill- 1952.

2. Engineering Hydrology by Linsely R.K. and others- McGraw Hill- 1949

3. Engineering Hydrology by Subramanya K- Tata McGraw Hill- 1998.

Reference Books

1. Introduction to Hydrology by Weissman (J) W.- Harper- and Row

2. Applied Hydrology Mutreja- K.N.- Tata McGraw Hill- 1986

3. Hand book of Hydrology by Chow V.T. (ed.)- McGraw Hill- 1988

4. Applied Hydrology by Chow V.T.- McGraw Hill- 1989

5. Statistical methods in Hydrology by Hann C.T.- A.E.W. Press- 1977

 WRE1.3 : REMOTE SENSING AND GIS APPLICATION TO WATER RESOURCES ENGINEERING

Introduction To Remote Sensing- Definition- Principle of Remote Sensing- History of Development of Remote Sensing- Stages In Remote Sensing- Electromagnetic Radiation and The Electromagnetic Spectrum- Interactions With The Atmosphere- Atmospheric Scattering- Atmospheric Absorption- Atmospheric Windows- Refraction- Interaction of EMR With The Earth's Surface- Reflection- Transmission- Spectral Signature.

 Remote Sensing Systems- Remote Sensing From Space- Remote Sensing Sensors- Resolution- Imaging Sensors- Optical Infrared (OIR) Imagers- Optical Sensors- Thermal Sensors- Microwave Sensors- Active Microwave Sensors- Data Preprocessing- Remote Sensing in India.

Introduction to Image Interpretation- Basic Principles of Image Interpretation- Elements of Image Interpretation- Techniques of Image Interpretation- Interpretation Keys- Introduction to Digital Image Processing- Digital Image- Image Rectification and Registration- Geometric Correction- Image Enhancement Techniques (Only Concepts)- Image Classification - Unsupervised Classification and Supervised Classification- Digital Photo geometry- Stereo Images From Satellites-Digital Ortho Photos (Only Definitions).

 Geographic Information Systems (GIS)- Definitions And Related Technology- GIS Operations- GIS Elements- GIS Concepts and Practice- Map Projection and Coordinate System. Vector Data Model- Introduction- Vector Data Representation- Geometric Objects- Topology.

Spatial Data Editing- Introduction- Type of Digitizing Errors- Location Errors- Topological Errors- Topological And Non–Topological Editing- Topological Editing- an Overview- Correction of Errors.

 Attribute Data Input and Management- Introduction- Attribute Data in GIS- Linking Attribute Data and Spatial Data- Type of Attribute Data- the Relational Database Model Normalization- Type of Relationship.

 Raster Data- Introduction- Elements of the Raster Data Model- Types of Raster Data- Satellite Imagery- Digital Elevation Models- GIS Software Specific Raster Data- Raster Data Structure- Projection and Geometric Transformation of Raster Data- Data Conversion- Integration of Raster and Vector Data.

 Vector Data Analysis- Introduction- Buffering- Applications of Buffering- Map Overlay- Feature Type and Map Overlay- Map Overlay Methods- Slivers- Error Propagation in Map - Overlay- Distance Measurement- Map Manipulation-

 Raster Data Analysis-Introduction- Analysis Environment- Local Operations- Local Operations with a Single Grid- Local Operations With Multiple Grids- Neighborhood Operations- Zonal Operations.

 Terrain Mapping and Analysis: Introduction- Data for Terrain Mapping and Analysis- DEM- TIN- Terrain Mapping- Contouring- Vertical Profiling- Hill Shading- Hypsometric Tinting- Perspective View- Terrain Analysis- Slope and Aspect- Surface Curvature- View Shed Analysis- Grid Versus TIN.

 GIS Models And Modeling-Introduction- GIS Modeling- Binary Models- Index Models Remote Sensing & GIS Application In Water Resources Engineering.

Text Books

1. Fundamentals of Remote Sensing 2nd Ed by George Joseph- University Press- New Delhi.

2. Introduction to Geographic Information systems by Kang tsung chang- Tata Mc. G. H. publications- New Delhi.

Reference Books

 1. Remote Sensing of the Environment – An earth resource perspective by John R. Jensen- Pearson Education- New Delhi.

2. Geographic information Systems: A Management Perspective by Aronoff- S. 1989. Ottawa: WDL publications.

3. Geographic Information Systems for Geoscientists: Modeling with GIS- Bonham – Carter- G-F. 1994. New York: Pergamon Press.

4. Principles of Geographical Information Systems by Burrough- P.A and R.A. McDonnell. 1998- Oxford: Oxford University Press.

5. Young concepts and Technologies of Geographic Information Systems by Lo- C.P.- and Albert K.W.- Prentice hall of India (Pvt) Ltd- New Delhi.

6. Remote sensing and image interpretation by Lillesand- T.M. and Kieffer- Joh Wiley and Sons- New York- 1987.

7. Introductory Digital Image processing by John R Jensen- Prentice Hall- New Jersey.

8. Application of remote sensing to hydrology including groundwater by Farsworth- R.K.- Bawetl- E.C. & Dhanju- M.S.-- IHP- UNESCO- 1984.

 WRE1.4(a) : WATER QUALITY MODELLING

 Introduction to Environment Overview- Components of Environment and Their Interaction- uses of Water.

 Water Quality Parameters: Concepts & Analysis Impurities and Water Quality Characterization- Physical- Chemical and Biological Parameters- Analytical Estimation- Movement of Pollutants in Aquatic Environment- Water Quality Issues- Transport and Transformation Processes in Surface and Groundwater Systems- Water Quality Modeling. Modeling Concept- Process and Classification- Groundwater Quality Modeling: Dispersion- Flow Equations- Saturated and Unsaturated Flow. Groundwater Modeling Techniques- Porous Media Models- Analog Models- Electrical Analogy Models- Digital Computer Models.

 Surface Water Quality Modeling: Completely Mixed Systems - Mass Balance and Steady State Equation/ Solutions. Euler’s Method- Runge-Kutta Method. Incompletely Mixed Systems – Diffusion- Fide’s First Law- Steady State Conditions- Plug Flow & Mixed Flow Systems. Time Variable Conditions- Plug Flow- Random walk and Spill Models.

 Transport and Variation of Dissolved Oxygen- Streeter-Phelps Equation and Modeling of Chemical Parameters- Modeling Ph- Toxics- Metals.(Oxygen Sag- BOD- Henry’s Law- Ideal Gas Law- DO Saturation- BOD Model).

 Water Quality Legislation and Management Water Quality Criteria and Standards- National and International Perspective- Surface and Groundwater Quality Management

Text Books

1. Water Quality Modeling by Steven. C. Chapra- McGraw Hill.

2. Groundwater Hydrology by David Keith Todd- John Wiley & Sons.

3. Water quality assessments by Chapman- D.- (Ed.)- 2nd Ed.- E&FNSPON (Imprint of Chapman & Hall- USA)- Pub. on behalf of UNESCO- WHO- UNEP-1992.

4. Chemistry for environmental engg by Sawyer- C.N.- & McCarty- P.L.- 3rd Ed.- Mc Graw Hill- 1987.

5. Environmental science & technology by Manobam- S.E.-- Lewis Pub.- 1997

6. Fundamentals of ecology by Odum- H.T.-- Oxford & IBH- 1975.

7. Groundwater Pollutions : Theory- Methodology- Modelling and Practical rules by Fried- J.J.-Elsevier Scientific Pub. Co.- 1975.

8. Mathematical Models in Water Pollution Control by James- A. John Wiely.

9. Application of Ecological Modeling in Environmental Management by Jorgensen- S.E.-- Part A & B- Elsevier Scientific Pub. Co.- 1983.

10. Principles of Surface Water Quality Modeling & Control by Thomann- R.V. & Mweller- Harper & Row-1987.

WRE1.4(b) : SUBSURFACE INVESTIGATIONS

 Introduction & Broad Classification of Subsurface Methods Direct Methods - Excavation & Pitting- Well Drilling Techniques- Drill Stem Testing- Geological Well Logs Indirect Methods -Geophysical Well Logging -Electrical Well Logging Methods -Normal & Lateral Resistivity Logs- Self Potential Logs- Induction & Micro Focussed Logs- Electrical Logging Practices -Evaluation of Aquifer Parameters Radiation Logging (Natural Gamma- Neutron & Gamma Gamma Logging) - Accoustic Logs - Caliper Logs & Dipmeter Surveys- & their Applications in Groundwater Prospecting

Text Books

 1. Water Well Technology by Campbell- M.D. & Lehr- Mc Graw Hill Book Co-1973.

2. Groundwater & Wells by E.E. Johnson- Inc. UOP Div-- E.E. Johnson Inc.- 1975.

3. Application of Bore hole geophysics to Water Resources Investigations by Keys- W.S. & McCary- L.M.- U.S. Geol. Survey. Book 2- EI.- 1971.

4. Formation Evaluation by Lynch- E.J.- Harper & Row- 1962.

5. Handbook of Subsurface Geology by Moore- C.A.- Harper & Row- 1968.

6. Geologic Well log analysis by Pirson- S.J.-- (Gulf Publishing Co.)- 977.

 WRE1.4(c) : FLOOD MODELLING AND DROUGHT ASSESSMENT

 Flood Estimation - Hydrologic extremes – Flood – Types of Flood – Effects of Flood – Design Flood - SPF/MPF - Estimation of design flood – Physical Indicators - Envelope curves - Empirical methods – Rational method - Statistical methods – Frequency analysis – Unit hydrograph method.

 Flood Modeling And Management - Hydrologic and Hydraulic Routing – Reservoir and Channel Routing - Flood Inundation Modeling – HEC HMS and HEC RAS softwares - Flood control methods – Structural and non structural measures - Flood Plain Zoning – Flood forecasting – Flood Mitigation - Remote Sensing and GIS for Flood modeling and management.

 Drought and Impacts - Definition – Definitions based on rainfall- stream flow- vegetation and comprehensive aspects - Characterization of Drought/water shortage /aridity /desertification - Types of Drought – NCA classification – Impacts of Drought – Environmental- Social and Economical aspects

 Drought Assessment- Drought Severity Assessment – Meteorological Hydrological and Agricultural methods – Drought Indices – GIS based Drought Information system – Drought Vulnerability Assessment and Mapping Using GIS.

Drought Monitoring and Management: DPAP Programme - Drought Monitoring – Application of Remote sensing – Drought Mitigation –Proactive and Reactive approach – Supply and Demand Oriented Measures – Long term and Short term Measures – Water Scarcity Management in Urban- Industrial and Agricultural sectors

Reference Books

1. Applied Hydrology by Chow V.T.- Maidment D.R.- Mays L.W.- McGraw Hill Publications- New York- 1995.

2. Elementary Hydrology by Vijay P.Singh.- Prentice Hall of India- New Delhi- 1994.

3. Drought Research Needs by Yevjevich V.- Water Resources Publications- Colorado State University- USA- 1977.

4. Flood Routing Methods as Applied to Indian Rivers by Rangapathy V.- Karmegam M.- and Sakthivadivel R.- Monograph Anna University Publications

 WRE1.5(a) CLIMATE CHANGE AND WATER RESOURCES
ENGINEERING

 Definitions- Climate- Climate System- Climate Change – Drivers of Climate Change – Characteristics of Climate System Components - Green House Effect – Carbon Cycle – Wind Systems - Trade Winds and the Hadley Cell – Ozone Hole in the Stratosphere - El Nino- La Nino

 Global Scenario – Indian Scenario – Observed Changes And Projected Changes of IPCC - Impacts on Water Resources – NATCOM Report –Impacts on Sectoral Vulnerabilities – SRES – Different Scenarios

 Need For Vulnerability Assessment – Steps for Assessment –Approaches for Assessment – Models – Quantitative Models- Economic Model- Impact Matrix Approach - Box Models- Zero-Dimensional Models - Radioactive-Convective Models - HigherDimension Models - Emics (Earth-System Models of Intermediate Complexity) - GCMS (Global Climate Models or General Circulation Models) – Sectoral Models

 Water-Related Adaptation to Climate Change in the Fields of Ecosystems and Biodiversity- - Agriculture and Food Security- Land Use and Forestry- Human Health- Water Supply and Sanitation- Infrastructure and Economy (Insurance- Tourism- Industry and Transportation) - Adaptation- Vulnerability and Sustainable Development SectorSpecific Mitigation - Carbon Dioxide Capture and Storage (CCS) - Bio-Energy Crops- Biomass Electricity- Hydropower- Geothermal Energy- Energy Use In Buildings- LandUse Change and Management- Cropland Management- Afforestation and Reforestation - Potential Water Resource Conflicts Between Adaptation and Mitigation - Implications for Policy and Sustainable Development.

 Case Studies: Water Resources Assessment Case Studies – Ganga Damodar Project - Himalayan Glacier Studies- Ganga Valley Project - Adaptation Strategies in Assessment of Water Resources- Hydrological Design Practices And Dam Safety- Operation Policies for Water Resources Projects - Flood Management Strategies - Drought Management Strategies - Temporal & Spatial Assessment of Water for Irrigation -Land Use & Cropping Pattern - Coastal Zone Management Strategies.

Reference Books

1. Climate change and water- IPCC Report Technical Paper VI- 2008.

2. UNFCC Technologies for Adaptation to climate change- 2006.

3. Climate Change and India: Vulnerability assessment and adaptation by P R Shukla- Subobh K Sarma- NH Ravindranath- Amit Garg and Sumana Bhattacharya- University Press (India) Pvt Ltd- Hyderabad.

4. Preliminary consolidated Report on Effect of climate change on Water Resources- GOI- CWC- MOWR- 2008.

 WRE1.5(b) PLANNING, MANAGEMENT AND ECONOMICS OF WATER RESOURCES PROJECTS

 (A) Planning & Management of Water Resources Projects -Introduction to the Fundamentals of Water Resource System Analysis- Involving the Determination of the Optimal Dimensions- Outputs And Operating Policies of Water Resource Projects.

 Introduction- Reservoir Capacity & Yield - Flow-Duration Curve - Reservoir Planning Reservoir Sediment Distribution- Cost Benefit Analysis- Conjunctive Water-Use Planning Flood Routing- Reservoir Operation- River Water Disputes- Integrated River-Basin Development - Inter-Basin River Water- Transfers- Environmental Aspects Overview of Methodologies of Analysis. use of Optimization and Simulation Techniques for Solving Water Resources Problems- Examples in Water Distribution Systems- Flood Management- River Basin Planning for Irrigation and Hydroelectric Power- The Storage Yield Relationship.

 (B) Engineering Economics -Objectives & Scope of Engineering Economics- Managerial Economics- Interest and Time-Value of Money- Depreciation- Economic Life.

 Demand Analysis and Forecasting. Cost Concept- Annual Cost Comparison- Present Worth- Production Functions- Pricing Policies- Pricing Methods- Price Forecasting.

 Profit- Measurement of Profit- Profit Planning & Forecasting- Break-Even Analysis- Return on Investment- Rate of Return. - Mathematics of Finance- Discounting Techniques- Estimation of Costs

 Estimation of Benefits- Graphical Optimization- Systems Approach Multi Objective Analysis - Financial Analysis - Cost Allocation- Case Studies Capital Budgeting- Cost of Capital- Project Appraisal.

Text Books & Reference Books

1. Principles of Water Resources Planning by Goodman- A.S.- Prentice Hall Inc.- New Jercy- 1984.

2. Economics of Water Resources Planning by James- L.D. and Lee- R.R.- Mc Graw Hill- 1971.

3. Hydropower Engineering by Warnic- C.C.-- Prentice Hall Inc.- New Jercy- 1984.

4. Principles of Water Resources Planning by Goodman- A.S.- Prentice Hall Inc.- New Jercy- 1984.

5. Water Resources Systems by Chaturvedi-- Planning & Development :

6. Water Resources Systems by Hall & Dracup-

7. Economic Analysis by . Barish N. Norman.

8. Managerial Economics by Varshney- R.L. & Maheshwari- K.L.

WRE1.6 COMPUTATIONAL FLUID MECHANICS LABORATORY

 Developing and Executing Programmes Using C-Language for the following Problems Related to Fluid Mechanics:

1) Pipe network analysis using hardy- cross method.

2) Pipe friction computations.

3) Gradually varied flow problems.

4) Hydraulic jump computations.

5) Unit hydrograph computations.

6) Flood routing. (Muskingum method)

7) Water hammer analysis

 WRE1.7 G.I.S. LABORATORY

 Students are Supposed to work on Various Problems involving the following Applications using any GIS Package.

 1) Creation of vector maps and raster maps through digitization and rasterisation 2) Image processing of digital images (geometric correction- image enhancement- image classification) 3) Preparation of thematic maps (land use/ land cover- road maps- drainage network map etc.) From satellite image of any region. 4) Watershed delineation from drainage map and contour map of any region. 5) Development of digital elevation model (DEM) using any technique. 6) Any simple case study of RS & GIS Application in WRE.

Civil Engineering M.Tech. (Water Resources Engineering)

 Syllabus (with effect from 2019-20 Admitted Batch)

 II – SEMESTER

 WRE2.1 CHANNEL AND FLUVIAL HYDRAULICS

 Review of Fundamentals of Hydraulics-Continuity Equation- Bernoulli's Equation and Impulse –Momentum Equation.

 Introduction to Open Channel Flows- Basic Features- Uniform Flow and Computation of Normal Depth- Specific Energy-Depth Relationship- Critical Flow and Computation of Critical Depth- Hydraulic Jump.

 Steady State Gradually-Varied Flow- Governing Differential Equation- Classification of GVF Profiles- Computation of Profiles.

 Transient Gradually-Varied Flow- Saint Venant's Equations- Kinematic Wave Theory- Flood Routing Through Channels- Muskingum Method.

 Fluvial Hydraulics- Incipient Condition- Bed Load- Suspended Load- Bed Forms & Field Measurements.

Text Books And Reference Books

1. Flow in Open Channels by Subramanya- K.-- Tata Mc Graw Hill- 1986.

2. Mechanics of Sediment Transport and Alluvial Stream Problems by Garde - R.J. and Rangaraju- K.G.

3. Open Channel Hydraulics by Chow-V.T.- Mc Graw Hill- Tokyo- 1959.

4. Flow through Open Channels by Rangaraju- K.G.

WRE2.2 : ENVIRONMENTAL IMPACT ASSESSMENT OF WATER RESOURCES PROJECTS

 Water Resources Development - an Overview-Impact Types- Beneficial & Adverse- Primary- Secondary- Long-Term- Short-Term- Reversible- and Irreversible Procedural Requirement for EIA and Clearance - Indian Scenario

 EIA - General- Purposes Principles and Processes- Identification- Prediction and Assessment Steps in EIA - EIA Approaches And Techniques- Data Requirement for EIA- Hydro-Indices- Case Studies.

Text Books

1. Environmental Impact Assessment for Developing Countries by Biswas- A.K. and Aggrawal- S.B.C.

2. Environmental Impact of Water Resources Projects by Canter- L.

3. Environmental Impact Assessment- Principle and Procedure by Munn- R.E.

4. Environmental Impact Analysis Handbook by Ray- S.G. & Wooten- D.C.

5. Environmental planning- policies & programmes in India by Saxena- K.D.- Shipra Publishers- Delhi.

Reference Books

1. Environmental Impact of Water Resources Projects by Canter- L.

2. Environmental Impact Assessment- Principle and Procedure by Munn- R.E.

3. Environmental Impact Analysis Handbook by Ray- S.G. & Wooten- D.C.

4. Environmental planning- policies & programmes in India by Saxena- K.D.- Shipra Publishers- Delhi.

5. Environmental Impact Assessment for Developing Countries by Biswas- A.K. and Agarwal S.B.C.

 WRE2.3 : WATERSHED BEHAVIOUR AND ITS CONSERVATION PRACTICES

 Soil And Water – Issues Related to Plant Life Like Composition of Soil- Water Requirement of Crops- Necessary Conditions for Plant Growth Etc. Soils- Their Origin and Classification. Land Classification for WM- Land Capability Rating- Determination of Land Capability Class- Land Capability and Suitability Surveys.

 Watershed Behavior – Physical Elements of a Watershed- Effects of Land Use Changes on Hydrological Cycle Component Concept of Vegetative Management of Water Yield and Quality. Watershed Experiments- Extrapolation of Results from Representative and Experimental Basins- Regional Studies

 Soil Erosion – Problem- Types- Conservation- and Control Measures in Agricultural and Non-Agricultural Land. Water Conservation and Harvesting – Agronomical Measures in Soil and Water Conservation. Examples and Critical Reviews.

 Inventory Techniques for Precipitation Runoff- Soil- Timber- Range-Land and Wild Life Water Harvesting Techniques– Elements- Development of Modern Harvesting Techniques Estimation of Peak Runoff Rate Land Capability Classification Erosion Process – Factors Affecting Erosion- Types of Erosion- Assessment of Erosion- Control Measures for Erosion

 Conservative Practices – Objective and General Practices- Land and Soil Classification- Identification of Critical Areas Watershed Management – Objectives of Planning Watershed Projects Guidelines for Project Preparation Approach in Govt. Programmes- People’s Participation- Conservation Farming- Watershed-Management Planning- Identification of Problems- Objectives and Priorities- Socioeconomic Survey- use of Tools Like GIS.

 Watershed Modeling: Runoff Components –Simple Parametric Models – Curve Number Method- Variable Source Area Models- Quasi- Physically based models- a simple physically based model.

Text Books & Reference Books

1. Hyrology and Management of Watersheds by Brooks- K.N.- Ffolliott- P.F.- Gregerson- H.M. and De Bano- L.F.- Iowa State University Press- 1991.

2. Soil and water conservation Practices by Frevert- R.K.- Schwab- G.O.- Edminster- T.W. and Barnes- K.K.- John Wiley and Sons- New York- 1990.

3. Forest Hydrology by Lee. R.

4. Guidelines for watershed Management – F.A.O. Conservation Guide No. l.

5. More Water for Arid Lands – Promising Techniques and Research opportunities – National Academy of Sciences.

6. Water shed Management by B.M. Tideman

7. Modern physical geography by Strahler A.N. and Strahler A.H

8. Linear programming and extensions by Dantzig- G.B.- Princeton University Press- Princeton- New Jersey- 1963

9. Water resources systems engineering by Hall- W.A. and Dracup- J.A.- Mc Graw Hill- 1970.

10. Water production functions for irrigated agriculture by Hexem- R.W. and Heady E.O.-- Iowa State University Press- 1978.

11. Economics of Water Resources Planning by James- L.D. & Robert- R. L.

12. Linear optimization for management by Lee- S.M.- Petrocelli/ Charter- New York- 1976.

 WRE2.4 (a) ESTUARINE HYDRODYNAMICS AND SALINITY TRANSPORT

 Common Syllabus for HCH2.4(a) and WRE2.4(a)

 Tidal Dynamics in Estuaries- Estuaries of Rectangular Section- General Review of Engineering Problems in Tidal Estuaries- General Characteristics of Estuaries- Mathematic Description of Tides Without Friction- Mathematic Description of Tides With Friction- Experimental Results on Co oscillating Tides. Real Estuaries- Introduction- Methods of Analysis- Numerical Integration Methods- and Harmonic Method- Damped Cooscillating Tide.

 The Mechanism of an Arrested Saline Wedge- Introduction- Form Characteristics of Arrested saline Wedges- The Pattern of Velocities- Mixing in Arrested Saline Wedge- Hydrodynamics of Layers- Estimation of the Length of Arrested Saline Wedges in Wide Channels. Diffusion Processes in Stratified Flow- Introduction- Convective-Diffusion Equation for Turbulent Flow- One-Dimensional Turbulent Diffusion in Constant-Density Flow- OneDimensional Turbulent Diffusion in Stratified Flow.

 Salinity Intrusion in Estuaries- Basics Factors Governing Salinity Distribution in Estuaries- Effects of Salinity and Fresh-Water Flow on Tidal Conditions- Internal Flow Processes- One-Dimensional Analysis of Mixed Estuaries- Experimental Results for WES Tidal Flume.

Reference Book

 1. Estuary and Coastline Hydrodynamics by A.T. Ippen- Publisher: McGraw-Hill Inc.

 WRE2.4 (b) : CONJUNCTIVE WATER RESOURCES PLANNING

 Introduction-Surface & Groundwater Components- System Constraints- Parameter Identification & Model Decomposition- Consumptive Water Requirement of Crops- Conjunctive Water use Model Deterministic & Stochastic Optimization- Water Quality & Legal Aspects- Economic & Multi-Objective Analysis

Text Books

1. Principles of water resources planning by Goodman- A.S.-- Prentice Hall Inc. - New Jercy- 1984.

2. Numerical methods in subsurface hydrology by Remson- I.- Hornberger- G.M.- and Molz. F.J.- Wiley Inter Science.

 WRE2.5 (a): IRRIGATION WATER SYSTEMS AND MANAGEMENT

Irrigation Systems – Major- Mini- Minor Potential Surface- Lift and GW Systems- Methods of Irrigation- Relative Merits and Demerits- Modeling Soil Physics and Soil Chemistry- Terminology- Soil-Water and Hydraulic Conductivity. Soil Chemical Properties- Impact of Soil And Water Chemical Concentrations on Yields –Management of Soil Chemical Concentrations.

Soil Physics and Soil Agriculture- Cropping Pattern- Irrigation- Sustainable Systems Planning Irrigation Systems – Crop Water Requirements- Irrigation Frequency- Yield – Methods of Estimation of Crop Water Requirements – Methods Based on Temperature and Pan Evaporation- Combined Method- Crop Coefficient Curves.

Surface System Design- Definitions –Furrow System Design – Level Basin System Design –Graded Border System Design

Sprinkler System Design: Uniformity and adequacy of Water Application-Evaporation and Wind Drift- Components of System Design. Distribution System Design and Layout- Centre Pivot System- Linear Move System- Big Gun and Boom Sprinkler Systems. Trickle (Drip) Irrigation System Design: Concept of Trickle System- Emitters – Flow Through Laterals – Filtration and Water Treatment Systems- Fertilizer Injection Systems- Water Logging and Prevention and Efficiencies. Optimization Techniques in Planning as Applied to Irrigation.

Agricultural Hydrology- Subsurface- Unsaturated Flow- Hysterisis- Soil Moisture and Deep Percolation- Return Flows and Modeling Droughts and Mitigation of Droughts.

Text Books

1. Water Resources Systems Planning and Management by Chaturvedi- M.C. Tata McGraw Hill

2. Economics of Water Resources Planning by James L.D and Lee R.R- McGraw Hill

3. Irrigation theory & Practice by Maichel

4. Irrigation System Design (An engineering approach) by Richard H. Cuenea- Prentice Hall

5. Water resources systems planning and analysis by Deniel P. Louchs- Jerry R. Stedinger and Danglass. A. Haith- Prentice Hall

Reference Books

1. Irrigation – Principles and methods by Irstelsen and Hanesn

2. Hydro systems Engineering and Management by Mays L.W. and Tung Y.K.- McGraw Hill- 1992

3. Systems analysis for Civil Engineer by Ossenburgen P.J.- John Wiley and Sons

WRE2.5(b) FINITE ELEMENT METHOD OF ANALYSIS

Common Syllabus for ST2.2, SMFE2.5(b), WRE2.5(b), HCH2.5(b) and TE2.5(b)

Introduction: A brief history of F.E.M. Need of the method, Review of basic principles of solid mechanics- Equations of equilibrium, Boundary conditions, Compatibility, Strain displacement relations, Constitutive relationship in matrix form, plane stress & plane strain and axisymmetric bodies of revolution with axi-symmetric loading, Energy principles - Reyleigh - Ritz method of functional approximation.

Theory relating to the formulation of the finite element method, Coordinate system (local and global), generalized coordinates, Concept of the element, Various element shapes, Discretisation of a structure, Mesh refinement Vs. Higher order element, Interconnections at nodes of displacement models, inter element compatibility, -shape functions.

Basic component – One dimensional FEM single bar element, Beam element : Derivation of stiffness matrix, Assembly of stiffness, Matrix boundary conditions, shape functions for 1 D elements, Initial strain and temperature effects, and trusses under axial forces.

Two dimensional FEM: Different types of elements for plane stress and plane strain analysis –Displacement models Generation of element stiffness and nodal load matrices – static condensation.

Isoparametric representation and its formulation for 2d analysis. Formulation of 4-noded and 8-noded isoparametric quadrilateral elements – Lagrangian elements-serendipity elements.

Text Books

1. Finite Element Analysis by C.S.Krishnamoorthy, (2002), Tata McGraw Hill Publishing Co. Ltd.

2. Introduction to Finite Element Method by Desai,C.S.and Abel, J.F.,Van Nostrand, 1972.

Reference Books

1. Introduction to Finite element Method by Tirupathi chandra Patla and Belugundu

2. The Finite Element Method in Engineering Science” by Zienkiewicz, P., McGraw Hill, 1971.

WRE2.6 HYDRAULICS AND ENVIRONMENTAL ENGG.
LABORATORY

1. Hydraulic Jump in horizontal and rectangular channels.

2. Gradually Varied Flow Profiles.

3. Studies on Groundwater flow and Well hydraulics.

4. Flow past Bluff bodies- Airfoil and Cylinder.

5. Principles of measurement and testing of water for parameters like pH- TDS- NO3 - PO4-P- Hardness- Turbidity- residual chlorine- DO- Chlorides- Jar test for coagulant dosing.

6. COD- BOD- SS- VSS- heavy metals using AAS- Microscopy.

7. Air for SPM- RSPM- NO2 & SO2 using High volume sampler- CO- NOX - SO2 using continuous analyzers- Noise measurement using SLM. (Demo only)

WRE2.7 SEDIMENT TRANSPORT & DREDGING

1. Study of Basics of Sediment Transport Phenomenon.

2. Estimation of Bed Load & Suspended Load and Reservoir Siltation

3. Sediment Samplers and Sampling: Bed Load Sampling- Suspended Load Sampling and Computation of Total Load.

4. Dredging and Disposal of Dredged Materials.

5. Case Studies of Reservoir Siltation.

6. Case Studies of Dredging in Ports and Harbours.

Reference Books

1. Mechanics of Sediment Transportation and Alluvial steam problems by Garde- R.J. and K.G. Ranga Raju- Second Edition- Wiley Eastern Limited.

2. Hydraulics of Sediment Transport by Graf- W.H.- McGraw-Hill Book Co.

3. Loose Boundary Hydraulics by Raudkivi- A.J.-Pergamon press.

4. Practical Dredging by Cooper- H.R.- Brown- Son & Ferguson- Glasgow.

5. Dock and Harbour Engineering Vols. I- II & III by Cornick- H.F.- Charles Griffin & Co.

6. Dock and Harbour Engineering by Seetharaman- S. Umesh Publication.

WRE2.8 SEMINAR

Each student has to select a topic and collect about 10 papers with at least 5 journal papers and prepare a report and give a seminar at the end of the semester

Civil Engineering

M.Tech. (Water Resources Engineering)

(with effect from 2019-20 Admitted Batch)

III – SEMESTER

WRE3.1(a) HYDROINFORMATICS

Overview of Numerical Engines/ Techniques Including Tools- Environments and Languages. Integration of Different Interfaces - Spatial Decision Support Systems and GIS-Emerging Techniques in Hydro-Informatics- Hydrological Applications. Text Books

1. Neural Network and Fuzzy logic by Rao- V.B. and Rao- H.V.- BPB Publications- New Delhi- 2. Hydro informatics by Babovic- V and Larsem- L.C. AA Balkema- The Netherlands- 1998. 3. Geographic Information by Cadoux- J. & Heywood- D.I.- Taylor & Frances Ltd.- London- U.K. 4. Neural Networks and fuzzy logic by Fu- L.-- Mc Graw-Hill Inc.- 1994. 5. Geographic Information System by Burrough - D.A.

WRE3.1(b) URBAN STORM WATER DRAINAGE

Introduction to Drainage Problems in Different Climates- Urbanization- its Effects and Consequences for Drainage-Interaction Between Urban and Peri-Urban Areas Process of Urbanization and Influence on Hydrologic Cycle

Planning Concepts and System Planning- Objectives of Urban Drainage and Planning Criteria- Drainage and System Layout. Planning Tools and Data Requirement- Drainage Master Plan- Examples for Drainage Structures.

Review of Hydrologic and Hydraulic Principles- Urban Hydrologic Cycle- Hydrologic Principles- Rainfall analysis in Urban Environment and Design Storm- Hydraulic Principles- Hydrodynamic Principles.

Urban Runoff Computations - Empirical- Time-Area and Unit Hydrograph approaches Design of Drainage System Elements: Hydraulic Fundamentals- Infiltration and on-Site Detention of Storm water- Design of Sewerage And Drainage Channels- Design of Appurtenances- Road Drainage- Design of Pumping Stations.

Control of Storm water Pollution- Pollution Build-Up and Wash off Process with Reference to Urban Drainage Systems. Source Control in Commercial and Industrial Complexes- Storage Options - Dry and Wet Ponds- Biological Treatment of Wastewater- Chemical Treatment of Storm water.

Operation and Maintenance of Urban Drainage Systems-Maintenance Requirement for Different Structures- Maintenance Planning- Cleaning of Sewers and Drains- Inventory of Damages- Repair Options.

Urban Drainage -Kinematic Wave Theory Approach Introduction to Urban Watershed Software's Hydrologic Cistern- Water Conservation and Ecological aspects Water Harvesting.

Text Books

1. Handbook of Applied Hydrology : A Compendium of Water resources by Chow- V.T.

2. Hydrology and hydraulic systems by Gupta- R.S.-- Prentice Hall- Englewood cliffs.

3. Urban Hydrology by Hall- M.J. 4. Hydrology by Viesmann & Knapp

WRE3.1(c) GROUND WATER FLOW AND CONTAMINANT
TRANSPORT

Introduction- Hydrologic Cycle- Movement & Occurrence of Groundwater- Properties of Groundwater- General Flow Equations- Dupuit Equation Fundamentals of Groundwater Flow :Occurrence of Ground Water- Vertical Distribution of G.W. Flow- Darcy’s Law- Permeability- Porosity- Anisotropic Aquifers- Differential Equations of G.W. Flow.

Potential Flow-Flow nets- Boundary Conditions- Flow-Net Construction for Confined and Unconfined Flow Systems.

Mechanics of Well Flow- Steady & Unsteady Flow in Confined & Unconfined Aquifers- Leaky Aquifers- Partial Penetration of Wells- Multiple Well Systems- Boundary Effects & Method of Images- Well Loses.

Ground Water Modeling- Sand Tank- Heleshaw- Electrical Analogous Models- Finite Element/Difference Models.

Ground Water Development and Management- Design of Wells- Construction of Wells- Well Development- Artificial Recharge- Conjunctive Use- Salinity of G.W.- Ground Water Pollution.

Sources & Type of Groundwater Contamination- Contaminant Transport Mechanisms: Advection- Diffusion & Dispersion- Mass Transport Equations- One & TwoDimensional Modeling

Sorption & other Chemical Reactions- Factors affecting Sorption- Sorption Isotherms- Sorption Effect on Fate & Transport of Pollutants- Estimation of Sorption Biodegradation Reactions & Kinetics: Biological Transformations- Microbial Dynamics- Kinetics of Biodegradation Nonaqueous-Phase Liquids- Types of Napls- General Processes- NAPL Transport Computational Methods

Groundwater Remediation and Design: Remedial Alternatives- Source Control- Hydraulic Controls- Bioremediation- Soil Vapor Extraction Systems- Remediating NAPL Sites- Emerging Technologies

Text Books

1. Ground Water Contamination- Transport and Remediation by Bedient- Rifai & Newell-- PTR Prentice Hall

2. Groundwater Hydrology by D.K . Todd-- John Wiley & Sons

Reference Books

1. Groundwater and Seepage by M.E. Harr.

HCH3.2(a) HYDRAULIC STRUCTURES

Common Syllabus for HCH3.2(a) and WRE3.2(a)

Dams- Types- Choice of Type of Dam- Forces Acting on Dams- Requirements of Stability- Causes of Failure.

Gravity Dams- Non-Overflow and Overflow Types- Modes Of Failure and Criteria For Structural Stability of Gravity Dams- Design of Gravity Dam- Single Step and Multistep Design- Cracks and Joints in a Gravity Dam- Foundation Treatment for Gravity Dams- Stress Concentration around Openings in Dams- Gravity Dams Subjected to Earthquakes. Spillways- Different Types of Spillways and Their Design Principles- Energy Dissipation Below Spillways- use of Hydraulic Jump as Energy Dissipater and Design of Stilling Basins- Types of Spillway Gates.

Arch Dams- Types- Loads on Arch Dams- Cylinder Theory – Constant Radius- Constant Angle- Variable Radius types- and Principles of Elastic Theory and Trial Load method of analysis.

Buttress Dams- Components- Advantages and Disadvantages- Types- Forces- Theory of Buttress Design- Buttress Spacing and Buttress Construction Details.

Earth Dams- Types of Earth Dams- Methods of Construction- Causes of Failure of Earth Dam- Design Criteria For Earth Dams- Selecting a Suitable Section for an Earth Dam- Requirements of Safety- Seepage- Construction of Seepage Line for Different Conditions- Seepage Control Methods- Stability Analysis for Different Conditions- Factor of Safety against Foundation Shear- Details of Method of Construction of Earth Dams- Maintenance and Treatment of Common Troubles in Earth Dams.

Appurtenance Works- Design Principles of Various types of Crest Gates- Stilling Basins- and Drainage Galleries. Water Hammer Analysis and Design of Surge Tanks- Penstocks- Draft Tubes and Scroll Casing.

Reference Books

1. Theory and Design of Irrigation Structures Vol. I & II by Varshney- R.S.- S.C. Gupta and Gupta- R.L.-Nem Chand & Brothers.

2. Irrigation: Practice and Design – Vols. II & III by Khushalani- K.B. and M Khushalani- Oxford of IBH Publishing Co

3. Irrigation and Hydraulic structures by Garg- S.K.- Khanna Publishers.

4. Engineering for Dams – Vols. I- II & III by Creager- W.P- J.D. Justin and J. Hinds-John Wiley & Sons.

5. Hand Book of Applied Hydraulics by Davis- C.V. and K.E.Sorensen- Third Edition- McGraw-Hill Book Co

WRE3.2(b) FLOOD FORECASTING

Objective- Importance- Historical Development and Classification of Hydrological Forecasts Data Collection and Flood Forecasting Network Design- Data Transmission- Physically Based Models Graphical and Statistical Models- Stochastic Models and Adaptive Filter Models- UH and SCS Based Deterministic Models- Flood Forecasting using Artificial Neural Network- Watershed Models

Updating- Verification and Dissemination of Forecast

Text Books

1. Manual on flood forecasting by Anderson- M.C.- Burt- T.P. - New Delhi- 1985.

2. Hydrological forecasting-Central Water Commission-John Willy and Sons-1989.

3. Automatic collection and transmission of hydrological observations WMO-

4. Operational Hydrology report no. 2- Geneva- Switzerland- 1973.

5. Inter comparison of conceptual models used in operational hydrological forecasting

6. WMO- Geneva- Switzerland.

7. Operational Hydrology report no. 7- 1975.

WRE3.3 : DISSERTATION (Preliminary)

The student shall submit a brief report on the selected topic of his/her dissertation work and attend for a formal viva-voce examination before a committee comprising the Chairman, BOS, Head of the Department and the Guide.

Civil Engineering

M.Tech. (Water Resources Engineering)

 (with effect from 2019-20 Admitted Batch)

IV – SEMESTER

WRE 4.1 DISSERTATION (Final)

The student shall submit his/her dissertation work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, the Guide and the External Examiner.