

# ANNA UNIVERSITY TIRUCHIRAPPALLI

Tiruchirappalli - 620 024

Regulations 2007

## Syllabus

### B.E CIVIL ENGINEERING

#### SEMESTER III

#### MA1201 – MATHEMATICS III

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(Common to all branches)

#### UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange’s linear equation – Linear partial differential equations of second and higher order with constant coefficients.

#### UNIT II FOURIER SERIES 9

Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval’s identity – Harmonic Analysis.

#### UNIT III BOUNDARY VALUE PROBLEMS 9

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

#### UNIT IV FOURIER TRANSFORM 9

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s identity.

#### UNIT V Z –TRANSFORM AND DIFFERENCE EQUATIONS 9

Z-Transform – Elementary properties – Inverse Z-Transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-Transform.

**L: 45 T: 15 Total: 60**

**TEXT BOOK**

1. Grewal B.S., “Higher Engineering Mathematics”, Fortieth Edition, Khanna Publishers, 2007.

**REFERENCES**

1. Churchill R.V. and Brown J.W., “Fourier Series and Boundary Value Problems”, Fourth Edition, McGraw-Hill Book Co., 1987.
2. Veerarajan .T, “Engineering Mathematics III”, Third edition, Tata McGraw-Hill Education, 2007.
3. Kandasamy P., Thilagavathy K. and Gunavathy K., “Engineering Mathematics Volume III”, S. Chand & Company Ltd., 1996.

## HS1201 – ENVIRONMENTAL SCIENCE AND ENGINEERING

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**3 0 0**

### **UNIT I IMPORTANCE OF ENVIRONMENTAL STUDIES 9**

Definition – Scope and Importance – Need for Public Awareness – Forest resources – Water resources – Mineral resources – Land resources – Energy resources – Food resources – Equitable use of resources for sustainable lifestyles.

### **UNIT II ECOSYSTEMS AND BIO DIVERSITY 12**

Concept of Ecosystem – Structure and function of an ecosystem – Energy flow in the ecosystem – Food chains – Food webs – Ecological Pyramids. Definition of Bio – diversity – Bio-geographical classification in India - Value of bio-diversity – Bio diversity at Global, National and local levels – India as a mega diversity nation – Hot spots of bio diversity – Threats to bio diversity – Conservation of bio diversity

### **UNIT III ENVIRONMENTAL POLLUTION 9**

Definition – Causes and Effects of Environmental Pollution – Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Hazards – Solid waste management – Societal role in Pollution prevention – Environmental Disasters and management.

### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9**

Unsustainable to sustainable development – Concept of conservation – Water and energy conservation – Rain water harvesting – Climate change – Global warming – Acid rain – Ozone layer depletion – Nuclear accidents and holocaust – Environmental protection Act – Issues involved in Enforcement of Environmental legislation – Public awareness.

### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth – Population explosion – Family welfare programme – Environment and Human Health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of IT in Environment and Human Health

**Total: 45**

### **TEXT BOOKS**

1. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Second Edition, Pearson Education Pvt., Ltd., 2007.
2. Miller T.G. Jr., “Environmental Science”, Wadworth Publishing Co.

### **REFERENCES**

1. Kurian Joseph, “Essentials of Environmental Studies”, First Edition, Pearson Education, 2004.
2. Cunningham, W.P. Copper, T.H. Gorhani, “Environmental Encyclopaedia”, Jaico Publ., House, 2001.
3. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol.I and II Environ Media.
4. Bharucha Erach, “The Biodiversity of India”, Mapin Publishing Pvt., Ltd.,

## CE1201 – APPLIED GEOLOGY

**L T P**  
**3 0 0**

### **UNIT I GENERAL GEOLOGY 9**

Geology in Civil Engineering – Branches of geology – Earth Structures and composition – Elementary knowledge on continental drift and plate technologies. Earth processes – Weathering – Work of rivers – wind and sea and their engineering importance – Earthquake belts in India. Ground water – Mode of occurrence – prospecting – importance in civil engineering

### **UNIT II MINERALOGY 9**

Elementary knowledge on symmetry elements of important crystallographic system – Physical properties of minerals – study of the following rock forming minerals – Quartz family. Feldspar family – Augite – Hornblende – Biotite – Muscovite – Calcite – Garnet – properties – behaviour and engineering significance of clay minerals – Fundamentals of process of formation of ore minerals – Coal and petroleum – Their origin and occurrence in India.

### **UNIT III PETROLOGY 9**

Classification of rocks – distinction between igneous, sedimentary and metamorphic rocks. Description occurrence – engineering properties and distribution of following rocks. Igneous rocks – Granite – syenite – Diorite – Gabbro – Pegmatite – Dolerite and Basalt Sedimentary rocks sandstone – Limestone – shale congl – Conglomerate and breccia. Metamorphic rocks. Quartzite – Marble. Slate – Phyllite – Gniess and Schist.

### **UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHOD 9**

Attitude of beds – Outcrops – Introduction to Geological maps – study of structures – Folds, faults and joints – Their bearing on engineering construction. Seismic and Electrical methods for Civil Engineering investigations

### **UNIT V GEOLOGICAL INVESTIGATIONS IN CIVIL ENGINEERING 9**

Remote Sensing techniques – Study of air photos and satellite images – Interpretation for Civil Engineering projects – Geological conditions necessary for construction of Dams – Tunnels – Buildings – Road cutting – Land slides – Causes and preventions. Sea erosions and coastal protection.

**Total: 45**

### **TEXT BOOKS**

1. Krynine and Judd, 'Engineering Geology and Geotechniques, McGraw Hill book Company, 1990.
2. Parbin Singh, 'Engineering and General Geology' Katson Publication House, 1987.

### **REFERENCES**

1. Blyth, "Geology for Engineers", ELBS, 1995.
2. Legeet, "Geology and Engineering" McGraw Hill Book Company 1998.
3. Marland, P Billings, " Structural Geology" Prentice Hall, 1959

## CE1202 – STRENGTH OF MATERIALS I

**L T P**  
**3 1 0**

### **UNIT I RIGID BODIES AND DEFORMABLE SOLIDS 10**

Types of external loads – self weight – internal stress – normal and shear stress – strain – Hooke's law - Poisson's ratio – relationship between elastic constants – stress strain diagrams - working stress – Mild steel – elongation of bars of constant and varying sections – statically determinate problems in tension and compression – assembly and thermal stresses – strain energy in tension – compression and shear.

### **UNIT II PRINCIPAL STRESS AND STRAIN, BMD AND SFD 10**

Stress on inclined planes - axial and biaxial stress field – principal stresses – Mohr's circle of stress – principal strains - different types of beams – shear force and bending moment diagrams for simply supported - overhanging and cantilever beams – relationship connecting intensity of loading – shear - bending moment slope and deflection.

### **UNIT III LATERALLY LOADED SYMMETRICAL BEAMS 8**

Theory of simple bending – limitations – bending stresses in beams of different cross sections – moment of resistance – beam of uniform strength leaf spring – shear stress distributions in beam sections – Slope and deflection due to bending – double integration – Maclauy's method – conjugate beam method.

### **UNIT IV TORSION - SPRINGS 9**

Torsion of circular solid and hollow shafts – power transmission – strain energy in shear and torsion – closely coiled and open coiled helical springs – stiffness.

### **UNIT V ANALYSIS OF PLANE TRUSSES 8**

Degree of redundancy – Determinate and indeterminate trusses – Analysis of determinate trusses – Methods of joints – Methods of sections – Tension Coefficient Method

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. Popov, "Engineering Mechanics of Solids", Second Edition, Pearson Education, 1998.
2. V.N. Vazirani, M.M Ratwani, Analysis of Structures, Volume – 1, Khanna Publishers.

### **REFERENCES**

1. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, 2003.
2. Srinath L.N, Advanced Mechanics of Solids, Tata McGraw Hill Publishing Co., 2003.
3. William Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, McGraw-Hill International Edition.

## CE1203 – BUILDING TECHNOLOGY

**L T P**  
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### **UNIT I PRELIMINARY INVESTIGATION 9**

Principles of Planning – Planning regulations and bye-laws-Site works and setting out – Excavations and Timbering – Sub soil drainage – Electricity Lighting on Building sites – Winter building – Preparation of layout – site Plan – Orientation of buildings.

### **UNIT II SITE SELECTION AND SUB STRUCTURES 9**

Site selection - Types of building as per NBC - Types of foundations – Shallow – Deep foundations – Machine foundation

### **UNIT III SUPER STRUCTURE 9**

Stone and Brick masonry – Composite masonry - Load bearing walls- Cavity Walls – Partition walls – Reinforced Brick masonry.

### **UNIT IV FLOORING & ROOFING 9**

Ground floors – Components – Types – suspended flooring – Upper floors – Types – Methods of laying. Type of roofs – Types of Pitched roof – Shell roofs – Folded Plate roofs – Constructional practices – Roof covering details.

### **UNIT V STAIRCASE & SERVICES 9**

Requirement of a good staircase – Type of staircase calculation for geometry – Ramps – Escalators, Lifts – Types – Handling Capacity.

**Total: 45**

### **TEXT BOOKS**

1. Arora S.P and Bindra S.P., Building Construction Planning Techniques and methods of construction, Dhanpat Rai and Sons, 1997.
2. B.C Punmia, Ashok Kumar Jain, and Arun Kumar Jain, “Building Construction”, Laxmi Publications Pvt., Ltd., 1997.

### **REFERENCES**

1. Chudley “Construction Technology” Vol.1,2,3 and 4 ELBS Publisher, 1997.
2. National Building Code of India, Parts III,IV,VII & IX 1983.

## CE1204 – SURVEYING I

**L T P**  
**3 0 0**

### **UNIT I INTRODUCTION AND CHAIN SURVEYING 10**

Definition – Principles – Classification – Field and office work – Scales – Conventional signs – Survey instruments, their care and adjustment – Ranging and chaining – Reciprocal ranging – Setting perpendiculars – well – conditioned triangles – Traversing – Plotting – Enlarging and reducing figures.

### **UNIT II COMPASS SURVEYING AND PLANE TABLE SURVEYING 8**

Prismatic compass – Surveyors compass – Bearing – Systems and conversions – Local attraction – Magnetic declination – Dip – Traversing – Plotting - Adjustment of errors - Plane table instruments and accessories – Merits and demerits – Methods – Radiation – Intersection – Resection – Traversing.

### **UNIT III LEVELLING AND APPLICATIONS 12**

Level line – Horizontal line – Levels and Staff – Spirit level Sensitiveness – Bench marks – Temporary and permanent adjustments – Fly and check levelling – Booking – Reduction – Curvature and refractions – Reciprocal levelling – Longitudinal and cross sections – Plotting – Calculation of areas and volumes – Contouring – Methods – Characteristics and uses of contours – Plotting – Earth work volume – Capacity of reservoirs.

### **UNIT IV THEODOLITE SURVEYING 8**

Theodolite – Vernier and microptic – Description and uses – Temporary and permanent adjustments of vernier transit – Horizontal angles – Vertical angles – Height and distances – Traversing – Closing error and distribution – Gales tables - Omitted measurements.

### **UNIT V ENGINEERING SURVEYING 7**

Reconnaissance – preliminary and location survey for engineering projects – Curves – Elements of Circular curves – Degree and Radius of curve and their relation – simple curves – compound curves – reverse curves and vertical curves. Definition and requirements of transition curves – Length of transition curve

**Total: 45**

### **TEXT BOOKS**

1. Bannister A, "Surveying", Seventh Edition, Pearson Education, 2006.
2. Punmia B.C Surveying Vols, I, II and III Laxmi Publications, 1989

### **REFERENCES**

1. Clark D., Plane and Geodetic Surveying Vols. I and II, C.B.S. Sixth Edition, Publishers and Distributors, 1971.
2. Heribert Kahmen and Wolfgang Faig, Surveying, Walter de Gruyter, 1995.
3. James M. Anderson and Edward M. Mikhail, Introduction to Surveying, McGraw Hill book Company, 1995.

**LIST OF EXERCISES**

1. Tension test on M Steel bar and HYSD bars
2. Torsion test on MS / CI specimens and shear test on MS
3. Test on Timber beam – Bending test - compression test on timber specimens
4. Test on brick crushing, water absorption
5. a. Hardness test on metals  
b. Impact test.
6. a. Crushing Test on concrete cubes  
b. Split Tension test on concrete cylinder.
7. Test on Springs for stiffness
8. Test on cement - fineness, normal consistency, setting times
9. Test on fine aggregates - sieves analysis test – bulking - fineness modulus
10. Test on coarse aggregate crushing value and impact value

**Total: 45**

**SURVEYING PRACTICAL I**

**LIST OF EXERCISES**

1. Chain survey - Traversing and plotting of details
2. Compass survey - Traversing with compass and Plotting
3. Plane table survey - Methods of Radiation and Intersection
4. Plane table survey - Solving three point problems
5. Plane table survey - Solving two point problems
6. Plane table survey - Traverse
7. Levelling - Fly levelling – Plane of collimation method
8. Levelling - Fly levelling – Rise and fall method
9. Levelling - Longitudinal and cross sectioning
10. Levelling - Contour surveying
11. Theodolite survey - Measurement of horizontal angle by method of repetition
12. Theodolite survey - Measurement of horizontal angle by method of reiteration

**Total: 60**

**SEMESTER IV**  
**MA1251 – NUMERICAL METHODS**

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**UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9**

Linear interpolation methods (method of false position) – Newton’s method –Solution of linear system by Gaussian elimination and Gauss – Jordan methods – iterative methods: Gauss Jacobi and Gauss-Seidel methods – Inverse of a matrix by Gauss–Jordan method – Eigen value of a matrix by power method

**UNIT II INTERPOLATION AND APPROXIMATION 9**

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulae.

**UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9**

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integrals using trapezoidal and Simpson's rules.

**UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9**

Single step Methods: Taylor Series method – Euler’s method – Modified and Improved Euler’s method – Fourth order Runge-Kutta method for solving first and second order equations – Multi-step methods: Milne’s and Adam’s predictor and corrector methods.

**UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9**

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by implicit and explicit methods – one dimensional wave equation and two dimensional Laplace and Poisson equations.

**L: 45 T: 15 Total: 60**

**TEXT BOOK**

1. C.F. Gerald and P.O. Wheatley “Applied Numerical Analysis”, Seventh Edition, Pearson Education, 2007.

**REFERENCES**

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods for Scientific and Engineering Computation” Fourth Edition, New Age International Publishers, 2003.
2. .M.K. Venkatraman, ‘Numerical Methods’, National Publication Company, 1991.
3. P. Kandasamy, K. Thilakavthy and K. Gunavathy, “Numerical Methods”, Second Edition, S.Chand & Co., 2003.

## CE1251 – HYDRO MECHANICS

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### UNIT I DEFINITIONS AND FLUID PROPERTIES 8

Definition – Fluid and fluid mechanics – Dimensions and units – Fluid properties – Continuum Concept of system volume.

### UNIT II FLUID STATICS & KINEMATICS 10

Pascal's Law and Hydrostatic equation – Forces on plane and curved surface – Buoyancy – Meta centre – Pressure measurement – Fluid mass under relative equilibrium.

#### Fluid Kinematics

Stream, streak and path lines – Classification of flows – Continuity equation (one, two and three dimensional forms) – Stream and potential functions – flow nets – Velocity measurement (Pilot tube, current meter, hot wire and hot film anemometer, float technique, Laser Doppler Velocimetry)

### UNIT III FLUID DYNAMICS 9

Euler and Bernoulli's equations – Application of Bernoulli's equation – Discharge measurement – Laminar flows through pipes and between plates – Hagen Poiseuille equation – Turbulent flow – Darcy Weisbach formula – Moody diagram – Momentum Principle

### UNIT IV BOUNDARY LAYER AND FLOW THROUGH PIPES 9

Definition of boundary layer – Thickness and classification – Displacement and momentum thickness – Development of laminar and turbulent flows in circular pipes – Major and minor losses of flow in pipes – Pipes in series and in parallel – Pipe network

### UNIT V SIMILITUDE AND MODEL STUDY 9

Dimensional Analysis – Rayleigh's methods – Buckingham's Pi-theorem – Similitude and models – Scale effect and distorted models.

**L: 45 T: 15 Total: 60**

### TEXT BOOKS

1. Kumar, K.L., "Engineering Fluid Mechanics" Eurasia Publishing House (P) Ltd., 1995.
2. Garde, R.J. and Mirajgaoker, A.G., "Engineering Fluid Mechanics" Nem Chand Bros.,

### REFERENCES BOOKS

1. Streeter, Victor, L. and Wylie, Benjamin E., "Fluid Mechanics" McGraw Hill Ltd., 1998.
2. E. John Einnemore and Josephs B. Franzini, "Fluid Mechanics with engineering Applications" McGraw Hill International Edition.
3. Pernard Messay, "Mechanics of Fluids" Seventh Edition, Nelson Thornes Ltd., 1998.

## CE1252 – SOIL MECHANICS

**L T P**  
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### **UNIT I INTRODUCTION 10**

Nature of soil – Problems with soil – phase relation – sieve analysis – sedimentation analysis – Atterberg limits – classification for engineering purpose - BIS Classification system – Soil compaction – factors affecting compaction – field compaction methods and monitoring.

### **UNIT II SOIL WATER AND WATER FLOW 8**

Soil water – various forms – Influence of clay minerals – Capillary rise – Suction – Effective stress concepts in soil – Total, neutral and effective stress distribution in soil – Permeability – Darcy's Law – Permeability measurements in the laboratory – quick sand condition – Seepage – Laplace Equation – Introduction to flow nets – properties and uses – Application to simple problems.

### **UNIT III STRESS DISTRIBUTION, COMPRESSIBILITY AND SETTLEMENT 12**

Stress distribution in soil media – Boussinesque formula – stress due to line load and circular and rectangular loaded area – approximate methods – Use of influence charts – Westergaard equation for point load – Components of settlement – Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – governing differential equation – laboratory consolidation test – Field consolidation curve – NC and OC clays – problems on final and time rate of consolidation.

### **UNIT IV SHEAR STRENGTH 8**

Shear strength of cohesive and cohesionless soils – Mohr – Coulomb failure theory – Saturated soil and unsaturated soil (basics only) – Strength parameters – Measurement of shear tests – Types of shear tests based on drainage and their applicability – Drained and undrained behaviour of clay and sand – stress path for conventional triaxial test.

### **UNIT V SLOPE STABILITY 9**

Slope failure mechanisms – Modes – Infinite slopes – Finite slopes – Total and effective stress analysis – Stability analysis for purely cohesive and C-f soils – Method of slices – Modified Bishop's method – Friction circle method – stability number – problems – Slope protection measures.

**Total: 45**

### **TEXT BOOKS**

1. Purushothama Raj.P, "Soil Mechanics and Foundation Engineering", First Edition, Pearson Education, 2007
2. Punima Pc., "Soil Mechanics and foundations" Laximi Publications, Ltd., 1995.
3. Gopal Ranjan and Rao A.S.R 'Basic and Applied Soil Mechanics' New Age., International Publications, 2000.

### **REFERENCES**

1. Coduto, D.P, 'Geotechnical Engineering Principles and Practices', First Edition, Prentice Hall of India Private Limited, 2002.
2. McCarthy D.F "Essentials of Soil Mechanics and Foundations Basic Geotechniques, Sixth Edition, Prentice Hall, 2002.
3. Das, B.M "Principles of Geotechnical Engineering", Fifth Edition, Thomas Books / cole, 2002.

## CE1253 – CONCRETE TECHNOLOGY

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**8**

### UNIT I CEMENT TYPES – TESTING

Cement – various types of cement – OPC, puzzolanas in cement and their effects - Rapid hardening cement - sulphate resisting cement– Quick setting cement – Port land slag cement – High alumina cement - Quality assessment by testing – Fineness tests – Test for standard consistency – setting times – sound ness test – compressive strength test on standard mortar cubes – Test - loss on ignition – acceptable standards on these tests Limitations.

### UNIT II COARSE AGGREGATES

**8**

Coarse aggregates – classification – sources – size, shape – texture - quality assessment tests - Flakiness and elongation index tests – uses – Aggregate crushing value – aggregate impact value – Abrasion tests – Deval attrition - Los Angeles test – Water absorbing test – soundness test - Sieve analysis grading – Brick aggregate.

### UNIT III FINE AGGREGATE AND WATER

**8**

Fine aggregates – river sand – crusher dust – tests – bulking - fineness modulus – Grading curves for aggregates – uses in concrete - Quality of water for concrete – Test on Water – allowable limits of – suspended particles, salts, oil contamination, Algae, sugar, Acid, Alkalis.

### UNIT IV CONCRETE

**12**

Classification of concrete – Cement grades – 33, 43 and 53 - concrete mix design methods – IS, ACI – water cement ratio - Duft Abram’s law – Limitations – Aggregate cement ratio – Gel space ratio – Workability, Durability – tests - Slump, Compaction factor - Compaction different vibrators – High Strength concrete mix design – Concrete Strength tests – Compression Flexure – Tension tests – Split tension - Double punch compression test – Acceptance criteria on Test Results - Study on curing methods – accelerated curing.

### UNIT V SPECIAL CONCRETE – NON DESTRUCTIVE TESTING OF CONCRETE

**9**

Under water concreting – Ferro Cement – Air entrained concrete – No fine concrete – Methods of Non destructive tests – Rebound Hammer test - principle – Limitations – Resonant frequency test method – Pulse Velocity Tests – Mechanical sonic pulse and ultrasonic pulse velocities – Factors affecting the measurement of pulse velocity – applications - X ray and gamma ray testing.

**Total: 45**

### TEXT BOOKS

1. Neville, “Concrete Technology”, First Edition, Pearson Education, 1987.
2. Duggal S.K – Building Materials – New age international Publishers, 2007 .
3. Shetty M.S – Concrete Technology – Theory and Practice, S. Chand & Company, 2002.

### REFERENCES

1. Jain O.P and J. Krishna - Plain and Reinforced Concrete – Vol – I, Nem Chand Brother, 1970
2. Punima B.C., “ Building Construction”, Laxmi Publications, 2007

## CE1254 – SURVEYING II

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### UNIT I TACHEOMETRIC SURVEYING 6

Tacheometric system – Tangential – stadia and subtense methods – Stadia system – Horizontal and inclined sights – Vertical and normal staffing – Fixed and movable hairs – Stadia constants – Analatic lens – Subtense bar.

### UNIT II CONTROL SURVEYING 8

Working from whole to part – Horizontal and vertical control methods – Triangulation – Signals – Base line – Instruments and accessories – Corrections – Satellite station – Reduction to centre – Trigonometric levelling – Single and reciprocal observations – Modern trends – Bench marking

### UNIT III SURVEY ADJUSTMENTS 8

Errors- Sources – Precautions and corrections – Classification of errors – True and most probable values – weighted observations – Methods of equal shifts – Principle of least squares – Normal equation – Correlates – Level nets – Adjustment of simple triangulation networks.

### UNIT IV ASTRONOMICAL SURVEYING 11

Celestial sphere – Astronomical terms and definitions – Motion of sun and stars – Apparent altitude and corrections – Celestial co-ordinate systems – Different time systems – Nautical almanac – Star constellations – Practical astronomy – Field observations and calculations for azimuth.

### UNIT V OTHER TOPICS 12

Photogrammetry – Introduction – Terrestrial and aerial Photographs – Stereoscapy – Parallax – Electromagnetic distance measurement – Carrier waves – Principles – Instruments – Trilateration – Hydrographic Surveying – Cartography – Cartographic concepts and techniques – Cadastral surveying – Definition – Uses – Legal values – Scales and accuracies.

**Total: 45**

### TEXT BOOKS

1. Bannister A and Raymond S., Sixth Edition, Surveying ELBS, 1992.
2. Punima B C., Surveying Vols. I, II and III, Laxmi Publications, 1989.

### REFERENCES

1. Clark D., Plane and Geodetic Surveying, Vols. I and II, Sixth Edition, C.B.S Publishers and Distributors, 1971.
2. James M. Anderson and Edward M. Mikhail, Introduction to Surveying, McGraw Hill Book Company, 1985.
3. Wolf P.R Elements of Photogrammetry, Second Edition, McGraw Hill Book Company, 1986.

## CE1255 – STRENGTH OF MATERIALS II

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### **UNIT I ENERGY PRINCIPLES 9**

Strain energy and strain energy density – strain energy due to shear, flexure torsion & axial forces – Castigliano’s theorems – principles of virtual of work – applications of energy theorems for computing deflections in beams and trusses – Maxwell’s reciprocal theorem.

### **UNIT II INDETERMINATE BEAMS 9**

Propped cantilever and fixed beams – fixed end moments and reactions for concentrated load (central, non central) – uniformly distributed load – triangular load (maximum at centre and maximum at end) – clapeyron’s theorem of three moments – analysis of continuous beams – shear force and bending moments diagrams for continuous beams – slope and deflection in continuous beams (qualitative study only)

### **UNIT III COLUMNS AND STRUTS 9**

Eccentrically loaded short columns – middle third rule – cores or kern of the section – columns of unsymmetrical sections – (angle sections) Euler’s theory of long columns – critical loads for prismatic columns with different end conditions; Rankine Gordon formula for eccentrically loaded columns.

### **UNIT IV STATE OF STRESS - THREE DIMENSIONS - TWO DIMENSIONS 9**

Spherical and deviatoric components of stress tensor – volumetric strain – theories of failures – principal stress – principal strain – shear stress – strain energy and distortion energy theories – interaction problems and interaction curves – residual stresses.

### **UNIT V ADVANCED TOPICS IN BENDING OF BEAMS 9**

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Hook – curved beams – Winkler Bach formula – fatigue and fracture endurance limit.

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. Egor P Popov “Engineering Mechanics of Solids” Prentice Hall of India, 2003.
2. V.N Vazirani M.M. Ratwani’ Analysis of Structures” Vol-1, Khanna Publishers.

### **REFERENCES**

1. Kazimi S.M.A, Solid Mechanics, Tata McGraw Hill Publishing Co, 2003.
2. William Nash “Theory and Problems of Strength of Materials’ Schaum’s Outline series, McGraw Hill International Edition.
3. R.S Khurmi “Strength of Materials, S. Chand & Company Ltd., 2003.

**LIST OF EXERCISES**

1. Grain size distributions – Sieve analysis
2. Grains size distribution – Hydrometer analysis
3. Specific gravity of soil grains
4. Relative density of sand.
5. Atterberg limits – test
6. Determination of moisture – Density relationship using standard Proctor test.
7. Permeability determination (constant head and falling head methods)
8. Determination of shear strength parameters.
  - Direct shear test on cohesion less soil
  - Unconfined compression test on cohesive soil
  - Triaxial compression test
9. One dimensional consolidation test (determination of coefficient of consolidation only)
10. Field density test (Core cutter and sand replacement methods)

**Total: 45**

## CE1257 – SURVEY PRACTICAL II

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### LIST OF EXERCISES

1. Study of Theodolite
2. Measurement of horizontal angles by reiteration and repetition and vertical angles
3. Theodolite survey traverse
4. Heights and distances – Triangulation – Single plane methods.
5. Tacheometry – Tangential system – Stadia system – Subtense system
6. Setting out works – Foundation marking – Simple curve (right/left-handed) – Transition curve.
7. Field observation for Calculation of azimuth
8. Demonstration of Total station

**Total: 60**

## SEMESTER V

### CE1301 – APPLIED HYDRAULICS AND MACHINERY

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**UNIT I OPEN CHANNEL FLOW 8**

Open channel flow – Types and regimes of flow – Velocity distribution in open channel – Wide open channel – Specific energy – Critical flow and its computation.

**UNIT II UNIFORM FLOW 8**

Uniform flow – Velocity measurement – Manning’s and Chezy’s formula – Determination of roughness coefficients – Determination of normal depth and velocity – Most economical sections – Non-erodible channels

**UNIT III VARIED FLOW 10**

Dynamic equations of gradually varied flow – Assumptions – Characteristics of flow profiles – Draw down and back water curves – Profile determination – Graphical integration, direct step and standard step method – Flow through transitions - Hydraulic jump – Types – Energy dissipation – Surges – Surge channel transitions.

**UNIT IV TURBINES 10**

Draft tube and cavitations – Application of momentum principle – Impact of jets on plane and curved plates - turbines - classification - radial flow turbines - axial flow turbines – Impulse and Reaction turbines.

**UNIT V PUMPS 9**

Centrifugal pump - minimum speed to start the pump – multistage Pumps – Jet and submersible pumps - Positive displacement pumps - reciprocating pump - negative slip - flow separation conditions - air vessels -indicator diagram and its variation - savings in work done - rotary pumps.

**Total: 45**

#### TEXT BOOKS

1. Subramanya K., "Flow in Open channels", Tata McGraw-Hill Publishing Company, 1994.
2. Kumar K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi, (7th Edition), 1995.
3. Jain A.K., "Fluid Mechanics (including Hydraulic Machines)", Khanna Publishers, 8th edition, 1995.

#### REFERENCE

1. Ranga Raju, K.G., "Flow through Open Channels", Tata McGraw-Hill, 1985

## CE1302 – DESIGN OF REINFORCED CONCRETE ELEMENTS

<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>0</b>	<b>0</b>

### **UNIT I      METHODS OF DESIGN OF CONCRETE STRUCTURES      12**

Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of flexural members and slabs by working stress method – Principles of Design of Liquid retaining structures – Properties of un-cracked section – Calculation of thickness and reinforcement for Liquid retaining structure

### **UNIT II      LIMIT STATE DESIGN FOR FLEXURE      12**

Analysis and design of one way and two way rectangular slab subjected to uniformly distributed load for various boundary conditions and corner effects – Analysis and design of singly and doubly reinforced rectangular and flanged beams

### **UNIT III      LIMIT STATE DESIGN FOR BOND, ANCHORAGE SHEAR & TORSION      12**

Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shear and torsion - Design of RC members for combined bending shear and torsion.

### **UNIT IV      LIMIT STATE DESIGN OF COLUMNS      12**

Types of columns – Braced and unbraced columns – Design of short column for axial, uniaxial and biaxial bending – Design of long columns.

### **UNIT V      LIMIT STATE DESIGN OF FOOTING AND DETAILING      12**

Design of wall footing – Design of axially and eccentrically loaded rectangular footing – Design of combined rectangular footing for two columns only – Standard method of detailing RC beams, slabs and columns – Special requirements of detailing with reference to erection process.

**Total: 60**

### **TEXT BOOKS**

1. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt. Ltd., New Delhi
2. Krishna Raju, N., “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors, New Delhi

### **REFERENCES**

1. Jain, A.K., “Limit State Design of RC Structures”, Nemchand Publications, Rourkee
2. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd., New Delhi
3. Unnikrishna Pillai, S., Devadas Menon, “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd., New Delhi

## CE1303 – STRUCTURAL ANALYSIS I

<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>0</b>	<b>0</b>

### **UNIT I      DEFLECTION OF DETERMINATE STRUCTURES      12**

Principles of virtual work for deflections – Deflections of pin-jointed plane frames and rigid plane frames – Willot diagram - Mohr's correction

### **UNIT II      MOVING LOADS AND INFLUENCE LINES      12** (DETERMINATE & INDETERMINATE STRUCTURES)

Influence lines for reactions in statically determinate structures – Influence lines for members forces in pin-jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads. Muller Breslau's principle – Influence lines for continuous beams and single storey rigid frames – Indirect model analysis for influence lines of indeterminate structures – Beggs deformeter

### **UNIT III      ARCHES      12**

Arches as structural forms – Examples of arch structures – Types of arches – Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches – Settlement and temperature effects.

### **UNIT IV      SLOPE DEFLECTION METHOD      12**

Continuous beams and rigid frames (with and without sway) – Symmetry and antisymmetry – Simplification for hinged end – Support displacements.

### **UNIT V      MOMENT DISTRIBUTION METHOD      12**

Distribution and carry over of moments – Stiffness and carry over factors – Analysis of continuous beams – Plane rigid frames with and without sway – Naylor's simplification.

**Total: 60**

### **TEXT BOOKS**

1. "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", Vaidyanadhan, R and Perumal, P, Laxmi Publications, New Delhi, 2003
2. "Structural Analysis", L.S. Negi & R.S. Jangid, Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 2003
3. "Intermediate Structures", Wang, C.K., McGraw-Hill

### **REFERENCE**

1. Analysis of Indeterminate Structures – C.K. Wang, Tata McGraw-Hill

## CE1304 – TRANSPORT ENGINEERING I

L	T	P
3	0	0

### UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of Road Construction, Highway Development in India – Necessity of Highway Planning – Classification of roads - Requirements of Ideal Alignment, Factors Controlling Highway Alignment Engineering Surveys for Alignment - Conventional Methods and Modern Methods (Remote Sensing, GIS and GPS techniques) Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements – Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards], Cross sections of different Class of Roads - Principles of Highway Financing

### UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Design of Horizontal Alignment – Horizontal Curves Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves-Sight Distances - Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD] -Geometric Design of Hill Roads [IRC Standards Only]

### UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9

Rigid and Flexible Pavements- Components and their Functions -Design Principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements - ESWL, Climate, Sub-grade Soil and Traffic - Design Practice for Flexible Pavements [CBR method, IRC Method and Recommendations- Problems] - Design Practice for Rigid Pavements – [IRC Recommendations-Problems] – Joints

### UNIT IV HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE 9

Desirable Properties of Bitumen - Penetration, Ductility, Viscosity, Binder content and Softening point Tests. - Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications] - Highway Drainage [IRC Recommendations]

### UNIT V HIGHWAY MAINTENANCE 9

Types of defects in Flexible pavements - Surface defects, Cracks, Deformation, Disintegration – Symptoms, Causes and Treatments. - Types of Pavement, Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping – and Special Repairs. - Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening - Overlay design by Benkelman Beam Method [Procedure only],

**Total: 45**

## **TEXT BOOKS**

1. Khanna K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001.
2. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 2000.

## **REFERENCES**

1. Transportation Engineering & Planning, C.S. Papacostas, P.D. Prevedouros, Prentice Hall of India Pvt ltd, 2006.
2. IRC Standards (IRC 37 - 2001 & IRC 58 -1998)
3. Bureau of Indian Standards (BIS) Publications on Highway Materials
4. Specifications for Road and Bridges, MORTH (India)

## CE1305 – ENVIRONMENTAL ENGINEERING

L T P  
3 0 0

### UNIT I WATER SUPPLY SYSTEMS – SOURCE & CONVEYANCE 6

Objectives – Population forecasting – Design period – Water demand characteristics – Sources of water – Source selection – Water quality parameters & significance – Standards – Intake structures – Conveyance – Hydraulics – Laying, jointing & testing of pipes – Pump selection – appurtenances

### UNIT II DESIGN PRINCIPLES OF WATER TREATMENT 10

Objectives – Selection of unit operations and processes – Principles of flocculation, sedimentation, filtration, disinfection – Design principles of flash mixer, flocculator, clarifiers, filters – Disinfection devices – Softening – Demineralisation – Aeration – Iron removal – Defluoridation – Operation and Maintenance aspects - Residue Management

### DISTRIBUTION

Requirements – Components – Service reservoir design – Analysis of distribution network – Hardy Cross method – Equivalent Pipe method – computer application – Leak detection

### UNIT III SEWERAGE SYSTEM: COLLECTION & TRANSMISSION 10

Sources of wastewater – Quantity of sanitary sewage – Storm run off estimation – Wastewater characteristics and significance – Effluent disposal standover – Design of sewers – Computer applications – Laying, jointing and testing of sewers – Sewer appurtenances – Pump selection

### UNIT IV SEWAGE TREATMENT & DESIGN PRINCIPLES 10

Objectives – Selection of unit operation and process – Design principles of primary and secondary treatment, screen chamber, grit chamber, primary sedimentation tanks, activated sludge process – Aeration tank & oxidation ditch – Trickling filter - Stabilisation ponds – Septic tanks with soak pits – Sludge: treatment and disposal – Biogas recovery – Sewage farming

### UNIT V DISPOSAL OF SEWAGE 9

Disposal on land – Disposal into water bodies – Oxygen sag curve – Streeter Phelp's model – Wastewater reclamation techniques

**Total: 45**

### TEXT BOOKS

1. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi
2. Modi, P.N., "Environmental Engineering I & II", Standard Book House, Delhi – 6

### REFERENCES

1. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999
2. Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1993
3. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987
4. Metcalf and Eddy, M.C., "Wastewater Engineering – Treatment & Reuse", Tata McGraw-Hill Publications, New Delhi, 2003

# CE1306 – FOUNDATION ENGINEERING

L	T	P
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## UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 12

Scope and objectives – Methods of exploration-averaging and boring – Water boring and rotatory drilling – Depth of boring – Spacing of bore hole - Sampling – Representative and undisturbed sampling – sampling techniques – Split spoon sampler, Thin tube sampler, Stationary piston sampler – Bore log report – Penetration tests (SPT and SCPT) – Data interpretation (Strength parameters and Liquefaction potential) – Selection of foundation based on soil condition.

## UNIT II SHALLOW FOUNDATION 12

Introduction – Location and depth of foundation – codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems - Bearing Capacity from insitu tests (SPT, SCPT and plate load) – Allowable bearing pressure, Settlement – Components of settlement – Determination of settlement of foundations on granular and clay deposits – Allowable settlements – Codal provision – Methods of minimising settlement, differential settlement.

## UNIT III FOOTINGS AND RAFTS 12

Types of foundation – Contact pressure distribution below footings & raft - Isolated and combined footings – types – proportioning - mat foundation – types – use - proportioning – floating foundation.

## UNIT IV PILES 12

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil - Static formula - dynamic formulae (Engineering news and Hiley's) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – uplift capacity – Group capacity by different methods (Feld's rule, Converse Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test – Forces on pile caps – under reamed piles – Capacity under compression and uplift.

## UNIT V RETAINING WALLS 12

Plastic equilibrium in soils – active and passive states – Rankine's theory – cohesionless and cohesive soil - Coloumb's wedge theory – condition for critical failure plane - Earth pressure on retaining walls of simple configurations – Graphical methods (Rebhann and Culmann) - pressure on the wall due to line load – Stability of retaining walls.

**Total: 60**

## **TEXT BOOKS**

1. Murthy, V.N.S, "Soil Mechanics and Foundation Engineering", UBS Publishers Distribution Ltd, New Delhi, 1999.
2. Gopal Ranjan and Rao, A.S.R. "Basic and Applied Soil Mechanics", Wiley Eastern Ltd., New Delhi (India), 2003.

## **REFERENCES**

1. Das, B.M. "Principles of Foundation Engineering (Fifth edition), Thomson Books / COLE, 2003
2. Swamisaran, "Analysis and Design of Structures – Limit state Design", Oxford IBH Publishing Co-Pvt. Ltd., New Delhi, 1998
3. Kaniraj, S.R, "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2002
4. Bowles J.E, "Foundation analysis and design", McGraw-Hill, 1994
5. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi publications pvt. Ltd., New Delhi, 1995.
6. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 1995
7. N.N. Som and S.C. Das, "Theory and Practice of Foundation Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2003

**LIST OF EXPERIMENTS**

1. Sampling and preservation methods and significance of characterisation of water and wastewater.
2. Determination of
  - i) P<sup>H</sup> and turbidity
  - ii) Hardness
3. Determination of iron & fluoride
4. Determination of residual chlorine
5. Determination of Chlorides
6. Determination of Ammonia Nitrogen
7. Determination of Sulphate
8. Determination of Optimum Coagulant Dosage
9. Determination of available Chlorine in Bleaching powder
10. Determination of dissolved oxygen
11. Determination of suspended, volatile and fixed solids
12. B.O.D. test
13. C.O.D. test
14. Introduction to Bacteriological Analysis (Demonstration only)

**Total: 45**

**REFERENCES**

1. Standard methods for the examination of water and wastewater, APHA, 20<sup>th</sup> Edition, Washington, 1998
2. Garg, S.K., “Environmental Engineering Vol. I & II”, Khanna Publishers, New Delhi
3. Modi, P.N., “Environmental Engineering Vol. I & II”, Standard Book House, Delhi-6

## LIST OF EQUIPMENTS

(for a batch of 30 students)

1.	P <sup>H</sup> meter		
2.	Turbidity meter	-	1 no.
3.	Conductivity meter	-	1 No.
4.	Refrigerator	-	1 No.
5.	BOD incubator	-	1 No.
6.	Muffle furnace	-	1 No.
7.	Hot air oven	-	1 No.
8.	Magnetic stirrer with hot plates	-	5 Nos.
9.	Desicator	-	1 No.
10.	Jar test apparatus	-	1 No.
11.	Water bath	-	1 No.
12.	Furniture	-	1 lot
13.	Glass waves / Crucibles	-	1 lot
14.	Chemicals	-	1 lot
15.	COD apparatus	-	1 No.
16.	Kjeldane apparatus	-	1 No.
17.	Heating mantles	-	5 Nos.
18.	Calorimeter	-	1 No.
19.	Chlorine comparator	-	1 No.
20.	Furniture: Work table	-	10 Nos.
21.	Beaker	-	30 Nos.
22.	Standard flask	-	30 Nos.
23.	Burette with stand	-	15 Nos.
24.	Pipette	-	15 Nos.
25.	Crucible	-	15 Nos.
26.	Filtration assembly	-	1 No.
27.	Chemicals	-	Lot

**LIST OF EXPERIMENTS**

1. Determination of co-efficient of discharge for orifice
2. Determination of co-efficient of discharge for notches
3. Determination of co-efficient of discharge for venturimeter
4. Determination of co-efficient of discharge for orifice meter
5. Study of impact of jet on flat plate (normal / inclined)
6. Study of friction losses in pipes
7. Study of minor losses in pipes
8. Study on performance characteristics of Pelton turbine.
9. Study on performance characteristics of Francis turbine
10. Study on performance characteristics of Kaplan turbine
11. Study on performance characteristics of Centrifugal pumps (Constant speed / variable speed)
12. Study on performance characteristics of reciprocating pump.

**Total 45**

**LIST OF EQUIPMENTS**

- |    |   |   |        |
|----|---|---|--------|
| 1. | Bernoulli's theorem – Verification Apparatus  | - | 1 No.  |
| 2. | Calculation of Metacentric height   |   |        |
|    | Water tank  | - | 1 No.  |
|    | Ship model with accessories   | - | 1 No.  |
| 3. | Measurement of velocity   |   |        |
|    | Pitot tube assembly   | - | 1 No.  |
| 4. | Flow measurement  |   |        |
|    | open channel flow   |   |        |
|    | (i) Channel with provision for fixing notches<br>(rectangular, triangular & trapezoidal forms)  | - | 1 Unit |
|    | (ii) Flume assembly with provisions for conducting<br>experiments on Hydraulic jumps, generation of<br>surges etc.  | - | 1 Unit |
| 5. | Flow measurement in pipes   |   |        |
|    | (i) Venturimeter, U tube manometer fixtures like<br>Valves, collecting tank   | - | 1 Unit |
|    | (ii) Orifice meter, with all necessary fittings in<br>pipe lines of different diameters   | - | 1 Unit |
|    | (iii) Calibration of flow through orifice tank with<br>Provisions for fixing orifices of different shapes,<br>collecting tank   | - | 1 Unit |
|    | (iv) Calibration of flow through mouth piece<br>Tank with provisions for fixing mouth pieces<br>Viz external mouth pieces & internal mouth piece<br>Borda's mouth piece | - | 1 Unit |

6.	Losses in Pipes		
	Major loss – Friction loss		
	Pipe lengths (min. 3m) of different diameters with		
	Valves and pressure rapping & collecting tank	-	1 Unit
	Minor Losses		
	Pipe line assembly with provisions for having		
	Sudden contractions in diameter, expansions		
	Bends, elbow fitting, etc.	-	1 Unit
7.	Pumps		
	(i) Centrifugal pump assembly with accessories		
	(single stage)	-	1 Unit
	(ii) Centrifugal pump assembly with accessories		
	(multi stage)	-	1 Unit
	(iii) Reciprocating pump assembly with accessories	-	1 Unit
	(iv) Deep well pump assembly set with accessories	-	1 Unit
8.	Turbine		
	(i) Impulse turbine assembly with fittings		
	& accessories	-	1 Unit
	(ii) Francis turbine assembly with fittings		
	& accessories	-	1 Unit
	(iii) Kaplan turbine assembly with fittings		
	& accessories	-	1 Unit

# CE1309 – TRANSPORTATION ENGINEERING LABORATORY

L T P  
0 0 3

## I Testing On Aggregate

1. Presence of deleterious materials - IS 2386 - Part 2
1. Water absorption & Bulk Specific gravity - IS 2386 - Part -3
2. Particle size distribution - IS 2386 - Part -1
3. Flakiness and Elongation Index tests - IS 2386 - Part -1
  
4. Mechanical properties - IS 2386 - Part - 4
  - a. Aggregate crushing Value
  - b. Impact Value
  - c. Abrasion test Value and
  - d. Polished store Value
  
6. Soundness Test - IS 2386 - Part -5

## II. CBR Test – Studies and Experimentation

## III. Bituminous Materials

1. Bituminous coating & Stripping test – IS 6241
2. Viscosity of bitumin
3. Penetration test
4. Softening point – test
5. Heat stability test

**Total: 45**

## Equipments

- |  |                  |
|--|------------------|
| 1. Universal Testing Machine                           | -1               |
| 2. Abrasion test Machine                               | -1               |
| 3. Visco meter   | - 2              |
| 4. Impact test equipments                              | - 1              |
| 5. Measuring jars with Burners                         | - 2 sets         |
| 6. Standard needle for penetration test                | - 2              |
| 7. Thermo meter  | - 2              |
| 8. Flakiness & elongation test Equipment & accessories | - 2 sets in each |
| 9. CBR test with accessories with loading arrangements | -1 set           |

## SEMESTER VI

### CE1351 – DESIGN OF REINFORCED CONCRETE AND MASONRY STRUCTURES

	<b>L</b>	<b>T</b>	<b>P</b>
	<b>3</b>	<b>1</b>	<b>0</b>
<b>UNIT I      RETAINING WALLS</b>			<b>9</b>
Design of cantilever and counter fort retaining walls.			
<b>UNIT II      WATER TANKS</b>			<b>9</b>
Underground rectangular tanks – Domes – Overhead circular and rectangular tanks – Design of staging and foundations			
<b>UNIT III     SPECIAL STRUCTURES</b>			<b>9</b>
Design of staircases (ordinary and doglegged) – Design of flat slabs – Design of Reinforced concrete walls – Principles of design of mat foundation, box culvert and road bridges			
<b>UNIT IV     YIELD LINE THEORY</b>			<b>9</b>
Application of virtual work method to square, rectangular, circular and triangular slabs			
<b>UNIT V      BRICK MASONRY</b>			<b>9</b>
Introduction – Classification of walls – Lateral supports and stability – Effective height of wall and columns – Effective length of walls – Design loads– Load dispersion, Permissible stresses – Design of axially and eccentrically loaded brick walls.			

**L: 45 T: 15 Total: 60**

#### TEXT BOOKS

1. Krishna Raju, N., “Design of RC Structures”, CBS Publishers and Distributors, 2003.
2. Dayaratnam, P., “Brick and Reinforced Brick Structures”, Oxford and IBH Publishing House, 1997.
3. Varghese, P.C., “Limit State Design of Reinforced Concrete Structures”, 2002.

#### REFERENCES

1. Mallick, D.K. and Gupta A.P., “Reinforced Concrete”, Oxford and IBH Publishing Company, 1992.
2. Syal, I.C. and Goel, A.K., “Reinforced Concrete Structures”, A.H. Wheelers and Co. Pvt. Ltd., 1994.
3. Ram Chandra, “Limit State Design”, Standard Book House. 1990.

## CE1352 – STRUCTURAL ANALYSIS II

L	T	P
3	1	0

### UNIT I FLEXIBILITY METHOD FOR INDETERMINATE FRAMES 9

Equilibrium and compatibility – Determinate Vs Indeterminate structures – Indeterminacy – Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

### UNIT II MATRIX STIFFNESS METHOD 9

Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames.

### UNIT III FINITE ELEMENT METHOD 9

Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain Triangular elements.

### UNIT IV PLASTIC ANALYSIS OF STRUCTURES 9

Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.

### UNIT V SPACE AND CABLE STRUCTURES 9

Analysis of space trusses using method of tension coefficients – Beams curved in plan Suspension cables – Cables with two and three hinged stiffening girders.

**L: 45 T: 15 Total: 60**

### TEXT BOOKS

1. Coates, R.C., Coutie M.G. and Kong F.K., “Structural Analysis”, ELBS and Nelson, 1990.
2. Negi, L.S. and Jangid, R.S. “Structural Analysis”, Tata McGraw-Hill Publications, 2003.

### REFERENCES

1. Ghali, A., Nebille, A.M. and Brown, T.G., “Structural Analysis-A Unified Classical and Matrix Approach”, 5th Edition, Spon Press, 2003.
2. Vazirani, V.N. and Ratwani, M.M., “Analysis of Structures”, Khanna Publishers, 1990.
3. William Jr, W. and Gere, J.M., “Matrix Analysis of Framed Structures” CBS Publishers and Distributors, 1986.

## CE1353 – IRRIGATION ENGINEERING

L	T	P
4	0	0

### UNIT I IRRIGATIONS ASPECTS 12

Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – Crop and crop seasons – Consumptive use of water – Duty – Factors affecting duty – Irrigation efficiencies – Planning and development of irrigation projects.

### UNIT II IRRIGATION METHODS 10

Canal irrigation – Lift irrigation – Tank irrigation – Flooding methods – Merits and demerits – Sprinkler irrigation – Drip irrigation.

### UNIT III DIVERSION AND IMPOUNDING STRUCTURES 14

Weirs – Elementary profile of a weir – Weirs on pervious foundations – Types of impounding structures – Tanks, sluices and weirs – Gravity dams – Earth dams – Arch dams – Spillways – Factors affecting location and type of dams – Forces on a dam – Hydraulic design of dams.

### UNIT IV CANAL IRRIGATION 14

Alignment of canals – Classification of canals – Canal drops – Hydraulic design of drops – Cross drainage works – Hydraulic design of cross drainage works – Canal head works – Canal regulators – River training works.

### UNIT V IRRIGATION WATER MANAGEMENT 10

Need for optimisation of water use – Minimising irrigation water losses – On farm development works – Percolation ponds – Participatory irrigation management – Water users associations – Changing paradigms in water management – Performance evaluation.

**Total: 60**

### TEXT BOOKS

1. Asawa, G.L., “Irrigation Engineering”, New Age International Publishers, 2005.
2. Sharma, R.K. and Sharma, T.K., “Irrigation Engineering”, S.Chand and Company, 2007.
3. Gupta, B.L., and Amir Gupta, “Irrigation Engineering”, Satya Prahesan, 2000.

### REFERENCES

1. Majumdar, D.K., “Irrigation Water Management – Principles and Practices”, Prentice Hall of India (P) Ltd., 2004.
2. Basak, N.N., “Irrigation Engineering”, Tata McGraw-Hill Publishing Co, 2006.
3. Garg, S.K., “Irrigation Engineering”, 1985.

# CE1354 – DESIGN OF STEEL STRUCTURES

(Limit State Design)

L	T	P
3	1	0

## UNIT I      **LIMIT STATE DESIGN**      **9**

Properties of steel – Structural steel sections – Limit state design concepts – Loads on structures – Metal joining methods using rivets, welding, bolting – Design of bolted, riveted and welded joints – Eccentric connections – Efficiency of joints – High tension bolts.

## UNIT II      **TENSION MEMBERS**      **9**

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

## UNIT III      **COMPRESSION MEMBERS**      **9**

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base.

## UNIT IV      **BEAMS**      **9**

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to biaxial bending – Design of plate girders riveted and welded – Intermediate and bearing stiffeners – Web splices – Design of beam columns.

## UNIT V      **ROOF TRUSSES AND INDUSTRIAL STRUCTURES**      **9**

Roof trusses – Roof and side coverings – Design loads, design of purlin and elements of truss, End bearing – Design of gantry girder.

**L: 45 T: 15 Total: 60**

### TEXT BOOKS

1. Dayaratnam, P., “Design of Steel Structures”, 2nd Edition, S. Chand and Company, 2003.
2. Subramaian, N., “Design of Steel Structures”, Oxford University Press, 2007.

### REFERENCES

1. Ramachandra, S., “Design of Steel Structures – Vol. I and II”, Standard Publication, 2002.
2. Anonymous, “Teaching Resources for Structural Steel Design” – Vol.I and II”, INSDAG, 2001.
3. Gaylord, E.H., Gaylord, N.C. and Stallmeyer, J.E., “Design of Steel Structures”, 3rd Edition, McGraw-Hill Publications, 1992.

## CE1355 – CONSTRUCTION TECHNIQUES AND EQUIPMENTS

L	T	P
4	0	0

### UNIT I CONSTRUCTION PRACTICES 15

Specifications, Details and sequence of activities and construction co-ordination – Site clearance – Marking – Earthwork – Masonry – Stone masonry – Concrete hollow block masonry – Flooring – Damp proof courses – Construction joints – Movement and expansion joints – Pre cast pavements – Building foundations – Basements – Temporary shed – Centering and shuttering sheet piles – Slip forms – Scaffoldings – De-shuttering forms – Fabrication and erection of steel trusses – Frames – Braced domes – Laying brick – Weather and water proof – Roof finishes – Air conditioning – Acoustic and fire protection.

### UNIT II SUB STRUCTURE CONSTRUCTION 15

Techniques of box jacking – Pipe jacking-under water construction of diaphragm walls and basement – Tunneling techniques – Piling techniques – Driving well and caisson – Sinking cofferdam – Cable anchoring and grouting – Driving diaphragm walls, sheet piles – Shoring for deep cutting – Large reservoir construction with membranes and earth system – Well points – Dewatering and stand by plant equipment for underground open excavation.

### UNIT III SUPER STRUCTURE CONSTRUCTION 15

Launching girders, bridge decks, off shore platforms – Special forms for shells – Techniques for heavy decks – In-situ pre-stressing in high rise structures, aerial transporting handling – Erecting light weight components on tall structures – Erection of transmission towers – Construction sequences in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges – Support structure for heavy Equipment and conveyors – Erection of articulated structures, braced domes and space decks.

### UNIT IV REPAIR AND REHABILITATION 5

Study on causes of building damage and deterioration – Assessment of materials and methods of repair and restoration.

### UNIT V CONSTRUCTION EQUIPMENTS 10

Selection of equipment for earth work – Earth moving operations – Types of earthwork equipment – Tractors, motor graders, scrapers, front end loaders, earth movers – Equipment for foundation and pile driving – Equipment for compaction, batching and mixing and concreting – Equipment for material handling and erection of structures – Equipment for dredging, trenching, tunneling, drilling, blasting – dewatering and pumping equipment – Transporters.

**Total: 60**

### TEXT BOOKS

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, 1995.
2. Arora, S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997.

### REFERENCES

1. Jha, J. and Sinha, S.K., "Construction and Foundation Engineering", Khanna Publishers, 1993.
2. Sharma, S.C., "Construction Equipment and Management", Khanna Publishers, 1988.
3. Mahesh Varma., "Construction Equipment and its Planning and Application", Metropolitan Book Company, 1983.



**CE1357 – DESIGN AND DRAWING OF IRRIGATION ENGINEERING AND ENVIRONMENTAL ENGINEERING STRUCTURES**

**L T P**  
**0 0 4**

**PART A**

<b>UNIT I</b>	<b>IMPOUNDING STRUCTURES</b>	<b>14</b>
Gravity dams – Earth dams – Arch dams – Spill ways – Energy dissipation devices – Drawing showing plan, elevation, half sections including foundation.		
<b>UNIT II</b>	<b>CANAL TRANSMISSION STRUCTURES</b>	<b>10</b>
Aqueducts – Syphon aqueducts – Super passage – Canal syphon – Canal drops – Notch type – Rapid type fall – Syphon well drops – Drawing showing plan, elevation and foundation details.		
<b>UNIT III</b>	<b>TANK IRRIGATION STRUCTURES</b>	<b>6</b>
Tank bunds – Tank surplus weirs – Tank sluices weirs on pervious foundations – Percolation ponds – Detailed drawings showing foundation details, plan and elevation.		

**PART B**

<b>UNIT IV</b>	<b>WATER TREATMENT PLANT</b>	<b>12</b>
Design and drawing of intake towers – Aerators – Chemical feeding facility – Flocculator, clarifier – Settling tanks – Slow sand filter – Rapid sand filter – Pressure filter.		
<b>UNIT V</b>	<b>SEWAGE TREATMENT PLANTS</b>	<b>18</b>
Design and drawing of screen chamber – Grit channel – Primary clarifier – Activated sludge process – Aeration tank and oxidation ditch – Trickling filters – Secondary clarifiers – Up flow anaerobic sludge blanket reactors – Up flow anaerobic filter – Sludge digester – Sludge drying beds – Stabilisation ponds – Septic tanks.		

**Total: 60**

**Note**

The examination will be a three hour one carrying 100 marks. Part – A shall carry one either or question carrying 50 marks. Part – B shall carry one either or question carrying 50 marks. Part – A and B together will form part of the question paper.

**TEXT BOOKS**

1. Garg, S.K., “Irrigation Engineering and Design of Structures” Khanna Publishers, 2000.
2. Satyanarayana Murthy Challa , “Water Resources Engineering Principles and Practice”, 2nd Edition, New Age International (P) Ltd., 2002.

**REFERENCES**

1. Sharma, R.K., “Irrigation Engineering and Hydraulic Structures”, Oxford and IBH Publishing Co., 2002.
2. Anonymous, “Manual on Water Supply and Treatment”, CPHEEO, Govt. of India, 2002.
3. Anonymous, “Manual on Sewage and Sewage Treatment”, CPHEEO, Govt. of India, 2003.

## CE1358 – FIELD SURVEY - SURVEY CAMP

L	T	P
0	0	3

Ten days survey camp using Theodolite, cross staff, levelling staff, tapes, plane table and total station. The camp must involve work on a large area of not less than 400 hectares. At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Triangulation

Trilateration

Sun / Star observation to determine azimuth

Use of GTS to determine latitude and longitude

**Total: 45**

### EVALUATION PROCEDURE

1. Internal Marks : 20 marks  
(decided by the staff in-charge appointed by the Institution)
2. Evaluation of Survey Camp Report : 30 marks  
(Evaluated by the external examiner appointed the University)
3. Viva voce examination : 50 marks  
(evaluated by the internal examiner appointed by the HOD  
with the approval of HOI and external examiner appointed by  
the University – with equal Weightage)

**Total : 100**

## CE1359 – COMPUTER AIDED BUILDING DRAWING

**L T P**  
**0 0 4**

- |    |  |    |
|----|--|----|
| 1. | Buildings with load bearing walls (Flat and pitched roof) – Including details of doors and windows | 15 |
| 2. | RCC framed structures  | 15 |
| 3. | Industrial buildings – North light roof structures – Trusses                                       | 15 |
| 4. | Perspective view of one and two storey buildings   | 15 |

**Total: 60**

### TEXT BOOKS

1. Civil Engg. Drawing & House Planning – Varma B.P., Khanna publishers, Delhi
2. Building drawing & detailing – Balagopal & T.S. Prabhu, Spades Publishers, Calicut.

### REFERENCES

1. Building drawing – Shah.M.G., Tata McGraw-Hill,1992
2. Building planning & Drawing –Kumaraswamy N., Kameswara Rao A., Charotar Publishing
3. Shah, Kale and Patki, Building Drawing with integrated approach to built environment, Tata McGraw-Hill.

### Examination Guideline

30% of the end semester examination paper shall deal with planning, while the rest 70% shall be based on the drafting skill.

### LIST OF EQUIPMENTS

(For a batch of 30 students)

Sl. No.	Description of Equipments	Quantity
1.	Computer system of Pentium IV or equivalent	1 for each student
2.	Licensed version of any reputed Analysis, Design & Drafting software	1 copy for a set of 3 students

# SEMESTER VII

## TOTAL QUALITY MANAGEMENT

(Common to all branches)

**L T P**  
**3 0 0**

### UNIT I INTRODUCTION 9

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of Total Quality Management – Historical review – Principles of TQM – Leadership – Concepts – Role of senior management – Quality Council – Quality statements – Strategic planning – Deming philosophy – Barriers to TQM Implementation.

### UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality – Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.

### UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

### UNIT IV TQM TOOLS 9

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

### UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and other quality systems – ISO 9000:2000 quality system – Elements – Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 – Concept, requirements and benefits.

**Total : 45**

### TEXT BOOKS

1. Dale H. Besterfield, “Total Quality Management”, Pearson Education, Inc. 2003.
2. James R. Evans and William M. Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western, 2002.

### REFERENCES

1. Feigenbaum, A.V., “Total Quality Management”, McGraw Hill, 1991.
2. Oakland, J.S., “Total Quality Management”, Butterworth Heineman, 1989.
3. Narayana V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
4. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

## **ESTIMATION AND QUANTITY SURVEYING**

**L T P**  
**3 0 0**

### **UNIT I INTRODUCTION 6**

Types of estimates – Units of measurements – Methods of estimates – Advantages Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

### **UNIT II ESTIMATE OF OTHER STRUCTURES 12**

Estimating of septic tank, soak pit – Sanitary and water supply installations – Water supply pipe line – Sewer line – Tube well – Open well – Estimate of bituminous and cement concrete roads – Estimate of retaining walls – culverts – Estimating of irrigation works – Aqueduct, syphon, fall.

### **UNIT III SPECIFICATION AND TENDERS 9**

Data – Schedule of rates – Analysis of rates – Specifications – sources – Detailed and general specifications – Tenders – Contracts – Types of contracts – Arbitration and legal requirements.

### **UNIT IV VALUATION 9**

Necessity – Basics of value engineering – Capitalised value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease.

### **UNIT V REPORT PREPARATION 9**

Principles for report preparation – Report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations – Tube wells – Open wells.

**Total :45**

### **TEXT BOOKS**

1. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers and Distributors Pvt. Ltd., 2003.
2. Kohli, D.D. and Kohli, R.C., “A Text Book of Estimating and Costing ”, S.Chand and Company Ltd., 2004.

## **PRESTRESSED CONCRETE STRUCTURES**

**L T P**  
**3 0 0**

### **UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9**

Basic concepts – Advantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections - Losses of prestress – Estimation of crack width .

### **UNIT II DESIGN 9**

Flexural strength – Simplified procedures as per codes – Strain compatibility method – Basic concepts in selection of cross section for bending – Stress distribution in end block, Design of anchorage zone reinforcement – Limit state design criteria – Partial prestressing – Applications.

### **UNIT III CIRCULAR PRESTRESSING 9**

Design of prestressed concrete tanks – Poles and sleepers.

### **UNIT IV COMPOSITE CONSTRUCTION 9**

Analysis for stresses – Estimate for deflections – Flexural and shear strength of composite members.

### **UNIT V PRESTRESSED CONCRETE BRIDGES 9**

General aspects – Pretensioned prestressed bridge decks – Post tensioned prestressed bridge decks – Principles of design only.

**Total: 45**

### **TEXT BOOKS**

1. Krishna Raju, N., “Prestressed Concrete”, Tata McGraw Hill Company, 1998.
2. Mallic, S.K. and Gupta, A.P., “Prestressed Concrete”, Oxford and IBH Publishing Co. Pvt. Ltd., 1997.

### **REFERENCES**

1. Ramaswamy, G.S., “Modern Prestressed Concrete Design”, Arnold Heinimen, 1990.
2. Lin, T.Y., “Design of Prestressed Concrete Structures”, Asia Publishing House, 1995.
3. Sheppard, D.A., William, R. and Philips, “Plant Cast Precast and Prestressed concrete – A Design Guide”, McGraw Hill, 1992.

## **HYDROLOGY**

<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>0</b>	<b>0</b>

**UNIT I      PRECIPITATION      12**

Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement of Rainfall – Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, and frequency relationship – Probable maximum precipitation.

**UNIT II      ABSTRACTION FROM PRECIPITATION      12**

Losses from precipitation – Evaporation process – Reservoir evaporation – Infiltration process – Infiltration capacity – Measurement of infiltration – Infiltration indices – Effective rainfall.

**UNIT III      HYDROGRAPHS      12**

Factors affecting Hydrograph – Baseflow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different deviations – Synthetic Unit Hydrograph

**UNIT IV      FLOODS AND FLOOD ROUTING      12**

Flood frequency studies – Recurrence interval – Gumbel’s method – Flood routing – Reservoir flood routing – Muskingum’s Channel Routing – Flood control

**UNIT V      GROUND WATER HYDROLOGY      12**

Types of aquifers – Darcy’s law – Dupuit’s assumptions – Confined Aquifer – Unconfined Aquifer – Recuperation test – Transmissibility – Specific capacity – Pumping test – Steady flow analysis only.

**Total: 60**

### **TEXT BOOKS**

1. Subramanya, K., “Engineering Hydrology”, Tata McGraw-Hill Publishing Co., Ltd., 2000.
2. Raghunath, H.M., “Hydrology”, Wiley Eastern Ltd., 2000.

### **REFERENCES**

1. Chow, V.T. and Maidment, “Hydrology for Engineers”, McGraw-Hill Inc., Ltd., 2000.
2. Singh, V.P., “Hydrology”, McGraw-Hill Inc., Ltd., 2000.

## COMPUTER AIDED DESIGN AND DRAWING

**L T P**  
**1 0 4**

1. Design and drawing of RCC cantilever and counterfort type retaining walls with reinforcement details
2. Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details
3. Design of pressed, rectangular and hemispherical bottomed steel tank – Staging – Detailed drawings
4. Design and drafting of Intz type water tank, Detailing of circular and rectangular water tanks
5. Design of plate girder bridge – Twin Girder deck type Railway Bridge – Truss Girder bridges – Detailed Drawings including connections

**Total: 60**

### TEXT BOOKS

1. Krishna Raju, N., “Structural Design and Drawing (Concrete and Steel)”, CBS Publishers, 2005.
2. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain., “Design of Steel Structures”, 2nd Edition, Lakshmi Publications Pvt. Ltd, 1998.

### REFERENCE

1. Krishnamurthy, D., “Structural Design and Drawing – Vol. I and Vol. II”, CBS Publishers and Distributors, 1990.

**EXAMINATION DURATION 4 HOURS**

## **CONCRETE LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>
<b>0</b>	<b>0</b>	<b>3</b>

### **UNIT I      CEMENT**

**12**

1.      Test for fineness
2.      Test for setting times including normal consistency test
3.      Mortar cube preparation and testing

### **UNIT II      AGGREGATES**

**12**

Sieve analysis test - Grade Curves  
Crushing Value - Test  
Test on Aggregates - Los Angeles Abrasive Testing Machine

### **UNIT III      CONCRETE**

**12**

Cube compression test  
Tension test of concrete - cylinder split test  
Flexural test on concrete specimen  
Test using Vee Bee consistometer  
Compaction factor test

Mix design using test parameters and assessing the strength of concrete

**9**

**Total: 45**

## HS1301 – COMMUNICATION AND SOFT SKILLS LABORATORY

<b>L</b>	<b>T</b>	<b>P</b>
<b>0</b>	<b>0</b>	<b>3</b>

(Common to All Branches of III Year B.E./ B.Tech students of Anna University Tiruchirappalli and affiliated colleges)

The aim of the course is two-fold: to enable the students to develop communication skills in the language laboratory and to arrange discussions for developing soft skills in the lab and/or the classroom. Each lab session shall last for three periods.

### **List of activities that are to be carried out: (15 sessions x 3 periods = 45)**

Lab session # 1: Listening and speaking practice exercises with communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 2: Practice with more advanced communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 3: Pronunciation exercises with Oxford Advanced Learners' Dictionary of Current English or any other standard Dictionary

Lab session # 4: Making an oral presentation in English. Learning Material: Professional Presentations VCD (Cambridge University Press)

Lab session # 5: Listening to telephone conversations in English and completing the tasks. Learning material: Essential Telephoning in English ACD (Cambridge University Press)

Lab session # 6: Giving an exposure to and practice with model group discussion and interviews. Learning material: How to Prepare for Group Discussion and Interview Audio Cassette (McGraw-Hill)

Lab session # 7: Giving insights into the format and the task types in the IELTS (International English Language Testing System). Learning Material: Objective IELTS, Intermediate Level (CUP)

Lab session # 8: Understanding the format and the task types in the TOEFL (Test of English as a Foreign Language). Learning Material: Understanding the TOEFL (Educational Testing Services, Princeton)

Lab session # 9: Administering the BEC (Business English Certificate) Diagnostic Test. Learning Material: BEC Practice Materials (British Council, Chennai)

Lab session # 10: Completing the steps involved in Career, Life Planning and Change Management. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 11: Setting goals and objectives exercises. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 12: Prioritizing and time planning exercises. Learning Material: Managing Time Multimedia Program CD

Lab session # 13: Taking a Personality Typing/ Psychometric Test Learning Material: 200 Psychometric Test prepared by the CUIC, Anna University Chennai

Lab session # 14: Critical and creative thinking exercises.

Lab session # 15: Improving body language and cross-cultural communication with pictures. Learning material: Body Language (S. Chand and Co.)

For a detailed plan, refer to the topics given below;

### **UNIT I LISTENING AND SPEAKING PRACTICE IN COMMUNICATIVE FUNCTIONS**

Introductions and Meetings – Talking about Studies and/or Job – Expressing Likes and Dislikes – Describing Daily Routines and Current Activities – Talking about Past States and Events – Talking about Future Plans and Intentions – Expressing Preferences – Giving Reasons – Expressing Opinions, agreement and Disagreement – Seeking and Giving Advice – Making Suggestions.

### **UNIT II SPEAKING APPLICATIONS**

Making an Oral Presentation – Preparing the Presentation – Performing the Presentation – Beginning – Language – Visual Aids and Body Language – Voice – Ending – Questions – Telephone Conversations – Group Discussion and Interview.

### **UNIT III UNDERSTANDING AND PREPARING FOR INTERNATIONAL ENGLISH LANGUAGE EXAMINATIONS**

International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Business English Certificate (BEC)

### **UNIT IV SOFT SKILLS (1)**

Preparing for and Dealing With Change – Motivation, Goal-Setting and Self-Esteem – Managing Time and Stress – Career and Life Planning – Team Work – Leadership Traits.

### **UNIT V SOFT SKILLS (2)**

Multiple Intelligences – Learning Styles and Personality Typing – Critical and Creative Thinking – People, Cultures and Self – Intercultural Communication.

## RESOURCES

1. Kamalesh Sadanand and Susheela Punitha, “Spoken English: A Foundation Course” for Speakers of Indian Languages, Part 2 Audio CD, Hyderabad: Orient Longman, 2008
2. Malcome Goodale, “Professional Presentations”, (VCD) New Delhi: Cambridge University Press, 2005
3. Barbara Garside and Tony Garside, Essential Telephoning in English (Audio CD), Cambridge: Cambridge University Press, 2002
4. Hari Mohan Prasad and Rajnish Mohan, “How to Prepare for Group Discussion and Interview (Audio Cassette)”, Tata McGraw-Hill Publishing
5. International English Language Testing System Practice Tests, CUP
6. Business English Certificate Materials, Cambridge University Press
7. Understanding the TOEFL. Educational Testing Services, Princeton, US
8. Interactive Multimedia Programs on Managing Time and Stress
9. Robert M. Sherfield and et al “Developing Soft Skills”, 4th Edition, New Delhi, Pearson Education, 2009.

**Total: 60**

**SEMESTER VIII**  
**ENGINEERING ECONOMICS AND COST ANALYSIS**

**L T P**  
**3 0 0**

**UNIT I BASIC ECONOMICS**

**15**

Definition of economics – Nature and scope of economic science – Nature and scope of managerial economics – Basic terms and concepts – Goods – Utility – Value – Wealth – Factors of production – Land – Its peculiarities – Labour – Economies of large and small scale – Consumption – Wants – Its characteristics and classification – Law of diminishing marginal utility – relation between economic decision and technical decision – Demand – Demand schedule – Demand curve – Law of demand – Elasticity of demand – Types of elasticity – Factors determining elasticity – Measurement – Its significance – Supply – Supply schedule – Supply curve – Law of supply – Elasticity of supply – Time element in the determination of value – Market price and normal price – Perfect competition – Monopoly – Monopolistic competition.

**UNIT II ORGANISATION**

**7**

Introduction – Principle of organisation – Organisation chart – Forms of business – Proprietorship – Partnership – Joint stock company – Cooperative organisation – State enterprise – Mixed economy – Money and banking – Banking – Kinds – Commercial banks – Central banking functions – Control of credit – Monetary policy – Credit instrument.

**UNIT III FINANCING**

**8**

Financial Management – Types of financing – Short term borrowing – Long term borrowing – Internal generation of funds – External commercial borrowings – Assistance from government budgeting support and international finance corporations – Analysis of financial statement – Balance Sheet – Profit and Loss account - Funds flow statement

**UNIT IV COST ANALYSIS**

**9**

Types of costing – Traditional costing approach – Activity base costing – Fixed Cost – Variable cost – Marginal cost – Cost output relationship in the short run and in long run – Pricing practice – Full cost pricing – Marginal cost pricing – Going rate pricing – Bid pricing – Pricing for a rate of return – Appraising project profitability – Internal rate of return – Pay back period – Net present value – Cost benefit analysis – Feasibility reports – Appraisal process – Technical feasibility- Economic feasibility – Financial feasibility.

**UNIT V BREAK EVEN ANALYSIS**

**6**

Introduction – Break even point and break even chart – P/V ratio - Managerial uses of break even analysis

**Total: 45**

**TEXT BOOKS**

1. Dewett, K.K. and Varma, J.D., “Elementary Economic Theory”, S Chand and Company, 2006.
2. Sharma, J.C., “Construction Management and Accounts” Satya Prakashan, 1994.

**REFERENCES**

1. Barthwal, R.R., “Industrial Economics - An Introductory Text Book”, New Age International (P) Ltd., 2007.
2. Jhingan, M.L., “Micro Economic Theory”, Konark Pvt. Ltd, 1987.
3. Khan, M.Y. and Jain, P.K., “Financial Management”, McGraw-Hill Publishing Co., Ltd, 2004.

# CONSTRUCTION PROJECT MANAGEMENT

L T P  
3 0 0

## UNIT I THE OWNER'S PERSPECTIVE 9

Introduction – The project life cycle – Major types of construction – Selection of professional services – Construction contractors – Financing of constructed facilities –Legal and regulatory requirements – The changing Environment of the construction Industry –The role project managers.

## UNIT II ORGANIZING FOR PROJECT MANAGEMENT 9

What is project management? – Trends in modern management-Strategic planning and project programming – Effects of project risks on organization – Organization of project participants – Traditional designer – Constructor sequence – Professional construction management – Owner – Builder– Operation – Turnkey operation – Leadership and motivation for the project team – Interpersonal behavior in project organization – perceptions of owners and contractors.

## UNIT III THEDESIGNANDCONSTRUCTIONPROCESS 9

Design and construction as an integrated system –Innovation and technological Feasibility– Innovation and technological feasibility–Design Methodology–Functional Design – Physical Structures – Geo- technical engineering investigation – Construction site environment –Value engineering – Construction planning – Industrialized construction and prefabrication – Computer aided Engineering.

## UNIT IV LABOUR, MATERIAL AND EQUIPMENT UTILIZATION 9

Historical perspective – Labor productivity – Factors affecting job– Site productivity–Labor relations in construction – Problems in collective bargaining – Materials management – Materials procurement and delivery – Inventory control – Tradeoffs of cost in material management – Construction equipment – Choice of equipment and standard production rates – Construction processes queues and resource bottlenecks

## UNIT V COST ESTIMATION 9

Costs associated with construction facilities – Approaches to cost estimation – Type of construction cost estimates – Effects of scale on construction cost – Unit cost – Method of estimation – Methods for allocation of joint costs – Historical cost data – Cost indices-Applications of cost Indices to estimating – Estimate based on engineers list of quantities – Allocation of construction costs over time – Computer aided cost estimation –Estimation of operating costs.

**Total : 45**

### TEXT BOOKS

1. Chris Hendrickson and Tung Au., “Project management for Construction – Fundamental Concepts for owners Engineers, Architects and Builders”, Prentice Hall, 2000.
2. Chitkara, K.K., “Construction Project Management Planning, Scheduling and Control”, Tata McGraw Hill Publishing Co., 1998.

### REFERENCES

1. Choudhury, S., “Project Management ”, Tata McGraw Hill Publishing Co., 1988.
2. Ernest E. Ludwig., "Applied Project Engineering and Management ", Gulf Publishing Co., 1988.
3. Harold Kerzner., “Project Mangement - A Systems Approach to Planning Scheduling and Controlling ", CBS Publishers and Distributors, 1988.

# ELECTIVES FOR SEMESTER VII

## ELECTIVE I and II (ODD SEMESTER)

### REMOTE SENSING TECHNIQUES AND APPLICATIONS

**L T P**  
**3 0 0**

#### **UNIT I INTRODUCTION 9**

Definition – Physics of remote sensing – Electromagnetic radiation (EMR) – Remote sensing windows – Interaction of EMR with atmosphere, earth surface, soils, water and vegetation – Platform and sensors – Image interpretations.

#### **UNIT II LAND USE STUDIES 9**

Definition of land use – Land use / land cover classification – Schemes and levels of classification systems with RS data – Land use mapping – Change detection – Urban land use planning – site suitability analysis – transportation planning.

#### **UNIT III WATER RESOURCES 9**

Areal assessment of surface water bodies – Capacity survey of water bodies – Mapping of snow – Covered areas – Flood risk zone mapping – Identification of groundwater potential zones, recharge areas – Droughts, definition, drought assessment and management.

#### **UNIT IV AGRICULTURE, SOIL AND FORESTRY 9**

Crop inventory mapping – Production estimation – Command area monitoring – Soil mapping – Crop stress detection – Estimation of soil erosion – Forest types and density mapping – Forest fire risk zone mapping.

#### **UNIT V EARTH SCIENCE 9**

Lithology – Lithological mapping – Structural mapping – Geomorphology – Nature and type of landforms – Identification – Use of remote sensing data for land slides – Targeting mineral resources – Engineering geology and Environmental geology.

**Total: 45**

#### **TEXT BOOKS**

1. Lillesand, T.M. and Kicter R.W., “Remote Sensing and Image interpretation”, John Willey and Sons, Inc. 2002.
2. Michael Hord, R., “Remote Sensing Methods and Application”, John Wiley and Sons, 1986.

#### **REFERENCES**

1. Steven, M.D. and Cllark, J.A., “Application of Remote Sensing in Agriculture”, Butterworths, 1990.
2. Sabins, F.F. Jr. “Remote Sensing Principles and Interpretation”, W.H. Freeman and Co., 1978.
3. “Manual of Remote Sensing Vol. II”. American Society of Photogrammetry, 1998.

## **AIRPORTS AND HARBOURS**

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>0</b>	<b>0</b>

**UNIT I      AIRPORT PLANNING AND DESIGN      8**

Components of Airports Airport Planning – Runway design – Orientation - Wind rose Diagram - Taxiway Design - Separation Distances - Design Speed – Drainage.

**UNIT II      AIRPORT AND LAYOUTS      10**

Airport zoning - Clearance over Highways and Railways – Airport Layouts – Apron – Hangars – Terminal Buildings – Airports Buildings – Passenger flow – Passenger facilities.

**UNIT III      AIR TRAFFIC CONTROL      8**

Visual aids – Runway and Taxiway markings – Wind direction indicators - Runway and Taxiway lightings – Air traffic control network – Helipads – Service equipments.

**UNIT IV      DOCKS AND HARBOURS      10**

Definition of Terms – Harbours – Ports – Docks – Tides – Waves – Littoral Drift – Sounding, Satellite Ports – Classification of harbors – Site Selection and investigation – Dry and Wet Docks – Light houses – Mooring accessories.

**UNIT V      COASTAL STRUCTURES      9**

Piers – Sliways – Breakwaters – Wharves – Jetties – Quays – Spring fenders – Coastal Shipping – Inland water Transport – Container Transportation – Pipe ways – Rope ways.

**Total : 45**

### **TEXT BOOKS**

1. Khanna, S.K., Arora, M.G. and Jain .S.S., “Airport Planning and Design”, Namchand and Brother,1999.
2. Bindra, S.P., “A course in Docks and Harbour Engineering”, Dhanpat Rai and Sons, 1993.

### **REFERENCES**

1. Seetha Raman, S., “Docks and Harbour Engineering ”, Umesh Publications, 1992.
2. Ranga Wala, S., “Airport Engineering “, Chasotar Publishing House , 1996.
3. Vazirani and Chandolas, S.P., “Transportation Engineering”. Khanna Publications 1991.

## **ELECTRONIC SURVEYING**

**L T P**  
**3 0 0**

**UNIT I      BASICS      9**

Methods of measuring distance, – Historical development – Basic principles – Classifications– Applications and comparison with conventional surveying.

**UNIT II      ELECTRONIC RESOURCE      9**

Fundamentals of electronics – Resonant circuits – Semiconductors – Lasers – Cathode ray tube – Photo multiplier tube – Transducers – Oscillators – Frequency mixing – Modulation and demodulation – Kerrcell modulator – Measurement of phase difference – Reflectors and power sources.

**UNIT III      PROPAGATION OF ELECTROMAGNETIC WAVES      9**

Definition – Classification – Applications – Propagation properties – wave propagation at lower and higher frequencies – Refractive index – Factors affecting – Computation of group refractive index for light and near infrared waves at standard conditions and ambient conditions – Reference refractive index – First velocity correction – Computation of refractive index for microwaves.

**UNIT IV      ATMOSPHERIC PARAMETERS – REFRACTIVE INDEX      9**

Measurement of atmospheric parameters – Mean refractive index – Real time application of first velocity correction – Second velocity correction and total atmospheric correction.

**UNIT V      ELECTROMAGNETIC DISTANCE MEASURING SYSTEM      9**

Electro optical system – Measuring principle – Working principle – Sources of error– Infrared EDM instruments – Laser EDM instruments and total station. Microwave system – Measuring principle – Working principle – Sources of error. Microwave EDM instruments – Comparison with Electro optical system – Care and maintenance of EDM instruments. Modern Positioning Systems – EDM traversing – Trilateration and base line measurement using EDM.

**Total: 45**

### **TEXT BOOKS**

1. Rueger, J.M., “Electronic Distance Measurement “, Springer-Verlag, 1990.
2. Laurila, S.H., “Electronic Surveying in Practice”, John Wiley and Sons Inc, 1983.

### **REFERENCES**

1. Burnside, C.D., “Electromagnetic Distance Measurement”, Crosby Lock wood staples, 1971.
2. Soastamoinen, J.J., “Surveyor’s Guide to Electro-magnetic Distance Measurement”, Adam Hilger Ltd., 1967.

## **CARTOGRAPHY**

**L T P**  
**3 0 0**

**UNIT I INTRODUCTION 9**

Cartography today – Nature of Cartography – History of Cartography – Graticules – Cartometry.

**UNIT II EARTH 9**

Earth –Map Relations – Basic Geodesy. Map Projections – Scale – Reference and Coordinate system – Transformation – Basic Transformation – Affin Transformation.

**UNIT III SOURCES OF DATA 9**

Sources of data – Ground Survey and Positioning – Remote Sensing data collection – Census and sampling – data – Models for digital cartographic information – Map digitizing.

**UNIT IV PERCEPTION AND DESIGN 9**

Cartographic design – Color theory and models – Color and pattern creation and specification – Color and pattern – Typography and lettering the map – Map compilation.

**UNIT V CARTOGRAPHY ABSTRACTION 9**

Selection and Generalisation Principles – Symbolisation – Topographic and thematic maps – Map production and Reproduction – Map series.

**Total: 45**

### **TEXT BOOKS**

1. Anson, R.W. and Ormeling, F.J., “Basic Cartography for Students and Technicians ”, Vol. I, II and III, 2nd Edition, Elsevier Applied Science Publishers, 1994.
2. Arthur H. Robinson, “Elements of Cartography”, 6th Edition, John Wiley and Sons, 1995.

### **REFERENCES**

1. John Campbell, “Introductory Cartography”, 2nd Edition, Brown Publishers, 1994.
2. Kraak, M.J. and Ormeling, F.J., “Cartography - Visualisation and Spatial Data”, Prentice Hall, 1996.



## STORAGE STRUCTURES

L T P  
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### UNIT I STEEL WATER TANKS 15

Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams – Design of staging – Base plates – Foundation and anchor bolts – Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – Side plates – Bottom plates – Joints – Ring girder – Design of staging and foundation.

### UNIT II CONCRETE WATER TANKS 15

Design of circular tanks – Hinged and fixed at the base – IS method of calculating shear forces and moments – Hoop tension – Design of intze tank – Dome – Ring girders – Conical dome – Staging – Bracings – Raft foundation – Design of rectangular tanks – Approximate methods and IS methods – Design of under ground tanks – Design of base slab and side wall – Check for uplift.

### UNIT III STEEL BUNKERS AND SILOS 5

Design of square bunker – Jansen’s and Airy’s theories – IS codal provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder – Stiffeners.

### UNIT IV CONCRETE BUNKERS AND SILOS 5

Design of square bunker – Side Walls – Hopper bottom – Top and bottom edge beams – Design of cylindrical silo – Wall portion – Design of conical hopper – Ring beam at junction.

### UNIT V PRESTRESSED CONCRETE WATER TANKS 5

Principles of circular prestressing – Design of prestressed concrete circular water tanks.

**Total: 45**

### TEXT BOOKS

1. Rajagopalan, K., “Storage Structures”, Tata McGraw-Hill, 1998.
2. Krishna Raju, N., “Advanced Reinforced Concrete Design”, CBS Publishers and Distributors, 1998.

# TALL BUILDINGS

L T P  
3 0 0

## UNIT I INTRODUCTION 9

The tall Building in the urban context – The tall building and its support structure – Development of high rise building structures – General planning considerations. Dead loads – Live loads – Construction loads – Snow, rain and ice loads – Wind loads – Seismic loading – Water and earth pressure loads – Loads – Loads due to restrained – volume changes of material – Impact and dynamic Loads – Blast loads – Combination of loads.

## UNIT II THE VERTICAL STRUCTURE PLANE 9

Dispersion of vertical forces – Dispersion of lateral forces – Optimum ground level space – Shear wall arrangement – Behaviour of shear walls under lateral loading. The floor structure or horizontal building plane floor framing systems – Horizontal bracing – Composite floor systems – The high rise building as related to assemblage kits skeleton frame Systems – Load bearing wall panel systems – Panel – Frame systems – Multistory box systems.

## UNIT III COMMON HIGH-RISE BUILDING STRUCTURES AND THEIR BEHAVIOUR UNDER LOAD 9

The Bearing Wall Structure – The Shear Core Structure - Rigid frame systems – The wall – Beam structure – Interspatial and staggered truss systems – Frame – Shear wall building systems – Flat slab building structures – Shear truss – Frame interaction system with rigid – Belt trusses – Tubular systems – Composite buildings – Comparison of high – Rise structural systems other design approaches controlling building drift efficient building Forms - The counteracting force or dynamic response.

## UNIT IV APPROXIMATE STRUCTURAL ANALYSIS AND DESIGN OF BUILDINGS 9

Approximate analysis of bearing wall buildings – The cross wall structure – The long wall structure – The rigid frame structure approximate analysis for vertical loading – Approximate analysis for lateral loading – Approximate design of rigid frame buildings–Lateral deformation of rigid frame buildings – The rigid frame – Shear wall structure – The vierendeel structure – The hollow tube structure.

## UNIT V OTHER HIGH-RISE BUILDING STRUCTURE 9

Deep-Beam systems – High rise suspension systems – Pneumatic high rise buildings – Space frame applied to high rise buildings – Capsule architecture.

**Total: 45**

### TEXT BOOKS

1. Wolfgang Schueller, “High - Rise Building Structures”, John Wiley and Sons, 1986.
2. Bryan Stafford Smith and Alex Coull., “Tall Building Structures Analysis and Design”, John Wiley and Sons, Inc., 1991.

### REFERENCES

1. Coull, A. and Smith, Stafford, B., “Tall Buildings”, Pergamon Press, 1997.
2. Lin, T.Y. and Burry D. Stotes., “Structural Concepts and Systems for Architects and Engineers”, John Wiley, 1994.
3. Lynn S. Beedle., “Advances in Tall Buildings”, CBS Publishers and Distributors, 1996.





## **TRAFFIC ENGINEERING AND MANAGEMENT**

**L T P**  
**3 0 0**

### **UNIT I INTRODUCTION 9**

Significance and scope – Characteristics of vehicles and road users – Skid resistance and braking efficiency (Problems) – Components of traffic engineering – Road, traffic and land use characteristics.

### **UNIT II TRAFFIC SURVEYS AND ANALYSIS 9**

Surveys and analysis – Volume – Capacity– Speed and delays– Origin and destination – Parking – Pedestrian studies – Accident studies and safety level of services – Problems.

### **UNIT III TRAFFIC CONTROL 9**

Traffic signs – Road markings – Design of Traffic signals and Signal co-ordination (Problems) – Traffic control aids and street furniture – Street lighting – Computer applications in signal design.

### **UNIT IV GEOMETRIC DESIGN OF INTERSECTIONS 9**

Conflicts at intersections – Classification of intersections at grade – Chanallised and unchanallised intersection – Grade separators concepts – Principles of intersection design – Elements of intersection design – Chanallisation and rotary design (Problems) – Grade separators

### **UNIT V TRAFFIC MANAGEMENT 9**

Traffic management – Traffic System Management (TSM) and Travel Demand Management (TDM) – Traffic forecasting techniques – Restrictions on turning movements – One-way Streets – Traffic segregation – Traffic calming – Tidal flow operations – Exclusive bus lanes – Introduction to Intelligence Transport System (ITS)

**Total : 45**

### **TEXT BOOKS**

1. Khanna, K. and Justo, C.E.G., “Highway Engineering”, Khanna Publishers, 2001.
2. Kadiyali, L.R., “Traffic Engineering and Transport Planning”, Khanna Publishers, 2000.

### **REFERENCES**

1. Indian Roads Congress (IRC) specifications: Guidelines and Special Publications on Traffic Planning and Management.
2. Guidelines of Ministry of Road Transport and Highways, Government of India.
3. Saxena,G.C., “A Course in Traffic Planning and Design”, Dhanpat Rai Publications, 1989.

## **INDUSTRIAL WASTE MANAGEMENT**

**L T P**  
**3 0 0**

### **UNIT I INTRODUCTION 9**

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – Effects of industrial effluents on streams – sewer – Land– Sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

### **UNIT II CLEANER PRODUCTION 9**

Waste management approach – Waste audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

### **UNIT III POLLUTION FROM MAJOR INDUSTRIES 9**

Sources – Characteristics – Waste treatment flow sheets for selected industries such as Textiles – Tanneries – Pharmaceuticals – Electroplating industries – Dairy – Sugar– Paper – Distilleries – Steel plants – Refineries – Fertilizer – Thermal power plants – Wastewater reclamation concepts.

### **UNIT IV TREATMENT TECHNOLOGIES 9**

Equalisation – Neutralisation – Removal of suspended and dissolved organic solids – Chemical oxidation – Adsorption – Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal.

### **UNIT V HAZARDOUS WASTE MANAGEMENT 9**

Hazardous wastes – Physico chemical treatment – Solidification – Incineration – Secured land fills.

**Total: 45**

### **TEXT BOOKS**

1. Rao, M.N. and Dutta, A.K., “Wastewater Treatment”, Oxford - IBH Publication, 1995.
2. Eckenfelder, W.W., “Industrial Water Pollution Control”, McGraw-Hill Book Company, 2000.

### **REFERENCES**

1. Shen, T.T., “Industrial Pollution Prevention”, Springer, 1999.
2. Freeman, H.M., “Industrial Pollution Prevention Hand Book”, McGraw - Hill, 1995.
3. Bishop, P.L., “Pollution Prevention: Fundamental and Practice”, McGraw-Hill, 2000.

# LIST OF ELECTIVES SEMESTER VIII

## ELECTIVE III and IV (EVEN SEMESTER)

### HOUSING PLANNING AND MANAGEMENT

**L T P**  
**3 0 0**

#### **UNIT I INTRODUCTION TO HOUSING 9**

Definition of basic terms – House – Home – Household – Apartments – Multi storeyed buildings– Special buildings – Objectives and strategies of national housing policies – Principle of sustainable housing – Housing laws at state level – Bye-laws at urban and rural local bodies – Levels – Development control regulations – Institutions for housing at national, state and local levels.

#### **UNIT II HOUSING PROGRAMMES 9**

Basic concepts – Contents and standards for housing programmes - Sites and services, neighbourhoods – Open development plots – Apartments – Rental Housing – Co-operative housing – Slum housing programmes – Role of public – Private and non-government organisations.

#### **UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9**

Formulation of housing projects – Site analysis – Layout design – Design of housing units (Design Problems).

#### **UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9**

New constructions techniques – Cost effective modern construction materials – Building centers – Concept – Functions and performance evaluation.

#### **UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9**

Appraisal of housing projects – Housing finance – Cost recovery – Cash flow analysis – Subsidy and cross subsidy, Pricing of housing units – Rents – Recovery pattern (Problems).

**Total: 45**

#### **TEXT BOOKS**

1. Meera Mehta and Dinesh Mehta, “Metropolitan Housing Markets”, Sage Publications Pvt. Ltd., 1999.
2. Francis Cherunilam and Heggade, O.D., “Housing in India ”, Himalaya Publishing House, 1997.

#### **REFERENCES**

1. “Development Control Rules for Chennai Metropolitan Area”, CMA, Chennai, 2002.
2. UNCHS, “National Experiences with Shelter Delivery for the Poorest Groups”, UNCHS (Habitat), 1994.
3. National Housing Policy, 1994, Government of India.

# GROUND WATER ENGINEERING

**L T P**  
**3 0 0**

## **UNIT I FUNDAMENTALS OF GROUND WATER 9**

Introduction – Characteristic of ground water – Distribution of water – Ground water column – Permeability – Darcy's law – Laboratory permeability test – Types of aquifers – Hydrogeological cycle – Water level fluctuations.

## **UNIT II HYDRAULICS OF FLOW 9**

Storage coefficient – Specific field – Heterogeneity and anisotropy – Transmissivity – Governing equations of ground water flow – Steady state flow – Dupuit forchheimer assumptions – Velocity potential – Flow nets.

## **UNIT III ESTIMATION OF PARAMETERS 9**

Transmissivity and storativity – Pumping test – Unsteady state flow – Thiess method – Jacob method – Image well theory – Effect of partial penetrations of wells – Collectors wells.

## **UNIT IV GROUND WATER DEVELOPMENT 9**

Infiltration gallery – Conjunctive use – Artificial recharge – Safe yield – Yield test – Geophysical methods – Selection of pumps.

## **UNITV WATER QUALITY 9**

Ground water chemistry – Origin – Movement and quality – Water quality standards – Saltwater intrusion – Environmental concern.

**Total: 45**

### **TEXT BOOKS**

1. Raghunath, H.M., “Ground Water Hydrology”, Wiley Eastern Ltd., 2000.
2. Todd, D.K., “Ground Water Hydrology”, John Wiley and Sons, 2000.

### **REFERENCE**

1. Walton, C., “Ground Water Resource Evaluation”, McGraw-Hill Publications.

## **WATER RESOURCES ENGINEERING**

**L T P**  
**3 0 0**

**UNIT I GENERAL 9**

Water resources survey – Water resources of India and Tamilnadu – Description of water resources planning – Economics of water resources planning, physical and socio economic data – National water policy – Collection of meteorological and hydrological data for water resources development.

**UNIT II NETWORK DESIGN 9**

Hydrologic measurements – Analysis of hydrologic data – Hydrologic station network – Station network design – Statistical techniques in network design.

**UNIT III WATER RESOURCE NEEDS 9**

Consumptive and non-consumptive water use – Estimation of water requirements for irrigation, for drinking and navigation – Water characteristics and quality – Scope and aims of master plan – Concept of basin as a unit for development – Water budget and development plan.

**UNITIV RESERVOIR PLANNING AND MANAGEMENT 9**

Reservoir – Single and multipurpose – Multi objective – Fixation of Storage capacity –Strategies for reservoir operation – Sedimentation of reservoirs – Design flood levees and flood walls – Channel improvement.

**UNIT V ECONOMIC ANALYSIS 9**

Estimation of cost and evaluation of benefits – Discount rate – Discounting factors – Discounting techniques – Computer Applications.

**Total: 45**

### **TEXT BOOKS**

1. Linsley, R.K. and Franzini, J.B., “Water Resources Engineering”, McGraw-Hill Inc, 2000.
2. Douglas, J.L. and Lee R.R., “Economics of Water Resources Planning”, Tata McGraw-Hill Inc. 2000.

### **REFERENCES**

1. Chaturvedi, M.C., “Water Resources Systems Planning and Management”, Tata McGraw-Hill Inc., 1997.
2. Goodman Alvin, S., “Principles of Water Resources Planning”, Prentice-Hall, 1984.
3. Duggal, K.N. and Soni, J.P., “Elements of Water Resources Engineering”, New Age International Publishers, 1996.



## **AIR POLLUTION MANAGEMENT**

**L T P**  
**3 0 0**

### **UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS 9**

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings – Materials – vegetation – Animals – Global warming-ozone layer depletion – Sampling and Analysis – Basic principles of sampling – Source and ambient sampling – Analysis of pollutants – Principles.

### **UNIT II DISPERSION OF POLLUTANTS 9**

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

### **UNIT III AIR POLLUTION CONTROL 9**

Concepts of control – Principles and design of control measures – Particulates control by gravitational – Centrifugal – Filtration – Scrubbing – Electrostatic precipitation – Selection criteria for equipment – Gaseous pollutant control by adsorption – Absorption – condensation – combustion – Pollution control for specific major industries.

### **UNIT IV AIR QUALITY MANAGEMENT 9**

Air quality standards – Air quality monitoring – Preventive measures – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental impact assessment and air quality.

### **UNIT V NOISE POLLUTION 9**

Sources of noise pollution – Effects – Assessment - Standards – Control methods - Prevention

**Total: 45**

### **TEXT BOOKS**

1. Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers 2002.
2. Heumann, W.L. “Industrial Air Pollution Control Systems ”, McGraw-Hill, 1997.

### **REFERENCES**

1. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw-Hill Publishing Company, 1991.
2. Peavy, S.W., Rowe D.R. and Tchobanoglous, G., “Environmental Engineering”, McGraw Hill, 1985.
3. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw-Hill, 1991.





## SMART STRUCTURES AND SMART MATERIALS

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### UNIT I INTRODUCTION 9

Introduction to smart materials and structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors.

### UNIT II MEASURING TECHNIQUES 9

Strain measuring techniques using electrical strain gauges – Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature compensation – Strain Rosettes.

### UNIT III SENSORS 9

Sensing technology – Types of sensors – Physical measurement using piezo electric strain measurement – Inductively read transducers – The LVDT – Fiber optic techniques.

Chemical and bio-chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre optic chemical sensing systems and distributed measurement.

### UNIT IV ACTUATORS 9

Actuator techniques – Actuator and actuator materials – Piezoelectric and electrostrictive material – Magnetostructure material – Shape memory alloys – Electro rheological fluids – Electro magnetic actuation – Role of actuators and actuator materials.

### UNIT V SIGNAL PROCESSING AND CONTROL SYSTEMS 9

Data acquisition and processing – Signal processing and control for smart structures – Sensors as geometrical processors – Signal processing – Control system – Linear and non-Linear.

**Total: 45**

### TEXT BOOK

1. Brain Culshaw, “Smart Structure and Materials”, Artech House, 1996.

### REFERENCES

1. Srinath, L. S., “Experimental Stress Analysis”, Tata McGraw-Hill, 1998.
2. Dally J. W. and Riley W. F., “Experimental Stress Analysis” , Tata McGraw-Hill, 1998.

# FINITE ELEMENT TECHNIQUES

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## UNIT I INTRODUCTION – VARIATIONAL FORMULATION 9

General field problems in engineering – Modelling – Discrete and continuous models – Characteristics – Difficulties involved in solution – The relevance and place of the finite element method – Historical comments – Basic concept of FEM, boundary and initial value problems – Gradient and divergence theorems – Functionals – Variational calculus – Variational formulation of VBPS – The method of weighted residuals – The Ritz method.

## UNIT II FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS 9

One dimensional second order equations – Discretisation of domain into elements – Generalised coordinates approach – Derivation of elements equations – Assembly of elements equations – Imposition of boundary conditions – Solution of equations – Cholesky method – Post processing – Extension of the method to fourth order equations and their solutions – Time dependant problems and their solutions – Example from heat transfer fluid flow and solid mechanics.

## UNIT III FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS 9

Second order equation involving a scalar – Valued function – Model equation – Variational formulation – Finite element formulation through generalised coordinates approach – Triangular elements and quadrilateral elements – Convergence criteria for chosen models – Interpolation functions – Elements matrices and vectors – Assembly of element matrices – Boundary conditions – Solution techniques.

## UNIT IV ISOPARAMETRIC ELEMENTS AND FORMULATION 9

Natural coordinates in 1, 2 and 3 dimensions – Use of area coordinates for triangular elements in – Two dimensional problems – Isoparametric elements in 1,2 and 3 dimensional – Lagrangean and serendipity elements – Formulations of elements equations in one and two dimensions - Numerical integration.

## UNIT V APPLICATIONS TO FIELD PROBLEMS IN TWO DIMENSIONALS 9

Equations of elasticity – Plane elasticity problems – Axisymmetric problems in elasticity – Bending of elastic plates – Time dependent problems in elasticity – Heat – Transfer in two dimensions – Incompressible fluid flow.

**Total: 45**

### TEXT BOOK

1. Chandrupatla, T.R. and Belegundu, A.D., “Introduction to Finite Element in Engineering”, Third Edition, Prentice Hall, 2003.

### REFERENCES

1. Reddy, J.N., “An Introduction to Finite Element Method”, McGraw-Hill, 1985.
2. Rao, S.S., “The Finite Element Method in Engineering”, Pergaman Press, 2003.
3. Desai, C.S. and Abel, J.F., “Introduction to the Finite Element Method”, Affiliated East West Press, 1972.

## REPAIR AND REHABILITATION OF STRUCTURES

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### UNIT I CONCRETE - INFLUENCE ON SERVICEABILITY AND DURABILITY 9

Quality assurance for concrete construction as built concrete properties strength permeability – Thermal properties and cracking. Effects due to climate – Temperature – Chemicals – Wear and erosion – Design and construction errors – Corrosion mechanism – Effects of cover thickness and cracking – Methods of corrosion protection – Corrosion inhibitors – Corrosion resistant steels – Coatings – Cathodic protection.

### UNIT II MAINTENANCE AND REPAIR STRATEGIES 9

Definitions – Maintenance, repair and rehabilitation. Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection – Assessment procedure for evaluating a damaged structure causes of deterioration – Testing techniques.

### UNIT III MATERIALS FOR REPAIR 9

Special concretes and mortar – Concrete chemicals – Special elements for accelerated strength gain – Expansive cement – Polymer concrete, sulphur infiltrated concrete, ferro cement – Fibre reinforced concrete.

### UNIT IV TECHNIQUES FOR REPAIR 9

Rust eliminators and polymers coating for rebars during repair foamed concrete – Mortar and dry pack – Vacuum concrete – Guniting and Shotcrete Epoxy injection – Mortar repair for cracks – Shoring and underpinning.

### UNIT V EXAMPLES OF REPAIR TO STRUCTURES - DEMOLITION 9

Repairs to overcome low member strength, – Deflection – Cracking – Chemical disruption – weathering wear – Fire, leakage – Marine exposure . Engineered demolition techniques for Dilapidated structures – case studies.

**Total : 45**

### TEXT BOOKS

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical, 1991.
2. Allen, R.T.and Edwards, S.C.. “Repair of Concrete Structures”, Blakie and Sons, 1987.

### REFERENCES

1. Shetty, M.S., “Concrete Technology - Theory and Practice”, S.Chand and Company,1992.
2. Raikar, R.N., “Learning from failures - Deficiencies in Design, Construction and Service” - R and D Centre (SDCPL), Raikar Bhavan, 1987.
3. Palaniappan, N., " Estate Management, Anna Institute of Management ", Chennai, 1992.

# STRUCTURAL DYNAMICS AND DESIGN OF SEISMIC STRUCTURES

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3 0 0

## UNIT I THEORY OF VIBRATIONS 9

Concept of inertia and damping – Types of Damping – Difference between static forces and dynamic excitation – Degrees of freedom – SDOF idealisation – Equations of motion of SDOF system for mass as well as base excitation – Free vibration of SDOF system – Response to harmonic excitation – Impulse and response to unit impulse – Duhamel integral

## UNIT II MULTIPLE DEGREE OF FREEDOM SYSTEM 9

Two degree of freedom system – Normal modes of vibration – Natural frequencies - Mode shapes - Introduction to MDOF systems – Decoupling of equations of motion – Concept of mode superposition (No derivations).

## UNIT III ELEMENTS OF SEISMOLOGY 9

Causes of Earthquake – Geological faults – Tectonic plate theory – Elastic rebound – Epicentre – Hypocentre – Primary, shear and raleigh waves – Seismogram – Magnitude and intensity of earthquakes – Magnitude and Intensity scales – Spectral Acceleration - Information on some disastrous earthquakes

## UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE 9

Response and design spectra – Design earthquake – concept of peak acceleration – Site specific response spectrum – Effect of soil properties and damping – Liquefaction of soils – Importance of ductility – Methods of introducing ductility into RC structures.

## UNIT V DESIGN METHODOLOGY 9

IS 1893, IS 13920 and IS 4326 – Codal provisions – Design as per the codes – Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquake on structures.

**Total: 45**

### TEXT BOOKS

1. Biggs, J.M., “Introduction to Structural Dynamics”, McGraw–Hill Book Co., N.Y., 1964.
2. Chopra, A.K., “Dynamics of Structures – Theory and Applications to Earthquake Engineering”, 2nd Edition, Pearson Education, 2003.

### REFERENCES

1. Arya, A.S., “Earthquake Engineering”, Jai Krishna 60th Birthday Anniversary Commemoration Volume, ISET, Sarita Prakashan, 1974.
2. Dowrick, D.J., “Earthquake Resistant Design”, John Wiley and Sons, 1977.
3. Paz, M., “Structural Dynamics Theory and Computation”, CSB Publishers and Distributors, 1985.