

## ENGINEERING MATHEMATICS – III

**CODE: 10 MAT 31**  
**Hrs/Week: 04**  
**Total Hrs: 52**  
**Marks:100**

**IA Marks: 25**  
**Exam Hrs: 03**  
**Exam**

### PART-A

#### Unit-I: FOURIER SERIES

Convergence and divergence of infinite series of positive terms, definition and illustrative examples\*

Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period  $2\pi$  and arbitrary period, half range Fourier series. Complex form of Fourier Series. Practical harmonic analysis. [7 hours]

#### Unit-II: FOURIER TRANSFORMS

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms [6 hours]

#### Unit-III: APPLICATIONS OF PDE

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace's equation by the method of separation of variables, Solution of all these equations with specified boundary conditions. D'Alembert's solution of one dimensional wave equation. [6 hours]

#### Unit-IV: CURVE FITTING AND OPTIMIZATION

Curve fitting by the method of least squares- Fitting of curves of the form  $y = ax+b$ ,  $y = ax^2 + bx+c$ ,  $y = ae^{bx}$ ,  $y = ax^b$

Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method.

[7 hours]

## **PART-B**

### **Unit-V: NUMERICAL METHODS - 1**

Numerical Solution of algebraic and transcendental equations: Regula-falsi method, Newton - Raphson method. Iterative methods of solution of a system of equations: Gauss-seidel and Relaxation methods. Largest eigen value and the corresponding eigen vector by Rayleigh's power method.

[6 hours]

### **Unit-VI: NUMERICAL METHODS – 2**

Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences - Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula.

Numerical integration: Simpson's one-third, three-eighth and Weddle's rules (All formulae/rules without proof)

[7 hours]

### **Unit-VII: NUMERICAL METHODS – 3**

Numerical solutions of PDE – finite difference approximation to derivatives, Numerical solution of two dimensional Laplace's equation, one dimensional heat and wave equations

[7 hours]

**Unit-VIII: DIFFERENCE EQUATIONS AND Z-TRANSFORMS**

Difference equations: Basic definition; Z-transforms – definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems. Inverse Z-transform. Application of Z-transforms to solve difference equations.

[6 hours]

**Note: \* In the case of illustrative examples, questions are not to be set.**

**Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

**Reference Book:**

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O’Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

**BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY  
(COMMON TO CV/TR/CTM)**

Sub Code	:	10 CV 32	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

Part-A

3

UNIT-1

FOUNDATION

Function and requirements of a good foundation, Types of foundations, Preliminary investigation of soil, Safe Bearing Capacity of Soil, Introduction to spread, combined, strap, mat and pile foundations, Design of strip and combined footings 6 hours

UNIT-2

MASONRY

Classification of Masonry, Definition of terms used in Masonry, Introduction to classification and qualities of bricks, Bonds in Brick work - English Bond, Flemish Bond, Reinforced, Brick Masonry, Common building stones, their properties and uses, Classification of stone masonry, Joints in stone masonry, Introduction to load bearing, cavity and partition walls. 8 hours

UNIT-3

ARCHES, LINTEL AND BALCONY

Elements of an arch, Classification of arches, Stability of arch, Definition and classification of Lintels, Definition and functions of Chejja, Canopy & Balcony. 6 hours

UNIT-4

ROOFS AND FLOORS

Types of Roofs & Roofing materials, Flat roof (RCC), Types of pitched roofs, Wooden Truss, Steel trusses, Types of flooring, Factors affecting selection of flooring materials. 7 hours

**Part-B**

UNIT-5

DOORS AND WINDOWS

Location of doors and windows, Definition of technical terms, Types of Doors, Types of windows, Varieties of materials for doors and windows & their properties. 6 hours

UNIT-6

STAIRS

Definition of technical terms, Requirements of ground stair, Types of Stairs, Geometrical design of RCC Dog legged and open well stairs (Plain and sector elevation). 6 hours

UNIT-7

PLASTERING AND PAINTING

Purpose of plastering, Materials of plastering, Methods of plastering, Defects in plastering, Introduction to Paintings and types of Painting, Constituents of paints & types, Purpose of Painting, Defects in Painting, Application of Paints to new and old surfaces. 6 hours

UNIT-8

MISCELLANEOUS TOPICS

Properties and uses of plastics, aluminum, glasses, varnishes, Introduction to smart materials and its application, Introduction to formwork and scaffolding,

Formwork details for RCC Column, Beams and Floors, Shoring and underpinning, Damp Proofing - Causes of Dampness, Effects of Dampness, Methods of Damp Proofing  
7 hours

#### TEXT BOOKS

1. **Engineering Materials**, Rangawala P.C. Charter Publishing House, Anand, India.
2. **Engineering Materials**, Sushil Kumar, Standard Publication and Distributors, New Delhi.
3. **Concrete technology – Theory and practice**, M..S. Shetty, S. Chand and Co, New Delhi, 2002.

#### REFERENCE BOOKS

1. **A Text Book Building Materials**, by P.G. Varghese, Prentice-Hall of India Pvt. Ltd., Publication.
2. **Advances in Building Materials and Construction** by Mohan Rai and M.P. Jain Singh – publication by CBRI, Roorkee.
3. **Concrete Technology**, Neville A.M and Brooks J.J — ELBS Edition. London
4. **Concrete Technology** – Gambhir M.L –Dhanpat Rai and Sons, New Delhi.

#### STRENGTH OF MATERIALS (COMMON TO CV/TR/EV/CTM)

Sub Code	: 10 CV 33	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

#### PART – A

##### UNIT 1:

##### Simple Stress and Strain

1.1 Introduction, 1.2 Properties of Materials, 1.3 Stress, Strain, Hook's law, 1.4 Poisson's Ratio, 1.5 Stress – Strain Diagram for structural steel and non ferrous materials, 1.6 Principles of superposition, 1.7 Total elongation of tapering bars of circular and rectangular cross sections. Elongation due to self – weight

7 Hours

##### UNIT 2:

##### Simple Stress and Strain continued...

2.1 Composite section, 2.2 Volumetric strain, expression for volumetric strain, 2.3 Elastic constants, relationship among elastic constants, 2.4 Thermal stresses (including thermal stresses in compound bars).

**6 Hours**

**UNIT 3:**

**Compound stresses**

3.1 Introduction, 3.2 Stress components on inclined planes, 3.3 General two-dimensional stress system, 3.4 Principal planes and stresses, 3.5 Mohr's circle of stresses.

**8 Hours**

**UNIT 4:**

**Bending moment and shear force in beams**

4.1 Introduction, 4.2 Types of beams loadings and supports, 4.3 Shearing force in beam, 4.4 Bending moment, 4.5 Sign convention, 4.6 Relationship between loading, shear force and bending moment, 4.7 Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams considering point loads, UDL, UVL and Couple.

**7 Hours**

**PART – B**

**UNIT 5:**

**Bending stress, shear stress in beams**

5.1 Introduction – Bending stress in beam, 5.2 Assumptions in simple bending theory, 5.3 Pure bending derivation of Bernoulli's equation, 5.4 Modulus of rupture, section modulus, 5.5 Flexural rigidity, 5.6 Expression for horizontal shear stress in beam, 5.7 Shear stress diagram for rectangular, symmetrical 'I' and 'T' section (Flitched beams not included).

**6 Hours**

**UNIT 6:**

**Deflection of beams**

6.1 Introduction – Definitions of slope, deflection, 6.2 Elastic curve-derivation of differential equation of flexure, 6.3 Sign convention 6.4 Slope and deflection for standard loading classes using Macaulay's method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple.

**6 Hours**

**UNIT 7:**

**Torsion of circular shafts**

7.1 Introduction – Pure torsion-torsion equation of circular shafts, 7.2 Strength and stiffness, 7.3 Torsional rigidity and polar modulus, 7.4 Power

transmitted by shaft of solid and hollow circular sections.

**6 Hours**

**UNIT 8:**

**Elastic stability of columns**

8.1 Introduction – Short and long columns, 8.2 Euler’s theory on columns, 8.3 Effective length slenderness ration, 8.4 radius of gyration, buckling load, 8.5 Assumptions, derivations of Euler’s Buckling load for different end conditions, 8.6 Limitations of Euler’s theory, 8.7 Rankine’s formula and problems.

**6 Hours**

**TEXT BOOKS:**

1. **Strength of Materials**, Subramanyam, Oxford University Press, Edition 2008
2. **Mechanics of Materials**, B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi.
3. **Strength of Materials**, Basavarajaiah and Mahadevappa Universities Press (2009).

**REFERENCE BOOKS:**

1. **Strength of Materials**, Singer Harper and Row Publications.
2. **Elements of Strength of Materials**, Timoshenko and Young Affiliated East-West Press.
3. **Mechanics of Materials**, James M. Gere (5<sup>th</sup> Edition), Thomson Learning.

**SURVEYING – I  
(COMMON TO CV/TR/EV/CTM)**

<b>Sub Code</b>	<b>:</b>	<b>10 CV 34</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>04</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>52</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

**PART – A**

**UNIT 1:**

**Introduction**

1.1 Definition of Surveying, 1.2 Classification of Surveys, 1.3 Uses of Surveying Units of Measurements, 1.4 Map & Classification, 1.5 Survey of India topographical Maps and their numbering., 1.6 Basic principles of surveying, 1.7 Errors, Classification, 1.8 Precision and accuracy.

**04 Hours**

**UNIT 2:**

**Measurement of horizontal distances.**

2.1 Chain and types, 2.2 Tape and types, 2.3 EDM devices, 2.3 Ranging of lines 2.4 Direct and Indirect, 2.5 Measurement of distances over sloping grounds, 2.6 Chain and Tape corrections - Numerical problems.

**5 Hours**

**UNIT 3:**

**Chain Surveying**

3.1 Accessories required, 3.2 Selection of stations and lines, 3.3 Offsets and types 3.4 Setting out of right angles, 3.5 Working principle and use of optical square, prism square, cross staff., 3.6 Linear methods of setting out right angles, 3.7 Booking of chain survey work, 3.8 Field book, entries, conventional symbols, 3.9 Obstacles in chain survey, Numerical problems, 3.10 Errors in chain survey and precautions to be taken.

**7 Hours**

**UNIT 4:**

**Compass Surveying**

4.1 Meridians and bearings, 4.2 Principle, working and use of - Prismatic compass 4.3 Surveyor's compass, 4.4 Magnetic bearing, true bearings, 4.5 WCB and Reduced bearing. 4.6 Dip and Declination  
4.7 Accessories required for compass surveying, 4.8 Traverse - closed and open traverse 4.9 Computation of bearings of legs of closed traverse given the bearing of one of the legs, 4.10 Computation of included angles given the bearings of legs of a closed traverse.

**6 Hours**

**PART – B**

**UNIT 5:**

**Compass Traversing** continued....

5.1 Local attraction, determination and corrections, 5.2 Dependent and independent co-ordinates, 5.3 Checks for closed traverse and determination of closing error and its direction 5.4 Bowditch's graphical method of adjustment of closed traverse, 5.5 Bowditch's rule and transit rule, 5.6 Omitted measurements (Only Length and corresponding bearing of one line).

**8 Hours**

**UNIT 6:**

**Introduction to Levelling**



6.1 Principles and basic definitions, 6.2 Fundamental axes and part of a dumpy level, 6.3 Types of adjustments and objectives, 6.4 Temporary adjustments of a dumpy level, 6.5 Sensitiveness of bubble tube, 6.6 Curvature and refraction correction, 6.7 Type of leveling, 6.8 Simple leveling, 6.9 Reciprocal leveling, 6.10 Profile leveling, 6.11 Cross sectioning, 6.12 Fly leveling,

**7 Hours**

**UNIT 7:**

**Reduction of Levelling** continued....

7.1 Booking of levels 7.2 Rise and fall method and Height of instrument method 7.3 comparison Arithmetic checks 7.4 Fly back leveling., 7.5 Errors and precautions.

**6 Hours**

**Contouring**

7.6 Contours and their characteristics, 7.7 Methods of contouring, 7.8 direct and indirect methods, 7.9 Interpolation techniques, 7.10 Uses of contours 7.11 Numerical problems on determining intervisibility, 7.12 Grade contours and uses.

**4 Hours**

**UNIT 8:**

**Plane Table Surveying**

8.1 Plane table and accessories, 8.2 Advantages and limitations of plane table survey, 8.3 Orientation and methods of orientation, 8.4 Methods of plotting – Radiation, Intersection, Traversing, 8.5 Resection method, 8.6 Two point and three point problems, 8.7 Solution to two point problem by graphical method, 8.8 Solution to three point problem Bessel's graphical method, 8.9 Errors in plane table survey.

**5 Hours**

**TEXT BOOKS:**

1. 'Surveying' Vol-1 – B.C. Punmia , Laxmi Publications, New Delhi.
2. **Surveying and Levelling** – R Subramanian. Oxford University Press (2007)

**Text Book of Surveying** – C. Venkataramiah. Universities Press.(2009 Reprint)

**REFERENCE BOOKS:**

1. **Fundamentals of Surveying** - Milton O. Schmidt – Wong, Thomson Learning.
2. **Fundamentals of Surveying** - S.K. Roy – Prentice Hall of India.

3. **Surveying** Vol. I, S.K. Duggal, Tata McGraw Hill - Publishing Co. Ltd., New Delhi.

\* Survey of India Publication on maps.

## **10 CV 35 FLUID MECHANICS**

Sub. Code: 10CV 35

IA Marks: 25

Hrs/Week : 04

Exam Hours: 03

Total Hrs: 52

Exam Marks: 100

### **PART-A**

#### **UNIT-1: BASIC PROPERTIES OF FLUIDS**

Introduction, Definition of Fluid, Systems of units, properties of fluid: Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension, & Capillarity. Newton's law of viscosity (theory & problems). Capillary rise in a vertical tube and between two plane surfaces (theory & problems). **06 Hrs.**

#### **UNIT-2: PRESSURE AND ITS MEASUREMENT**

Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Vapour pressure. Measurement of pressure using a simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices. **07 Hrs.**

#### **UNIT-3: HYDROSTATIC PRESSURE ON SURFACES**

Basic definitions, equations for hydrostatic force and depth of centre of pressure for Vertical and inclined submerged laminae (plane and curved )- Problems. **06 Hrs**

#### **UNIT-4: KINEMATICS OF FLOW**

Introduction, methods of describing fluid motion, definitions of types of fluid flow, streamline, pathline, streamtube. Three dimensional continuity equation in Cartesian Coordinates ( derivation and problems ). General Continuity equation ( problems ). Velocity potential, Stream function, Equipotential line, Stream line- problems, Physical concepts of Streamfunction. Introduction to flow net.

**07 Hrs**

### **PART-B**

#### **UNIT-5: DYNAMICS OF FLUID FLOW**

Introduction, Energy possessed by a fluid body. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses). Introduction to kinetic energy correction factor. Momentum equation problems on pipe bends.

**07 Hrs**

#### **UNIT-6: PIPE FLOW**

Introduction, losses in pipe flow,. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion- problems. Water hammer in pipes, equation for pressure rise due to gradual

valve closure & sudden closure for rigid and elastic pipes-problems. **07 Hrs**

### **UNIT-7: DEPTH AND VELOCITY MEASUREMENTS**

Introduction, Measurement of depth, point & hook gauges, self recording gauges. Staff gauge, Weight gauge, float gauge. Measurement of velocity- single and double gauges, pitot tube, Current meter- Problems.

**06 Hrs**

### **UNIT-8: DISCHARGE MEASUREMENTS**

Introduction, Venturimeter, Orificemeter, Rotometer, Venturiflume, Triangular notch, Rectangular notch, Cipolletti notch, Ogee weir and Broad crested weir, Small orifices-Problems. **06 Hrs**

#### **TEXT BOOKS:**

1. 'A TextBook of Fluid mechanics & Hydraulic Machines'- R.K.Rajput, S.Chand & Co, New Delhi, 2006 Edition.
2. 'Principles of Fluid Mechanics and Fluid Machines'- N.Narayana Pillai, Universities Press(India), Hyderabad,2009 Edition.
3. ' Fluid Mechanics and Turbomachines'- Madan Mohan Das, PHI Learning Pvt. Limited, New Delhi. 2009 Edition.

#### **REFERENCE BOOKS:**

1. ' Fundamentals of Fluid Mechanics' – Bruce R. Munson, Donald F.Young, Theodore H. Okiishi, Wiley India, New Delhi, 2009 Edition.
2. 'Introduction To Fluid Mechanics' – Edward j. Shaughnessy,jr; Ira m. Katz.; James p Schaffer, Oxford University Press, New Delhi, 2005 Edition.

3. 'Text Book Of Fluid Mechanics & Hydraulic Machines'- R.K.Bansal, Laxmi Publications, New Delhi, 2008 Edition.
4. 'Fluid Mechanics' – Streeter, Wylie, Bedford New Delhi, 2008(Ed)

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### APPLIED ENGINEERING GEOLOGY

<b>Sub Code</b>	<b>:</b>	<b>10 CV-36</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>04</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>52</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

### PART – A

#### Unit: 1 - INTRODUCTION:

Geology and its role in the field of civil engineering. Earth: Its internal structure and composition. – 2 hours

#### MINERALOGY:

Description and identification of Rock forming minerals and Ores, based on physical and special properties;

Quartz and its varieties; Feldspar group; Mica group; carbonate group;

Hornblende, Augite, Olivine, Asbestos, Kaolin, Talc, Gypsum, Garnet, Corundum.

Magnetite, Hematite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Psilomalane, Chromite, Galena, Bauxite. – 6 hours

#### Unit: 2- PETROLOGY:

Rocks as fundamental units and building materials of the earth crust and their engineering applications: As building stones, road metals and stones for decoration, pavement, cladding, roofing, flooring, concreting and foundation engineering.

Igneous rocks: Origin, classification (chemical and textural), mode of occurrence; Identification and description of Granite, Syenite, Diorite, Gabbro, Dunite; Pegmatite, Porphyries, Dolerite; Rhyolite, Basalt and Pumice.

Sedimentary rocks: Origin, classification, primary structures and description of Sandstones, Conglomerate, Breccia, Shale, Limestones and Laterite.

Metamorphic rocks: Kinds of metamorphism, description of Gneiss, Quartzite, Marble, Slate, Phyllite and Schists. – 6 hours

**Unit: 3-GEOMORPHOLOGY:**

Epigene and Hypgene geological agents; rock weathering and its types; Soil formation, types, erosion and remedial measures; Geological action of rivers with different drainage patterns; Geological action of wind. – 5 hours

**Unit: 4-GEODYNAMICS:**

Earthquakes- seismic waves, seismograph, causes, effects, seismic zones, shield areas and seismic resisting structures. Coastal zones, coastal landforms, continental shelf, continental rise, continental slope, abyssal plain, mid-oceanic ridges, trenches, tsunamis. Land slides; causes, effects and remedial measures – 5 hours

**PART B**

**Unit: 5- ROCK MECHANICS:**

Stress, strain and deformational effects on different rocks; Out crop, Dip, strike and escarpment, Clinometer-compass- Joints, faults, folds and unconformities their effects on civil engineering structures. – 6 hours

**Unit:6- ENGINEERING GEOLOGY:**

Geotechnical investigations for civil engineering projects: Study of toposheets and geological maps, importance of lithological and structural features studies for the construction of Dams, Reservoirs, Tunnels, Bridges and Highways – 6 hours

**Unit: 7-HYDROGEOLOGY:**

Hydrological cycle; distribution of ground water in the earth crust; properties of water bearing geological formation: Aquifers and their types; selection of sites for well locations and spacing of wells; geological, hydrological and geophysical (electrical resistivity) investigations for ground water exploration; artificial recharge of groundwater methods and rain water harvesting. Sea water intrusion and remedial measures. – 9 hours

**Unit:8- GEOMATICS AND ENVIRONMENTAL GEOLOGY:**

Introduction to remote sensing (RS), geographical information system (GIS) and global positioning system (GPS); land satellite imageries, stereoscopes and their applications in civil engineering. Impact of quarrying, mining and dams on Environment. Quality of ground water in different geological terrain. – 7 hours

**QUESTION PAPER PATTERN:**

Question paper shall be consisting of eight full questions, selecting four from each part.

The student has to answer any five, selecting at least two from each part.

Each question carry 20 marks.

**References books:**

1. Text book of Geology by P.K. Mukerjee, World Press Pvt. Ltd. Kolkatta.
1. Foundations of Engineering Geology, by Tony Waltham (3<sup>rd</sup> Ed.) Universities Press.
2. Structural Geology (3<sup>rd</sup> Ed.) by M. P. Billings, Published by Prentice Hall of India Pvt. Ltd. New Delhi
3. Text of Engineering and General Geology by Parbin Singh, Published by S. K. Kataria and Sons, New Delhi.
4. Rock Mechanics for Engineers by Dr B.P. Verma, Khanna Publishers, New Delhi.
5. Engineering Geology for Civil Engineering by D. Venkata Reddy, Oxford and IBH Publishing Company, New Delhi.
6. Ground water geology by Todd D.K. John Wiley and Sons, New York.
7. Remote sensing Geology by Ravi P Gupta, Springer Verilog, New York.
8. Physical Geology by Arthur Holmes, Thomson Nelson and Sons, London.
9. Environmental Geology by K. S. Valdiya, Tata Mc Graw Hills.
10. A text book of Engineering Geology by Chenna Kesavulu, Mac Millan India Ltd.
11. Remote sensing and GIS by M. Anji Reddy.
12. Ground water assessment, development and management by K.R. Karanth, Tata Mc Graw Hills

**BASIC MATERIAL TESTING LAB  
(COMMON TO CV/TR)**

<b>Sub Code</b>	<b>:</b>	<b>10 CVL 37</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>03</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>42</b>	<b>Exam Marks</b>	<b>:</b>	<b>50</b>

1. Tension test on Mild steel and HYSD bars.
2. Compression test of Mild Steel, Cast iron and Wood.
3. Torsion test on Mild Steel circular sections
4. Bending Test on Wood Under two point loading
5. Shear Test on Mild steel.
6. Impact test on Mild Steel (Charpy & Izod)
7. Hardness tests on ferrous and non-ferrous metals – Brinell’s, Rockwell and Vicker’s
8. Test on Bricks and Tiles
9. Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking
10. Tests on Coarse aggregates – Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis
11. Demonstration of Strain gauges and Strain indicators

**NOTE:** All tests to be carried out as per relevant BIS Codes

**REFERENCE BOOKS:**

1. **Testing of Engineering Materials**, Davis, Troxell and Hawk, International Student Edition – McGraw Hill Book Co. New Delhi.
2. **Mechanical Testing of Materials**”, Fenner, George Newnes Ltd. London.
3. **“Experimental Strength of Materials”**, Holes K A, English Universities Press Ltd. London.
4. **“Testing of Metallic Materials”**, Suryanarayana A K, Prentice Hall of India Pvt. Ltd. New Delhi.
5. **Relevant IS Codes**
6. **“Material Testing Laboratory Manual”**, Kukreja C B- Kishore K. Ravi Chawla Standard Publishers & Distributors 1996.
7. **Concrete Manual**, M.L.Gambhir –Dhanpat Rai & Sons- New Delhi.

**Scheme of Examination:**

Group Experiments: Tension, Compression Torsion and Bending Tests

Individual Experiments: Remaining tests

Two questions are to be set – one from group experiments and the other as individual experiment.



**SURVEYING PRACTICE – I  
(COMMON TO CV/TR/EV/CTM)**

<b>Sub Code</b>	<b>:</b>	<b>10 CVL 38</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>03</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>42</b>	<b>Exam Marks</b>	<b>:</b>	<b>50</b>

Exercise – 1

- a) To measure distance between two points using direct ranging
- b) To set out perpendiculars at various points on given line using cross staff, optical square and tape.

Exercise – 2

Setting out of rectangle, hexagon using tape/chain and other accessories

Exercise – 3

Measurement of bearing of the sides of a closed traverse & adjustment of closing error by Bowdich method and Transit method

Exercise – 4

To set out rectangles, pentagon, hexagon, using tape /chain and compass.

Exercise – 5

To determine the distance between two inaccessible points using chain/tape & compass.

Exercise – 6

To locate points using radiation and intersection method of plane tabling

Exercise – 7

To solve 3-point problem in plane tabling using Bessel's graphical solution

Exercise – 8

To determine difference in elevation between two points using fly leveling technique & to conduct fly back leveling. Booking of levels using both HI and Rise & Fall methods.

Exercise – 9

To determine difference in elevation between two points using reciprocal leveling and to determine the collimation error

Exercise – 10

To conduct profile leveling for water supply /sewage line and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level.

**Demonstration**

Minor instruments – Clinometer, Ceylon ghat tracer, Hand level, Box sextant, Planimeter and Pantagraph.

**Scheme of Examination:**

Any one of the above exercise is to be conducted in the examination by the student.

**TEXT BOOKS:**

1. 'Surveying' Vol.-1, B.C. Punmia , Laxmi Publications, New Delhi.
2. 'Plane Surveying' Vol-1-A.M. Chandra , Newage International ® Ltd.
3. 'Plane Surveying' – ALAK , S. Chand and Company Ltd., New Delhi.

**REFERENCE BOOKS :**

1. **Fundamentals of Surveying** - S.K. Roy – Prentice Hall of India.
2. **Fundamentals of Surveying** - Milton O. Schmidt – Wong, Thomson Learning.
4. **Surveying** Vol. I, S.K. Duggal

**ENGINEERING MATHEMATICS – IV**

**CODE: 10 MAT 41**  
**Hrs/Week: 04**  
**Total Hrs: 52**  
**Marks:100**

**IA Marks: 25**  
**Exam Hrs: 03**  
**Exam**

**PART-A**

**Unit-I: NUMERICAL METHODS - 1**

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

[6 hours]

**Unit-II: NUMERICAL METHODS – 2**

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order.

Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

[6 hours]

**Unit-III: Complex variables – 1**

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions.

Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

[7 hours]

**Unit-IV: Complex variables – 2**

Conformal Transformations: Bilinear Transformations.  
Discussion of Transformations:  
 $w = z^2$ ,  $w = e^z$ ,  $w = z + (a^2 / z)$ . Complex line integrals-  
Cauchy's theorem and Cauchy's integral formula.

[7 hours]

## **PART-B**

### **Unit-V: SPECIAL FUNCTIONS**

Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

**[7 hours]**

### **Unit-VI: PROBABILITY THEORY - 1**

Probability of an event, empirical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

**[6 hours]**

### **Unit-VII: PROBABILITY THEORY- 2**

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

**[7 hours]**

### **Unit-VIII: SAMPLING THEORY**

Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

**[6 hours]**

**Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

**Reference Book:**

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

**CONCRETE TECHNOLOGY  
(COMMON TO CV/TR/CTM)**

<b>Sub Code</b>	<b>:</b>	<b>10 CV 42</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>04</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>52</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

**PART – A**

**Unit- 1**

Cement, Chemical composition, hydration of cement, Types of cement, manufacture of OPC by wet and dry, process (flow charts only) Testing of cement - Field testing, Fineness by sieve test and Blaine's air permeability test, Normal consistency, testing time, soundness, Compression strength of cement and grades of cement, Quality of mixing water. -7 Hours

**Unit-2**

Fine aggregate - grading, analysis, Specific gravity, bulking, moisture content, deleterious materials. Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. - 6 Hours

**Unit-3**

Workability - factors affecting workability, Measurement of workability - slump, flow tests, Compaction factor and vee-bee consistometer tests, Segregation and bleeding, Process of manufacture of concrete : Batching, Mixing, Transporting, Placing, Compaction, Curing. -7 Hours

**Unit-4**

Chemical admixtures - plasticizers, accelerators, retarders and air entraining agents, Mineral admixtures - Fly ash, Silica fumes and rice husk ash.

-6 Hours

**Part-B**

**Unit-5**

Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, relation between compressive strength, and tensile strength, bond strength, modulus of rupture, Accelerated curing, aggregate - cement bond strength, Testing of hardened concrete - compressive strength, split tensile strength, Flexural strength, factors influencing strength test results.

- 6Hours

**Unit-6**

Elasticity - Relation between modulus of elasticity and Strength, factors affecting modulus of elasticity, Poisson , Ratio, Shrinkage - plastic shrinkage and drying shrinkage, Factors affecting shrinkage, Creep - Measurement of creep, factors affecting creep, effect of creep,

- 7 Hours

**Unit-7**

Durability - definition, significance, permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks, construction joints, Thermal expansion, transition zone, structural design deficiencies, - 6 Hours

**Unit-8**

Concept of Concrete Mix design, variables in proportioning , exposure conditions, Procedure of mix design as per IS 10262-1982, Numerical examples of Mix Design

- 7 Hours

**TEXT BOOKS:**

1. "Concrete Technology" - Theory and Practice, M.S.Shetty, S.Chand and Company, New Delhi, 2002.

**REFERENCES :**

1. "Properties of Concrete" Neville, A.M. : , ELBS, London
2. "Concrete Technology" – A.R.Santakumar. Oxford University Press (2007)
3. "Concrete Manual" - Gambhir Dhanpat Rai & Sons, New Delhi.
4. "Concrete Mix Design" - N.Krishna Raju, Sehgal - publishers.
5. "Recommended guidelines for concrete mix design" - IS:10262,BIS Publication

**STRUCTURAL ANALYSIS –I  
(COMMON TO CV/TR)**

<b>Sub Code</b>	<b>:</b>	<b>10 CV 43</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>04</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>52</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

**PART – A**

**UNIT 1:**

**STRUCTURAL SYSTEMS AND ENERGY CONCEPT**

1.1 Forms of structures, 1.2 Conditions of equilibrium, 1.3 Degree of freedom, 1.4 Linear and Non linear structures, 1.5 One, two, three dimensional structural systems, 1.6 Determinate and indeterminate structures [Static and Kinematics]. 1.7 Strain energy and complimentary strain energy, 1.8 Strain energy due to axial load, bending and shear, 1.9 Theorem of minimum potential energy, 1.10 Law of conservation of energy, 1.11 Principle of virtual work,

**7 Hours**

**UNIT 2:**

**DEFLECTION OF BEAMS**

2.1 Moment area method, 2.2 Conjugate beam method

**6 Hours**

**UNIT 3:**

**DEFLECTION OF BEAMS AND FRAMES BY STRAIN ENERGY**

3.1 The first and second theorem of Castigliano, problems on beams, frames and trusses, 3.2 Betti's law, 3.3 Clarke - Maxwell's theorem of reciprocal deflection.

**7 Hours**

**UNIT 4:**

**ANALYSIS OF BEAMS AND PLANE TRUSSES BY STRAIN ENERGY**

4.1 Analysis of beams (Propped cantilever and Fixed beams) and trusses using strain energy and unit load methods

**7 Hours**

**PART – B**

**UNIT 5:  
ARCHES AND CABLES**

5.1 Three hinged circular and parabolic arches with supports at same levels and different levels, 5.2 Determination of thrust, shear and bending moment, 5.3 Analysis of cables under point loads and UDL, length of cables (Supports at same levels and at different levels).

**6 Hours**

**UNIT 6:  
ANALYSIS OF BEAMS**

6.1 Consistent deformation method – Propped cantilever and fixed beams

**6 Hours**

**UNIT 7:**

7.1 Clapeyron's theorem of three moments – continuous beams and fixed beams

**6 Hours**

**UNIT 8:  
ANALYSIS OF ARCHES**

8.1 Two hinged parabolic arch, 8.2 Two hinged Circular Arch

**7 Hours**

**TEXT BOOKS:**

1. **Theory of Structures**, Pandit and Guptha, Vol. – I, Tata McGraw Hill, New Delhi.
2. **Basic Structural Analysis** Reddy C. S., Tata McGraw Hill, New Delhi.
3. **Strength of Materials and theory of structures** Vol I & II, B.C. Purnia, R.K., Jain Laxmi Publication New Delhi

**REFERENCE BOOKS:**

1. **Elementary Structural Analysis**, Norris and Wilbur, International Student Edition. McGraw Hill Book Co: New York
2. **Structural Analysis**, 4<sup>th</sup> SI Edition by Amit Prasanth & Aslam Kassimali, Thomson Learning.
3. **Analysis of Structures**, Thandava Murthy, Oxford University Press, Edition 2005.



**SURVEYING – II**  
**(COMMON TO CV/TR/EV/CTM)**

<b>Sub Code</b>	<b>:</b>	<b>10 CV 44</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>04</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>52</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

**PART – A**

**UNIT 1:**  
**THEODOLITE SURVEY**

1.1 Theodolite and types, 1.2 Fundamental axes and parts of a transit theodolite, 1.3 Uses of theodolite, 1.4 Temporary adjustments of a transit theodolite, 1.5 Measurement of horizontal angles – Method of repetitions and reiterations, 1.6 Measurements of vertical angles, 1.7 Prolonging a straight line by a theodolite in adjustment and theodolite not in adjustment

**6 Hours**

**UNIT 2:**  
**PERMANENT ADJUSTMENT OF DUMPY LEVEL AND TRANSIT THEODOLITE**

2.1 Interrelationship between fundamental axes for instrument to be in adjustment and step by step procedure of obtaining permanent adjustments

**7 Hours**

**UNIT 3:**  
**TRIGONOMETRIC LEVELING**

3.1 Determination of elevation of objects when the base is accessible and inaccessible by single plane and double plane method, 3.2 Distance and difference in elevation between two inaccessible objects by double plane method. Salient features of Total Station, Advantages of Total Station over conventional instruments, Application of Total Station.

**8 Hours**

**UNIT 4:**  
**TACHEOMETRY**

4.1 Basic principle, 4.2 Types of tacheometric survey, 4.3 Tacheometric equation for horizontal line of sight and inclined line of sight in fixed hair method, 4.4 Anallactic lens in external focusing telescopes, 4.5 Reducing the constants in internal focusing telescope, 4.6 Moving hair method and

tangential method, 4.7 Substance bar, 4.8 Beaman stadia arc.

**7 Hours**

**PART – B**

**UNIT 5:**

**CURVE SETTING (Simple curves)**

5.1 Curves – Necessity – Types, 5.2 Simple curves, 5.3 Elements, 5.4 Designation of curves, 5.5 Setting out simple curves by linear methods, 5.6 Setting out curves by Rankines deflection angle method.

**6 Hours**

**UNIT 6:**

**CURVE SETTING (Compound and Reverse curves)**

6.1 Compound curves 6.2 Elements 6.3 Design of compound curves 6.4 Setting out of compound curves 6.5 Reverse curve between two parallel straights (Equal radius and unequal radius).

**6 Hours**

**UNIT 7:**

**CURVE SETTING (Transition and Vertical curves)**

7.1 Transition curves 7.2 Characteristics 7.3 Length of Transition curve 7.4 Setting out cubic Parabola and Bernoulli's Lemniscates, 7.5 Vertical curves – Types – Simple numerical problems.

**6 Hours**

**UNIT 8:**

**AREAS AND VOLUMES**

8.1 Calculation of area from cross staff surveying, 8.2 Calculation of area of a closed traverse by coordinates method. 8.3 Planimeter – principle of working and use of planimeter to measure areas, digital planimeter, 8.4 Computations of volumes by trapezoidal and prismoidal rule, 8.5 Capacity contours

**6 Hours**

**TEXT BOOKS:**

1. 'Surveying' Vol 2 and Vol 3 - B. C. Punmia, Laxmi Publications
2. 'Plane Surveying' A. M. Chandra – New age international (P) Ltd
3. 'Higher Surveying' A.M. Chandra New age international (P) Ltd

**REFERENCE BOOKS:**

1. **Fundamentals of Surveying** - Milton O. Schmidt – Wong, Thomson Learning.

2. **Fundamentals of Surveying** - S.K. Roy – Prentice Hall of India
3. **Surveying**, Arther Bannister et al., Pearson Education, India

**HYDRAULICS & HYDRAULIC MACHINES  
(COMMON TO CV/TR/EV)**

<b>Sub Code</b>	<b>:</b>	<b>10 CV 45</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>04</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>52</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

**PART-A**

**UNIT-1: DIMENSIONAL ANALYSIS AND MODEL STUDIES**

Introduction, Systems of units, Dimensions of quantities, Dimensional Homogeneity of an equation. Analysis- Raleigh's method, Buckingham's II theorem- problems.

Model Studies, Similitude, Non-dimensional numbers: Froude models-Undistorted and Distorted models. Reynold's models-Problems

**07 hrs**

**UNIT-2: UNIFORM FLOW IN OPEN CHANNELS**

Introduction, Geometric properties of Rectangular, Triangular, Trapezoidal and Circular channels. Chezy's equation, Manning's equation-problems.

Most economical open channels-Rectangular, Triangular, Trapezoidal and Circular channels- problems.

**06 Hrs**

**UNIT-3: NON-UNIFORM FLOW IN OPEN CHANNELS**

Introduction, Specific energy, Specific energy diagram, Critical depth, Conditions for Critical flow- Theory & problems.

Hydraulic jump in a Horizontal Rectangular Channel- Theory and problems.

Dynamic equation for Non-Uniform flow in an Open channel, Classification of Surface profiles- simple Problems.

**07 Hrs**

#### **UNIT-4: IMPACT OF JET ON FLAT VANES**

Introduction, Impulse- Momentum equation. Direct impact of a jet on a stationary flat plate, Oblique impact of a jet on a stationary flat plate, Direct impact on a moving plate, Direct impact of a jet on a series of flat vanes on a wheel. Conditions for maximum hydraulic efficiency. Impact of a jet on a hinged flat plate- problems.

**06 Hrs**

#### **PART-B**

#### **UNIT-5: IMPACT OF JET ON CURVED VANES**

Introduction, Force exerted by a jet on a fixed curved vane, moving curved vane.

Introduction to concept of velocity triangles, Impact of jet on a series of curved vanes-problems.

**06 Hrs**

#### **UNIT-6: PELTON WHEEL**

Introduction to Turbines, Classification of Turbines. Pelton wheel- components, working and velocity triangles. Maximum power, efficiency, working proportions- problems.

**07 Hrs**

## **UNIT-7: KAPLAN TURBINES**

Introduction, Components, Working and Velocity triangles, Properties of the Turbine, Discharge of the Turbines, Number of Blades-Problems. Draft Tube: Types, efficiency of a Draft tube. Introduction to Cavitation in Turbines.

**07 Hrs**

## **UNIT-8: CENTRIFUGAL PUMPS**

Introduction, Classification, Priming, methods of priming. Heads and Efficiencies. Equation for work done, minimum starting speed, velocity triangles. Multistage Centrifugal Pumps ( Pumps in Series and Pumps in parallel). Characteristic Curves for a Single stage Centrifugal Pumps- problems.

**06 Hrs**

### **TEXT BOOKS:**

4. 'A TextBook of Fluid mechanics & Hydraulic Machines'- R.K.Rajput, S.Chand & Co, New Delhi, 2006 Edition.
5. 'Text Book Of Fluid Mechanics& Hydralic Machines'- R.K.Bansal, Laxmi Publications, New Delhi, 2008 Edition.
3. 'Fluid Mechanics and Turbomachines'- Madan Mohan Das, PHI Learning Pvt. Limited, New Delhi. 2009 Edition.

### **REFERENCE BOOKS:**

5. 'Introduction to Fluid Mechanics' – Robert w. Fox: Philip j. Pritchard: Alan t. McDonald, Wiley India, New Delhi, 2009 Edition.
6. 'Introduction To Fluid Mechanics' – Edward j. Shaughnessy,jr; Ira m. Katz;; James p Schaffer, Oxford University Press, New Delhi, 2005 Edition.

7. 'Hydraulics and Fluid Mechanics' – Dr. P.N. Modi & Dr S.M. Sethi, Standard Book House- New Delhi. 2009 Edition..

**BUILDING PLANNING AND DRAWING  
(COMMON TO CV/TR)**

<b>Sub Code</b>	<b>: 10 CV 46</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>: 06 (3 x 2 = 6) Practical</b>	<b>Exam Hours</b>	<b>:</b>	<b>04</b>
	<b>01 Theory</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

1. To prepare geometrical drawing of component of buildings i) Stepped wall footing and isolated RCC column footing, ii) Fully paneled and flush doors, iii) Half paneled and half-glazed window, iv) RCC dog legged and open well stairs, v) Steel truss.

**15 Hours**

2. Functional design of building (Residential, Public and Industrial), positioning of various components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio.

**9 Hours**

3. Development of plan, elevation, section and schedule of openings from the given line diagram of residential buildings, i) Two bed room building, ii) Two storeyed building.

**27 Hours**

4. Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram only for following building i) Primary health centre, ii) Primary school building, iii) College canteen iv) Office building

**12 Hours**

5. For a given single line diagram, preparation of water supply, sanitary and electrical layouts

**6 Hours**

**REFERENCE BOOKS:**

- 1 **"Building Drawing"**, Shah M.H and Kale C.M, Tata Mc Graw Hill Publishing co. Ltd., New Delhi.

- 2 “**Building Construction**”, Gurucharan Singh, Standard Publishers & distributors, New Delhi.
- 3 **National Building Code**, BIS, New Delhi.

**IA MARKS**

15 Marks for term work.

10 Marks for a test conducted at the end of the semester of 4hrs duration on the Line of VTU examination.

**TERM WORKS DETAILS:**

- Sheet No: 1 to 4 from chapter No1**  
**Sheet No: 5 to 8 from chapter No3**  
**Sheet No: 9 to 13 from chapter No4**  
**Sheet No: 14 & 15 from chapter No5**

**SCHEME OF EXAMINATION**

**Section-I** Compulsory question from chapter No 3 for 60 Marks  
Plan.....25 }  
Elevation.....15 } 60  
Section.....15 }  
Schedule of opening.....05 }

**Section-II** Four questions from chapters 1, 2, 4 and 5 should be set, out of which two have to be answered (20 x 2 = 40 Marks).

**Note:** No theory question shall be asked from any chapter.

**SURVEYING PRACTICE – II LABORATORY  
(COMMON TO CV/TR/CTM)**

<b>Sub Code</b>	<b>:</b>	<b>10 CVL 47</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>03</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>42</b>	<b>Exam Marks</b>	<b>:</b>	<b>50</b>

Exercise – 1

Measurement of horizontal angles with method of repetition and reiteration using theodolite, Measurement of vertical angles using theodolite.

Exercise – 2

To determine the elevation of an object using single plane method when base is accessible and inaccessible.

Exercise – 3

To determine the distance and difference in elevation between two inaccessible points using double plane method.

Exercise – 4

To determine the tachometric constants using horizontal and inclined line of sight.

Exercise – 5

To set out simple curves using linear methods – perpendicular offsets from long chord and offsets from chords produced.

Exercise – 6

To set out simple curves using Rankine's deflection angles method.

Exercise – 7

To set out compound curve with angular methods with using theodolite only.

Exercise – 8

To set out the center line of a simple rectangular room using offset from base line

Exercise – 9

To set out center lines of columns of a building using two base lines at right angles

**Demonstration**

Exposure to use of Total Station. Traversing, Longitudinal sections, Block levelling, Usage of relevant softwares for preparation of the contour drawings.

**Scheme of Examination:**

Any one of the above exercise is to be conducted in the examination by the student.

**APPLIED ENGINEERING GEOLOGY LABORATORY  
(COMMON TO CV/TR)**

<b>Sub Code</b>	<b>:</b>	<b>10 CVL 48</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>03</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>



Total Hrs. : 42

Exam Marks : 50

1. Describe and identify the minerals based on their physical, special properties, chemical composition and uses. Study of important rock forming minerals, ores and other important industrial minerals. (As per the III semester theory syllabus) – 2 practicals
2. Describe and identify the rocks as per the theory syllabus by giving their physical properties and engineering uses. – 2 practicals
3. Study of Geological maps and their sections: interpreting them in terms of selecting the sites for various civil engineering structures. - 3 practicals
4. Dip and strike (surface method) problems: To find out the dip and strike of the geological formation to select suitable site for civil engineering structures. – 2 practicals
5. Borehole problems (sub surface dip and strike): three point level ground methods: - 2 practicals
6. Thickness of strata (out crops) problems: To determine the true thickness, vertical thickness and the width of the out crops on different topographical terrain. – 1 practical
7. Filed visit to Civil engineering projects –Dams, Reservoirs, Harbours etc. – 3 days

### **Scheme of Examination**

1. Identification of Minerals (5 Nos.): 5x2 : 10 marks
2. Identification of Rocks (5Nos.): 5x2 : 10 marks
3. Geological Map: 1x 15 : 15 marks
4. Borehole Problems: 1x 05 : 05 marks
5. Dip and Strike Problems: 1x04 : 04 marks
6. Thickness of strata problems: 1x03 : 03 marks
7. Viva- Voce: 03 marks

**I.A. Marks should be assessed by conducting a test for 10 Marks and 15 Marks for practical record. (Total Marks: 25)**

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University Updates

## V SEMESTER

### MANAGEMENT & ENTREPRENEURSHIP

Subject Code	: 10AL51	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

#### PART - A

#### MANAGEMENT

##### UNIT - 1

**MANAGEMENT:** Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management – Management as a science, art or profession – Management & Administration – Roles of Management, Levels of Management, Development of Management Thought – early management approaches – Modern management approaches.

**7 Hours**

##### UNIT - 2

**PLANNING:** Nature, importance and purpose of planning process - objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

**6 Hours**

##### UNIT - 3

**ORGANIZING AND STAFFING:** Nature and purpose of organization – principles of organization – Types of organization – Departmentation – Committees – Centralisation Vs Decentralisation of authority and responsibility – Span of control – MBO and MBE (Meaning only) Nature and importance of Staffing – Process of Selection & Recruitment (in brief).

**6 Hours**

##### UNIT - 4

**DIRECTING & CONTROLLING:** Meaning and nature of directing – Leadership styles, Motivation Theories, Communication – Meaning and importance – Coordination, meaning and importance and Techniques of Co-ordination. Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control (in brief).

**7 Hours**

**PART - B**

**ENTREPRENEURSHIP**

**UNIT - 5**

**ENTREPRENEUR:** Meaning of Entrepreneur, Evolution of Concept, Functions of Entrepreneur, Types of Entrepreneur, Entrepreneur – An emerging class. Concept of Entrepreneurship – Evolution of Entrepreneurship, Development of Entrepreneurship, Stages in entrepreneurial process, Role of Entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

**7 Hours**

**UNIT - 6**

**SMALL SCALE INDUSTRY:** Definition; Characteristics; Need and rationale: Objectives, Scope, role of SSI in Economic Development. Advantages of SSI. Steps to start an SSI – Government policy towards SSI, Different Policies of SSI., Government Support on SSI., during 5 year plans. Impact of Liberalization, Privatisation, Globalization on SSI. Effect of WTO / GATT Supporting Agencies of Government for SSI Meaning. Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only).

**7 Hours**

**UNIT - 7**

**INSTITUTIONAL SUPPORT:** Different Schemes, TECKSOK, KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI, NSIC, SIDBI, KSFC.

**6 Hours**

**UNIT - 8**

**PREPARATION OF PROJECT:** Meaning of Project, Project Identification, Project Selection, Project Report, Need and significance of Project, Contents, formulation, Guidelines by Planning Commission for Project Report, Network Analysis, Errors of Project Report, Project Appraisal. Identification of Business Opportunities. Market Feasibility Study: Technical Feasibility Study, Financial Feasibility Study & Social Feasibility Study.

**6 Hours**

**TEXT BOOKS:**

1. **Principles of Management** – P.C. Tripathi, P.N. Reddy, Tata McGraw Hill.
2. **Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House

3. **Entrepreneurship Development** – Small Business Enterprises – Poonima M. Charantimath – Pearson Education – 2006.

**REFERENCE BOOKS:**

1. **Management Fundamentals** – Concepts, Application, Skill Development – Robert Lusier – Thomson.
2. **Entrepreneurship Development** – SS Khanka – S Chand & Co.
3. **Management** – Stephen Robbins – Pearson Education / PHI – 17<sup>th</sup> Edition, 2003.
4. **Management & Entrepreneurship** by N V R Naidu & T Krishna Rao – I K International Publishing House Pvt. Ltd. 1<sup>st</sup> edition

**DESIGN OF RCC STRUCTURAL ELEMENTS**

Subject Code	: <b>10CV52</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

**GENERAL FEATURES OF REINFORCED CONCRETE:** Introduction, Design Loads, Materials for Reinforced Concrete and Code requirements. Design Philosophy – Limit State Design principles. Philosophy of limit state design, Principles of limit states, Factor of Safety, Characteristic and design loads, Characteristic and design strength.

**6 Hours**

**UNIT - 2**

**PRINCIPLES OF LIMIT STATE DESIGN AND ULTIMATE STRENGTH OF R.C. SECTION:** General aspects of Ultimate strength, Stress block parameters for limit state of collapse, Ultimate flexural strength of singly reinforced rectangular sections, Ultimate flexural strength of doubly reinforced rectangular sections, Ultimate flexural strength of flanged sections, Ultimate shear strength of RC sections, Ultimate torsional strength of RC sections, Concepts of development length and anchorage, Analysis examples of singly reinforced, doubly reinforced, flanged sections, shear strength and development length.

**7 Hours**

**UNIT - 3**

**FLEXURE AND SERVICEABILITY LIMIT STATES:** General Specification for flexure design of beams-practical requirements, size of beam, cover to reinforcement-spacing of bars. General aspects of serviceability-Deflection limits in IS: 456 – 2000-Calculation of deflection (Theoretical method), Cracking in structural concrete members, Calculation of deflections and crack width.

**6 Hours**

**UNIT - 4**

**DESIGN OF BEAMS:** Design procedures for critical sections for moment and shears. Anchorages of bars, check for development length, Reinforcement requirements, Slenderness limits for beams to ensure lateral stability, Design examples for Simply supported and Cantilever beams for rectangular and flanged sections.

**8 Hours**

**PART - B**

**UNIT - 5**

**DESIGN OF SLABS:** General consideration of design of slabs, Rectangular slabs spanning one direction, Rectangular slabs spanning in two directions for various boundary conditions. Design of simply supported, cantilever and continuous slabs as per IS: 456 – 2000.

**8 Hours**

**UNIT - 6**

**DESIGN OF COLUMNS:** General aspects, effective length of column, loads on columns, slenderness ratio for columns, minimum eccentricity, design of short axially loaded columns, design of column subject to combined axial load and uniaxial moment and biaxial moment using SP – 16 charts.

**5 Hours**

**UNIT - 7**

**DESIGN OF FOOTINGS:** Introduction, load for footing, Design basis for limit state method, Design of isolated rectangular footing for axial load and uniaxial moment, design of pedestal.

**6 Hours**

**UNIT - 8**

**DESIGN OF STAIR CASES:** General features, types of stair case, loads on stair cases, effective span as per IS code provisions, distribution of loading on stairs, Design of stair cases. With waistlabs.

**6 Hours**

**REFERENCE BOOKS:**

1. **Limit State Design of Reinforced concrete**-by P.C. Varghese, PHI Learning Private Limited 2008-2009
2. **Fundamentals of Reinforced concrete Design**-by M.L.Gambhir, PHI Learning Private Limited 2008-2009.
3. **Reinforced concrete Design**-by Pallai and Menon, TMH Education Private Limited,
4. **Reinforced concrete Design**-by S.N.Shinha, TMH Education Private Limited,

5. **Reinforced concrete Design**-by Karve & Shaha, Structures Publishers Pune.
6. **Design of RCC Structural Elements** S. S. Bhavikatti, Vol-I, New Age International Publications, New Delhi.
7. **IS-456-2000 and SP-16**

## STRUCTURAL ANALYSIS – II

Subject Code	: <b>10CV53</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

### **PART - A**

#### **UNIT - 1**

**ROLLING LOAD AND INFLUENCE LINES:** Rolling load analysis for simply supported beams for several point loads and UDL.

Influence line diagram for reaction, SF and BM at a given section for the cases mentioned in above unit 1

**6 Hours**

#### **UNIT - 2**

**SLOPE DEFLECTION METHOD:** Introduction, Sign convention, Development of slope-deflection equations and Analysis of Beams and Orthogonal Rigid jointed plane frames (non-sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid)

**8 Hours**

#### **UNIT - 3**

**MOMENT DISTRIBUTION METHOD:** Introduction, Definition of terms- Distribution factor, Carry over factor, Development of method and Analysis of beams and orthogonal rigid jointed plane frames (non-sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid)

**8 Hours**

#### **UNIT - 4**

**SWAY ANALYSIS:** Analysis of rigid jointed plane frames (sway, members assumed to be axially rigid and kinematic redundancy  $\leq 3$ ) by slope deflection and moment distribution methods.

**4 Hours**

**PART - B**

UNIT - 5

**KANIS METHODS: Introduction, Basic Concept, Analysis of Continuous beams and Analysis of rigid jointed non-sway plane frames.**

6 Hours

UNIT - 6

**FLEXIBILITY MATRIX METHOD OF ANALYSIS: Introduction, Development of flexibility matrix for plane truss element and axially rigid plane framed structural elements and Analysis of plane truss and axially rigid plane frames by flexibility method with static indeterminacy  $\leq 3$ .**

Hours

7

UNIT - 7

**STIFFNESS MATRIX METHOD OF ANALYSIS: Introduction, Development of stiffness matrix for plane truss element and axially rigid plane framed structural elements. And Analysis of plane truss and axially rigid plane frames by stiffness method with kinematic indeterminacy  $\leq 3$ .**

7 Hours

UNIT - 8

**BASIC PRINCIPLES OF DYNAMICS: Basic principles of Vibrations and causes, periodic and aperiodic motion, harmonic and non-harmonic motion. Period and frequency.**

Forced and Free Vibration, Damping and Equations of Single Degree of Freedom System with and without damping

6 Hours

**REFERENCE BOOKS:**

1. **Basic Structural Analysis-** Reddy C.S. - Second Edition, Tata McGraw Hill Publication Company Ltd.
2. **Theory of Structures Vol. 2** - S.P. Gupta, G.S. Pandit and R. Gupta, Tata McGraw Hill Publication Company Ltd.
3. Structural Dynamics-by M.Mukhopadhyay,
4. **Structural Analysis-II** -S. S. Bhavikatti – Vikas Publishers, New Delhi.
5. **Basics of Structural Dynamics and Aseismic Design** By Damodhar Swamy and Kavita PHI Learning Private Limited
6. **Structural Analysis-** D.S. Prakash Rao,, A Unified Approach, University Press
7. **Structural Analysis**, 4<sup>th</sup> SI Edition by Amit Prasanth & Aslam Kassimali, Thomson Learning.



## GEOTECHNICAL ENGINEERING – I

Subject Code	: 10CV54	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### PART - A

#### UNIT- 1

**INTRODUCTION:** History of soil mechanics, Definition, origin and formation of soil. Phase Diagram, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Water content, Specific Gravity of soil solids and soil mass, Densities and Unit weights - Bulk, Dry, Saturated & Submerged and their inter relationships.

**6 Hours**

#### UNIT - 2

**INDEX PROPERTIES OF SOIL AND THEIR DETERMINATION:** Index Properties of soil- Water content , Specific Gravity, Particle size distribution, Relative Density, Consistency limits and indices, in-situ density, Activity of Clay, Laboratory methods of determination of index properties of soil: Water content (Oven Drying method & Rapid Moisture method), Specific gravity of soil solids (Pycnometer and density bottle method), Particle size distribution (Sieve analysis and Hydrometer analysis only), Liquid Limit- (Casagrande and Cone penetration methods), Plastic limit and shrinkage limit.

**7 Hours**

#### UNIT - 3

**CLASSIFICATION OF SOILS:** Purpose of soil classification, Particle size classification – MIT classification and IS classification, Textural classification. IS classification - Plasticity chart and its importance, Field identification of soils.

**CLAY MINERALOGY AND SOIL STRUCTURE:** Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

**8 Hours**

#### UNIT - 4

**FLOW OF WATER THROUGH SOILS:** Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage

velocity, Superficial velocity and coefficient of percolation, quick sand phenomena, Capillary Phenomena.

**6 Hours**

**PART - B**

**UNIT - 5**

**SHEAR STRENGTH OF SOIL:** Concept of shear strength, Mohr-coulomb theory, conventional and modified failure envelopes, Effective stress concept-total stress, effective stress and Neutral stress, Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils, Sensitivity and Thixotropy of clay.

**7 Hours**

**UNIT - 6**

**COMPACTION OF SOIL:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control – compactive effort & method, lift thickness and number of passes, Proctor's needle, Compacting equipment.

**6 Hours**

**UNIT - 7**

**CONSOLIDATION OF SOIL:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations (no derivation), Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil ( $C_c$ ,  $a_v$ ,  $m_v$  and  $C_v$ ).

**UNIT- 8**

**DETERMINATION OF SHEAR STRENGTH AND CONSOLIDATION OF SOIL:** Measurement of shear parameters- Direct shear test, unconfined compression test, Triaxial compression test and vane shear test, Test under different drainage conditions. Laboratory one dimensional consolidation test, Determination of consolidation characteristics of soils-compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method).

**6 Hours**

**TEXT BOOKS:**

1. **Soil Mechanics and Foundation Engg.-** Punmia B.C. (2005), 16<sup>th</sup> Edition Laxmi Publications Co. , New Delhi.
2. **Principles of Soil Mechanics and Foundation Engineering-** Murthy V.N.S. (1996), 4<sup>th</sup> Edition, UBS Publishers and Distributors, New Delhi.

3. **Geotechnical Engineering**; Braja, M. Das (2002), Fifth Edition, Thomson Business Information India (P) Ltd., India

**REFERENCES BOOKS:**

1. **Foundation Analysis and Design**- Bowles J.E. (1996), 5<sup>th</sup> Edition, McGraw Hill Pub. Co. New York.
2. **Soil Engineering in Theory and Practice**- Alam Singh and Chowdhary G.R. (1994), CBS Publishers and Distributors Ltd., New Delhi.
3. **Basic and Applied Soil Mechanics**- Gopal Ranjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi.
4. **Geotechnical Engineering**- Donald P Coduto Phi Learning Private Limited, New Delhi
5. **Geotechnical Engineering**- Shashi K. Gulathi & Manoj Datta. (2009), "Tata Mc Graw Hill.
6. **Text Book of Geotechnical Engineering**- Iqbal H. Khan (2005), 2<sup>nd</sup> Edition, PHI, India.
7. **Numerical Problems, Examples and objective questions in Geotechnical Engineering**- Narasimha Rao A. V. & Venktrahmaiah C. (2000), Universities Press., Hyderabad.

## Hydrology and Irrigation Engineering

<b>Sub Code</b>	<b>:</b>	<b>10CV55</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>04</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>52</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

### PART-A

#### HYDROLOGY

##### UNIT 1: INTRODUCTION & PRECIPITATION

Introduction ,Hydrologic cycle (Horton's representation). Water budget equation

Precipitation: introduction, forms of precipitation, types of precipitation, measurement of precipitation (Simon's gauge & Syphon gauge only), selection of rain gauge station. Adequacy of raingauges, methods of computing average rainfall, interpolation of missing data, adjustment of missing data by double mass curve method. Hyetograph and mass curve of rainfall, 07 hrs

##### UNIT 2 : LOSSES FROM PRECIPITATION

Evaporation: Definition, factors affecting, measurement (Class A pan). Estimation using empirical methods (Meyer's and Rohwer's equation), evaporation control.

Evapo-transpiration: Definition, factors affecting, measurement, estimation ( Blaney criddle method)

Infiltration: Definition, factors affecting, measurement ( double ring infiltrometer ), infiltration indices, Horton's equation of infiltration. 07 hrs

### UNIT 3: HYDROGRAPHS

Definition, components of hydrographs, unit hydrograph and its derivation from simple storm hydrograph, base flow separation, Prepositions of unit hydrograph- problems

06 hrs

### UNIT 4: ESTIMATION OF FLOOD & FLOOD ROUTING

Definition of flood, factors affecting flood, methods of estimation ( envelope curves, empirical formulae, rational method ).

Flood routing: Introduction to hydrological routing, relationship of out flow and storage, general storage equation, Muskingum routing method. 07 hrs

## PART-B

### IRRIGATION ENGINEERING

#### UNIT 5 : INTRODUCTION

Introduction, need for irrigation, advantages and disadvantages of irrigation, environmental impacts of irrigation, Systems of irrigation: Gravity irrigation, lift irrigation, well irrigation, tube well irrigation, infiltration galleries, sewage irrigation, supplemental irrigation.

06 hrs

#### UNIT 6: SOIL-WATER-CROP RELATIONSHIP

Introduction, soil profile, physical properties of soil, soil classification. Indian soils, functions of irrigation soils, maintaining soil fertility, soil-water-plant relationship, soil-moisture. Irrigation relationship, frequency of irrigation.  
06 hrs

#### UNIT 7: WATER REQUIREMENT OF CROPS

Introduction, definitions, crop seasons of India, water requirement of a crop, duty, delta, base period. Consumptive use. Irrigation efficiencies. Assessment of irrigation water.

07 hrs

#### Unit 8: Canals

Definition, Types of canals, Alignment of canals, Design of canals by Kenedy's and Lacey's methods- Problems

06 hrs

#### TEXT BOOKS:

1. Engineering Hydrology – Subramanya.K; Tata Mcgraw Hill NewDelhi-2008 (Ed)
2. Hydrology- Madan Mohan Das, Mim Mohan Das-PHI Learning private Ltd. New Delhi-2009 (Ed)
3. A Text Book Of Hydrology- Jayarami Reddy, Laksmi Publications, New Delhi-2007 (Ed)
4. Irrigation, water Resources and water power Engineering- P.N.Modi- standard book house, New Delhi.
5. Irrigation and Water Power Engineering-Madan Mohan Das & Mimi Das Saikia; PHILearning pvy. Ltd. New Delhi 2009 (Ed).

#### REFERENCE BOOKS:

1. Hydrology & Soil Conservation Engineering- Ghanshyam Das- PHI Learning Private Ltd., New Delhi-2009 (Ed)
2. Hydrology & Water Resources Engineering- Patra K.C. Narosa Book Distributors Pvt. Ltd. New Delhi-2008 (Ed)
3. Hydrology & Water Resources Engineering- R.K.Sharma & Sharma, Oxford and Ibh, New Delhi
4. Irrigation Engineering and Hydraulic structures- S. K. garg- Khanna Publication, New Delhi.

### **TRANSPORTATION ENGINEERING I**

Subject Code		:10CV56
I A Marks	:25	
No. of lecture Hours/week	:04	
Exam Hours	:03	
Total No. of Lecture Hours	:52	
Exam Marks	:100	

### **PART – A**

#### UNIT – 1

#### **PRINCIPLES OF TRANSPORTATION ENGINEERING:**

Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute

**04 Hrs**

#### UNIT – 2

**HIGHWAY DEVELOPMENT AND PLANNING:** Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3<sup>rd</sup> and 4<sup>th</sup> twenty year

road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDC) Road development plan - vision 2021.

**06 Hrs**

UNIT – 3

**HIGHWAY ALIGNMENT AND SURVEYS:** Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects **04 Hrs**

**HIGHWAY GEOMETRIC DESIGN – I:** Importance, Terrain classification, Design speed, Factors affecting geometric design, **Cross sectional elements**-Camber- width of pavement-Shoulders-, Width of formation- Right of way, Typical cross sections **05 Hrs**

UNIT – 4

**HIGHWAY GEOMETRIC DESIGN – II: Sight Distance**-Restrictions to sight distance- Stopping sight distance- Overtaking sight distance- overtaking zones- Examples on SSD and OSD- Sight distance at intersections, **Horizontal alignment**-Radius of Curve- Superelevation – Extra widening- Transition curve and its length, setback distance – Examples, **Vertical alignment**-Gradient-summit and valley curves with examples. **07 Hrs**

**PART - B**

UNIT – 5

**PAVEMENT MATERIALS: Subgrade soil** - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction-Examples on CBR and Modulus of subgrade reaction, **Aggregates**- Desirable properties and list of tests, **Bituminous materials**-Explanation on Tar, bitumen,cutback and emulsion-List of tests on bituminous materials **06 Hrs**

UNIT – 6

**PAVEMENT DESIGN:** Pavement types, component parts of flexible and rigid pavements and their functions, design factors, ESWL and its determination-Examples, **Flexible pavement-** Design of flexible pavements as per IRC:37-2001-Examples, **Rigid pavement-** Westergaard's equations for load and temperature stresses- Examples- Design of slab thickness only as per IRC:58-2002

**06 Hrs**

UNIT – 7

**PAVEMENT CONSTRUCTION:** Earthwork –cutting-Filling, Preparation of subgrade, Specification and construction of i) Granular Subbase, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads

**05**

**Hrs**

**HIGHWAY DRAINAGE:** Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials

**03 Hrs**

UNIT – 8

**HIGHWAY ECONOMICS:** Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods-Examples, Highway financing-BOT-BOOT concepts

**06 Hrs**

**TEXT BOOKS:**

1. **Highway Engineering** – S K Khanna and C E G Justo, Nem Chand Bros, Roorkee



2. **Highway Engineering** - L R Kadiyali, Khanna Publishers, New Delhi
3. **Transportation Engineering** – K P Subramaniam, Scitech Publications, Chennai
4. **Transportation Engineering** – James H Banks, Mc. Graw. Hill Pub. New Delhi
5. **Highway Engineering** –R. Sreenivasa Kumar, University Press. Pvt.Ltd. Hyderabad

**REFERENCE BOOKS:**

1. **Relevant IRC Codes**
2. **Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.**
3. **Transportation Engineering** – C. Jotin Khisty, B. Kent lal, PHI Learning Pvt. Ltd. New Delhi.

**HYDRAULICS AND HYDRAULICS MACHINERY  
LABORATORY**

<b>Sub Code</b>	<b>:</b>	<b>10CV 57</b>	<b>IA Marks</b>	<b>:</b>	<b>25</b>
<b>Hrs/ Week</b>	<b>:</b>	<b>03</b>	<b>Exam Hours</b>	<b>:</b>	<b>03</b>
<b>Total Hrs.</b>	<b>:</b>	<b>42</b>	<b>Exam Marks</b>	<b>:</b>	<b>100</b>

1. Calibration of collecting tank ( gravimetric method )
2. Calibration of pressure gauge ( dead weight method )
3. Verification of Bernoulli's equation
4. Calibration of 90<sup>0</sup> V-notch
5. Calibration of Rectangular and Cipolletti notch
6. Calibration of Broad- crested weir
7. Calibration of Venturiflume
8. Calibration of Venturimeter
9. Determination of Darcy's friction factor for a straight pipe
10. Determination of Hydraulic coefficients of a vertical orifice
11. Determination of vane coefficients for a flat vane & semicircular vane

12. Performance characteristics of a single stage centrifugal pump

13. Performance characteristics of a Pelton wheel

14. Performance characteristics of a Kaplan turbine

Reference:

Experiments in Fluid Mechanics – Sarbjit Singh- PHI Pvt. Ltd.- NewDelhi- 2009-12-30

Hydraulics and Hydraulic Mechines Laboratory Manual – Dr. N. Balasubramanya

### COMPUTER AIDED DESIGN LABORATORY

Subject Code	: 10CVL58	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

#### 1. AUTOCAD

##### 1.1 Basics of AUTOCAD:

**DRAWING TOOLS:** Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, *Modify tools:* Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, *Using Text:* Single line text, Multiline text, Spelling, Edit text, *Special Features:* View tools, Layers concept, Dimension tools, Hatching, Customising toolbars, Working with multiple drawings

**3 Hours**

##### 1.2 Use of AUTOCAD in Civil Engineering Drawings:

Following drawings are to be prepared for the data given using AUTOCAD

- i) Cross section of Foundation - masonry wall, RCC columns (isolated)
- ii) Different types of staircases
- iii) Lintel and chajja
- iv) RCC slabs and beams
- v) Drawing of Plan, elevation and sectional elevation of single storied residential and public buildings given the single line diagram and preparing excavation plan.

**18 Hours**

#### 2. STRUCTURAL ANALYSIS SOFTWARE

Use of commercially available software for the analysis of

- i) Plane Trusses

- ii) Continuous beams
- iii) 2D Portal frames-single storied and multistoried

**9Hours**

### **3. USE OF EXCEL IN CIVIL ENGINEERING PROBLEMS**

Use of spread sheet for the following civil engineering problems

- i) SFD and BMD for Cantilever and simply supported beam subjected to uniformly distributed and uniformly varying load acting throughout the span
- ii) Design of singly reinforced and doubly reinforced rectangular beams
- iii) Computation of earthwork
- iv) Design of horizontal curve by offset method
- v) Design of super elevation

**12 Hours**

#### **REFERENCE BOOKS:**

1. **Computer Aided Design Laborator-** Dr M.N.Shesha Prakash, Dr.G.S.Suresh, Lakshmi Publications
2. **CAD Laboratory-** M.A.Jayaram, D.S.Rajendra Prasad- Sapna Publications
3. **AUTOCAD 2002-** Roberts JT, -BPB publications
4. **AUTOCAD 2004-** Sham Tickoo, A beginner's Guide, Wiley Dreamtech India Pvt Ltd.,
5. **Learning Excel 2002-** Ramesh Bangia, -Khanna Book Publishing Co (P) Ltd.,
6. **Microsoft Excel-** Mathieson SA, Starfire publishers

VI SEMESTER

ENVIRONMENTAL ENGINEERING-I

Subject Code	: 10CV61	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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Part - A

Unit - 1

INTRODUCTION: Human activities and environmental pollution. Water for various beneficial uses and quality requirement. Need for protected water supply.

2 Hours

DEMAND OF WATER: Types of water demands- domestic demand in detail, institutional and commercial, public uses, fire demand. Per capita consumption –factors affecting per capita demand, population forecasting, different methods with merits &demerits- variations in demand of water. Fire demand – estimation by Kuichling’s formula, Freeman formula & national board of fire underwriters formula, peak factors, design periods & factors governing the design periods

6 Hours

Unit - 2

SOURCES: Surface and subsurface sources – suitability with regard to quality and quantity.

3 Hours

COLLECTION AND CONVEYANCE OF WATER: Intake structures – different types of intakes; factor of selection and location of intakes. Pumps- Necessity, types – power of pumps; factors for the selection of a pump. Pipes – Design of the economical diameter for the rising main; Nomograms – use; Pipe appurtenances.

6 Hours

Unit - 3

QUALITY OF WATER: Objectives of water quality management. wholesomeness & palatability, water borne diseases. Water quality parameters – Physical, chemical and Microbiological. Sampling of water for examination. Water quality analysis (IS: 3025 and IS: 1622) using analytical and instrumental techniques. Drinking water

standards BIS & WHO guidelines. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc. and toxic / trace organics.

6 Hours

Unit - 4

WATER TREATMENT: Objectives – Treatment flow-chart. Aeration-Principles, types of Aerators.

2

Hours

SEDIMENTATION: Theory, settling tanks, types, design. Coagulant aided sedimentation, jar test, chemical feeding, flash mixing, and clariflocculator.

4

Hours

#### Part - B

Unit - 5

FILTRATION: Mechanism – theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design – excluding under drainage system – back washing of filters. Operational problems in filters.

6 Hours

Unit - 6

DISINFECTION: Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. UV irradiation treatment – treatment of swimming pool water

4

Hours

SOFTENING – definition, methods of removal of hardness by lime soda process and zeolite process RO & Membrane technique.

3 Hours

Unit - 7

MISCELLANEOUS TREATMENT: Removal of color, odor, taste, use of copper sulfate, adsorption technique, fluoridation and defluoridation.

4 Hours

DISTRIBUTION SYSTEMS: System of supply, service reservoirs and their capacity determination, methods of layout of distribution systems.

Unit - 8

MISCELLANEOUS: Pipe appurtenances, various valves, type of fire hydrants, pipefitting, Layout of water supply pipes in buildings.

2

Hours

TEXT BOOKS:

1. Water supply Engineering –S.K.Garg, Khanna Publishers
2. Environmental Engineering I –B C Punima and Ashok Jain
3. Manual on Water supply and treatment –CPHEEO, Ministry of Urban Development, New Delhi

## REFERENCES

1. Hammer, M.J., (1986), **Water and Wastewater Technology** –SI Version, 2nd Edition, John Wiley and Sons.
2. Karia, G.L., and Christian, R.A., (2006), **Wastewater Treatment – Concepts and Design Approach**, Prentice Hall of India Pvt. Ltd., New Delhi.
3. Metcalf and Eddy, (2003), **Wastewater Engineering, Treatment and Reuse**, 4th Edition, Tata McGraw Hill Edition, Tata McGraw Hill Publishing Co. Ltd.
4. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering**–Mc Graw Hill Book Co.
5. Raju, B.S.N., (1995), **Water Supply and Wastewater Engineering**, Tata McGraw Hill Pvt. Ltd., New Delhi.
6. Sincero, A.P., and Sincero, G.A., (1999), **Environmental Engineering – A Design Approach**–Prentice Hall of India Pvt. Ltd., New Delhi.

**DESIGN & DRAWING OF RC STRUCTURES**

Subject Code	: <b>10CV62</b>	IA Marks	: 25
No. of Lecture	: 02 (T) +03 (D)	Exam Hours	: 04
Hours/Week			
Total No. of Lecture	: 26 (T) + 39 (D)	Exam Marks	: 100
Hours			

**PART - A**

**UNIT-1**

Layout Drawing: General layout of building showing, position of columns, footings, beams and slabs with standard notations.

**UNIT-2**

Detailing of Beam and Slab floor system, continuous beams.

**UNIT-3**

Detailing of Staircases: Dog legged and Open well.

**UNIT-4**

Detailing of Column footings: Column and footing (Square and Rectangle).

**13 (T) + 18 (D)**

**PART - B**

**UNIT-5**

Design and detailing of Rectangular Combined footing slab and beam type.

**UNIT-6**

Design and detailing of Retaining walls (Cantilever and counter fort type).

**UNIT-7**

Design and detailing of Circular and Rectangular water tanks resting on ground and free at top(Flexible base and Rigid base), using IS: 3370 (Part IV) only.

**UNIT-8**

Design and detailing of Simple Portal Frames subjected to gravity loads.(Single bay & Single storey)

**13 (T) + 21 (D)**

**REFERENCE BOOKS:**

1. **Structural Design & Drawing Reinforced Concrete & Steel**- N. Krishnaraju, University Press.

2. **Structural Design and Drawing-** Krishnamurthy -, (Concrete Structures), CBS publishers, New Delhi. Tata Mc-Graw publishers.
3. **Reinforced Concrete Structures** - B.C. Punmia – Laxmi Publishing Co.
4. **Reinforced Concrete Design** – S.N.Sinha, McGrawHill Education,

**SCHEME OF QUESTION PAPER:**

**Part A** : Three questions each carrying 20 marks is to be set. Student has to answer two questions out of three.

**Part B**: Two questions each carrying 60 marks is to be set. Student has to answer one question out of two.

**TRANSPORTATION ENGINEERING II**

Subject Code	:	10CV63
I A Marks	:	25
No. of lecture Hours/week	:	04
Exam Hours	:	03
Total No. of Lecture Hours	:	52
Exam Marks	:	100

**PART – A**  
**RAILWAY ENGINEERING**

UNIT – 1

**INTRODUCTION:** Role of railways in transportation, Indian Railways, Selection of Routes, Permanentway and its requirements, Gauges and types, Typical cross sections-single and double line B G track in cutting, embankment and electrified tracks, Coning of wheels and tilting of rails, **Rails**-Functions-requirements—types and sections-length-defects-wear-creep-welding-joints, creep of rails

**06 Hrs**

UNIT – 2

**SLEEPERS AND BALLAST:** Functions, requirements, Types, Track fitting and fasteners-Dog spike, screw spike and Pandrol clip,-Fish plates-bearing plates, Calculation of quantity of materials required for laying a track-Examples, **Tractive resistances** and hauling capacity with examples

**06Hrs**

56



UNIT – 3

**GEOMETRIC DESIGN:** Necessity, Safe speed on curves, **Cant-cant** deficiency-negative cant-safe speed based on various criteria,(both for normal and high speed tracks) Transition curve, Gradient and types, grade compensation, Examples on above.

**06 Hrs**

UNIT – 4

**POINTS AND CROSSING:** Components of a turnout, Details of Points and Crossing, Design of turnouts with examples (No derivations) types of switches, crossings, track junctions Stations and Types, Types of yards, Signalling-Objects and types of signals, station and yard Equipment-Turn table, Fouling mark, buffer stop, level crossing, track defects, and maintenance.

**08 Hrs**

**PART – B**  
**AIRPORT ENGINEERING**

UNIT – 5

**INTRODUCTION:** Layout of an airport with component parts and functions, Site selection for airport, Aircraft characteristics affecting the design and planning of airport, Airport classification, Runway orientation using wind rose with examples

**06 Hrs**

UNIT – 6

**RUNWAY-** Basic runway length-Corrections and examples, Runway geometrics, **Taxiway**-Factors affecting the layout - geometrics of taxiway-Design of exit taxiway with examples, **Visual aids-** Airport marking – lighting-Instrumental Landing System.

**06 Hrs**

**TUNNEL ENGINEERING**

UNIT – 7

**TUNNELS:** Advantages and disadvantages, Size and shape of tunnels, Surveying-Transferring centre line, and gradient from surface to inside the tunnel working face, Weisbach triangle-Examples, Tunnelling in rocks-methods, Tunnelling methods in soils-Needle beam, Liner plate, Tunnel lining, Tunnel ventilation, vertical shafts, Pilot tunneling, mucking and methods, drilling and drilling pattern.

**06Hrs**

UNIT – 8

**HARBOURS:** Harbour classifications, Layout with components, Natural phenomenon affecting the design of harbours - wind, wave and tide, currents, Breakwater-Types Wharf and Quays, Jetties and Piers, Dry dock and wet docks, Slipways, Navigational aids, warehouse and transit-shed.

**08 Hrs**

**TEXT BOOKS**

1. **Railway Engineering** - Saxena and Arora, Dhanpat Rai & Sons, New Delhi
2. **Indian Railway Track** – M M Agarwal, Jaico Publications, Bombay
3. **Airport Planning and Design** – Khanna Arora and Jain, Nem Chand Bros, Roorkee
4. **Docks and Tunnel Engineering** – R Srinivasan, Charaotar Publishing House
5. **Docks and Harbour Engineering** –H P Oza and G H Oza Charaotar Publishing House
6. **Surveying** – B C Punmia, Laxmi Publications

**REFERENCE BOOK**

1. **Railway Engineering** – Mundrey, McGraw Hill Publications

**GEOTECHNICAL ENGINEERING – II**

Subject Code	: 10CV64	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

**SUBSURFACE EXPLORATION:** Importance of exploration program, Methods of exploration: Boring, Seismic refraction method of geophysical exploration, Types of samples - undisturbed, disturbed and representative samples, Samplers, sample disturbance, area ratio, Recovery ratio, clearance, Stabilisation of boreholes - Typical bore log. Number and depth of borings for various civil engineering structures, soil exploration report.

**DRAINAGE AND DEWATERING:** Determination of ground water level by Hvorslev's method, Control of ground water during excavation: Dewatering - Ditches and sumps, well point system, Vacuum method, Electro- Osmosis method.

**8 Hours**

**UNIT - 2**

**STRESSES IN SOILS:** Boussinesq's and Westergaard's theories for concentrated, circular and rectangular loads. Comparison of Boussinesq's and Westergaard's analysis. Pressure distribution diagrams, Contact pressure, Newmark's chart.

**6**

**Hours**

**UNIT - 3**

**FLOWNETS:** Laplace equation (no derivation) assumptions and limitations only, characteristics and uses of flownets, Methods of drawing flownets for Dams and sheet piles. Estimating quantity of seepage and Exit gradient. Determination of phreatic line in earth dams with and without filter. Piping and protective filter.

**5 Hours**

**UNIT - 4**

**LATERAL EARTH PRESSURE:** Active and Passive earth pressures, Earth pressure at rest. Rankine's and Coulomb's Earth pressure theories—assumptions and limitations, Graphical solutions for active earth pressure (cohesionless soil only) – Culmann's and Rebhann's methods, Lateral earth pressure in cohesive and cohesionless soils, Earth pressure distribution.

**7 Hours**

**PART - B**

**UNIT - 5**

**STABILITY OF EARTH SLOPES:** Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of infinite slopes, Stability of finite slopes by Method of slices and Friction Circle method, Taylor's stability number, Fellenius method.

**7  
Hours**

**UNIT - 6**

**BEARING CAPACITY:** Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's and Brinch Hansen's bearing capacity equations - assumptions and limitations, Bearing capacity of footing subjected to eccentric loading. Effect of ground water table on bearing capacity. Field methods of evaluation of bearing capacity - Plate load test, Standard penetration test and cone penetration test.

**8 Hours**

**UNIT - 7**

**FOUNDATION SETTLEMENT:** Importance and Concept of Settlement Analysis, Immediate, Consolidation and Secondary settlements (no derivations, but, computation using relevant formula for Normally Consolidated soils), Tolerance. BIS specifications for total and differential settlements of footings and rafts.

**5 Hours**

**UNIT – 8**

**PROPORTIONING SHALLOW AND PILE FOUNDATIONS**

Allowable Bearing Pressure, Factors influencing the selection of depth of foundation, Factors influencing Allowable Bearing Pressure, Factors influencing the choice of foundation, Proportioning isolated, combined, strip and mat foundations, Classification of pile foundation, Pile load capacity, Proportioning pile foundation.

**6 Hours**

**TEXT BOOKS:**

1. **Soil Engineering in Theory and Practice-** Alam Singh and Chowdhary G.R. (1994), CBS Publishers and Distributors Ltd., New Delhi.
2. **Soil Mechanics and Foundation Engg.-** Punmia B.C. (2005), 16<sup>th</sup> Edition Laxmi Publications Co. , New Delhi.

**REFERENCES BOOKS:**

1. **Foundation Analysis and Design-** Bowles J.E. (1996), 5<sup>th</sup> Edition, McGraw Hill Pub. Co. New York.

2. **Soil Mechanics and Foundation Engineering-** Murthy V.N.S. (1996), 4<sup>th</sup> Edition, UBS Publishers and Distributors, New Delhi.
3. **Basic and Applied Soil Mechanics-** Gopal Ranjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi.
4. **Geotechnical Engineering-** Venkatrahmaiah C. (2006), 3<sup>rd</sup> Edition New Age International (P) Ltd., New Delhi.
5. **Soil Mechanics-** Craig R.F. (1987), Van Nostrand Reinhold Co. Ltd.
6. **Principles of Geotechnical Engineering-** Braja M. Das (2002), 5<sup>th</sup> Edition, Thomson Business Information India (P) Ltd., India.
7. **Text Book of Geotechnical Engineering-** Iqbal H. Khan (2005), 2<sup>nd</sup> Edition, PHI, India.

## HYDRAULIC STRUCTURES & IRRIGATION DESIGN-DRAWING

Subject Code	: 10CV65	IA Marks	: 25
No. of Lecture Hours/Week	: 02+03	Exam Hours	: 04
Total No. of Lecture Hours	: 25+40	Exam Marks	: 100

### PART-A

#### Hydraulic Structures

##### Unit1: Reservoir Planning

Introduction, classification of Reservoirs, Storage zones of a reservoir, Mass curve, fixing capacity of a reservoir, safe yield, problems, density currents, Trap efficiency, Reservoir sedimentation, life of a reservoir, economic height of a dam, problems. environmental effects of reservoirs, **6 hours**

##### Unit2: Gravity Dams

Introduction, forces on a gravity dam, stress analysis in gravity dam, Problems, combination of forces for design. Elementary & practical profiles of a gravity dam, stability analysis (without earthquake forces), problems, galleries in gravity dams, **7 hours**

##### Unit3: Earth Dams

Introduction, types of Earth dams, construction methods, Design criteria for Earth dams, causes of failure of earth dams, section of dam, preliminary design criteria, problems, control of seepage through earth dams, Safety measures. **6 hours**

##### Unit4: Spillways

Introduction, essentials of a spillway, spillway components, factors affecting type & design of spillways. Ogee spillway ( simple design problems ). Energy dissipation below spillways ( hydraulic jump- No design ). **6 hours**

### **PART-B**

#### **Irrigation Design- Drawing**

**Design and Drawing with all the three views of :**

1. Surplus weir with stepped apron
2. Tank Plug sluice without tower head
3. Canal gate sluice without tower head
4. Notch type Canal Drop
5. Canal Cross regulator.
6. Aqueduct (Hydraulic Design only)

**40 hours**

Text Books:

1. Text book of irrigation engineering & Hydraulic Structures- R.K.Sharma, Oxford & IBH publishing Co., New Delhi ( 2002)
2. Irrigation & Water resources engineering- G.L.Asawa, New Age International Publishers, New Delhi ( 2005)
3. Irrigation, Water Resources & Water power engineering- Modi . P.N., Standard Book House, New Delhi
4. Design of minor irrigation and Canal structures- C. Sathya Narayana Murthy, Wiley eastern limited, New Delhi (1990)

Reference Books:

1. Irrigation engineering & Hydraulic structures- Garg.S.K., khanna publishers, New Delhi
2. Hydraulic Structures & Irrigation Design Drawing - Dr.N.Balasubramanya, Tata Mcgraw-Hill Education Pvt.Ltd., New Delhi
3. irrigation and Water Power Engineering- Madan Mohan Das & Mimi Das Saikia, PHI Learning Pvt. Ltd., New Delhi (2009)

#### **Question paper pattern:**

**Four** questions are to be set from Part A of which **Two** full questions are to be answered for 40 marks

Two questions are to be set from Part B of which one full question is to be answered for 60 marks ( 25 marks for design + 35 marks for two views )

### THEORY OF ELASTICITY

Subject Code	: 10CV661	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

#### PART - A

##### **UNIT -1**

Introduction to Mathematical theory of elasticity, definition of continuum, stress and strain at a. point, Generalised Hooke's Law, Strain- displacement relations, St. Venant's principle

**5  
Hours**

##### **UNIT - 2**

Differential equations of equilibrium, boundary conditions, compatibility equations, Airy's stress function, problems, Stress polynomials – for Two Dimensional cases only.

**8  
Hours**

##### **UNIT- 3**

Plane stress and plane strain, Principal stresses and strains, measurement of surface strains, strain rosettes, Mohr's circle of stress and strain, analytical method.

**4 Hours**

##### **UNIT - 4**

Two-dimensional problems in rectangular coordinates, bending of a cantilever beam subjected to end load, effect of shear deformation in beams, Simply supported beam subjected to UDL.

**10  
Hours**

## PART - B

### UNIT - 5

Two-dimensional problems in polar coordinates, strain-displacement relations, equations of equilibrium, compatibility equation, stress function.

**8  
Hours**

### UNIT - 6

Axi Symmetric stress distribution - Rotating discs, Lamé's equation for thick cylinder.

**5  
Hours**

### UNIT- 7

Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

**7  
Hours**

### UNIT - 8

Torsion: Inverse and Semi-inverse methods, stress function, torsion of circular and elliptical sections.

**5 Hours**

### TEXT BOOKS:

1. **"Theory of Elasticity" - International Students-** Timoshenko. S.P. and Goodier. J.N. - Edition, McGraw Hill Book Co. Inc., New Delhi.
2. **Applied Elasticity-** Wang. P.C.

### REFERENCE BOOKS:

1. **Continuum Mechanics Fundamentals-** Valliappan. C : Oxford and IBH Publishing Co. Ltd., New Delhi.
2. **Advanced Mechanics of Solids-** Srinath.L.S. : Tata McGraw Hill Publications Co.Ltd., New Delhi.
3. **Structural Mechanics with Introduction to Elasticity and Plasticity-** Venkataraman and Patel : McGraw Hill Book Inc., New York.
4. **Mechanics of Solids-** Arbind Kumar Singh : Prentice hall of India Pvt. Ltd. New Delhi -2007.



## ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES

Subject Code	: 10CV662	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

### PART - A

#### UNIT - 1

##### INTRODUCTION:

1. Energy in building materials
2. Environmental issues concerned to building materials
3. Global warming and construction industry
4. Environmental friendly and cost effective building technologies.
5. Requirements for building of different climatic regions.
  6. Traditional building methods and vernacular architecture.

6 Hours

#### UNIT - 2

##### ALTERNATIVE BUILDING MATERIALS:

1. Characteristics of building blocks for walls
2. Stones and Laterite blocks
3. Bricks and hollow clay blocks
4. Concrete blocks
5. Stabilized blocks: Mud Blocks, Steam Cured Blocks, Fal-G Blocks and Stone Masonry Block

6 Hours

#### UNIT - 3

##### LIME-POZZOLANA CEMENTS

1. Raw materials
2. Manufacturing process
3. Properties and uses
4. Fibre reinforced concretes
5. Matrix materials
6. Fibers : metal and synthetic
7. Properties and applications
8. Fibre reinforced plastics
9. Matrix materials
10. Fibers : organic and synthetic
11. Properties and applications
12. Building materials from agro and industrial wastes
13. Types of agro wastes

14. Types of industrial and mine wastes
15. Properties and applications
16. Field quality control test methods

**6  
Hours**

**UNIT - 4**

**ALTERNATIVE BUILDING TECHNOLOGIES**

1. Alternative for wall construction
2. Types
3. Construction method
4. Masonry mortars
5. Types
6. Preparation
7. Properties
8. Ferrocement and ferroconcrete building components
9. Materials and specifications
10. Properties
11. Construction methods
12. Applications
13. Alternative roofing systems
14. Concepts
15. Filler slabs
16. Composite beam panel roofs
17. Masonry vaults and domes

**8 ours**

**PART - B**

**UNIT - 5**

**STRUCTURAL MASONRY**

1. Compressive strength of masonry elements
2. Factors affecting compressive strength
3. Strength of units, prisms / wallettes and walls
4. Effect of brick work bond on strength
5. Bond strength of masonry : Flexure and shear
6. Elastic properties of masonry materials and masonry

**6  
Hours**

**UNIT - 6**

1. IS Code provisions
2. Design of masonry compression elements
3. Concepts in lateral load resistance

**8  
Hours**

**UNIT - 7**

**COST EFFECTIVE BUILDING DESIGN**

1. Cost concepts in buildings
2. Cost saving techniques in planning, design and construction
3. Cost Analysis : Case studies using alternatives.

**6 Hours**

**UNIT - 8**

**EQUIPMENT FOR PRODUCTION OF ALTERNATIVE MATERIALS**

1. Machines for manufacture of concrete
2. Equipments for production of stabilized blocks
3. Moulds and methods of production of precast elements.

**6  
Hours**

**TEXT BOOKS:**

1. **Alternative building methodologies for engineers and architects, lecture notes edited:** K.S. Jagadish and B.V. Venkatarama Reddy, Indian Institute of science, Bangalore.
2. **Structural Masonry** by Arnold W. Hendry.

**REFERENCE BOOKS:**

1. **Relevant IS Codes.**
2. **Alternative building materials and technologies.**
3. **Proceedings of workshop on Alternative building material and technology, 19<sup>th</sup> to 20<sup>th</sup> December 2003 @ BVB College of Engineering. & Tech., Hubli.**

## GROUND IMPROVEMENT TECHNIQUES

Subject Code	: 10CV663	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**GROUND IMPROVEMENT:** Definition, Objectives of ground improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. Ground modification for Black Cotton soil

4

#### Hours

#### UNIT - 2

**COMPACTION:** Effect of grain size distribution on compaction for various soil types like lateritic soil, coarse-grained soil and micaceous soil. Effect of compaction on engineering behaviour like compressibility, swelling and shrinkage, permeability, relative density, liquefaction potential. Field compaction – static, dynamic, impact and vibratory type. Specification of compaction. Tolerance of compaction. Shallow and deep compaction, Dynamic Compaction, Vibrofloatation.

8 Hours

#### UNIT - 3

**HYDRAULIC MODIFICATION:** Definition, Principle and techniques. gravity drain, lowering of water table, multistage well point, vacuum dewatering. Discharge equations. Design of dewatering system including pipe line effects of dewatering.

6

Hours

#### UNIT - 4

**DRAINAGE & PRELOADING:** Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.

6

#### Hours

## PART - B

### UNIT - 5

**CHEMICAL MODIFICATION-I:** Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.

6

Hours

### UNIT - 6

**CHEMICAL MODIFICATION-II:** Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

6

Hours

### UNIT - 7

**GROUTING:** Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

6

Hours

### UNIT - 8

**MISCELLANEOUS METHODS (ONLY CONCEPTS & USES):** Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micropiles.

8

Hours

#### TEXT BOOKS:

1. **Ground Improvement Techniques-** Purushothama Raj P. (1999) Laxmi Publications, New Delhi.
2. **Construction and Geotechnical Method in Foundation Engineering-** Koerner R.M. (1985) - Mc Graw Hill Pub. Co., New York.

#### REFERENCE BOOKS:

1. **Engineering principles of ground modification-** Manfred Hausmann (1990) - Mc Graw Hill Pub. Co., New York.

2. **Methods of treatment of unstable ground-** Bell, F.G. (1975) Butterworths, London.
3. **Expansive soils-** Nelson J.D. and Miller D.J. (1992) -, John Wiley and Sons.
4. **Soil Stabilization; Principles and Practice-** Ingles. C.G. and Metcalf J.B. (1972) - Butterworths, London.

### ADVANCED SURVEYING

Subject Code	:10CV664	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

##### **THEORY OF ERRORS AND TRIANGULATION ADJUSTMENT:**

Errors and classification of errors Precision and accuracy, Laws of weights and accidental errors.

5

##### Hours

##### UNIT - 2

**PROBABILITY:** Probability distribution function and density function-normal distribution. RMS error-measure of precision. Rejection of observations-principles of least squares-Normal equations.

6

##### Hours

##### UNIT - 3

**METHOD OF CORRELATES:** Triangulation adjustment. Angle adjustment, station adjustment and figure adjustment.

6

##### Hours

##### UNIT - 4

**ELECTRONIC DISTANCE MEASUREMENT (EDM):** Introduction, Electro Magnetic (EM) Waves. Phase comparison and modulations. Instruments – Geodimeter – Tellurimeter – Distomat – Range finders – Radars. Introduction to GPS Total station.

8

Hours

## PART - B

### UNIT - 5

**FIELD ASTRONOMY:** Earth celestial sphere. Solar system Position by altitude and azimuth system-spherical triangle and spherical trigonometry. Astronomical triangle. Nepiers rule.

8

Hours

### UNIT - 6

**TIME:** Siderial time, day and year-solar time and day-Greenwich mean time-standard time. Meridian and azimuth-their determination-latitude and its determination.

6

Hours

### UNIT - 7

**HYDROGRAPHIC SURVEYING:** Methods of soundings. Instruments. Three point problem. Tidal and Stream discharge measurement

7

Hours

### UNIT - 8

**SETTING OUT WORKS:** Introduction. Setting out of buildings, culverts, bridge, pipeline and sewers, tunnels.

6

Hours

#### TEXT BOOKS:

1. **Surveying Vol I, II & III-** Punmia. B.C. - Lakshmi Publications, New Delhi.
2. **Surveying Vol I & II-** Duggal S.K. - Tata Mc Graw-Hill publishing Co.,
3. **Surveying Levelling-Part I & II** – Kanitkar T.P. & Kulkarni S.V. – Pune Vidhyarthi Gruha Prakashana.

#### REFERENCE BOOKS:

1. **Introduction to Surveying-** James, M. Anderson and Edward, M. Mikhail – Mc Graw Hill Book Co., 1985.
2. **Analysis and survey measurements-** M. Mikhailil and Gracie, G. - Van Nostrand Reinhold Co., (NY)-1980.
3. **Plane and Geodetic Surveying for Engineers** - David Clark -Vol I & II-CBS publishers and distributors, New Delhi.

## GROUND WATER HYDROLOGY

Subject Code	: 10CV665	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION:** Importance. Vertical distribution of sub-surface water. Occurrence in different types of rocks and soils. Definition of aquifer, Aquifuge, Aquitard and Aquiclude. Confined and unconfined aquifers.

**6 Hours**

#### UNIT - 2

**AQUIFER PROPERTIES:** Aquifer parameters – Specific yield, Specific retention, Porosity, Storage coefficient, derivation of the expression. Determination of specific yield. Land subsidence due to ground water withdrawals.

**6 Hours**

#### UNIT - 3

**DARCY'S LAW AND HYDRAULIC CONDUCTIVITY:** Introduction. Darcy's law. Hydraulic conductivity. Coefficient of permeability and Intrinsic permeability, Transmissibility, Permeability in Isotropic, Unisotropic layered soils. Steady one dimensional flow, different cases with recharge.

**7 Hours**

#### UNIT - 4

**WELL HYDRAULICS – STEADY FLOW:** Introduction. Steady radial flow in confined and unconfined aquifers. Pumping tests.

**7 Hours**

### PART - B

#### UNIT - 5

**WELL HYDRAULICS – UNSTEADY FLOW:** Introduction. General equation derivation; Theis method, Cooper and JaCob method, Chow's method. Solution of unsteady flow equations.

**7 Hours**



**UNIT - 6**

**GROUND WATER DEVELOPMENT:** Types of wells. Methods of constructions. Tube well design. Dug wells. Pumps for lifting water: Working principles, Power requirements.

**7 Hours**

**UNIT - 7**

**GROUND WATER EXPLORATION:** Seismic method, Electrical resistivity method, Bore hole geo-physical techniques; Electrical logging, Radio active logging, Induction logging, Sonic logging and Fluid logging.

**6 Hours**

**UNIT - 8**

**GROUND WATER RECHARGE AND RUNOFF:** Recharge by vertical leakage. Artificial recharge. Ground water runoff. Ground water budget.

**6 Hours**

**TEXT BOOKS:**

1. **Ground Water-** H.M. Raghunath, - Wiley Eastern Limited, New Delhi.
2. **Ground Water Hydrology-** K. Todd, - Wiley and Sons, New Delhi.
3. **Numerical Ground Water Hydrology-** A.K. Rastogi, - Penram, International Publishing (India), Pvt. Ltd., Mumbai.

**REFERENCE BOOKS:**

1. **Ground Water Hydrology-** Bower H.- McGraw Hill, New Delhi.
2. **Ground Water and Tube Wells-** Garg Satya Prakash, - Oxford and IBH, New Delhi.
3. **Ground Water Resource Evaluation-** W.C. Walton, - McGraw Hill - Kogakusha Ltd., New Delhi.
4. **Water wells and Pumps** – Michel D.M., Khepar. S.D., Sondhi. S.K., McGraw Hill Education – 2<sup>nd</sup> Edition.

## RURAL WATER SUPPLY AND SANITATION

Subject Code	:10CV666	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### Part - A

#### UNIT - 1

RURAL WATER SUPPLY: Introduction: Need for a protected water supply, investigation and selection of water sources, water borne diseases, protection of well water, drinking water quality standards.

6

Hours

#### UNIT - 2

Types of pumps, supply systems viz., BWS MWS, PWS, water treatment methods – disinfection, deflouridation, hardness and iron removal, ground water contamination and control.

6

Hours

#### UNIT - 3

RURAL SANITATION: public latrine, concept of Eco-sanitation, trenching and composting methods, Two pit latrines, aqua privy, W.C, septic tank, soak pit.

8

Hours

#### UNIT - 4

DRAINAGE SYSTEMS: Storm water and sullage disposal, rain water harvesting and uses.

3

Hours

### Part - B

#### UNIT - 5

COMMUNICABLE DISEASES: Terminology, classifications, methods of communication, general methods of control.

4 Hours

#### UNIT - 6

**REFUSE COLLECTION AND DISPOSAL:** collection methods, transportation, disposal – salvaging, dumping, manure pits, dumping in low lands , composting, dung disposal – digester, biogas plant.

10

Hours

**UNIT - 7**

**MILK SANITATION:** Essentials, test for milk quality, pasteurization, quality control, cattle borne diseases, planning for a cow shed.

9

Hours

**UNIT - 8**

**INSECT CONTROL:** House fly and mosquito – life cycle, diseases, transmission and control measures.

6

Hours

**TEXT BOOKS:**

1. Environmental Sanitation - Joseph. A. Solveto
2. Water Supply & Sanitary Engineering - E.W.Steel

**REFERENCE BOOK:**

1. Preventive & Social Medicine - Park & Park

### **TRAFFIC ENGINEERING**

Subject Code	: <b>10CV667</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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#### **PART - A**

**UNIT - 1**

**INTRODUCTION:** Definition, objectives of Traffic Engineering and scope of Traffic Engineering.

2

Hours

**UNIT - 2**

**TRAFFIC CHARACTERISTICS:** Road user characteristics, vehicular characteristics – static and dynamic characteristics, power

performance of vehicles, Resistance to the motion of vehicles –  
Reaction time of driver – Problems on above.

6

**Hours**

**UNIT - 3**

**TRAFFIC STUDIES:** Various types of traffic engineering studies, data collection, analysis objectives and method of study – Definition of study area – Sample size and analysis.

6

**Hours**

**UNIT - 4**

**INTERPRETATION OF TRAFFIC STUDIES:** Classified traffic Volume at mid block and intersections, PCU, origin and destination, spot speed, speed and delay, parking – on street parking, off street parking, Accident – causes, analysis measures to reduce accident – problems on above.

6 Hours

**PART - B**

**UNIT - 5**

**TRAFFIC FLOW THEORIES:** Traffic flow theory, Green shield theory – Goodness of fit, - correlation and regression analysis (linear only) – Queuing theory, Car following theory and relevant problems on above.

8 Hours

**UNIT - 6**

**STATISTICAL ANALYSIS:** Poisson's distribution and application to traffic engineering. Normal Distribution – Significance tests for observed traffic data, Chi Square test – problems on above. Traffic forecast – simulation technique.

12 Hours

**UNIT - 7**

**TRAFFIC REGULATION AND CONTROL:** Driver, vehicle and road controls – Traffic regulations – one way – Traffic markings, Traffic signs, Traffic signals – Vehicle actuated and synchronized signals – Signals co-ordination. Webster's method of signal design, IRC method, traffic rotary elements and designs, traffic operation – Street lighting, Road side furniture, Relevant problems on above.

10

**Hours**

**UNIT - 8**

**INTELLIGENT TRANSPORT SYSTEM:** Definition, Necessities, Application in the present traffic scenario

**2**

**Hours**

**TEXT BOOKS:**

1. **Traffic Engineering & Transport Planning** – L.R. Kadiyali-Khanna Publishers.
2. **Highway Engineering Nemchand & Bros-** Khanna & Justo-Roorkee (UA).
3. **Traffic Engg.** - Matson & Smith:-Mc.Graw Hill and Co.
4. **Traffic flow theory** – Drew- Mc. Graw Hill and Co.

**REFERENCE BOOKS:**

1. **Traffic Engineering.** Pignataro- Prentice Hall.
2. **Highway Capacity Manual** – 2000.
3. **An introduction to traffic engineering-** Jotin Khistey and Kentlal- PHI.
4. **Traffic Engineering-** Mc Shane & Roess- PHI.

**GEOTECHNICAL ENGINEERING LABORATORY**

Subject Code	: <b>10CVL67</b>	IA Marks	: 25
No. of Practical	: 03	Exam Hours	: 03
Hours/Week			
Total No. of Practical Hours	: 42	Exam Marks	: 50

1. Identification of gravel type, sand type, silt type and clay types soils, Tests for determination of Specific gravity (for coarse and fine grained soils) and Water content (Oven drying method).

**3  
Hours**

2. Grain size analysis of soil sample (sieve analysis).

**Hours**

**3**

3. In situ density by core cutter and sand replacement methods.

**3 Hours**

4. Consistency Limits – Liquid Limit (Casagrande and Cone Penetration Methods), plastic limit and shrinkage limit.

**3 Hours**

5. Standard Proctor Compaction Test and Modified Proctor Compaction Test.

**3**

**Hours**

6. Coefficient of permeability by constant head and variable head methods.

**3**

**Hours**

7. Strength Tests

- a. Unconfined Compression Test

**3 Hours**

- b. Direct Shear Test

**3**

**Hours**

- c. Triaxial Compression Test (undrained)

**3 Hours**

8. Consolidation Test- Determination of compression index and coefficient of consolidation.

**3 Hours**

9. Laboratory vane shear test

**Hours**

**3**

10. Determination of CBR value

**Hours**

**3**

11. a) Demonstration of miscellaneous equipments such as Augers, Samplers, Rapid Moisture meter, Proctor's needle.

- b) Demonstration of Hydrometer Test.

- c) Demonstration of Free Swell Index and Swell Pressure Test

- d) Demonstration of determination of relative density of sands.

**3 Hours**

12. Preparing a consolidated report of index properties and strength properties of soil

**3 Hours**

**REFERENCE BOOKS:**

1. **Soil Mechanics and Foundation Engg.-** Punmia B.C. (2005), 16<sup>th</sup> Edition Laxmi Publications Co. , New Delhi.
2. **BIS Codes of Practice:** IS 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1966, IS 2720 (Part-60) 1965.
3. **Mittal**
4. **Soil Testing for Engineers-** Lambe T.W., Wiley Eastern Ltd., New Delhi.
5. **Manual of Soil Laboratory Testing-** Head K.H., (1986)- Vol. I, II, III, Princeton Press, London.
6. **Engineering Properties of Soil and Their Measurements-** Bowles J.E. (1988), - McGraw Hill Book Co. New York.

**EXTENSIVE SURVEY VIVA - VOCE**

Subject Code	: <b>10CVL68</b>	IA Marks	: 25
No. of Practical	: 03	Exam Hours	: 03
Hours/Week			
Total No. of Practical Hours	: 42	Exam Marks	: 50

(To be conducted between 5<sup>th</sup> & 6<sup>th</sup> Semester for a period of 2 weeks, Viva voce conducted along with 6<sup>th</sup> semester exams)

An extensive survey training involving investigation and design of the following projects is to be conducted for 2 weeks (14 days). The student shall submit a project report consisting of designs and drawings. **(Drawings should be done using AutoCAD)**

1. General instructions, Reconnaissance of the sites and fly leveling to establish bench marks.
2. **NEW TANK PROJECTS:** The work shall consist of
  - i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.

- ii) Capacity surveys.
- iii) Details at Waste weir and sluice points.
- iv) Canal alignment.

**(At least one of the above new tank projects should be done by using TOTAL STATION)**

3. **WATER SUPPLY AND SANITARY PROJECT:** Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers.
4. **HIGHWAY PROJECT:** Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.
5. **OLD TANK PROJECTS:** The work shall consist of
  - i) Alignment of center line of the existing bund, Longitudinal and cross sections of the centre line.
  - ii) Capacity surveys to explore the quantity.
  - iii) Details at existing Waste weir and sluice points.



**VII SEMESTER  
ENVIRONMENTAL ENGINEERING – II**

Subject Code	: 10CV71	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**PART - A**

**UNIT - 1**

**INTRODUCTION:** Necessity for sanitation, methods of domestic waste water disposal, types of sewerage systems and their suitability.

Dry weather flow, factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of design flow, estimation of storm flow, rational method and empirical formulae of design of storm water drain. Time of concentration.

**6 Hours**

**UNIT - 2**

**DESIGN OF SEWERS:** Hydraulic formulae for velocity, effects of flow variations on velocity, self cleansing and non scouring velocities, Design of hydraulic elements for circular sewers flowing full and flowing partially full (No derivations).

**MATERIALS OF SEWERS:** Sewer materials, shapes of sewers, laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers.

**6 Hours**

**UNIT - 3**

**SEWER APPURTENANCES:** Catch basins, manholes, flushing tanks, oil and grease traps, Drainage traps. Basic principles of house drainage. Typical layout plan showing house drainage connections, maintenance of house drainage.

**6 Hours**

**UNIT - 4**

**WASTE WATER CHARACTERIZATION:** Sampling, significance, techniques and frequency. Physical, Chemical and Biological characteristics, Aerobic and Anaerobic activity, CNS cycles. BOD and COD. Their significance & problems

**06 Hours**

**PART – B**

**UNIT - 5**

**DISPOSAL OF EFFLUENTS :** Disposal of Effluents by dilution, self-purification phenomenon. Oxygen sag curve, Zones of purification, Sewage farming, sewage sickness, Effluent Disposal standards for land, surface water

& ocean. Numerical Problems on Disposal of Effluents. Streeter Phelps equation.

**6 Hours**

**UNIT - 6**

**TREATMENT OF WASTE WATER:** Flow diagram of municipal waste water treatment plant. Preliminary & Primary treatment : Screening, grit chambers, skimming tanks, primary sedimentation tanks – Design criteria & Design examples.

**6 Hours**

**UNIT - 7**

**SECONDARY TREATMENT:** Suspended growth and fixed film bioprocess. Trickling filter – theory and operation, types and designs. Activated sludge process- Principle and flow diagram, Modifications of ASP, F/M ratio. Design of ASP.

**8 Hours**

**UNIT - 8**

Anaerobic Sludge digestion, Sludge digestion tanks, Design of Sludge drying beds. Low cost waste treatment method. Septic tank, Oxidation Pond and Oxidation ditches – Design. Reuse and recycle of waste water.

**8 Hours**

**REFERENCES**

1. **Manual on Waste Water Treatment** : CPHEEO, Ministry of Urban Development, New Delhi.
2. **Water and Wastewater Engineering Vol-II** :- Fair, Geyer and Okun : John Willey Publishers, New York.
3. **Waste Water Treatment, Disposal and Reuse** : Metcalf and Eddy inc : Tata McGraw Hill Publications.
4. **Water Technology**.- Hammer and Hammer
5. **Environmental Engineering**: Howard S. Peavy, Donald R. Rowe, George Tchobanoglous McGraw Hill International Edition.

**DESIGN OF STEEL STRUCTURES**

Subject Code	: <b>10CV72</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART-A**

**UNIT-1**

**INTRODUCTION:** Advantages and Disadvantages of Steel structures, Loads and Load combinations, Design considerations, Limit State Method (LSM) of design, Failure criteria for steel, Codes, Specifications and section classification.

**6 Hours**

**UNIT-2**

**BOLTED CONNECTIONS:** Introduction, Behaviour of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG), Pin Connections, Simple Connections, Moment resistant connections, Beam to Beam connections, Beam and Column splices, Semi rigid connections **6 Hours**

**UNIT-3**

**WELDED CONNECTIONS:** Introduction, Welding process, Welding electrodes, Advantages of Welding, Types and Properties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Design of welds, Simple joints, Moment resistant connections, Continuous Beam to Column connections, Continuous Beam to Beam connections, Beam Column splices, Tubular connections **6 Hours**

**UNIT-4**

**Plastic Behaviour of Structural Steel:** Introduction, Plastic theory, Plastic hinge concept, Plastic collapse load, conditions of plastic analysis, Theorem of Plastic collapse, Methods of Plastic analysis, Plastic analysis of continuous beams. **7 Hours**

**PART-B**

**UNIT-5**

**Design of Tension Members:** Introduction, Types of tension members, Design of strands, Slenderness ratio, Behaviour of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Other sections, Design of tension member, Lug angles, Splices, Gussets. **6 Hours**

**UNIT-6**

**Design of Compression Members:** Introduction, Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members, Built up compression members. **8 Hours**

**UNIT-7**

**Design of Column Bases:**, Design of simple slab base and gusseted base **6 Hours**

**UNIT-8**

**Design of Beams:** Introduction, Beam types, , Lateral stability of beams, factors affecting lateral stability, Behaviour of simple and built-up beams in bending(without vertical stiffeners), Design strength of laterally supported beams in Bending, Design strength of laterally unsupported beams, Shear strength of steel beams, Maximum deflection, Design of beams and purlins **7 Hours**

Note: Study of this course should be based on **IS: 800-2007**

**Reference Books**

- 1) **Design of Steel Structures**, N.Subramanian, Oxford, 2008
  2. Limit State Design of Steel Structures. Duggal. TATA Megra Hill 2010
  - 3) Bureau of Indian Standards, IS800-2007, IS875-1987
- 4) **Steel Tables**

#### ESTIMATION & VALUATION

Subject Code	: 10CV73	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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#### PART - A

**ESTIMATION:** Study of various drawings with estimates, important terms, units of measurement, abstract Methods of taking out quantities and cost – center line method, long and short wall method or crossing method. Preparation of detailed and abstract estimates for the following Civil Engineering works – Buildings – RCC framed structures with flat, sloped RCC roofs with all Building components.

**16 Hours**

#### PART - B

**ESTIMATE:** Different type of estimates, approximate methods of estimating buildings, cost of materials. Estimation of wooden joineries such as doors, windows & ventilators.

**5 Hours**

**ESTIMATES:** Steel truss (Fink and Howe truss), manhole and septic tanks, RCC Culverts.

**6 Hours**

**SPECIFICATIONS:** Definition of specifications, objective of writing specifications, essentials in specifications, general and detail specifications of common item of works in buildings.

**5 Hours**

#### PART - C

**RATE ANALYSIS:** Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works for doors, windows and ventilators.

**6 Hours**

**MEASUREMENT OF EARTHWORK FOR ROADS:** Methods for computation of earthwork – cross sections – mid section formula or average end area or mean sectional area, trapezoidal & prismoidal formula with and without cross slopes.

**6 Hours**

**CONTRACTS:** Types of contract – essentials of contract agreement – legal aspects, penal provisions on breach of contract. Definition of the terms – Tender, earnest money deposit, security deposit, tender forms, documents and types. Acceptance of contract documents. Termination of contract, completion certificate, quality control, right of contractor, refund of deposit. Administrative approval – Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.

Valuation- Definitions of various terms, method of valuation, Freehold & Leasehold properties, Sinking fund, depreciation and method of estimating depreciation, Outgoings.

**8 Hours**

**REFERENCE BOOKS:**

1. **Estimating & Costing**, B. N. Dutta, Chand Publisher
2. **Quantity Surveying**- P.L. Basin S. Chand : New Delhi.
3. **Estimating & Specification** - S.C. Rangwala :: Charotar publishing house, Anand.
4. **Text book of Estimating & Costing**- G.S. Birde, Dhanpath Rai and sons : New Delhi.
5. **A text book on Estimating, Costing and Accounts**- D.D. Kohli and R.C. Kohli S. Chand : New Delhi.
6. **Contracts and Estimates**, B. S. Patil, University Press, 2006.

**DESIGN OF PRE-STRESSED CONCRETE STRUCTURES**

Subject Code	: 10CV74	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

**MATERIALS:** High strength concrete and steel, Stress-Strain characteristics and properties.

**2 Hours**

**BASIC PRINCIPLES OF PRESTRESSING:** Fundamentals, Load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning systems, tensioning methods and end anchorages.

**4 Hours**

**UNIT - 2**

**ANALYSIS OF SECTIONS FOR FLEXURE:** Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles.

**8 Hours**

**UNIT - 3**

**LOSSES OF PRE-STRESS:** Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force.

**6 Hours**

**UNIT - 4**

**DEFLECTIONS:** Deflection of a pre-stressed member – Short term and long term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep on deflection, load verses deflection curve, methods of reducing deflection

**6 Hours**

**PART - B**

**UNIT - 5**

**LIMIT STATE OF COLLAPSE:** Flexure -IS Code recommendations – Ultimate flexural strength of sections.

**5 Hours**

**UNIT - 6**

**LIMIT STATE OF COLLAPSE (cont...):** Shear - IS Code recommendations, shear resistance of sections, shear reinforcement. Limit state of serviceability – control of deflections and cracking.

**7 Hours**

**UNIT - 7**

**DESIGN OF END BLOCKS:** Transmission of prestress in pretensioned members, transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force-stresses in end blocks-Methods, I.S. Code, provision for the design of end block reinforcement.

**6 Hours**

**UNIT - 8**

**DESIGN OF BEAMS:** Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections. Permissible stress, design of prestressing force and eccentricity, limiting zone of pre-stressing force cable profile.

**8 Hours**

**REFERENCE BOOKS:**

1. **Pre-stressed Concrete-** N. Krishna Raju - Tata Mc. Graw Publishers.
2. **Pre-stressed Concrete-** P. Dayarathnam : Oxford and IBH Publishing Co.

3. **Design of pre-stressed concrete structures-** T.Y. Lin and Ned H. Burns - John Wiley & Sons, New York.
4. **Fundamental of pre-stressed concrete-** N.C. Sinha & S.K. Roy
5. IS : 1343 : 1980
6. **Pre-stressed Concrete-** N. Rajgopalan

### MATRIX METHODS OF STRUCTURAL ANALYSIS

Subject Code	: <b>10CV751</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

Introduction to flexibility method, Element flexibility matrix, Principle of contragradience, and Force Transformation Matrix, Member Flexibility matrix, Construction of structure flexibility matrix. Matrix determination of the displacement vector, Determination of member forces.

**6 Hours**

##### UNIT - 2

Analysis of axially rigid continuous beams by flexibility method using Force Transformation Matrix

**6 Hours**

##### UNIT - 3

Analysis of rigid plane frames with axially rigid members by flexibility method using Force Transformation Matrix.

**6 Hours**

##### UNIT - 4

Analysis of trusses by flexibility method Using Force Transformation Matrix.

**6 Hours**

#### PART - B

##### UNIT - 5

Fundamentals of the stiffness method, equivalent joint loads, Displacement Transformation matrix. Member stiffness matrix, Total or System stiffness matrix, Truss analysis by stiffness method using Displacement Transformation Matrix.

**8 Hours**

##### UNIT - 6

**Continuous Beam and rigid frame analysis with axially rigid members by stiffness method using Displacement Transformation Matrix.**

**8 Hours**

##### UNIT - 7

Introduction to direct stiffness method, Local and global co-ordinate system, Transformation Of variables, Transformation of the member displacement matrix, Transformation of the member Force matrix, Transformation of the

member stiffness matrix, Transformation of the stiffness Matrix of the member of a truss, Transformation of the stiffness matrix of the member of the Rigid frame, Overall stiffness matrix, Boundary conditions, Computation of internal forces.

**4 Hours**

**UNIT - 8**

Analysis of trusses and continuous beams by direct stiffness method.

**8 Hours**

**REFERENCE BOOKS:**

1. **Matrix, finite elements, Computer and Structural analysis-** M Mukhopadhyay - Oxford &IBW,1984
2. **Matrix Analysis of framed structures-** W. Weaver J.M. Gere - CBS publishers and Disributers,1986
3. **Computational structural Mechanics-** S Rajshekharan. G Sankara Subramanian - PHI, 2001
4. **Structural Analysis A Matrix Approach-** G.S Pandit & S P Gupta Tata Mc Graw-Hill, 1981
5. **Basic structural Analysis-** C.S Reddy - Tata Mc Graw-Hill, 1996
6. **Structural Analysis-** L S Negi and R S Jangid - Tata Mc Graw-Hill, 1997
7. **Introduction to Matrix Methods of Structural analysis -** H C Martin -International text book Company, 1996

**ADVANCED DESIGN OF RC STRUCTURES**

Subject Code	: <b>10CV752</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

Design of RCC overhead circular and rectangular water tanks with supporting towers.

**8 Hours**

**UNIT - 2**

Design of silos, bunkers using Janssen's Theory and Airy's Theory.

**7 Hours**

**UNIT - 3**

Design of RCC Chimneys.

**6 Hours**



**UNIT - 4**

Introduction to shell and folded plate roofs, their forms and structural behaviour. Design of simple cylindrical shell roof by beam theory.

**6 Hours**

**PART - B**

**UNIT - 5**

Yield line analysis of slabs by virtual work.

**7Hours**

**UNIT - 6**

Yield line analysis by equilibrium methods.

**6 Hours**

**UNIT - 7**

Design of Grid Floors Slabs by approximate method.

**6 Hours**

**UNIT-8**

Design of flat slabs by Direct Designer Method (with and without drops)

**6 Hours**

**REFERENCE BOOKS:**

1. **Reinforced Concrete Structures, Vol-II-** B C Punmia : Laxmi Publications (P) Ltd, New Delhi.
2. **Limit State Design of Reinforced Concrete Vol-II-** P C Varghese: Prentice Hall of India (P) Ltd, New Delhi.
3. **Plain and Reinforced Concrete – Vol-II-** Jai Krishna and Jain,: Nem Chand Bros, Roorkee.
4. **Analysis of Structures- Vol-II :** Vazirani V N & M M Ratwani : Khanna Publishers, New Delhi.
5. **Design Construction of Concrete Shell Roofs :** Ramaswamy G S : CBS Publishers and Distributors, new Delhi.
6. **Advanced Structural Design-** Bensen C
7. IS 456 – 2000 IS 3370 – 1967 (Part I, II and IS 1893)
8. **Advanced RCC Design- Vol-II,-** S. S. Bhavikatti New Age International Publication, New Delhi.

## DESIGN OF MASONRY STRUCTURES

Subject Code	: 10CV753	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**MASONRY UNITS, MATERIALS, TYPES & MASONRY CONSTRUCTION:** Brick, stone and block masonry units – strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks.

**6 Hours**

#### UNIT - 2

**STRENGTH AND STABILITY:** Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.

**6 Hours**

#### UNIT - 3

**PERMISSIBLE STRESSES:** Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

**6 Hours**

#### UNIT - 4

**DESIGN CONSIDERATIONS:** Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels.

**8 Hours**

### PART - B

#### UNIT - 5

**LOAD CONSIDERATIONS FOR MASONRY:** Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, free standing wall.

**6 Hours**

#### UNIT - 6

**DESIGN OF MASONRY WALLS:** Design of load bearing masonry for building up to 3 storeys using IS : 1905 and SP : 20 procedure.

**10 Hours**

#### UNIT - 7

**REINFORCED MASONRY:** Application, flexural and compression elements, shear walls.

**5 Hours**

**UNIT - 8**

**MASONRY WALLS IN COMPOSITE ACTION:** Composite wall-beam elements, infilled frames.

**5 Hours**

**TEXT BOOKS:**

1. **Structural Masonry-** Henry, A.W. : Macmillan Education Ltd., 1990.
2. **Brick and Reinforced Brick Structures-** Dayaratnam P. : Oxford & IBH, 1987.

**REFERENCE BOOKS:**

1. **Design of masonry structures-** Sinha B.P. Davies S.R. : E&FN spon 1997
2. IS 1905–1987 “Code of practice for structural use of un-reinforced masonry- (3<sup>rd</sup> revision) BIS, New Delhi.
3. SP 20 (S&T) – 1991, “Hand book on masonry design and construction (1<sup>st</sup> revision) BIS, New Delhi.

**EARTH & EARTH RETAINING STRUCTURES**

Subject Code	: <b>10CV754</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

**EARTH DAMS AND EMBANKMENTS** - Different types of earthen dams with sketches and their suitability. Hydraulic fill and rolled fill methods of construction – Causes of failure of earth dam – Design criteria of earth dams – Stability analysis of earthen dams – Seepage control in earthen dams. Role of Filters in Earth Dam Design.

**7 Hours**

**UNIT - 2**

**RETAINING WALLS:** Types of retaining walls, failure of retaining walls by sliding, overturning and bearing. Stability analysis and Principles of the design of retaining walls – Gravity retaining walls, Cantilever retaining walls, Counterfort retaining walls (no structural design) – Modes of failure of retaining walls – Drainage from the backfill.

**7 Hours**

**UNIT - 3**

**BULK HEADS: Cantilever sheet pile walls** Types of sheet pile walls – Free cantilever sheet pile - cantilever sheet pile in cohesion-less soils – cantilever sheet pile in clay.

**6 Hours**

**UNIT - 4**

**BULK HEADS: Anchored Sheet Pile Walls:** Anchored sheet pile with free earth support in cohesion-less and cohesive soil. bulkheads with fixed earth support method – Types, locations and design of anchors.

**6 Hours**

**PART - B**

**UNIT - 5**

**BRACED CUTS:** Introduction, Lateral earth pressure on sheeting, Different types of sheeting and bracing systems – design of various components of bracings.

**7 Hours**

**UNIT- 6**

**ROCK FILL DAMS:** Introduction, Origin and usage of rock fill dams, types of rock fill dams, design of rock fill dams and construction of rock fill dams.

**6 Hours**

**UNIT- 7**

**COFFER DAMS & CELLULAR COFFER DAMS I:** Introduction – types of coffer dams - Design of cellular coffer dams on rock by Tennessee Valley Authority (TVA) method – safety against sliding, slipping, overturning, vertical shear and stability against bursting.

**7 Hours**

**UNIT- 8**

**CELLULAR COFFER DAMS II:** Design of cellular coffer dam on soil - safety against sliding, slipping, overturning, vertical shear and stability against bursting.

**6 Hours**

**TEXT BOOKS:**

1. **Soil Mechanics and Foundation Engineering** : Dr. K.R. Arora : Pub : Standard Publishers & Distributors.
2. **Soil Mechanics and Foundation Engineering**, : S.K. Garg : Pub : Khanna Publishers.

**REFERENCE BOOKS:**

1. **Soil Mechanics and Foundation Engineering**,: Dr. B.C. Punmia : Pub : Laxmi Publications Ltd.,
2. **Foundation Engineering**.: Dr. B.J. Kasmalkar
3. **Numericals in Geotechnical Engineering** : A.V. Narasimha Rao & C. Venkataramaiah :Pub : University Press.
4. **Hydraulic Structures**: S.K. Garg : Pub : Khanna Publishers.

5. **Soil Mechanics and Foundation Engineering**, : Dr. V.N.S. Murthy : Pub : Sai Tech.
6. **Geotechnical Engineering**, : Dr. C. Venkataramaiah : Pub : New age publications.
7. **Geotechnical Engineering** : Purushotam Raj .
8. **Theory and Practice of Soil Engineering** : Alum Singh .
9. **Principles of Geotechnical Engineering**, Das, B. M., Cengage Learning, 2009

### HIGHWAY GEOMETRIC DESIGN

Subject Code	: 10CV755	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

#### PART - A

##### UNIT - 1

**INTRODUCTION:** Geometric Control factors like Topography -design speed – design vehicle – Traffic – Capacity – volume – environment and other factors as per IRC and AASHTO standards and specifications- PCU concept – factors controlling PCU for different design purpose

**6 Hours**

##### UNIT - 2

**CROSS SECTIONAL ELEMENTS:** Pavement surface characteristics – friction – skid resistance – pavement unevenness – light reflecting characteristics – camber – objectives – types of camber – methods of providing cambers in the field – problems – carriage way – kerb – median – shoulder – foot path – parking lanes – service roads – cycle tracks – Driveways – Right of way – Factors influencing right of way – Design of Road humps as per latest IRC provisions.

**10 Hours**

##### UNIT - 3

**SIGHT DISTANCE:** Important, types, Side distance at uncontrolled intersection, derivation, factors affecting side distance, IRC, AASHTO standards, problems on above.

**6 Hours**

##### UNIT - 4

**HORIZONTAL ALIGNMENT:** Definition, Checking the stability of vehicle, while moving on horizontal curve, Super elevation, Ruling minimum and maximum radius, Assumptions – problems – method of providing super elevation for different curves – Extra widening of pavement on curves – objectives – Mechanical widening – psychological widening – Transition curve – objectives – Ideal requirements – Types of transition curve – Method of evaluating length of transition curve – Setting the transition curve in the field, set back distance on horizontal curve and problems on above

**8 Hours**

## PART - B

### UNIT - 5

**VERTICAL ALIGNMENT:** Gradient – Types of gradient – Design criteria of summit and valley curve – Design of vertical curves based on SSD – OSD – Night visibility considerations – Design standards for hilly roads – problems on the above.

**5 Hours**

### UNIT - 6

**INTERSECTION DESIGN:** Principle – Atgrade and Grade separated junctions – Types – channelization – Features of channelising Island – median opening – Gap in median at junction.

**6 Hours**

### UNIT - 7

**ROTARY INTERSECTION:** Elements – Advantages – Disadvantages – Design guide lines – problem on the above – Grade separated intersection – Three legged inter section – Diamond inter change – Half clover leaf – clover leaf- Advantages- Disadvantages only

**6 Hours**

### UNIT - 8

**HIGHWAY DRAINAGE:** Importance – sub surface drainage –surface drainage – Design of road side drives – Hydrological – Hydraulic considerations and design of filter media, problems on above.

**5 Hours**

#### TEXT BOOKS:

1. **Principle and practice of Highway Engineering-** L R KADIYALI & N B LAL : Khanna publications
2. **Highway Engineering** – Khanna S K & Justo, Nemchand & Bros.
3. **Highway Engineering** by Srinivas Kumar.

#### REFERENCE BOOKS:

1. **Highway Engineering-** Kadiyali L R : Khanna publications
2. **Relavent IRC** Publications
3. **Transportation Engineering and Planning-** Papa Coastas and Prevendors PHI, New Delhi.

### OPEN CHANNEL HYDRAULICS

Subject Code	: 10CV756	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

## PART - A

### UNIT - 1

**INTRODUCTION:** Difference between pipe flow and open channel flow, classification of flow, energy equation, momentum equation, kinetic energy and momentum factors.

**8 Hours**

**UNIT - 2**

**UNIFORM FLOW:** Concepts, uniform flow equations, conveyance and hydraulic exponent for uniform flow, design of channels for uniform flow.

**8 Hours**

**UNIT - 3**

**CRITICAL FLOW:** Concept of specific Energy – Classification of flow. Design of channel, Section Factor, Hydraulic exponent for critical flow critical depth as a flow measurement.

**6 Hours**

**UNIT - 4**

**GRADUALLY VARIED FLOW:** Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation, Characteristics of flow profile and classification.

**6 Hours**

**PART - B**

**UNIT - 5**

Analysis of flows profiles, Method of singular point and transitional depth, Methods of computation, Practical problems.

**6 Hours**

**UNIT - 6**

Gradually Varied Flow Computations: Different methods, direct integration method, Bress's Solution, Chow's solution, direct method, standard step method.

**8 Hours**

**UNIT - 7**

Rapidly Varied Flow: Concepts, hydraulic jump in rectangular channels, classification of jumps, characteristics of jump – length location height, application of hydraulic jump stilling basins, shape type-2 and type-4.

**6 Hours**

**UNIT - 8**

Hydraulic jump in rectangular channels, Sloping channels, Jump in non rectangular channels, application of hydraulic jump as energy dissipator

**4 Hours**

**TEXTBOOKS:**

1. **Open Channel Hydraulics** : Subramanya : Tata Mc Graw Hill Publishing Co Ltd, New Delhi
2. **Open Channel Flow** – Madan Mohan Das, Prentice Hall of India Pvt. Ltd., New Delhi 2008 Edition.

3. **Flow Through Open Channels** – Rajesh Srivastava, Oxford Press, New Delhi 2008 Edition.

#### REFERENCE BOOKS:

1. **Open Channel Hydraulics** : French : Mc Graw Hill Book Company, New Delhi.
2. **Fluid Mechanics** : Modi and Seth : Standard Book Home, New Delhi.
3. **Open Channel Hydraulics** : Henderson : Mr. Millan Publishing Co. Ltd., New York.
4. **Open Channel Hydraulic** : Ven Te Chow : Mc Graw Hill Book Company, New Delhi.

#### SOLID WASTE MANAGEMENT

Subject Code	<b>10CV757</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

#### PART - A

##### UNIT - 1

**INTRODUCTION:** Definition, Land Pollution – scope and importance of solid waste management, functional elements of solid waste management.

**SOURCES:** Classification and characteristics – municipal, commercial & industrial. Methods of quantification.

**08 Hours**

##### UNIT - 2

**COLLECTION AND TRANSPORTATION:** Systems of collection, collection equipment, garbage chutes, transfer stations – bailing and compacting, route optimization techniques and problems.

**06 Hours**

##### UNIT - 3

**TREATMENT / PROCESSING TECHNIQUES:** Components separation, volume reduction, size reduction, chemical reduction and biological processing problems.

**6 Hours**

##### UNIT - 4

**INCINERATION:** Process – 3 T's, factors affecting incineration process, incinerators – types, prevention of air pollution, pyrolysis, design criteria for incineration.

**7 Hours**



## PART - B

### UNIT - 5

**COMPOSTING:** Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermicomposting.

**6 Hours**

### UNIT - 6

**SANITARY LAND FILLING:** Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geosynthetic fabrics in sanitary land fills.

**8 Hours**

### UNIT - 7

**DISPOSAL METHODS:** Open dumping – selection of site, ocean disposal, feeding to hogs, incineration, pyrolysis, composting, sanitary land filling, merits and demerits, biomedical wastes and disposal.

**6 Hours**

### UNIT - 8

**RECYCLE AND REUSE:** Material and energy recovery operations, reuse in other industries, plastic wastes, environmental significance and reuse.

**5 Hours**

### REFERENCES

1. **Integrated Solid Waste Management:** Tchobanoglous : M/c Graw Hill.
2. **Solid Waste Management in developing countries.** Bhide and Sunderashan
3. **Hand book on Solid Waste Disposal.**: Pavoni J.L.
4. **Environmental Engineering** : Peavy and Tchobanoglous
5. **Environmental Engineering – Vol II.**: S.K. Garg
6. **Biomedical waste handling rules** – 2000.
7. **Solid Waste Engineering** by Vesilind.Pa Worrell & Reinhart.D. – 2009, Cengage Learning India Private Limited, New Delhi.

## NUMERICAL METHODS IN CIVIL ENGINEERING

Subject Code	: 10CV761	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### PART -A

#### UNIT - 1

**INTRODUCTION:** Historical development of Numerical techniques, role in investigations, research and design in the field of civil engineering

**1 Hour**

**DEVELOPMENT OF ALGORITHM/ FLOW CHARTS FOR FOLLOWING METHODS FOR SOLUTION OF LINEAR SIMULTANEOUS EQUATION:**

- a) Gaussian elimination method,
- b) Gauss-Jordan matrix inversion method,
- c) Gauss-Siedel method and
- d) Factorization method

**6 Hours**

#### UNIT - 2

**APPLICATION OF SOLUTION OF LINEAR SYSTEM OF EQUATIONS TO CIVIL ENGINEERING PROBLEMS :** Construction planning, slope deflection method applied to beams, frames and truss analysis.

**5 Hours**

#### UNIT - 3

**APPLICATION OF ROOT FINDING TO CIVIL ENGINEERING PROBLEMS:** Development of algorithm for a) Bisection method and b) Newton-Raphson method and its applications for solution of non linear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering.

**6 Hours**

#### UNIT - 4

**APPLICATION OF NUMERICAL INTEGRATION FOR SOLVING SIMPLE BEAM PROBLEMS:** Development of algorithm for a) Trapezoidal rule and b) Simpson's one third rule and its application for computation of area of BMD drawn for statically determinate beams.

**6 Hours**

### PART -B

#### UNIT - 5

New Marks method for computation of slopes and deflections in statically determinate beams.

**6 Hours**

**UNIT - 6**

**DEVELOPMENT OF ALGORITHM AND APPLICATION OF SOLUTION OF ORDINARY DIFFERENTIAL EQUATION TO CIVIL ENGINEERING PROBLEMS BY:** a) Euler's method b) Runge Kutta 4<sup>th</sup> order method

**7 Hours**

**UNIT - 7**

**APPLICATION OF FINITE DIFFERENCE TECHNIQUE IN STRUCTURAL MECHANICS:** i. Introduction, expression of derivatives by finite difference: backward differences, forward differences and central differences. ii. Application of finite difference method for analysis of a) statically determinate beams, b) statically indeterminate beams

**8 Hours**

**UNIT - 8**

Application of Finite difference technique in structural mechanics (Contd..) a) Buckling of columns, b) Beams on elastic foundation.

**7 Hours**

**REFERENCE BOOKS:**

1. **Numerical Methods for Engineers-** Chapra S.C. & R.P.Canale : McGraw Hill, 1990.
2. **Numerical methods in Engineering Problem-** N.Krishna Raju, K.U.Muthu : MacMillan Indian Limited, 1990.
3. **Numerical methods for Engineers and Scientists-** Iqbal H.Khan, Q. Hassan : Galgotia, New Delhi, 1997.
4. **Numerical methods in Computer Programs in C++** - Pallab Ghosh : Prentice Hall of India Private Limited, New Delhi, 2006.
5. **Numerical methods for engineers using MATLAB and C – I** Edition SCHILLING “ Thomson Publications”

**ROCK MECHANICS**

Subject Code	: 10CV762	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Definition, Importance, History of Rock Mechanics, Distribution of rocks – Archean Rocks, Cuddapah Rocks, Vindhyan Rocks, Palaeozoic Rocks, Mesozoic rocks, Gondwana Rocks, Deccan Traps, Steriographic presentation of Geological data – Representation and plotting line and plane

**6 Hours**

**UNIT - 2**

**LABORATORY TESTS ON ROCKS** Tests for Physical Properties, Compressive strength, Tensile strength, Direct shear, Triaxial Shear, Slake Durability, Schmidt Rebound Hardness, Sound Velocity, Swelling Pressure & Free Swell, Void Index

**6 Hours**

**UNIT – 3**

**STRENGTH, MODULUS AND STRESS STRAIN BEHAVIOUR OF ROCKS**

Factors influencing rock behaviour, Strength criteria for Isotropic Intact Rocks, Modulus of Isotropic Intact Rocks, Compressive strength and modulus from SPT, Stress Strain models – Elastic model, Elasto plastic model, Visco elastic model

**6 Hours**

**UNIT - 4**

**ENGINEERING CLASSIFICATION OF ROCK AND ROCK MASS –** RQD, RMR system, Terzaghi's rock load classification, Deere Miller, CMRS and RSR System. Classification based on strength and modulus, Classification based on strength and failure strain, rock discontinuity qualitative description, friction in rocks – Amonton's law of friction,

**8 Hours**

**PART - B**

**UNIT - 5**

**FIELD TESTS ON ROCKS AND ROCK MASS** Geophysical methods Seismic Refraction method, Electrical Resistivity method, Deformability tests – Plate Jack Test, Goodman Jack Test, Field shear test - Field Permeability Test – Open end Test, Packers Test.

**6 Hours**

**UNIT - 6**

**STABILITY OF ROCK SLOPES** Modes of failure – Rotational, Plane and wedge failures, Plane failure method of Analysis, Wedge method of Analysis, Toppling failure, Protection against slope failure.

**6 Hours**

**UNIT - 7**

**ROCK FOUNDATION** Estimation of Bearing Capacity – Intact, Fractured rocks, Stress distribution in rocks, Factor of Safety, Sliding stability of dam foundation, Settlement in rocks, Bearing capacity of piles in rock, Measures for strengthening rock mass – Concrete shear keys, Bored concrete piles, Tensioned cable anchors, concrete block at toe

**6 Hours**

**UNIT - 8**

**MISCELLANEOUS TOPICS** Drilling, Blasting and underground open excavation, Mining and other Engineering applications, criteria for design of underground excavations, tubular excavations, pillars and ribs support multiple excavations. Structural defects in Rock masses, their improvement

by rock bolting, grouting and other methods. Rock grouting, Rock Reinforcement

**8 Hours**

**TEXT BOOKS:**

1. **Foundation of Rock masses** - Joegar and Cook : 3<sup>rd</sup> Edition Chapman and Hall, London.
2. **Engineering in Rocks for Slopes foundations and Tunnels – Ramamurthy, T., PHI Publishers, 2007**
3. **Introduction to rock mechanics-** Goodman : : Wiley International.

**REFERENCE BOOKS:**

1. **Rock Mechanics and the design of structures in Rock-** : John Wiley, New York.
2. **Rock Mechanics in Engineering practice-** Ziekiewicz. O.C. and Stagg K.G. : John, Wiley, New York.

**PAVEMENT MATERIALS AND CONSTRUCTION**

Subject Code	: 10CV763	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A  
PAVEMENT MATERIALS**

**UNIT - 1**

**AGGREGATES:** Origin, classification, requirements, properties and tests on road aggregates, concepts of size and gradation – design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.

**6 Hours**

**UNIT - 2**

**BITUMEN AND TAR:** Origin, preparation, properties and chemical constitution of bituminous road binders; requirements.

**4 Hours**

**UNIT - 3**

**BITUMINOUS EMULSIONS AND CUTBACKS:** Preparation, characteristics, uses and tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.

**8 Hours**

**UNIT - 4**

**BITUMINOUS MIXES:** Mechanical properties, dense and open textured mixes, flexibility and brittleness, (no Hveem Stabilometer & Hubbar – Field Tests) bituminous mix, design methods using Rothfuch's Method only and

specification, Marshal mixed design criteria- voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen.

**6 Hours**

## **PART - B**

### **PAVEMENT CONSTRUCTION**

#### **UNIT - 5**

**EQUIPMENT IN HIGHWAY CONSTRUCTION:** Various types of equipment for excavation, grading and compaction – their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

**6 Hours**

#### **UNIT - 6**

**SUBGRADE:** Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests.

**6 Hours**

#### **UNIT - 7**

**FLEXIBLE PAVEMENTS:** Specifications of materials, construction method and field control checks for various types of flexible pavement layers.

**8 Hours**

#### **UNIT - 8**

**CEMENT CONCRETE PAVEMENTS:** Specifications and method of cement concrete pavement construction (PQC Importance of providing DLC as sub-base and polythene thin layer between PQC and sub-base); Quality control tests; Construction of various types of joints.

**8 Hours**

#### **TEXT BOOKS:**

1. **Highway Engineering-** Khanna, S.K., and Justo, C.E.G., : Nem Chand and Bros. Roorkee
2. **Construction Equipment and its Management-** Sharma, S.C. : Khanna Publishers.
3. **Hot Mix Asphalt Materials, Mixture Design and Construction-** Freddy L. Roberts, Kandhal, P.S. : University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

#### **REFERENCES BOOKS:**

1. RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
2. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
3. Relevant IRC codes and MoRT & H specifications.

**PHOTOGRAMMETRY AND REMOTE SENSING**

Subject Code	: <b>10CV764</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**Part A**

**Unit 1: Photogrammetry** – Introduction, basic definitions, terrestrial photogrammetry, phototheodolite, horizontal and vertical angles from terrestrial photographs, horizontal position of a point from photographic measurements, elevation of points by photographic measurements, determination of focal length. **8Hours**

**Unit 2: Aerial Photogrammetry**- advantages, vertical, tilted and oblique photographs, geometry of vertical photographs, scale of vertical photograph over flat and variable terrain, ground coordinates, computation of length of a line, computation of flying height, relief displacement, overlaps, flight planning, computation of required number of photographs for a given area, ground control in photogrammetry **9 Hours**

**Unit 3:** Basics of stereoscopy, stereoscopes, uses, parallax. Basic elements in photographic interpretation. Introduction to digital photogrammetry

6Hours

**Part B:****Unit 4: Remote sensing:**

Introduction, Ideal remote sensing system, basic principles of electromagnetic remote sensing, electromagnetic energy, electromagnetic spectrum, interaction with earth's atmosphere, interaction with earth- surface materials, spectral reflectance of earth surface materials **6Hours**

**Unit 5:**

**Remote sensing platforms and sensors:** Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal)

6Hours

**Unit 6:** Properties of digital image data, data formats, Basics of digital image processing- radiometric and geometric corrections, image enhancements, image transforms based on arithmetic operations, image filtering **6Hours**

**Unit 7:**

Remote sensing image interpretation, thematic classification (supervised and unsupervised) , maximum likelihood classification, introduction to accuracy assessment of classification **6Hours**

**Unit 8:**

Applications of Remote sensing: applications in land use land cover analysis, change detection, water resources, urban planning, environmental and geological applications.

5Hours

**Reference Books:**

1. Mikhail E., J. Bethel, and J.C. McGlone, **Introduction to modern photogrammetry**. Wiley, 2001.
2. Wolf P.R, and B.A. Dewitt, **Elements of photogrammetry : with applications in GIS**. 3<sup>rd</sup> ed, McGraw-Hill, 2000.
3. Lillesand T.M., and R.W. Kiefer, **Remote sensing and image interpretation**. 4th ed, John Wiley & Sons, 2000.
4. Jensen J.R., **Introductory digital image processing: a remote sensing perspective**. 2<sup>nd</sup> ed Prentice Hall, 1996.
5. Richards J.A., and X. Jia, **Remote sensing digital image analysis: an introduction**. 3rd ed Springer, 1999.
6. Mather P.M., **Computer processing of remotely-sensed images: an introduction**. Wiley,1988.

### AIR POLLUTION AND CONTROL

Subject Code	<b>10 CV765</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

#### PART - A

##### UNIT - 1

**INTRODUCTION:** Definition – Classification and Characterization of Air Pollutants, Emission Sources, Behavior and Fate of air Pollutants, Chemical Reactions in the Atmosphere, Photo-chemical Smog, Coal-induced smog, Air Pollution Inventories.

**6 Hours**

##### UNIT - 2

**EFFECTS OF AIR POLLUTION:** On Human Health, Animals, Plants and Materials – Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog & Bhopal Gas Tragedy.

**6 Hours**

##### UNIT - 3

**METEOROLOGY:** Introduction – Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Windrose, General Characteristics of Stack Plumes, Meteorological Models.

**8 Hours**

##### UNIT - 4

Factors to be considered in Industrial Plant Location and Planning  
Noise pollution – sources, measurement units, effects and control

**4 Hours**

#### PART - B



**UNIT - 5**

**SAMPLING, ANALYSIS AND CONTROL:** Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement, Air Pollution Control Methods – Particulate, Emission Control, Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers, Selection of a Particulate Collecting Equipment, Control of Gaseous Emissions, Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.

**16 Hours**

**UNIT - 6**

**AIR POLLUTION DUE TO AUTOMOBILES:** Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control.

**5 Hours**

**UNIT - 7**

**BURNING ENVIRONMENTAL ISSUES:**

1. Acid Rain
2. Global Warming
3. Ozone Depletion in Stratosphere
4. Indoor Air Pollution

**4 Hours**

**UNIT - 8**

**ENVIRONMENTAL LEGISLATION:** Environmental Policy, Environmental Acts, Water, Air and Noise Pollution Standards.

**3 Hours**

**REFERENCES**

1. Boubel, R.W., Donald, L.F., Turner, D.B., and Stern, A.C., (1994), **Fundamentals of Air Pollution** –Academic Press.
2. Crawford, M., (1980), **Air Pollution Control Theory** –TMH Edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
3. Henry. C. Perkins, (1980), **Air Pollution** –McGraw Hill.
4. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering** –Mc Graw Hill Book Co.
5. Sincero, A.P and Sincero, G.A., (1999), **Environmental Engineering - A Design Approach** –Prentice Hall of India.
6. Wark, K., Warner, C.F. and Davies, W.T., (1998), **Air Pollution- Its Origin and Control** –Harper & Row Publishers, New York.

## DESIGN AND DRAWING OF BRIDGES

Subject Code	: 10CV766	IA Marks	: 25
No. of Lecture Hours/Week	: 02 (T) + 3 (D)	Exam Hours	: 04
Total No. of Lecture Hours	: 26 (T) + 39 (D)	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**BRIDGE PRELIMINARIES:** Classification of bridges and standard loads, Bridge-definition, components of bridges, various classification, types of bridges, forces to be considered for the design, IRC standards.

**HYDRAULIC DESIGN:** Methods of finding design discharge, natural, artificial and linear water ways, afflux, economic span.

**SUBSTRUCTURES AND FOUNDATIONS:** Types of abutments, piers and wing walls, forces to be considered for the design, Types of foundations and forces to be considered for the design, depth of scour.

**6 Hours**

#### UNIT - 2

**DESIGN AND DRAWING OF RC SLAB CULVERT** for IRC class-AA loading, & class A loading. Design of pipe culvert. Empirical design of bank connections. Drawing slab culvert & pipe culvert for given site particulars.

**6+12 Hours**

### PART - B

#### UNIT - 3

**DESIGN AND DRAWING OF RC T BEAM BRIDGE** with cross beams by Piegaud's and Courbon's method for class-AA loading, empirical design of substructures and foundations.

**5+12 Hours**

#### UNIT - 4

**DESIGN OF COMPOSITE BRIDGE:** Design of composite bridge for EUDL, Shear connectors-design requirements for shear connectors. Drawing of composite bridge.

**5+9 Hours**

#### UNIT - 5

Typical Design and detailing of approach slab, Hand rails- Typical design and detailing of slab culverts and girder bridges as per MOT standards

**4+6 Hours**

#### TEXT BOOKS:

1. **Essentials of Bridge Engineering** : Johnson – victor : Oxford IBH Publications, New Delhi.

2. **Design of Bridges** : Krishna Raju N : Oxford IBH Publications, New Delhi.

**REFERENCE BOOK:**

1. **Design of Bridge Structures** : Jagadish T. R. & Jayaram M. A. : Prentice Hall of India, New Delhi.

**STRUCTURAL DYNAMICS**

Subject Code	: 10CV767	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**PART - A**

**UNIT - 1**

Introduction to structural dynamics, Brief history of vibration and Earthquakes, Major earthquakes, Earthquakes zones, some basic definitions, Vibration of single degree of freedom system, undamped, damped, free vibrations, logarithmic decrement.

**6 Hours**

**UNIT - 2**

Forced vibrations of single degree freedom systems, response of undamped and damped systems subjected to harmonic loading, rotation unbalance, reciprocating unbalance.

**6 Hours**

**UNIT - 3**

Duhamel's integral, response due to general system of loading, dynamic load factor, response spectrum, response of SDOF subjected to harmonic base excitation, vibration isolation.

**7 Hours**

**UNIT - 4**

Free vibration of multi degree of freedom systems, natural frequencies, normal modes, orthogonality property of normal modes, eigen values.

**7 Hours**

**PART - B**

**UNIT - 5**

Shear buildings modeled as multi degree of freedom systems, free vibrations, natural frequencies.

**6 Hours**

**UNIT - 6**

Forced vibration motion of shear buildings, modal super position method, response of shear buildings to base motion, harmonic forced excitation.

**6 Hours**

### UNIT - 7

Damped motion of shear buildings, equations for damped shear buildings, uncoupled damped equations, conditions for damping uncoupling.

**7 Hours**

### UNIT - 8

Dynamic analysis of beams stiffness matrices, lumped mass and consistent mass formulation equations of motion.

**7 Hours**

### REFERENCE BOOK:

1. **Vibrations, structural dynamics**- M. Mukhopadhaya : Oxford IBH
2. **Structural Dynamics**- Mario Paz : CBS publishers.
3. **Structural Dynamics**- Anil Chopra : PHI Publishers.
4. **Structural Dynamics**- Clough & Penzen : TMH.

### ENVIRONMENTAL ENGINEERING LABORATORY

Subject Code	<b>10CVL77</b>	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

1. Determination of Solids in Sewage: Total Solids, Suspended Solids, Dissolved Solids, Volatile Solids, Fixed Solids, Settleable Solids.
2. Electrical conductivity. Determination of Chlorides and Sulphates.
3. Determination of Alkalinity, Acidity and pH.
4. Determination of Calcium, Magnesium and Total Hardness.
5. Determination of Dissolved Oxygen. Determination of BOD.
6. Determination of COD.
7. Determination of percentage of available chlorine in bleaching powder, Residual Chlorine and Chlorine Demand.
8. Jar Test for Optimum Dosage of Alum, Turbidity determination by Nephelometer.
9. Determination of Iron. Phenanthroline method.
10. Determination of Fluorides SPANDS Method.

11. MPN Determination
12. Determination Nitrates by spectrophotometer.
13. Determination of sodium and potassium by flame photometer.

#### REFERENCES

1. **Manual of Water and Wastewater Analysis** – NEERI Publication.
2. **Standard Methods for Examination of Water and Wastewater** (1995), American Publication – Association, Water Pollution Control Federation, American Water Works Association, Washington DC.
3. **IS Standards** : 2490-1974, 3360-1974, 3307-1974.
4. **Chemistry for Environment Engineering**. Sawyer and Mc Carthy,

#### CONCRETE AND HIGHWAY MATERIALS LABORATORY

Subject Code	: <b>10CVL78</b>	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

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#### PART - A

**CEMENT:** Normal Consistency, Setting time, Soundness by Autoclave method, Compression strength test and Air permeability test for fineness, Specific gravity of cement.

**FRESH CONCRETE:** Workability – slump, Compaction factor and Vee Bee tests.

**HARDENED CONCRETE:** Compression strength and Split tensile tests. Test on flexural strength of RCC beams, Permeability of concrete.

#### PART - B

**SOIL:** Density of Soil by Sand replacement method, CBR Text.

**AGGREGATES:** Crushing, abrasion, impact and Shape tests (Flaky, Elongation, Angularity number) Specific gravity and water absorption.

**BITUMINOUS MATERIALS AND MIXES:** Specific Gravity, Penetration, Ductility, Softening point, Flash and fire point, Viscosity, proportioning of aggregate mixes by Rothfutch Method, Marshall Stability tests.

#### REFERENCE BOOK:

1. Relevant IS Codes and IRC Codes.

2. **Highway Material Testing Laboratory Manual** by Khanna S K and Justo, – CEG Nemi Chand & Bros.
3. M. L. Gambhir : Concrete Manual : Dhanpat Rai & sons New – Delhi.

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University Updates

## VIII -SEMESTER

### ADVANCED CONCRETE TECHNOLOGY

Subject Code	: 10CV81	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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#### PART - A

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##### UNIT - 1

Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete, transition Zone, Elastic Modulus, factors affecting strength and elasticity of concrete, Rheology of concrete in terms of Bingham's parameter.

**7 Hour**

##### UNIT - 2

**CHEMICAL ADMIXTURES-** Mechanism of chemical admixture, Plasticizers and super Plasticizers and their effect on concrete property in fresh and hardened state, Marsh cone test for optimum dosage of super plasticizer, retarder, accelerator, Air-entraining admixtures, new generation superplasticiser.

**MINERAL ADMIXTURE-**Fly ash, Silica fume, GCBS, and their effect on concrete property in fresh state and hardened state.

**6 Hours**

##### UNIT - 3

**MIX DESIGN** - Factors affecting mix design, design of concrete mix by BIS method using IS10262 and current American (ACI)/ British (BS) methods. Provisions in revised IS10262-2004.

**6 Hours**

##### UNIT - 4

**DURABILITY OF CONCRETE** - Introduction, Permeability of concrete, chemical attack, acid attack, efflorescence, Corrosion in concrete. Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, IS456-2000 requirement for durability.

**7 Hours**

#### PART - B

##### UNIT - 5

RMC concrete - manufacture, transporting, placing, precautions, Methods of concreting- Pumping, under water concreting, shotcrete, High volume fly ash concrete concept, properties, typical mix

Self compacting concrete concept, materials, tests, properties, application and Typical mix.

**6 Hours**

**UNIT - 6**

Fiber reinforced concrete - Fibers types and properties, Behavior of FRC in compression, tension including pre-cracking stage and post-cracking stages, behavior in flexure and shear, Ferro cement - materials, techniques of manufacture, properties and application

**7 Hours**

**UNIT - 7**

Light weight concrete-materials properties and types. Typical light weight concrete mix High density concrete and high performance concrete-materials, properties and applications, typical mix.

**6 Hours**

**UNIT - 8**

Test on Hardened concrete-Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition. Compression, tension and flexure tests. Tests on composition of hardened concrete-cement content, original w/c ratio. NDT tests concepts-Rebound hammer, pulse velocity methods.

**7 Hours**

**TEXT / REFERENCE BOOKS:**

1. **Properties of Concrete-** Neville, A.M. - ELBS Edition, Longman Ltd., London
2. **Concrete Technology-** M.S. Shetty
3. **Concrete Technology-** A.R. Santhakumar,-Oxford University Press.
4. **Concrete-** P.K. Mehta, P J M Monteiro,- Prentice Hall, New Jersey (Special Student Edition by Indian Concrete Institute Chennai)
5. ACI Code for Mix Design
6. IS 10262-2004
7. **Concrete Mix Design-** N. Krishna Raju - Sehgal Publishers
8. **Concrete Manual-** Gambhir M.L.- Dhanpat Rai & Sons, New Delhi
9. **Advanced Concrete Technology Processes-** John Newman, Ban Seng Choo, - London.
10. **Advanced Concrete Technology Constituent materials-** John Newman, Ban Seng Choo- London
11. **Non-Destructive Test and Evaluation of Materials-** J.Prasad, C G K Nair,-Mc Graw Hill.
12. **High Performance Concrete-** Prof Aitcin P C- E and FN, London.
13. **Properties of Fresh Concrete-** Power T.C.- E and FN, London



## DESIGN AND DRAWING OF STEEL STRUCTURES

Subject Code	<b>:10CV82</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 02 (T) + 3 (D)	Exam Hours	: 04
Total No. of Lecture Hours	: 26 (T) + 39 (D)	Exam Marks	: 100

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### PART - A

(DRAWINGS TO BE PREPARED FOR GIVEN STRUCTURAL DETAILS)

#### UNIT - 1

**CONNECTIONS:** Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened.

#### UNIT - 2

**COLUMNS:** Splices, Column-column of same and different sections. Lacing and battens.

#### UNIT - 3

**COLUMN BASES:** Slab base and gusseted base, grillage foundation.

**08 (T) + 15 (D)**

### PART - B

#### UNIT - 4

**Design and drawing of**

- i) Bolted and welded plate girder
- ii) Roof Truss (Forces in the members to be given)
- iii) Gantry girder

**18 (T) + 24 (D)**

**Note :**

- i. In part A, Two questions to be set, out of which one question to be answered (30% weightage).
- ii. In part B, Two questions to be set, out of which one question to be answered (70% weightage).

#### TEXT / REFERENCE BOOKS:

1. **Structural Design & Drawing** – N.Krishna Raju, Universities Press, India.
2. **Design of Steel Structures** - N. Subramanian : Oxford University, Press.
3. **Design of Steel Structures** - Negi - Tata Mc Graw Hill Publishers.
4. **Design of Steel Structures** - Arya and Ajaman- Nem Chand & Bros. Roorkee.
5. **Design of Steel Structures.**- Raghupati
6. IS : 800 – 2007,
7. SP 6 (1) – 1984 or Steel Table.

## ADVANCED PRESTRESSED CONCRETE STRUCTURES

Subject Code	: 10CV831	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**ANCHORAGE ZONE STRESSES IN POST-TENSIONED MEMBERS:** Introduction, stress distribution in end block, investigations on Anchorage zone stresses, Magnel and Guyon's Methods, Comparative Analysis, Anchorage zone reinforcement.

**6 Hours**

#### UNIT - 2

**SHEAR AND TORSIONAL RESISTANCE:** Shear and principal stresses, ultimate shear resistance, design of shear reinforcement, Torsion, Design of reinforcement for torsion.

**6 Hours**

#### UNIT - 3

**COMPOSITE BEAMS:** Introduction, types of composite beams, analysis for stresses, differential shrinkage, serviceability limit state. Design for flexural and shear strength.

**8 Hours**

#### UNIT - 4

**TENSION MEMBERS:** Introduction, Ties, Pressure pipes – fabrication process, analysis, design and specifications. Cylindrical containers - construction techniques, analysis, design and specifications.

**6 Hours**

### PART - B

#### UNIT - 5

**STATICALLY INDETERMINATE STRUCTURES:** Introduction, Advantages of continuous members, effect of prestressing in indeterminate structures, methods of analysis for secondary moments, concordant cable profile, Guyon's theorem, Ultimate load analysis, Design of continuous beams and portal frames.

**8 Hours**

#### UNIT - 6

**COMPRESSION MEMBERS:** Introduction, Columns, short columns, long columns, biaxially loaded columns, Design specifications.

**6 Hours**

**UNIT - 7**

**SLAB AND GRID FLOORS:** Types of floor slabs, Design of one way ,two way and flat slabs. Distribution of prestressing tendons, Analysis and design of grid floors.

**5 Hours**

**UNIT - 8**

**PRECAST ELEMENTS:** Introduction, Prestressed concrete poles-manufacturing techniques, shapes and cross sectional properties, design loads, design principles. Railway sleepers-classification and Manufacturing techniques, design loads, analysis and design principles. Prestressed concrete pavements, slab and wall panels.

**7 Hours**

**TEXT / REFERENCE BOOKS:**

1. **Design of Prestressed concrete structures** - Lin T.Y. and H. Burns - John Wiley & Sons, 1982.
2. **Prestressed Concrete**- N. Krishna Raju - Tata Megrahill, 3<sup>rd</sup> edition, 1995.
3. **Prestressed Concrete Structures**- P. Dayaratnam - Oxford & IBH, 5<sup>th</sup> Edition, 1991.
4. **Prestressed Concrete**- G.S. Pandit and S.P. Gupta - CBS Publishers, 1993.
5. IS : 1343 : 1980.

**ADVANCED FOUNDATION DESIGN**

Subject Code : **10CV832** IA Marks : 25

No. of Lecture Hours/Week : 04 Exam Hours : 03

Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**BEARING CAPACITY & SETTLEMENT:** Presumptive bearing capacity according to BIS, Factors affecting bearing capacity, Factors influencing selection of depth of foundation, types of shallow foundations, Settlement of Shallow Foundations: Immediate, consolidation, & differential settlements, Factors influencing settlement, Safe Bearing Capacity and Allowable Bearing Pressure.

**6 Hours**

**UNIT - 2**

**SHALLOW FOUNDATIONS:** Principles of Design of foundation, Definition for Shallow and Deep foundation, Requirements for geotechnical and structural aspects of design, Proportioning of isolated footing, combined footing, Strap footing, Strip footing and Raft foundation.

**6 Hours**

**UNIT - 3**

**PILE FOUNDATIONS – SINGLE PILE:** Historical Development, Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests, Laterally Loaded Pile.

**6 Hours**

**UNIT - 4**

**PILE FOUNDATIONS – GROUP EFFECT:** Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, Under reamed piles.

**7 Hours**

**PART - B**

**UNIT - 5**

**WELL FOUNDATIONS:** Historical Development, Different shapes and characteristics of wells, Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies for tilts and shifts.

**6 Hours**

**UNIT - 6**

**DRILLED PIERS & CAISSONS:** Construction, advantages and disadvantages of drilled piers. Design concepts and Advantages and disadvantages of open, pneumatic and floating caissons.

**7 Hours**

**UNIT - 7**

**FOUNDATIONS ON EXPANSIVE SOILS:** Definition, Identification, Mineral Structure, Index properties of expansive soils, Swell potential and Swell pressure, Free swell, Tests on expansive soils, foundation treatment for structures in expansive soil, CNS layer.

**6 Hours**

**UNIT - 8**

**MACHINE FOUNDATIONS:** Basic definitions in vibration, free and forced vibrations, determination of natural frequency, types of Machine foundations, general criteria for design of machine foundation.,vibration

analysis of a machine foundation, degrees of freedom of a block foundation, vibration isolation and control,

**8 Hours**

**TEXT BOOKS:**

1. **Soil Mechanics & Foundation Engineering** - V.N.S. Murthy - Pub: Sai Tech.
2. **Foundation Engineering** - Braja M. Das – Cengage Learning.
3. **Soil Mechanics Foundations** - Dr. B.C. Punmia - Pub : Laxmi publications, pvt. Ltd.

**REFERENCE BOOKS:**

1. **Foundation Analysis and Design** - Bowles J.E. (1996) - 5th Ed, McGraw Hill Pub. Co., New York.
2. **Advanced Foundation Engineering** - V.N.S. Murthy - Pub : Sai Tech.
3. **Pile Foundation**.- Chellies
4. **Geotechnical Engineering**.- P. Purushotham Raj
5. **Geotechnical Engineering** - Dr. C. Venkataramaiah - Pub : New age Publications.
6. **Foundation Engineering** - Dr. P.C. Varghese :- Pub : Prentice Hall of India.

**PAVEMENT DESIGN**

Subject Code	: <b>10CV833</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Desirable characteristics of pavement, types and components, Difference between Highway pavement and Air field pavement – Design strategies of variables – Functions of sub-grade, sub base – Base course – surface course – comparison between Rigid and flexible pavement.

**6 Hours**

**UNIT - 2**

**FUNDAMENTALS OF DESIGN OF PAVEMENTS:** Design life – Traffic factors – climatic factors – Road geometry – Subgrade strength and drainage, Stresses and deflections, Boussinesqs theory – principle, Assumptions – Limitations and problems on above - Busmister theory – Two layered analysis – Assumptions – problems on above

**6 Hours**

**UNIT - 3**

**DESIGN FACTORS:** Design wheel load – contact pressure – ESWL concept – Determination of ESWL by equivalent deflection criteria – Stress criteria – EWL concept.

**6 Hours**

**UNIT - 4**

**FLEXIBLE PAVEMENT DESIGN:** Assumptions – McLeod Method – Kansas method – Tri-axial method - CBR method – IRC Method (old) - CSA Method using IRC 37-2001, problems on above.

**6 Hours**

**PART - B**

**UNIT - 5**

**STRESSES IN RIGID PAVEMENT:** Principle – Factors - wheel load and its repetition – properties of sub grade – properties of concrete. External conditions – joints – Reinforcement – Analysis of stresses – Assumptions – Westergaard's Analysis – Modified Westergaard equations – Critical stresses – Wheel load stresses, Warping stress – Frictional stress – combined stresses (using chart / equations) - problems on above.

**6 Hours**

**UNIT - 6**

**DESIGN OF RIGID PAVEMENT:** Design of C.C. Pavement by IRC: 38 – 2002 for dual and Tandem axle load – Reinforcement in slabs – Requirements of joints – Types of joints – Expansion joint – contraction joint – warping joint – construction joint – longitudinal joint, Design of joints, Design of Dowel bars, Design of Tie bars – problems of the above

**8 Hours**

**UNIT - 7**

**FLEXIBLE PAVEMENT FAILURES, MAINTENANCE AND EVALUATION:** Types of failures, causes, remedial/maintenance measures in flexible pavements – Functional Evaluation by visual inspection and unevenness measurement by using different techniques - Structural Evaluation by Benkelman Beam Deflection Method, Falling weight deflectometer, GPR Method. Design factors for Runway Pavements - Design methods for Airfield pavements and problems on above.

**7 Hours**

**UNIT - 8**

**RIGID PAVEMENT FAILURES, MAINTENANCE AND EVALUATION:** Types of failures, causes, remedial/maintenance measures in rigid pavements – Functional Evaluation by visual inspection and

unevenness measurements. Design factors for Runway Pavements - Design methods for Airfield pavements.

**7 Hours**

**TEXT BOOKS:**

1. **Highway Engineering**- Khanna & Justo
2. **Principles & Practices of Highway Engineering**- L R Kadiyalli & N B. Lal
3. **Pavement Analysis & Design** - Yang H. Huang- II edition.
4. Relavent IRC codes

**REFERENCE BOOKS:**

1. **Principles of Pavement Design**- Yoder and Witzack - 2nd edition, John Wileys and Sons
2. **Principles of Pavement Design**- Subha Rao

**EARTHQUAKE RESISTANT DESIGN OF STRUCTURES**

Subject Code	<b>:10CV834</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

Earthquake ground Motion, Engineering Seismology, Theory of plate tectonics, seismic waves, Magnitude and intensity of earthquakes, local site effects, seismic zoning map of India.

**6 Hours**

**UNIT - 2**

Seismic Design Parameters. Types of Earthquakes, earthquake ground motion characteristics, response spectra and design spectrum.

**6 Hours**

**UNIT - 3**

Structural modelling, Code based seismic design methods. Response control concepts, seismic evaluation and retrofitting methods.

**6 Hours**

**UNIT - 4**

Effect of Structural Irregularities on seismic performance of RC buildings. Vertical irregularity and plan configuration problems, Seismo resistant building architecture – lateral load resistant systems, building characteristics.

**6 Hours**

**PART - B**

**UNIT - 5**

Seismic design philosophy, Determination of design lateral forces - Equivalent lateral force procedure, dynamic analysis procedure.

**8 Hours**

**UNIT - 6**

Step by step procedure for seismic analysis of RC buildings (maximum of 4 storeys , without infills) - Equivalent static lateral force method, response spectrum methods.

**7 Hours**

**UNIT - 7**

Earthquake resistant analysis and design of RC buildings – Preliminary data, loading data, load combinations, analysis and design of subframes. ( maximum of 4 storeys, without infills).

**7 Hours**

**UNIT - 8**

Earthquake resistant design of masonry buildings - elastic properties of structural masonry, lateral load analysis, Design of two storied masonry buildings.

**6 Hours**

**TEXT / REFERENCE BOOKS:**

1. **Earthquake resistant design of structures** - Pankaj Agarwal, Manish Shrikande - PHI India.
2. **Earthquake Resistant Design of Structures** - S.K. Duggal - Oxford University Press, 2007.
3. **Earthquake Resistant Design**- Anil Chopra
4. **Earth Quake Engineering Damage Assessment and Structural design**- S.F. Borg - (John Wiley and Sons. 1983).



## INDUSTRIAL WASTEWATER TREATMENT

Subject Code	: 10CV835	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION:** Difference between Domestic and Industrial Wastewater, Effect on Streams and on Municipal Sewage Treatment Plants. Stream Sampling, effluent and stream Standards and Legislation to Control Water Pollution.

**5 Hours**

#### UNIT - 2

Stream Quality, Dissolved oxygen Sag Curve in Stream, Streeter– Phelps formulation, Numerical Problems on DO prediction.

**6 Hours**

#### UNIT - 3

**TREATMENT METHODS-I:** Volume Reduction, Strength Reduction, Neutralization, Equalization and Proportioning.

**5 Hours**

#### UNIT - 4

**TREATMENT METHODS-II:** Removal of Inorganic suspended solids, Removal of Organic Solids, Removal of suspended solids and colloids. Treatment and Disposal of Sludge Solids.

**6 Hours**

### PART - B

#### UNIT - 5

**COMBINED TREATMENT:** Feasibility of combined Treatment of Industrial Raw Waste with Domestic Waste, Discharge of Raw, Partially Treated and completely treated Wastes to Streams.

**6 Hours**

#### UNIT - 6

**TREATMENT OF SELECTED INDUSTRIAL WASTE:** Process flow sheet showing origin / sources of waste water, characteristics of waste, alternative treatment methods, disposal, reuse and recovery along with flow sheet. Effect of waste disposal on water bodies

**THE INDUSTRIES TO BE COVERED ARE:**

1. Cotton Textile Industry
2. Tanning Industry
3. Cane Sugar Industry & Distillery Industry

**10 Hours**

**UNIT - 7**

**TREATMENT OF SELECTED INDUSTRIAL WASTE-I:**

1. Dairy Industry
2. Canning Industry
3. Steel and Cement Industry

**7 Hours**

**UNIT - 8**

**TREATMENT OF SELECTED INDUSTRIAL WASTE-II:**

1. Paper and Pulp Industry
2. Pharmaceutical Industry
3. Food Processing Industry

**7 Hours**

**REFEENCES**

1. **Industrial Waste Water Treatment**- Nelsol L. Nemerow.
2. **Industrial Waste Water Treatment**.- Rao MN, and Dutta A.K.
3. **Waste Water Treatment, Disposal and Reuse** - Metcalf and Eddy inc - Tata McGraw Hill Publications, 2003.
4. **Industrial Wastewater Treatment** – Patwardhan A.D., PHI Learning Private Ltd., New Delhi, 2009
5. **Pollution Control Processes in industries**- Mahajan S.P.
6. Relevant IS Codes.

**QUALITY MANAGEMENT SYSTEM  
IN CIVIL ENGINEERING**

Subject Code	: 10CV836	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

**QUALITY MANAGEMENT SYSTEM - QMS:** Introduction – Evolution of Quality Management System, Element of Quality, Quality Management System, Concept of Process, Network of Process in an organization, ISO 9000 Family, Applying ISO 9000 in practice, Importance of ISO 9000, Benefits of ISO standards of society, Total Quality Management,

Comparison of ISO 9000 and TQM – Quality related definitions – Leaders in Quality or Quality Gurus – Customer Orientation – Mahatma Gandhi.

**5 Hours**

**UNIT - 2**

**IMPLEMENTING ISO 9001-2000 QUALITY MANAGEMENT SYSTEM:** ISO 9000 – Quality Management Principles, ISO 9000 Documents Content of ISO 9001 : 2000, ISO 9001-2000 Quality Management System Requirements, General Requirements, Documentation Requirements, Management Responsibilities, Resource Management, Product Realization, Measurement, analysis and Improvement Monitoring and Measurement, Non-conforming Product, Analysis of data, Improvement, Implementing ISO 9001-2000 Quality Management System.

**5 Hours**

**UNIT - 3**

**PREPARING A ISO 9001-200 QUALITY MANAGEMENT SYSTEM FOR CIVIL ENGINEERING:** Quality Manual, Introduction, Scope of the Quality Manual, Applicability, Responsibility, Quality Management System, General Requirements, Management Responsibilities, Management Commitment, Customer Focus, Indian Construction Company Quality Policy, Planning Responsibility, Authority and Communication, Management Review, Resource Management, Provision of Resources, Human Resources Product Realization, Planning or Product Realization, Customer Related Processes, Design and Development, Purchasing, Production and Service Provision, Control of Monitoring and Measuring Devices Measurement, analysis and Improvement, Monitoring and Measurement, Non-conforming product, Analysis of data, Improvement

**8 Hours**

**UNIT - 4**

**QUALITY MANAGEMENT SYSTEM PROCEDURES:** Introduction, procedure for management review, Format for writing procedures, procedure for preparing Quality plans/ work instructions, Contract review, Design control, Document and data control, Document numbering system, Change request, procedure for purchasing, procedure for control of customer supplied product, procedure for product identification and traceability, procedure for process control, procedure for inspection and testing, procedure for control of inspection, measuring and test equipments, procedure for inspection and test status, procedure for the control of non-conforming product, procedure for corrective and preventive action, procedure for handling, storage, packaging and delivery, control of quality records, procedure for internal quality audits.

**8 Hours**

## PART - B

### UNIT - 5

**WORK INSTRUCTIONS:** Introduction – Document and Data Control, Material Procurement, Material Handling, Tendering and Estimating, Planning, Design, Training, Plant and Equipment, Bar Bending Schedule, Concrete Works, Earthworks and Compaction, General Soil Investigation works, Survey works, Concrete Repair Works, Road Works, Painting Works, Water Proofing works, Drainage Works, Quality Assurance and Control, Patching and Transportation of Concrete.

**5 Hours**

### UNIT - 6

**METHOD STATEMENT:** Introduction, Concrete Works, Earthworks and Compaction, General Soil Investigation works, Survey works, Concrete Repair works, Concrete Demolition works, Road Works, Fencing works etc.

**5 Hours**

### UNIT - 7

1. **JOB DESCRIPTION:** Introduction, Job Description of : Managing Director, Project Manager, Site Manager, Site Engineer, QA/QC Engineer, Foreman, Typist/Clerk, Design Engineer, Planning Engineer.

2. **QUALITY CONTROL PLAN/INSPECTION AND TEST PLANS (ITPS):** Introduction-Preparation of Project Quality Plans, Inspection and Test plant.

**8 Hours**

### UNIT - 8

**QUALITY RECORD/FORMATS:** Preparation of Standard Formats: Revision Control form, Document Distribution List, Document Master List, Non-Conformance Report, Store Issue/Receipt Voucher, Local Purchase Order, Material Stock Card, Audit Notification, Quality Audit Report, Corrective Action Report, Calibration Record, Calibration Master Sheet, Work Instruction, Job Description, Contract/Tender Review Form, Quantity Survey Estimation/Take off sheet, Material/Plant Requisition, Drawing Schedule, Bar-bending Schedule, Design Calculation Sheet, Request for Inspection, Concrete Inspection Request, Inspection Check List – Drainage, Painting, Request for Inspection-Concrete Repair, Accident Report Form, Concrete Production, Concrete Compressive Strength Test Results, Request to Conduct Cube Test, Quality Awareness Training Record.

**8 Hours**

### REFERENCE BOOKS:

1. **Quality Management System in Civil Engineering** - D.S. Rajendra Prasad - ISO 9001-2000, Sapna Book House, Bangalore.
2. **Productivity and Quality Improvement** - John L. Hardsky - McGraw Hill Book Company.

3. **ISO 9000 Concepts, Methods, Implementation-** Bagchi - Wheeler Publishing.
4. **Training Manual on ISO 9000-2000 and TQM-** Girdhar J. Gyani - Raj Publishing House.
5. **Documenting Quality for ISO 9000 and other Industry Standards** - Gary E. MacLean -Tata McGraw Hill Publishing Company Limited.
6. **Total Quality Management for Engineers** - Mohamed Zairi - Aditya Books Private Limited.
7. **Data Book for Civil Engineers Field Practice** - Elwyn E. Seelye - John Wiley & Sons, Inc.
8. **Properties of Concrete** - A.M. Neville - ELBS Publications.
9. IS : 456-2000 : Indian Standard Specifications for Plain and Reinforced Concrete Code of Practice : 4<sup>th</sup> Revision, Bureau of Indian Standards.
10. IS : 383-1990 : Indian Standard Specifications for Coarse and Fine Aggregates from Natural Sources for Concrete : Bureau of Indian Standards.
11. **Quality Management** - Kanishka Bedi -(Oxford university press).

### FINITE ELEMENT ANALYSIS

Subject Code	: 10CV841	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

**INTRODUCTION:** Basic Concepts, Background Review: Theory of Elasticity, Matrix displacement formulation, Energy concepts, Equilibrium and energy methods for analyzing structures.

**6 Hours**

##### UNIT - 2

Raleigh - Ritz Method, Galerkin's Method, Simple applications in structural analysis.

**8 Hours**

##### UNIT - 3

**FUNDAMENTALS OF FINITE ELEMENT METHOD:** Displacement function and natural coordinates, construction of displacement functions for 2 D truss and beam elements.

**5 Hours**

**UNIT - 4**

Applications of FEM for the analysis of plane truss, continuous beam and simple plane frame problems.

**7 Hours**

**PART - B**

**UNIT - 5**

**ANALYSIS OF 2D CONTINUUM PROBLEMS:** Elements and shape functions, Triangular, rectangular and quadrilateral elements, different types of elements, their characteristics and suitability for application.

**7 Hours**

**UNIT - 6**

Polynomial shape functions, Lagrange's and Hermitian polynomials, compatibility and convergence requirements of shape functions.

**6 Hours**

**UNIT - 7**

**THEORY OF ISOPARAMETRIC ELEMENTS:** Isoparametric, subparametric and super-parametric elements, characteristics of isoparametric quadrilateral elements.

**7 Hours**

**UNIT - 8**

**FEM PROGRAM:** Structure of computer program for FEM analysis, description of different modules, pre and post processing.

**6 Hours**

**TEXT / REFERENCE BOOKS:**

1. **Finite Element Analysis – Theory and Programming-** Krishnamoorthy – Tata McGraw Hill Co. Ltd., New Delhi.
2. **Finite Element Analysis for Engineering and Technology-** Chadrupatla, Tirupathi R., University Press, India
3. **Introduction to the Finite Element Method-** J.F. Abel and Desai. C.S. - Affiliated East West Press Pvt. Ltd., New Delhi.
4. **Finite Element Methods** - Debatis Deb - Prentice hall of India.
5. **Finite element analysis in engineering design-** Rajasekharan. S. - Wheeler Pulishers.
6. **A First Course on Finite Element Method** – Daryl L Logan, Cengage Learning
7. **The Finite Element Method-** Zienkeiwicz. O.C. - Tata McGraw Hill Co. Ltd., New Delhi.
8. **Finite Element Analysis-** S.S. Bhavikatti, - New Age International Publishers, New Delhi.

## REINFORCED EARTH STRUCTURES

Subject Code : **10CV842**

IA Marks : 25

No. of Lecture Hours/Week : 04 Exam Hours : 03

Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

#### UNIT- 1

**BASICS OF REINFORCED EARTH CONSTRUCTION:** Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

**06 Hours**

#### UNIT- 2

##### GEOSYNTHETICS AND THEIR FUNCTIONS

Historical developments, Recent developments, manufacturing process-woven & non-woven, Raw materials – polypropylene (polyolefin), Polyethylene (Polyolefin), Polyester, Polyvinyl chloride, Elastomers, Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics – Geotextiles, Geogrids, Geomembranes, Geocomposites, Geonets, Geofoam, Geomats, Geomeshes, Geowebbs etc.

**06 Hours**

#### UNIT- 3

##### PROPERTIES AND TESTS ON MATERIALS

Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties

**07 Hours**

#### UNIT - 4

##### DESIGN OF REINFORCED EARTH RETAINING WALLS

Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, typical design problems

**07 Hours**

## **PART-B**

### **UNIT- 5**

#### **DESIGN OF REINFORCED EARTH FOUNDATIONS AND EMBANKMENTS**

**Foundations** - Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

**Embankments** - Concept of Reinforced Embankments, Internal and external stability, Selection of materials, typical design problems

**07 Hours**

### **UNIT - 6**

#### **SOIL NAILING TECHNIQUES**

Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.

**06 Hours**

### **UNIT- 7**

#### **GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS:**

Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability.

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps

**07 Hours**

### **UNIT- 8**

#### **GEOSYNTHETICS FOR ROADS AND SLOPES**

Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements

Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique.

**06 Hours**



**TEXT BOOKS:**

1. **Design with geosynthetics-** Koerner. R.M. - Prince Hall Publication, 2005.
2. **Construction and Geotechnical Engineering using synthetic fabrics-** Koerner. R.M. & Wesh, J.P.- Wiley Inter Science, New York, 1980.
3. **An introduction to Soil Reinforcement and Geosynthetics –** Sivakumar Babu G. L., Universities Press, Hyderabad, 2006
4. **Reinforced Soil and its Engineering Applications, Swami Saran,** I. K. International Pvt. Ltd, New Delhi, 2006
5. **Engineering with Geosynthetics-** Venkattappa Rao, G., & Suryanarayana Raju., G. V.S. - Tata Mc Graw Hill publishing Company Limited., New Delhi.

**REFERENCE BOOKS:**

1. **Earth reinforcement and Soil structure-** Jones CJEPButterworths, London, 1996.
2. **Geotextile Hand Book-** Ingold, T.S. & Millar, K.S. - Thomas, Telford, London.
3. **Earth Reinforcement Practices -** Hidetoshi Octial, Shigenori Hayshi & Jen Otani -Vol. I, A.A. Balkema, Rotterdam, 1992.
4. **Ground Engineer's reference Book-** Bell F.G. - Butterworths, London, 1987.
5. **Reinforced Earth-** Ingold, T.S. - Thomas, Telford, London.
6. **Geosynthetics in Civil Engineering,** Editor Sarsby R W, Woodhead Publishing Ltd & CRC Press, 2007

**URBAN TRANSPORT PLANNING**

Subject Code	: 10CV843	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Scope of Urban transport planning – Inter dependency of land use and traffic – System Approach to urban planning.

**6 Hours**

**UNIT - 2**

**STAGES IN URBAN TRANSPORT PLANNING:** Trip generation – Trip production - Trip distribution – Modal split – Trip assignment.

**6 Hours**

**UNIT - 3**

**URBAN TRANSPORT SURVEY** - Definition of study area-Zoning-Types of Surveys – Inventory of transportation facilities – Expansion of data from sample.

**8 Hours**

**UNIT - 4**

**TRIP GENERATION:** Trip purpose – Factors governing trip generation and attraction – Category analysis – Problems on above

**5 Hours**

**PART - B**

**UNIT - 5**

**TRIP DISTRIBUTION:** Methods – Growth factors methods – Synthetic methods – Fractor and Furness method and problems on the above.

**5 Hours**

**UNIT - 6**

**MODAL SPLIT:** Factors affecting – characteristics of split – Model split in urban transport planning – problems on above

**6 Hours**

**UNIT - 7**

**TRIP ASSIGNMENT:** Assignment Techniques – Traffic fore casting – Land use transport models – Lowry Model – Garin Lowry model – Applications in India – (No problems on the above)

**8 Hours**

**UNIT - 8**

**URBAN TRANSPORT PLANNING FOR SMALL AND MEDIUM CITIES:** Introduction – Difficulties in transport planning – Recent Case Studies

**8 Hours**

**TEXT BOOKS:**

1. **Traffic Engineering and Transport Planning-** L.R. Kadiyali - Khanna Publishers.
2. **Principles of urban transport system planning** - B.G. Hutchinson - Scripta Book Co., Washington D.C. & McGraw Hill Book Co.
3. **Introduction to transportation engineering-** Jotin Kristey and Kentlal - PHI, New Delhi.

**REFERENCE BOOKS:**

1. **Urban Transport planning-** Black John - Croom Helm ltd, London.
2. **Urban and Regional models in geography and planning-** Hutchison B G - John Wiley and sons London.
3. **Entropy in urban and regional modeling-** Wilson A G - Pion ltd, London.

### **GEOGRAPHIC INFORMATION SYSTEM**

Subject Code	: 10CV844	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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#### **PART - A**

##### **UNIT - 1**

Geographic Information system concepts and spatial models. Introduction, Spatial information, temporal information, conceptual models of spatial information, representation of geographic information. GIS Functionality – Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction.

**7 Hours**

##### **UNIT - 2**

Computer Fundamentals of GIS and Data storage, Fundamentals of computers vector/raster storage character files and binary files, file organization, linked lists, chains, trees. Coordinate systems and map projection : Rectangular polar and spherical coordinates, types of map projections, choosing a map projection.

**8 Hours**

##### **UNIT - 3**

**GIS DATA MODELS AND STRUCTURES** – Cartographic map model, Geo-relation model, vector/raster methods, non-spatial data base structure viz., hierarchal network, relational structures.

**5 Hours**

##### **UNIT - 4**

**DIGITIZING EDITING AND STRUCTURING MAP DATA** – Entering the spatial data (digitizing), the non-spatial, associated attributes, linking spatial and non-spatial data, use of digitizers and scanners of different types.

**5 Hours**

#### **PART - B**

##### **UNIT - 5**

**DATA QUALITY AND SOURCES OF ERROR** – Sources of errors in GIS data, obvious sources, natural variations and the processing errors and

accuracy. Principles of Spatial data access and search, regular and object oriented decomposition, introduction to spatial data analysis, and overlay analysis, raster analysis, network analysis in GIS.

**10 Hours**

**UNIT - 6**

GIS and remote sensing data integration techniques in spatial decision support system land suitability and multicriteria evaluation, role based systems, network analysis, special interaction modeling, Virtual GIS.

**6 Hours**

**UNIT - 7**

Data base positioning systems, desirable characteristics of data base management systems, components of a data base management system, understanding the data conceptual modeling.

**6 Hours**

**UNIT - 8**

Global positioning system, hyper spectral remote sensing, DIP techniques, hardware and software requirements for GIS, overview of GIS software.

**5 Hours**

**TEXT BOOKS:**

1. **Principles of GIS** - Peter A Burrough Reachael A Mc. Donnel - (Oxford).
2. **The GIS Book** - George B. Korte, P.E. - 5<sup>th</sup> Edn., Thomson Learning.
3. **Remote sensing and image interpretation** - Lillesand - (John Wiley and Sons).
4. **Geographical Information system:** Bernhard Sen-Wiley publications.
5. **GIS and Computer cartography** - Christopher Jones - (Longman).

**REFERENCE BOOKS:**

1. **Fundamentals of Remote Sensing** – George Joseph, Universities Press, Hyderabad.
2. **Introduction to GIS – Kang tsuang Chang** – Tata McGraw Hill, New Delhi 2009.
3. **Geographical Information Science** – Narayan Panigrahi, Universities Press, New Delhi 2010.
4. **Geographical Information system & Environmental Modeling:** Keith C. Clarke, Bradley O Parks, Michel P. Crane, PHI Learning, New Delhi 2009 Edition.
5. **Concepts and Techniques of Geographic Information Systems** – C.P.Lo. Albert K.W. Yeung, PHI Learning, New Delhi – 2009 2<sup>nd</sup> Edition.

## ADVANCED DESIGN OF STEEL STRUCTURES

Subject Code	:10CV845	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION:** Basic principles of design, stress strain relationship for mild steel, shape factors for different cross sections. Evaluation of full plastic moment for mild steel beams, plastic hinges - Fixed, simply supported beams, effect of partial fixity, rectangular portal frames and gable frames.

**5 Hours**

#### UNIT - 2

Statement of theorems with examples, application of principles of virtual work, partial and over collapse. Trial error method. Method of combined mechanisms, plastic moment distribution method and other methods of determining plastic collapse load. Estimation of deflection, factors affecting fully plastic moment.

**7 Hours**

#### UNIT - 3

Minimum weight theories. Application of theorems and methods of solution. Plastic analysis applied to the design of fixed and continuous beams, portal and gable frames.

**8 Hours**

#### UNIT - 4

Design of Built-up beams. Design of encased beams.

**6 Hours**

### PART - B

#### UNIT - 5

Design of open web structures - Advantages and design methods

**7 Hours**

#### UNIT - 6

Small moment resistant connections, large moment resistant connections, semi-rigid and behavior of semi-rigid connections, Beam line method, modified slope deflection method, modified moment distribution method.

**8 Hours**

**UNIT - 7**

Principal axes of section, maximum stress due to unsymmetrical bending, the Z-polygon, deflection of beams under unsymmetrical bending, design of purlins subjected to unsymmetrical bending.

**5 Hours**

**UNIT - 8**

Tubular structures – Introduction, permissible stresses, tubular columns and compression members, tubular tension members. Design of tubular members roof truss for given member forces and their combination, joints in tubular trusses, design of tubular beams and purlins.

**6 Hours**

**TEXT/REFERENCE BOOKS:**

1. **Plastic Analysis**- B.G. Neal.
2. **Introduction to Plastic Analysis of Steel Structures**- J.F. Banker and Heyman
3. **Plastic Analysis of steel structures**.- Beedle
4. **Design of steel structures** – William T.Segui, Cengage Learning, India-2007.
5. **Steel Structures Vol - 1 and 2**- J.F. Baker
6. **Design of Steel Structures**- Ramachandra.
7. **Design of Steel Structures**.- Arya and Ajmani
8. CMERI Design Hand Book for Open Web Structures, Durgapur.
9. SP-6 (6) , IS : 800-2007,Steel Table

**WATER RESOURCES ENGINEERING**

Subject Code	: <b>10CV 846</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**UNIT:1 INTRODUCTION**

Introduction, The world's fresh water resources, water use in the world, water management sectors, the water management community, the future of water resources. 06 hrs.

**UNIT:2 HYDROLOGIC PROCESS**

Introduction to hydrology, hydrologic cycle, atmospheric and ocean circulation.

Precipitation: formation and types, rainfall variability, disposal of rainfall on a watershed, design storms. 06 hrs.

**UNIT:3 SURFACE RUNOFF**

Drainage basins, hydrologic losses and rainfall excess, rainfall-runoff analysis using unit hydrograph approach, SCS rainfall-runoff relation.  
07 hrs.

#### UNIT:4 WATER WITHDRAWALS AND USES

Water use data: classification of uses, water for energy. Water for agriculture: irrigation trends and needs, irrigation infrastructures, irrigation system selection and performance, water requirement for irrigation, impacts of irrigation Drought management: options, severity, economic aspects of water storage.

Analysis of surface water supply: surface water reservoir systems, storage-firm yield analysis for water supply reservoir simulation.

08 hrs.

#### UNIT:5 FLOOD CONTROL

Introduction, flood plain management, flood plain definition, hydrologic and hydraulic analysis of floods, storm water management.

Flood control alternatives: structural and non-structural measures.

Flood damage and net benefit estimation: damage relationships, expected damages, risk based analysis.

Operation of reservoir systems for flood control.

08 hrs.

#### UNIT:6 STORM WATER CONTROL:

Storm water management, storm system: information needs and design criteria. Rational method design. Hydraulic analysis of design, storm sewer appurtenances.

Storm detention: effects of urbanisation, types of surface detention, subsurface disposal of storm water. 07 hrs.

#### UNIT:7 STORM WATER CONTROL STREET AND HIGHWAY DRAINAGE AND CULVERTS:

Drainage of street and highway pavements: design considerations, flow in gutters, pavement drainage inlets, inlet locations, median, embankment and bridge culvert design.

Hydraulic design of culverts: culvert hydraulics, culver design.

08 hrs.

#### UNIT:8 DESIGN OF SPILLWAYS FOR FLOOD CONTROL, STORAGE AND CONVEYANCE SYSTEM:

Hydrologic considerations, Dams: types, hazard classification, spillway capacity, criteria, safety of existing dams.

Spillways: functions, overflow and free overfall spillways, ogee spillways, baffled chute spillways, culvert spillways.

Gates and valves: spillway crest gates, gates for outlet works, valves for outlet works. 08 hrs.

Text Books:

1. Water resources engineering: Ralph A Wurbs, Wesley P. James, PHI Learning pvt. Ltd. New Delhi (2009 Ed.).
2. water resources engineering: Chin D.A., Prentice Hall (2009 Ed.).

3. water resources engineering: Larry W. Mays, John Wiley & sons (2005).

Reference Books:

1. Water resources engineering : Sathya Narayana Murthy Challa, New Age International Publishers, New Delhi, (2002 Ed.).
2. Water resources engineering, lecture notes, IIT Kharagpur.
3. Elements of water resources engineering, Duggal K.N., Soni J.P., New age international publishers, New Delhi.
4. Water resources engineering, David Chin, Pearson Educaion, NJ, (2006 Ed.).

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**ENVIRONMENTAL IMPACT ASSESSMENT**

Subject Code	: <b>10CV847</b>	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**PART - A**

**UNIT - 1**

Development Activity and Ecological Factors EIA, Rapid and Comprehensive EIA, EIS, FONSI. Need for EIA Studies, Baseline Information,

**6 Hours**

**UNIT - 2**

Step-by-step procedures for conducting EIA, Limitations of EIA.

**6 Hours**

**UNIT - 3**

Frame work of Impact Assessment. Development Projects-Environmental Setting, Objectives and Scope, Contents of EIA, Methodologies, Techniques of EIA.

**8 Hours**

**UNIT - 4**

Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

**6 Hours**

**PART - B**



**UNIT - 5**

EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

**6 Hours**

**UNIT - 6**

Public Participation in Environmental Decision making. Practical Considerations in preparing Environmental Impact Assessment and Statements.

**6 Hours**

**UNIT - 7**

Salient Features of the Project Activity-Environmental Parameter Activity Relationships- Matrices.

**4 Hours**

**UNIT - 8**

EIA for Water resource developmental projects, Highway projects: Nuclear-Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

**10 Hours**

**REFERENCES**

1. **Environmental Impact Analysis**-Jain R.K.-Van Nostrand Reinhold Co.
2. **Environment Impact Assessment.**- Anjaneyalu. Y.
3. Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
4. **Environment Impact Assessment** - Larry W. Canter - McGraw Hill Publication.