DEPARTMENT
OF
CIVIL ENGINEERING

Code No.	Subject Name	Credit
CE101	Basic Civil Engineering	3:0:0
CE201	Mechanics of Deformable bodies-I	3:1:0
CE202	Mechanics of Deformable bodies-II	3:1:0
CE203	Mechanics of Solids	3:1:0
CE204	Engineering Mechanics	3:1:0
CE205	Strength of Materials Laboratory	0:0:2
CE206	Fluid Mechanics and Machinery Lab	0:0:2
CE207	Surveying-I	3:1:0
CE208	Surveying-II	3:1:0
CE209	Surveying Practical-I	0:0:2
CE210	Surveying Practical-II	0:0:2
CE211	Mechanics of Fluids	3:1:0
CE212	Fluid Mechanics and Machinery	3:1:0
CE213	Applied Hydraulics & Fluid Machines	3:1:0
CE214	Fluid Mechanics and Machinery Laboratory	0:0:2
CE215	Fluid Machinery Laboratory	0:0:1
CE216	Fluid Mechanics Laboratory	0:0:1
CE217	Mechanics of Soils	3:1:0
CE218	Foundation Engineering	3:1:0
CE219	Soil Mechanics Laboratory	0:0:2
CE220	Reinforced Concrete Structures-I	3:!:0
CE221	Reinforced Concrete Structures-II	3:1:0
CE222	Design and Drawing (R.C.C & Steel)	3:1:0
CE223	Design of Steel Structures	3:1:0
CE224	Water Supply Engineering	4:0:0
CE225	Sanitary Engineering	4:0:0
CE226	Environmental Engineering Laboratory	0:0:2
CE227	Structural Analysis-I	3:1:0
CE228	Structural Analysis-II	3:1:0
CE229	Concrete and Highways Laboratory	0:0:2
CE230	Design and Drawing (Irrigation and Environmental Engineering)	3:1:0
CE231	Civil Engineering Drawing	0:0:2
CE232	Estimating, costing and Specifications	0:0:2
CE233	Computer Application Laboratory-I	0:0:2
CE234	Computer Application Laboratory-II	0:0:2
CE235	Basic Structural Design	3:1:0
CE236	Engineering Geology and Civil Engineering Materials	4:0:0
CE237	Elements of Town Planning and Architecture	4:0:0
CE238	Irrigation Engineering	4:0:0
CE239	Strength of Materials Laboratory	0:0:1

Code No.	Subject Name	Credit
CE301	Matrix Computer Methods of Structural Analysis	3:1:0
CE302	Applied Elasticity and Plasticity	3:1:0
CE303	Structural Dynamics	3:1:0
CE304	Finite Element Methods in Engineering	3:1:0
CE305	Advanced Design of Reinforced Concrete Structures	3:1:0
CE306	Analysis and Design of Plate and Shell Structures	3:1:0
CE307	Advanced Design of Steel Structures	3:1:0
CE308	Advanced Computer Application Laboratory	0:0:2
CE309	Design of Foundation Structures	3:1:0
CE310	Stability of Structures	3:1:0
CE311	Advanced Bridge Engineering	3:1:0
CE312	Maintenance and Rehabilitation of Structures	3:1:0
CE313	Seismic Analysis and Design of Structures	3:1:0
CE314	Advanced Concrete Technology	4:0:0
CE315	Advanced Concrete Technology Laboratory	0:0:2
CE316	Prestressed Concrete Structures	3:1:0
CE317	Advanced Construction Techniques and Project Management	4:0:0
CE318	Theory of Plates	4:0:0
CE319	Mechanics of Composite Materials	4:0:0
CE320	Discrete Structural Optimization	4:0:0
CE321	Design of Structures for Dynamic Loads	4:0:0
CE322	Digital Image Processing	4:0:0
CE323	Geographic Information System for Resource Management	4:0:0
CE324	Traffic Flow Theory and Network Analysis	4:0:0
CE325	Remote Sensing Application to Environmental Studies	4:0:0
CE326	Remote Sensing Application to Hydrology and Water Resources	4:0:0
CE327	Optimization	4:0:0

CE101 BASIC CIVIL ENGINEERING

Credit : 3:0:0
Marks : 40 + 60

Unit I

Introduction : Engineering – Civil Engineering – History and development of Civil Engineering – Scope of Civil Engineering – Functions of Civil Engineers.

Construction Materials : Characteristics of good building materials such as stones, bricks, A.C. sheets, G.I. sheets and Ceramic tiles, timber, cement, aggregates and concrete.

Surveying : Definition and purpose – classification – Basic principles – Measurement of length by chains and tapes – Calculation of area of a plot – Measurement of bearings and angles using a prismatic compass – Levelling – Contours and their applications – Use of transit theodolite.

Unit II

General concepts relating to Buildings: Selection of site – Basic functions of buildings – Major components of buildings.

Foundations: Purpose of a foundation – Bearing capacity of soils – types of foundations.

Proper methods of construction of : Brick masonry – Stone masonry – hollow Block masonry. Beams – Lintels – Columns – Flooring – Damp proof course – surface finishes – Doors and windows – Roofing.

Valuation of buildings : Definition – Purpose of valuation – Factors which govern value of a building – Valuation of a building by plinth area method – Valuation of old buildings.

Unit III

Water supply Engineering : Sources of water supply – Quantity of water requirements – Purification of water involving sedimentation, filtration and disinfection.

Sanitary Engineering : Definition of terms – Collection and disposal of solid wastes – Sewage systems – Septic tanks – Oxidation ponds.

Unit IV

Transportation Engineering : Importance of roads – Classification of Highways – Cross sections of water bound macadam, bituminous and cement concrete roads – Traffic signs and signals.

Railways : Importance of railways – Gauges – Components of a permanent way.

Bridges : Components of Culverts – Causeways, Slab Bridge, T-beam and slab bridge, Suspension bridge.

Unit V

Functions and general layout of an airport

Functions and general layout of a harbour

Dams : Purpose of Dams – Types of dams – Earth, masonry and concrete, arch and buttress dams – Selection of site for a dam.

Irrigation Engineering : Definition of irrigation – Types of irrigation – Canal irrigation system.

Text Book

1. Johnson Victor D. and Esther Malini, 'Basic Civil Engineering', Allied Publishers Limited, Madras

Reference Books

1. Arunachalam N., 'Basic Civil Engineering', Pratheeba Publishers, Coimbatore, 2000
2. Ramesh Babu V., 'Basic Civil Engineering', Anuradha Agencies, Kumbakonam, 2001

CE201 MECHANICS OF DEFORMABLE BODIES - I

Credit 3:1:0
Marks 40+60

Unit I : Stress, Strain And Deformation In Solids

Tension, compression and shear stresses – Hooke's law – stress – strain diagram for mild steel – ultimate stress and working stress – Elastic constants and relationships between them –

composite bars – Temperature stresses – Strain energy due to axial load – stress due to suddenly applied load and impact load.

Unit II : Two Dimensional State Of Stress

Two dimensional state of stress at a point – Normal and shear stresses on any plane – principal planes and principal stresses – Graphical treatment – two dimensional state of strains at a point - principal strains and their directions – stresses and deformations in thin cylinders and spherical shells due to internal pressure.

Unit III : Beams And Bending

Types of beams – Types of supports – shear force and bending moment at any cross section of a beam. Sketching of shear force and bending moment diagrams for cantilever, simply supported and over hanging beams for any type of loading – Relationship between rate of loading, shear force and bending moment.

Unit : IV Stresses In Beams

Theory of Simple Bending – Analysis for bending Stresses – Load Carrying Capacity of Beams – proportioning sections – Flitched Beams – Leaf Springs – Strain Energy Due to Bending Moment – Shear Stress distribution – Strain Energy due to Transverse shear force.

Unit V : Stresses Due To Torsion

Elastic Theory of Torsion – Stresses and Deformation in Solid Circular and Hollow Shafts – Stepped Shafts – Composite Shaft – Stress due to combined bending and Torsion – Strain Energy due to Torsion.

Deformations and Stresses in Helical Springs – Design of Buffer springs

Text Books

1. Kazimi, S.M.A., Solid Mechanics, Tata McGraw –Hill Book co Ltd., 1998.
2. Punmia, B.C., etal. - “Strength of Materials”, Laxmi Publications, 1992.

Reference Book

1. Popov, E.P, Engineering Mechanics of solids, Prentice Hall of India, New Delhi, 1996.

CE202 MECHANICS OF DEFORMABLE BODIES – II

Credit 3:1:0
Marks 40+60

Unit I : Deflection Of Determinate Beams

Governing differential equation – Macaulay’s method – Moment area method – conjugate beam method – Newmark’s method.

Curved Beams: Curved beams – stresses due to bending by Winkler Bach theory – rectangular, trapezoidal, circular solid sections – crane hook problem.

Unit II : Columns And Struts
Columns – Behaviour of axially loaded short, medium and long column members – Buckling load - Euler's theory – Different end conditions – Empirical formulae – Rankine's formula – Straight line formula – Secant formula for columns subjected to eccentric loading.

Unit III : Thick Cylinders
Thick cylinders – Lame's equation – Hoop stress and radial stress distribution – compound cylinders – shrink fit.

Theories Of Elastic Failure : Maximum principal stress theory – Maximum shear stress theory – Maximum principal strain theory – Strain energy theory - Mohr's theory – simple problems.

Unit IV : Torsion Of Non-Circular Sections
Torsional Stresses in Solid rectangular members (no derivation)
Analysis of hollow thin-walled members – Open – closed and multiple connected cross – sections based on shear flow (without warping).

Shear Centre For Thin Walled Beam Of Open Section
Approximations employed for shear in thin walled beam sections – shear flow in thin walled beam cross – sections – shear centre of mono- symmetric open sections.

Unit V : Unsymmetrical Bending Of Straight Beams
Moment of Inertia – Product of Inertia – Principal Axes – Principal Moments of Inertia of Symmetrical and Unsymmetrical sections - Symmtrical and unsymmetrical bending – bending stresses in beams subjected to unsymmetrical bending – change in direction of neutral axis and increase in stress compared to symmetrical bending.

Text Books
1. Bedi D.S., "Strength of Materials", S.Chand & Co. Ltd., 1984.
2. Punmia, B.C, etal., "Strength of Materials", Laxmi Publications, 1992.

Reference Books
1. Boresi A.P., Side Bottom O.M., Seeli F.B & Smith J.P., "Advanced Mechanics of Materials", John Wiley & Sons, 1993.
2. Sadhu Singh, Strength of Materials, Khanna Publishers, 1988.

CE203 MECHANICS OF SOLIDS

Credit 3:1:0
Marks 40+60

Unit I : Simple stress and strain
Stresses and strain due to axial force. Hooke's law, factor of safety, stepped bars - uniformly varying sections - stresses in composite bars due to axial force and temperature - strain energy due to axial force, stresses due to sudden loads and impact. Lateral strain: Poisson's ratio - change in volume – shear stress - shear strain - relationship between elastic constants - Hoop and

longitudinal stress in thin cylindrical and spherical shells subjected to internal pressure - changes in dimensions and volume.

Unit II : Shear Force And Bending Moment

Relationship between loading - shear force and bending moment - shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to concentrated loads and uniformly distributed loads only - maximum bending moment and point of contraflexure.

Unit III : Bending Stresses

Theory of simple bending and assumptions - derivation of the equation $M/I = E/R = f/y$ - section modulus - calculation of normal stresses due to flexure application. Torsion: Theory of torsion and assumptions - derivation of the equation $T/J = C/L = q/r$, polar modulus, power transmitted by a shaft, stresses in solid and hollow circular shafts - close coiled helical spring with axial load.

Unit IV : Principal Stresses (Two Dimensional)

State of stress at a point, normal and tangential stresses on inclined planes - principal stresses and their planes - plane of maximum shear - Mohr's circle of stresses.

Unit V : Deflection Of Beams

Differential equation of elastic line - deflection in statically determinate beams - Macaulay's method for prismatic members - area moment method for stepped beams with concentrated loads. Long columns: Buckling of long columns due to axial load - Euler's and Rankine's formulae for columns of different end conditions.

Text Book

1. Ramamrutham, S., Strength of Materials, Dhanpat Rai & sons, 1991

Reference Books

1. Popov, E.P., Mechanics of Materials, Prentice Hall Inc., 1976
2. Andrew, P. and Singer, F.L., Strength of Materials, Harper and Row Publishers, New York, 1987.

CE204 ENGINEERING MECHANICS

Credit 3:1:0
Marks 40+60

Unit I : Introduction

Force and force systems – parallelogram law of forces – resultant of a system of coplanar forces acting on a particle – equilibrium of a particle under coplanar forces – resultant of a system of spaces force acting on a particle – equilibrium of a particle under space forces – free body diagram.

Unit : II

Definition of a rigid body – moment of a force about an axis – moment of a force couple – properties of force couples – resolution of a given force into a force acting at a given point and a couple – reduction of a system of coplanar forces acting on a rigid body into a single force and a single couple – equilibrium of a rigid body under coplanar forces – types of supports – reactions at supports of beams and frames – problems involving equilibrium of rigid bodies – stable, unstable and neutral equilibrium Friction – angle of friction and coefficient of friction – laws of dry friction – friction in wedges, ladders, screws and belts.

Unit :III

Analysis of cables – analysis of roof trusses by method of joints and method of sections properties of plane sections – areas, centroid, first moment of area, moment of inertia, polar moment of inertia and radius of gyration – parallel axis theorem and its application – mass centre of bodies – mass moment of inertia of thin circular and rectangular plates – mass moment of inertia of solid rectangular prisms, cylinders and cones.

Unit : IV

Kinematics of particles – rectilinear motion of a particle – uniformly accelerated rectilinear motion – curvilinear motion of particles – rectangular components – motion of projectiles – curvilinear motion in terms of normal and tangential components – relative motion.

Unit : V

Kinetics of particles – equation of motion for a particle in rectilinear motion – equations of motion for a particle in curvilinear motion in terms of x and y components and in terms of normal and tangential components – kinetic energy and potential energy – principle of work and energy – conservation of mechanical energy – principle of impulse and momentum – impact direct central impact – oblique central impact.

Text Book

1. Beer, F.P and Johnston, E.R, “Vector Mechanics for Engineers, Statics and Dynamics”, McGraw hill International Book co.

Reference Books

1. Meriam, J.L. and Kraige, L.S., “Engineering Mechanics (Statics and Dynamics)”, John Wiley & sons.
2. Meriam.,J.L. and Kraige, L.S., Irving H.shames, “ Engineering Mechanics (Statics and Dynamics)”, Prentice Hall of India Pvt. Ltd.
3. Rajasekaran, S and Sankarasubramanian, G., “Engineering Mechanics”, Vikas Publishing House Pvt. Ltd, 1999
4. Kottiswaran, “Engineering Mechanics”, Balaji Publication.

CE205 STRENGTH OF MATERIALS LABORATORY

Credit 0:0:2
Marks 50+50

1. Tension test on mild steel
2. Double shear test on mild steel
3. Torsion test on a rod
4. Torsion test on thin wire
5. Brinell, Rockwell and Vicker's Hardness tests
6. Charpy and Izod Impact tests
7. Cold bend test
8. Ductility test
9. Tension, compression (Parallel as well as perpendicular to the grains) and impact tests on timber specimens
10. Test on springs (Both closed coil and open coiled springs)
11. Deflection tests on timber and steel beams.
12. Studies on Fatigue test

(Note: All the above tests shall be carried out based on all the relevant I.S Codes.)

Reference Book

1. The Testing of Engineering Materials – H.E. Daris, G.E. Troxell, G.F.W. Hauck – 4th Edition, International Student Edition. Mc Graw Hill International Book Company.

Reference Book

1. The Testing of Engineering Materials – H.E. Daris, G.E. Troxell, G.F.W. Hauck – 4th Edition, International Student Edition. Mc Graw Hill International Book Company.

CE 206 FLUID MECHANICS AND MACHINERY LABORATORY

Credit: 0:0:2 **Marks : 50+50**

Fluid Mechanics

1. Determination of Darcy's Friction Factor.
2. Calibration of Flow Meters.
3. Flow over weirs / Notches.
4. Flow Through Mouth piece / orifice.
5. Determination of Minor Losses in pipes
6. Determination of Manning's Co-efficient of Roughness.
7. Calibration of pressure Gauges.
8. Impact of jet on vanes.
9. Reynolds' Experiment.

Fluid Machinery

1. Performance of Centrifugal Pump.
2. Performance of Submersible Pump.

3. Performance of Reciprocating pump.
4. Performance of Gear Oil pump
5. Performance of Jet pump
6. Performance of Vertical Turbine pump.
7. Load Test on Pelton Wheel.
8. Load Test on Francis Turbine
9. Load Test on Kaplan Turbine

Examination should be conducted to cover both Fluid Mechanics and Fluid Machinery experiments.

Details
Procedure for the following experiments required

Fluid Mechanics
1. Verification of Momentum Principle
2. Determination of Manning's Co-efficient of Roughness
3. Calibration of pressure Gauges.

Text Books

1. Modi, P.N. & Seth, S.M., "A Text book of Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi, 10th Edition, 1991.
2. Rajput, R.K.," A Text book of Fluid Mechanics and Hydraulic Machines" , S.Chand and Co., New Delhi,1998.

Reference Books

1. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 1998.

CE 207 SURVEYING – I

Credit 3:1:0
Marks 40+60

Unit I : Introduction And Chain Surveying
Definition, principle and classification of surveying – field and office works – conventional signs – equipments used in chain survey – ranging and chaining – reciprocal ranging – setting perpendiculars – offsets – well conditioned triangles – errors and obstacles – cross staff and optical square – traversing – plotting.

Unit II : Compass Surveying
Prismatic compass – surveyor's compass – bearings – systems and conversions – local attraction – magnetic declination – dip – traversing – plotting - adjustment of error by graphical method – Bowditch's rule.

Plane Table Surveying: Plane table instruments and accessories – advantages and disadvantages – different methods – radiation – intersection – traversing – resection – two point and three point problems – errors and adjustments in plane tabling.

Unit III : Levelling
Type of levels and staves – sensitivity of bubble – bench marks – temporary and permanent adjustments – fly, check, profile and block levelling – booking - reduction – arithmetic checks – longitudinal and cross sectioning – plotting – curvature and refraction correction – reciprocal levelling – difficulties and errors in levelling – Precise levelling.

Unit IV : Theodolite Surveying
Description and uses of vernier, micrometer and microptic theodolites – temporary and permanent adjustments of vernier transit – measurement of horizontal and vertical angles – height and distances – traversing – closing error and distribution – Gale's traverse table – omitted measurements.

Unit V : Contouring, Areas And Volumes
Contouring – characteristics and uses of contours – calculation of areas from field notes and plan – graphical and instrumental methods – enlarging and reducing the size of figures – volume of earth work – capacity of reservoirs.

Text Books

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and levelling parts 1 and 2, pune Vidyarthi Griha Prakashan, 1968.
2. Punmia, B.C., Surveying and levelling Vol.I and II, Standard Publishers, 1968.

CE208 SURVEYING – II

Credit 3:1:0
Marks 40+60

Unit I : Tacheometric Surveying
Principle of stadia method – Distance and elevation formulae for staff held vertical – Instrumental constants – Analytic lens – Tangential method – use of substense bar – tacheometric contouring Electromagnetic distance Measurement – Principles.

Unit II : Curves & Mine Survey
Elements of simple curves – setting out simple curves by chain and tape methods – Rankine's method of tangential angles – Two theodolite method – obstacle in setting out curves – Elements of Transition curves and Vertical curves and Methods of Setting out - Equipments for Mine Survey – Station and Station marker – Tunnel Alignment and setting out work.

Unit III : Triangulation
Triangulation figures – classification of triangulation systems – selection of triangulation stations – Intervisibility and Height of stations – station marks – signals and towers – Measurement of

angles – reduction to centre – Field work and correction to baseline measurements – Extension of base – trignometric levelling – single and reciprocal observations.

Introduction To Geo Information System

Unit IV : Theory Of Errors And Triangulation Adjustments

Kinds of errors – Laws of weights – principle of least squares – Determination of most probable value of quantities – probable error – distribution of error to the field measurements – Normal equation – Method of correlates – Adjustment of simple triangulation figures.

Unit V : Hydrographic Surveying

Equipments – Methods of locating soundings – Reduction and plotting of soundings – use of sextants and station pointer.

Fundamentals Of Field Astronomy

Spherical trignometry – Latitude and longitude of a place – Definitions of astronomical terms – coordinate systems to define the position of a heavenly body – Determination of the azimuth of a line by extra meridian observation on the sun.

Text Books

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and Levelling, Vol.II, Pune Vidyarthi Griha Prakashan, Pune, 1968.
2. Punmia, B.C., Surveying Vol.III, Standard Publishers, 1994.

CE 209 SURVEYING PRACTICAL – I

Credit 0:0:2
Marks 50+50

1. Measuring the distance between two stations using a chain
2. Overcoming obstacles in chaining and ranging
3. Observations and plotting the salient features in an area by chain survey.
4. Measurement of bearing of survey lines by prismatic compass.
5. Running a closed compass traverse – plotting and adjustments.
6. Plotting the salient features in an area by plane table survey.
7. Two point problem
8. Three point problem
9. Fly levelling
10. Measurement of horizontal angles using a theodolite by the method of repetition
11. Measurement of horizontal angle using a theodolite by the method of reiteration.
12. Solution to problems on heights and distances by observations using a theodolite.
13. Traversing using a theodolite-distribution of errors using Gale's Traverse Table.

Text Books

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and Levelling Part 1 and 2, Pune Vidyarthi Griha Prakashan.
2. Punmia, B.C., Surveying and Levelling Vol.I and II, Standard Publishers, 1968.

CE210 SURVEYING PRACTICAL – II

Credit 0:0:2
Marks 50+50

1. Study of electronic theodolites, electronic distance meter and total station.
2. Stadia Tacheometry
3. Determination of the constants of a transit theodolite
4. Tangential tacheometry
5. Subtense bar method
6. Tacheometric contouring (Radial)
7. Setting out a simple circular curve by ordinates from long chord
8. Setting out a circular curve by Rankine's method of tangential angles.
9. Setting out a circular curve by Double Theodolite method
10. Setting out transition curves.
11. Determination of the azimuth of a survey line by observations on the sun
12. Setting out works – Foundation marking.

Text Books

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and Levelling Part 1 and 2, Pune Vidyarthi Griha Prakashan.
2. Punmia, B.C., Surveying and Levelling Vol II, Standard Publishers.
3. Punmia, B.C., Surveying Vol. III, Standard Publishers.

CE 211 MECHANICS OF FLUIDS

Credit 3:1:0
Marks 40+60

Unit I : Fluid Properties
Dimensions and units – continuum – Density – Specific weight - Specific gravity – Viscosity – surface tension – Capillarity – compressibility – Vapour pressure.
Fluid Statics:
Pressure relation – Pascal's law – Atmospheric, Absolute, Gauge and Vacuum pressures - Measurements of pressure – Forces on plane and curved surfaces – Total pressure and centre of pressure – Buoyancy and floatation.

Unit II : Equations Of Fluid Flow
Types of flow – Stream line – Stream tube – Control volume – Continuity equation – one dimensional and three dimensional flow – velocity potential and stream function – Free and forced vortex flow – Energy equation – Euler's equation in one dimensional form – Bernoulli's equation.

Unit III : Flow Measurements
Venturi meter – Orifice meter – pitot tube – Mouthpiece and orifice – Water meter – current meter - Weirs and Notches.

Laminar Flow:
Definition – Reynold's experiment – Reynold's Number – Hagen Poiseuille equation for a circular pipe.

Turbulent Flow:
Definition – Loss of head due to friction – Darcy's equation – Friction factor for Laminar and Turbulent Flow – Moody's diagram – Resistance to flow of fluid in smooth and rough pipes.

Unit IV : Flow Through Pipes
Loss of energy in pipes – Hydraulic Gradient, Energy Gradient - Major energy loss - Minor energy losses – pipes in series and parallel – power transmission through pipes – Syphon – Water hammer (Definition)

Unit V : Dimensional Analysis And Similitude
Dimensional Homogeneity – Rayleigh and Buckingham 'π' methods – Similitude - Significance of Reynold's number, Froude number, Euler number, Mach number and Weber number – Classification of Hydraulic Models - Scale effect – Distorted models.

Text Books
1. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 1998.
2. Modi, P.N., and Seth, S.N., "Hydraulics and Fluid Machines", Standard Book House, New Delhi, 1995.

Reference Books
1. Natarajan, M.K., Principles of Fluid Mechanics, Oxford and IBH publishing Co., New Delhi, 1994.
2. Jain,A.K., Fluid Mechanics, Khanna Publishers, New Delhi, 1996.
3. Som, S.K., and Biswas, G., Fluid Mechanics, Tata McGraw Hill Book Co., 1998.
4. Agarwal, S.K., Fluid Mechanics and Machinery, Tata Mc Graw Hill Co., 1997.
5. Rajput, R.K., Text book of Fluid Mechanics , S.Chand and Co., New Delhi, 1998.

CE212 FLUID MECHANICS AND MACHINERY

Credit 3:1:0
Marks 40+60

Unit I : Fluid Properties
Dimensions and units – continuum – Density – Specific weight - Specific gravity – Viscosity – surface tension – Capillarity – compressibility – Vapour pressure.
Fluid Statics:
Pressure relation – Pascal's law –Measurements of pressure – Forces on plane and curved surfaces – Total pressure and centre of pressure.

Unit II : Equations Of Fluid Flow

Types of flow – Stream line – Stream tube – Control volume – Continuity equation – one dimensional and three dimensional flow – velocity potential and stream function – Free and forced vortex flow – Energy equation – Euler's equation in one dimensional form – Bernoulli's equation.

Unit III : Flow Measurements

Venturi meter – Orifice meter – pitot tube – Weirs and Notches.

Flow Through Pipes:

Loss of energy in pipes – Major energy loss - Minor energy losses – pipes in series and parallel – power transmission through pipes – Syphon – Water hammer (Definition)

Unit : IV

Impulse momentum equation- Impact of Jets-plane and curved- stationary and moving plates.

Pumps: Positive displacement pumps - reciprocating pumps - operating principles -slip - indicator diagram - separation- air vessels. centrifugal pumps - operation - velocity triangles - performance curves-cavitation -multi staging -selection of pumps.

Unit V : Turbines

Impulse momentum equation- moment of momentum equation (theory only) - turbine classification-working principles -pelton wheel, Francis, Kaplan turbines - velocity triangles - similarity laws - specific speed - governing of turbines- surge tanks- Miscellaneous pumps- Jet pump, Gear oil pump-submersible pump –principle.

Text Books

3. Modi, P.N. & Seth, S.M., "A Text book of Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi, 10th Edition, 1991.
4. Rajput, R.K.," A Text book of Fluid Mechanics and Hydraulic Machines" , S.Chand and Co., New Delhi,1998.

Reference Books

1. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 1998.
2. Som,S.R, & Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, 1998.
3. Agarwal, S.K., Fluid Mechanics and Machinery, Tata Mc Graw Hill Co., 1997.

CE213 APPLIED HYDRAULICS AND FLUID MACHINES

Credit 3:1:0

Marks 40+60

Unit – I Uniform Flow In Open Channels

Types of Flow - Uniform flow – Chezy's and Manning's equations – Hydraulically best sections – Uniform flow Computations.

Varied Flow In Open Channels
Specific energy – critical flow – Mild and steep slopes – critical depth – Hydraulic jump – Gradually varied flow – Energy Equations and Solutions – Back water and drawdown curves – Study of flow profiles.

Unit II : Boundary Layer And Flow Around Submerged Bodies
Definition – Displacement, momentum, Energy thickness - Boundary layer equations – Boundary Layer Seperation – Laminar and Turbulent boundary layers – Forces on submerged bodies – Expression for drag and lift-Pressure drag – Friction drag – Stream lined and bluff bodies.

Unit III : Momentum Principle
Impulse momentum equation – Application of Linear momentum principle – Impact of Jet - Force exerted by a jet on normal, Inclined and curved surfaces for stationary and moving cases only.

Unit IV : Water Turbines
Classification – Working principles and Design of Pelton wheel, Francis and Kaplan Turbine – Velocity Triangles - head and efficiency – Draft tube - Theory and types – Similarity laws – specific speed – Operating characteristics – Governing of Turbines – Selection of Turbines – Model Studies.

Unit V : Pumps
Classification – Centrifugal pump – Components and working – Velocity triangles – priming – Head Losses and Efficiencies - Minimum starting speed – performance curves – specific speed – Cavitation – selection of pumps.

Positive Displacement Pump
Reciprocating pump – types – Components and working – slip – Indicator diagram – Air vessel.

Miscellaneous Pumps (Operating Principles Only)
Multistage pumps – submersible pumps –Jet pumps – Airlift pumps- Gear Oil pump - Hydraulic ram.

Text Books

1. Rajput, R.K.A Text Book of Fluid Mechanics, S.Chand and Co., New Delhi, 1998.
2. Modi, P.N. and Seth, S.M., Hydraulic and Fluid Machines, Standard book house, New Delhi, 1995.

Reference Books

1. Natarajan M.K., 'Fluid Machines', Anuradha Agencies, 1987
2. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 1998.

3. Agarwal, S.K., Fluid Mechanics and Machinery, Tata McGRaw- Hill Publishing Co. Ltd.,
4. Som,S.K., and Biswas, G., 'Fluid Mechanics and Fluid Machines', Tata McGraw Hill book co., 1998.

CE214 FLUID MECHANICS AND MACHINERY LABORATORY

Credit 0:0:2
Marks 50+50

Fluid Mechanics

1. Determination of Darcy's Friction Factor.
2. Calibration of Flow Meters.
3. Flow over weirs / Notches.
4. Flow Through Mouth piece / orifice.
5. Determination of Minor Losses in pipes
6. Determination of Manning's Co-efficient of Roughness.
7. Calibration of pressure Gauges.
8. Impact of jet on vanes.
9. Reynolds' Experiment.

Fluid Machinery

1. Performance of Centrifugal Pump.
2. Performance of Submersible Pump.
3. Performance of Reciprocating pump.
4. Performance of Gear Oil pump
5. Performance of Jet pump
6. Performance of Vertical Turbine pump.
7. Load Test on Pelton Wheel.
8. Load Test on Francis Turbine
9. Load Test on Kaplan Turbine

Examination should be conducted to cover both Fluid Mechanics and Fluid Machinery experiments.

Text Books

1. Rajput, R.K., A Text Book of Fluid Mechanics & Fluid Machines, S. Chand & Co., New Delhi, 1998.
2. Modi, P.N and Seth, S.M, Hydraulics & Fluid Machines, Standard Book House, New Delhi, 1995.

CE215 FLUID MACHINERY LABORATORY

Credit 0:0:1
Marks 25+25

1. Performance study of centrifugal pump.
2. Performance study of reciprocating pump.
3. Performance study of gear oil pump.
4. Performance study of jet pump/deep well pump.
5. Performance study of submersible pump.
6. Performance study of Kaplan turbine.
7. Performance study of Pelton turbine.
8. Performance study of Francis turbine.
9. Performance of Turbine Pump.

Text Books

1. Modi P.N. and Seth S.M., Hydraulics & Fluid Machines, Standard Book House, New Delhi, 1995
2. Rajput.R.K. 'A Text book of Hydraulics & Fluid Machines', S.Chand & Co., New Delhi, 1998.

Reference Book

1. Agarwal S.K., Fluid Mechanics & Machinery, Tata Mc Graw Hill Publishing Co., New Delhi, 1997.

CE216 FLUID MECHANICS LABORATORY

Credit 0:0:1
Marks 25+25

1. Buoyancy Experiment - Metacentric Height
2. Measurement of flow using pitot tube.
3. Calibration of orifice meter and Venturimeter.
4. Determination of flow through pipes, losses in pipes.
5. Flow through nozzles and weirs - Cd and Cc.
6. Flow measurement using Rotameter and water meter.
7. Flow visualization-Reynold's apparatus.
8. Pressure gauge and vacuum gauge calibration.
9. Experiments on Fluid jets-force and efficiency calculation

Text Books

1. Modi,P.N and Seth, S.M., Fluid Mechanics & Fluid Machines, Standard Book House, New Delhi,1995.
2. Bansal R.K., Fluid Mechanics & Fluid Machinery, Laxmi Publications, New Delhi 1998.

CE217 MECHANICS OF SOILS

Credit: 3:1:0
Marks : 40+60

Unit I : Mechanical Properties
Objectives and importance of Geotechnical Engineering – physical properties of soil – Phase relations – Grain size distribution – Atterberg limits – Sensitivity and Thixotropy of Clays - Classification of soils as per B.I.S.

Unit II : Permeability and Seepage
One dimensional flow through soil – permeability – Darcy's Law – Field and laboratory permeability tests – Flow through stratified soil – Seepage pressure and quick sand phenomenon – Two dimensional flow – Laplace equation – Electrical analogy – flow net – applications for sheet pile cut off and earth dam – phreatic line – Piping.

Unit III : Compaction and Consolidation
Compaction – Proctor's test – Moisture – density relations – Factors affecting compaction – Field compaction methods – Field compaction control – primary consolidation concept - void ratio - pressure curve – Field curve – Laboratory test – Definition of terms – Consolidation Settlement – Pre-consolidation pressure – Terzaghi's theory of one dimensional consolidation – Partial differential equation (no analytical solution) – Boundary condition – Time factor – Time rate of consolidation – Determination of Cv.

Unit IV : Stress Distribution and Settlement
Concept of effective and neutral stresses – Soil Water statics – Capillary phenomenon – Vertical Stress distribution in soil – Boussinesq equation – line load – Uniformly distributed loads – Influence chart – approximate methods – Westergaard's equation – Pressure bulb – causes of settlement - components of settlement – Immediate and consolidation Settlement – Methods of minimising settlement – Codal Provisions.

Unit V : Shear Strength & Stability of Slopes
Shear Strength of soil – Importance – Mohr – Coulomb's Strength theory – Laboratory and field tests – Factors affecting shear strength – Types of shear tests based on drainage condition – Behaviour of saturated cohesive soils.

Stability of Slopes – Infinite and finite slopes – Types of Failure – Slip circle method – Friction Circle method – Taylor's Stability Chart.

Text Books
1. Punmia, B.C., Soil Mechanics and Foundations, Punmia B.C., Suara & Co., Madras 1988.
2. Arora, K.R., Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, New Delhi, 1987.

Reference Book

1. Venkatramiah, "Geotechnical Engineering", Willey Eastern Ltd., 1993.

CE218 FOUNDATION ENGINEERING

Credit: 3:1:0
Marks: 40+60

Unit I : Soil Exploration And Selection Of Foundation

Introduction – Objectives of Soil Exploration - Disturbed and undisturbed sampling - Depth of soil exploration - Number and disposition of bore holes - Geophysical methods - Penetration tests - Requirements of good foundation - Factors governing location and depth of foundation- Different types of foundation - Choice of types of foundation - Foundation in expansive soil.

Unit II : Bearing Capacity

Bearing capacity – Types of Failure - Terzaghi's formula - Skempton's formula – IS Formula - Effect of water table, shape of foundation, inclination of load and eccentricity of load on bearing capacity - Allowable bearing pressure - bearing pressure based on 'N'value - plate load test - Methods of improving bearing capacity - Contact pressure distribution below footings and raft.

Unit III : Earth Pressure

Lateral earth pressure - Plastic equilibrium in soil- Rankine's theory - Surcharge, Inclined backfill - Soil Stratification - Coulomb's Theory - Graphical Methods (Rebhan's and Culmann's) – Drainage of backfill.

Sheet pile walls – types – Cantilever sheet pile walls in cohesionless and cohesive soil – Anchored sheet pile walls – free earth support method and fixed earth support method.

Unit IV : Pile Foundation

Functions of pile - Classification of piles - Relative merits - Static and dynamic formulae - Pile load test - Pile spacing and group action - Design of pile group - Settlement of pile group - Negative skin friction - Under-reamed pile foundation.

Unit V : Well and Raft Foundations

Well Foundation – Shapes of Wells – Grip length and Bearing Capacity – Forces acting on Well foundation – Banerjees and Gangopadhyay's analysis – IRC method - Individual components of a Well – Sinking of Wells – Rectification of Tilts and Shifts.

Raft Foundation – Common Types of Raft Foundation – Principles of Design.

Text Books

1. Punmia,B.C.,Soil Mechanics and Foundation Engineering, A. Saurabh & Co., Madras, 1988.
2. Kasmalkar,B.J.,Foundation Engineering, Pune Vidyarthi Griha Prabakar, Pune, 1989.

3. K.R.Arora., "Soil Mechanics and Foundation Engineering" Standard Publishers and Distributers, 1997.

Refrence Books

1. Teng,W.C.,Foundation Engineering, Prentice Hall of India (P) Ltd., 1984.
2. Peck,R.B., Hanson amd Thornburn , Foundation Engineering, Wiley Eastern Ltd., 1980.
3. Venkataramiah, C., Geotechnical Engineering, Wiley Eastern Ltd., 1993.

CE219 SOIL MECHANICS LABORATORY

Credit: 0:0:2
Marks: 50+50

List of Experiments and Equipments

1. Moisture content determination (Oven, Infrared Moisture meter)
2. Specific gravity and relative density test for sand (Pycnometer, relative density test apparatus)
3. Sieve analysis for coarse grained soil (Set of Sieves)
4. Hydrometer analysis for fine grained soil (Hydrometer)
5. Consistency limits and Indices (Liquid Limit, Plastic Limit, Shrinkage limit apparatus)
6. Standard Proctor's compaction test. (Compaction Test Apparatus)
7. Field Density test (sand replacement test apparatus and core cutter)
8. Permeability tests – Constant head and variable Head (Permeameter)
9. Unconfined compression test for Cohesive Soil. (Load frame, Samplers)
10. Vane Shear test
11. Direct Shear test (Direct Shear Test apparatus)
12. Triaxial Compression Test (Triaxial test apparatus)
13. Consolidation Test (Consolidometer)
14. California Bearing Ratio Test

Text Books

1. Lambe,T.N.,Soil Testing for Engineers, John Wiley and Sons, New York, 1951
2. Prakash,S., Introductory Soil Testing , Asia Publishing House, New Delhi, 1969

Reference Book

1. Bowles, I.E., Engineering Properties of soils and their measurement, McGraw Hill Book Co., Newyork, 1978.

CE220 REINFORCED CONCRETE STRUCTURES – I

Credit: 3:1:0
Marks : 40+60

Unit I : Cement Concrete

Classification and composition of cement – specifications for portland cement - Aggregates and water for concrete – measurement of materials – water cement ratio – A.C.I and I.S methods of proportioning concrete mixes – compacting and curing of concrete – Tests on fresh and hardened concrete – Grades of concrete and characteristic strength – permissible stresses in concrete – steel reinforcements and their characteristics – Admixtures and durability of concrete.

Unit II : Design For Flexure, Shear And Torsion

Actual and idealized stress – strain diagrams of concrete and steel (mild steel & high strength deformed bars) Behaviour of R.C beams under gradually increased flexural loading – working stress method of design for flexure of rectangular beams, T- beams and L – beams – Design for shear, bond and anchorage and torsion – Design of lintels and sunshades.

Unit III : Working Stress Design

Working stress method of design of continuous beams and slabs, two way slabs, axially and eccentrically loaded columns, isolated column footings and combined rectangular footings for two columns.

Unit IV : Limit State Method – Introduction

Introduction to limit state method – limit state design of rectangular, T and L shaped beams for flexural, shear, bond and torsion – Limit State Design for Deflection and Crackwidth.

Unit V : Slabs, Columns And Footings By Limit State Method

Limit state design of two way slabs, short and long columns for axial and eccentric loadings – use of SP 16 – Limit state design of isolated square and rectangular footings for axially and eccentrically loaded columns – combined rectangular footings for two columns – Flat Slabs with and without Drops. - Use of Design softwares for design of R.C slab beams,columns and footings *

Text Books

1. Krishna Raju, N., Design of Reinforced Concrete Structures, CBS Publishers and distributors, New Delhi, 1989.
2. Unnikrishnanpillai and Devadass Menon, Reinforced Concrete Design, Tata McGraw-Hill Publishing Co Ltd, 1998.
3. Varghese P.C., 'Limit State Design of Reinforced Concrete', Prentice Hall of India, New Delhi, 1999.

Reference Books

1. Jain, A.K., Limit state Design of R.C. Structures , New Chand Publications.
2. Sinha, N.C and Roy, S.K., Fundamentals of Reinforced concrete, S.Chand & Company (Pvt.) Ltd. New Delhi, 1983.
3. I.S.456 2000 Published by B.I.S.
4. S.P-16 Published by B.I.S
5. Purushothaman, P., Reinforced Concrete Structural Elements, Tata Mc Graw- Hill Publishing Co., 1984.
6. Nilson, A.H., Design of Concrete Structures, McGraw Hill Co, 1997.
7. Leet, K.M., Bernal, D., Reinforced Concrete Design, Mc Graw Hill Publishing Co., 1997.

*Software like STADD, STRUDS and STRAPS may be suggested depending on their availability.

CE 221 REINFORCED CONCRETE STRUCTURES - II

Credit: 3:1:0
Marks: 40+60

Unit I : Stair Case And Retaining Walls

Design of stair cases and cantilever and counterfort types retaining walls by working stress method of design. - use of Design software for design of retaining walls. *

Unit II : Water Tanks

Design of circular and rectangular underground water tanks - Design of circular and rectangular tanks resting on ground - Design of overhead rectangular tanks and circular tanks with domical roof - Design of staging and foundations. - use of Design software for design of water tanks. *

Unit III : Bridges

Design of slab bridge and T-beam & slab bridge for various types of IRC loadings - Load distribution in interconnected girders by Courbon's method.

Unit IV : Building Frames

Design of single bay, single storey portal frame. Design of multibay, multistoreyed R.C.frames - substitute frames - preliminary design of members - Analysis for wind loads by the portal method - Detailing of connections – use of design software. *

Unit V : Yield Line Theory

Assumptions - Guidelines for locating yield line patterns - virtual work and equilibrium methods of analysis - Application to square, rectangular, triangular and circular slabs - Strip method of analysis.

Text Books

1. Krishnaraju,N., Design of R.C.Structures, CBS Publishers and Distributors, Delhi 1989.
2. Jaikrishna and O.P.Jain, Plain and Reinforced concrete, Vols. I &II, Nem Chand Publishers, 1959.

Reference Books

1. Krishnaraju.N, Bridge Engineering,
2. Jain, A.K., 'Limit State Design of R.C.Structures', Nem Chand Publications, 1985..

Note : Indian Standard Codes of Practice 456 & 3370 IRC Bridge Codes and Pigeaud's charts are to be permitted for use in the Examinations.

* Software like STAAD, STRUDS and STRAPS may be suggested depending on their availability.

CE 222 - DESIGN AND DRAWING (R.C.C AND STEEL)

Credit 3:1:0
Marks 40+60

PART-A

Detailed design and drawing of the following reinforced concrete structures.

1. Building floors consisting of slabs and beams.
2. Isolated and combined footings
3. Cantilever and counterfort retaining walls.
4. Circular and rectangular underground water tanks.
5. Circular and rectangular water tanks resting on the ground.
6. Circular and rectangular overhead water tanks.
7. Intze type water tank.
8. Slab bridge.
9. T-beam and slab bridge.

PART-B

Detailed design and drawing of the following steel structures.

1. Columns, base plates and their foundations
2. Grillage foundation.
3. Plate Girder (welded)
4. Gantry Girder
5. Simple roof trusses
6. Rectangular and circular overhead water tanks

PART-C
Use of AUTOCAD (for internal assessment only)

Note

1. Autonomous examination will be of four hours duration.
2. Indian Standard codes 456,800,3370 and I.R.C. codes are permitted for the use in the examination.
3. There will be two questions in part-A and two in Part-B out of which the students shall answer one in each.

Text Books

1. Krishna Raju N., "Design and Drawing (R.C.C. & Steel)", Prentice Hall Publishers, New Delhi, 1999
2. Krishna Raju N., "Design of Reinforced Concrete Structures", CBS Publishers and Distributors, New Delhi, 1996.

Reference Books

1. Jai Krishna & O.P. Jain, "Plain and Reinforced Concrete Volume I & II", New Chand Publishers, New Delhi, 1989.
2. Punmia B.C., Ashok Kumar Jain & Arun Kumar Jain, "Design of Steel Structures Volume I", Arihant Publications, Bombay, 1995.

CE 223 - DESIGN OF STEEL STRUCTURES

Credit 3:1:0
Marks 40+60

Unit I : Design Of Tension Members
Net area - effective area - design of tension members - tension rods.

Design Of Compression Members
Design criteria - simple members - laced columns - battened columns- Simple bases - gussetted base - column bases subjected to moment - design of hold down bolts- column splices.

Unit II : Design Of Laterally Supported Beams
Design considerations - bending - shear - bearing - web buckling and crippling - deflection - compound beams - curtailment of plates.

Lateral Buckling Of Beams:
Effective laterally unbraced length - concept of lateral torsional buckling - biaxial bending of doubly symmetric sections - design of gantry girders.

Unit III : Welded Plate Girders
Design of flanges and webs - intermediate stiffeners -bearing stiffeners - design of web and flange splices.

Framed Connections:
Beam to Column - Beam to beam - Rigid Frame connections.

Unit IV : Roof Trusses And Light Gauge Sections
Types - Load Calculation - Design of purlins, trusses and lattice girders.
Design of light gauge steel section for compression and flexural members – connections.

Unit V : Miscellaneous
Design of Rectangular and Circular Steel Tanks – Design of Chimneys.
(Self supporting and guyed type)

Text Books

1. Dayaratnam, P., "Design of Steel Structures", A.H.Wheeler & Co. Ltd., Allahabad, 1996.
2. Arya and Ajmani, "Design of Steel Structures", NemChand Brothers, Roorkee, 1989.

Reference Books

1. Ragupathy M, "Design of Steel Structures", Tata McGraw-Hill Publishing Co.,

Ltd., New Delhi, 1996.
2. Punmia B.C., Ashok kumar Jain and Arun kumar Jain, `Design of Steel Structures', Vol. 1, Arihant Publications, Bombay, 1995.
3. Explanatory notes published by M/s. Institute of Steel Development and Growth

CE224 WATER SUPPLY ENGINEERING

Credit 4:0:0
Marks 40+60

Unit I : Water Quality And Perspectives
Water Quality Parameters and Analysis – Physical, Chemical, and Biological – MTFT and MFT Methods – Water Quality Standards and Planning Factors in India – Objectives of Public Water Supply Scheme – Health, Acceptability, Adequacy, Convenience and Economy Aspects – Population Forecasts – Percapita Demand and Variation in Demand Pattern – Rural Water Supply Scheme – Necessity and State -of -art Methods.

Unit II : Water Supply Sources
Surface, Sub-surface, and Ground Waters – Hydrology and Impounded Storage Requirements – Mass–Inflow Curve and Analytical Methods – Hydraulics of Ground Water Flow – Estimating Yields of Wells by Steady State Methods (without derivation) – Intake Structures for Different Sources – River, Canal, Lake, Reservoir, Wells and Infiltration Galleries – Construction, Development, and Sanitary Protection of Wells – Salt Water Intrusion and Control Strategies - Rain water harvesting.

Unit III : Water Transmission Systems
Gravity and Pressure Systems – Hydraulics and Design of Pressure Pipes – Analytical Methods and Nomograms – Series and Parallel Pipes - Different Materials of Pipes - Selections and Class of Pipes – Laying, Jointing and Testing of Commonly used Pipes – Appurtenances of Pipes – Pumps and their Selections – Pumping Stations - Automatic Controls.

Unit IV : Water Treatment Processes
Characteristics of Surface and Ground Waters – Conventional and Un-conventional Treatment Schemes – Principles, Functions, and Design of Flash Mixer, Flocculator, Sedimentation Tank, Slow and Rapid Sand Filters, and Disinfection Process – Principles of Ion Balancing Bar Graph, Water Softening, Aeration , Iron and Manganese Removal, and Fluoride Removal.

Unit V : Distribution And Storage Systems
Types, Functions and Requirements of Distribution System – Pressure Requirements and Surveys – Analysis of Distribution System – Method of Sections, Equivalent Pipe Method, and Hardy-Cross Method of Balancing Network – Operation and Maintenance of Distribution Systems – Leak Detection, Corrosion Control and Langelier Index, and Lining of Pipes – Storage Reservoirs – Types, Functions, Location, and Capacity – House Connections and Appurtenances.

Text Book

1. Raju, B.S.N., "Water Supply and Waste Water Engineering", Tata McGraw-Hill Book Co., New Delhi, 1995.

Reference Books

1. Hammer, M.J., "Water and Waste Water Technology", 2nd Edn. (SI Version), John Wiley and Sons, N.Y. 1986.
2. Birdie, G.S., and Birdie, J.S., "Water Supply and Sanitary Engieneering", 8th Edn., Dhanpat Rai and Sons Ltd., 1997.

CE225 SANITARY ENGINEERING

Credit: 4:0:0
Marks: 40+60

Unit I : Sewage And Sewerage Engineering

Definition & Classification of Sewage - Quantity of Sanitary Sewage and Storm Water – Fluctuations in Flow Pattern – Design Flow of Sewage – Physio-chemical and Biological Characteristics – Assessment of Organic Solids by BOD, COD, TOC, ThOD, & TOD – Microbiology of Sewage – Systems and Layouts of Sewerage – Analysis and Design of Sewers under Different Flow Situations - Sewer Sections – Materials for Sewers – Laying, Jointing, and Testing of Sewers – Appurtenances and Maintenance - Pumping of Sewage and Pumping Stations.

Unit II : Preliminary And Primary Treatments Of Sewage

Principles and Objectives of Sewage Treatment – Operation and Design of Bar Rack and Grit Chamber with Velocity Control Devices – Principles of Primary Treatment and Design of Primary Sedimentation Tank – Disposal of Rackings, Gritty Materials, and Sludge Solids.

Unit III : Biological Treatment Processes

Objectives of Biological Treatment – Path Ways of Decomposition – Aerobic, Anaerobic, and Anoxic Processes – Operation & Design of Convensional Activated Sludge Process with Diffuser and Mechanical Aerators – Process Modifications – Analysis and Design of Trickling Filter – High rate and Standard Rate Filters – Low Cost Waste Water Treatments – Principles and Design of Stabilization Ponds, Oxidation Ponds and Aerated Lagoons – Rural Sanitation – Operation and Design of Septic and Imhoff Tanks – Excreta Disposal Schemes.

Unit IV : Engineering Methods Of Sludge Disposal

Objectives of Sludge Disposal – Types and Characteristics of Sludges in a Typical Treatment Plant – Operation and Design of Sludge Digestions – Energy Recovery Aspects regarding Methane Production – Sludge Lagooning, Unconvensional Methods of Disposal - Disposal of Sewage by Dilution in Streams, Rivers, and Estuaries – Self-purification and Oxygen Sag-curve Analysis – Trophic Status of Aquatic Bodies.

Unit V : House Drainage Works
Sanitary Fittings – One Pipe and Two Pipe Systems - General Layout of House Drainage Works – Street Connections.

Recycling Of Waste Water

Text Book
1. Steel.E.W.and McGhee, T.J., "Water Supply and Sewerage", 5th Edn., McGraw Hill International Editions, New York, 1988.

Reference Books
1. Metcalf and Eddy, Inc., "Waste Water Engineering – Treatment, Disposal and Reuse", 3rd Edn., McGraw Hill Book Co., N.Y. 1985.
2. Raju, B.S.N., "Water Supply and Waste Water Engineering", Tata McGraw-Hill Co., New Delhi, 1995.

CE226 ENVIRONMENTAL ENGINEERING LABORATORY

Credit: 0:0:2
Marks: 50+50

I. Analysis of Water Quality Parameters:-
1. Determination of pH
2. Determination of Acidity and Alkalinity
3. Determination of Chlorides
4. Determination of Dissolved Oxygen
5. Determination of Fluorides
6. Estimation of Iron and Manganese
7. Estimation of Phosphates
8. Estimation of Sulphates
9. Estimation of Total Dissolved Solids.
10. Estimation of Conductivity
11. Determination of Turbidity and Optimum Coagulant Dose by Jar Test Apparatus
12. Determination of Available Chlorine in Bleaching Powder, Residual Chlorine, Break Point Chlorination and Chlorine Demand.
13. Determination of MPN Index for Coliforms

II. Analysis of Waste Water Characteristics:-
1. Determination of Total Solids, Settlable Solids, Dissolved Solids, Suspended Solids and Volatile Solids.
2. Determination of BOD and COD
3. Determination of Ammonia–nitrogen and Nitrates.

Text Book

1. Sawyer, N.C., and McCarty, P.L., “Chemistry for Environmental Engineering”, 5th Edn., McGraw-Hill Book Co., New York., 1985.

Reference Book

1. “Standard Methods for the Examination of Water and Waste Water”, APHA-AWWA-WPCF, 25th Edn., Washington (D.C), 1995.

CE227 STRUCTURAL ANALYSIS –I

Credit: 3:1:0
Marks: 40+60

Unit I : Fundamental Concepts In Structures

Definition and Determination of Static and Kinematic Indeterminacy – Beams, Trusses and Frames – Degree of Freedom – Equillibrium and Kinematic Stability – Principle of Superposition – Basic Methods of Structural Analysis.

Energy Methods:

Work – Energy principles – Principle of Stationary Potential Energy – Principle of Virtual Displacements – Complementary Energy – Principle of virtual Forces – Castigliano’s First Theorem – Engessor’s Theorem – Castigliano’s Second Theorem – Betti Maxwell’s law – Theorem of least work – Application to simple problems of Statically determinate beams, trusses and frames.

Unit II : Moving Loads And Influence Lines

Effect of moving load – Description of Influence line – Influence line for Reaction, Shear Force and Bending Moment – Load position – Absolute maximum bending moment – Muller Breslau’s Principle – Application to beams with one degree of indeterminacy – Influence line for forces in members of determinate trusses.

Unit III : Arches

Three hinged arch – Two hinged arch – parabolic and semi circular arches – Concentrated loads – Uniform loads – Temperature effects – Determination of Reaction, Normal Thrust, Radial shear and Bending Moment – Influence line for Stress Resultants in two hinged and three hinged arches – load position for maximum values.

Unit IV : Three Dimensional Frames (Determinate)

Analysis of pin jointed Space frames – forces in various members – Analysis of Rigid jointed space frames – Determination of stress resultants – Application to Simple problems – Analysis of Suspension Bridges. - Use of Analysis Software for application to space trusses. *

Unit V : Force Method

Consistent Deformation Method – General Concept – Application to Truss subjected to Loads – Application of Clapeyron’s Theorem of Three Moments to fixed and continuous beams – Temperature, Lack of fit, Settlement of Support – effects in structures. - Use of Analysis software for application to plane trusses for nodal displacement.

Text Book

1. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co., 1996.

References

1. Armenakas A.E., Classical Structural Analysis, McGraw Hill Book Co., 1988.
2. Au T and Christiano, P, Structural analysis, Prentice Hall, 1982.
3. Hibbeler R.C, Structural Analysis, Macmillan Pub.Co., 1985.
4. Laible J.P, Structural Analysis, Mc Graw Hill Book Co., 1984.
5. Smith J.C., Structural Analysis, Harper and Row Pub., 1988.

* Software like ANSYS, SAP, FEAST may be suggested depending on their availability.

CE228 STRUCTURAL ANALYSIS II

Credit: 3:1:0
Marks: 40+60

Unit I : Slope Deflection Method To Beams And Frames

Displacement method concept - Slope Deflection equations - Fixed End moments Application to Statically indeterminate beams and frames - Effect of temperature, settlement - Deformed shape, Bending Moment and Shear Force Diagrams and axial force diagram.

Unit II : Moment Distribution Method To Beams And Frames

Basic concepts - Stiffness factor, distribution factor and carry over factors - Single span beams with different support conditions - Fixed End Moments - Moment Distribution in Continuous Beams - Portal frames with and without side Sway - Deflected shape, bending moment, shear force and Thrust Diagrams - Symmetric Structure subjected to Symmetric and Antisymmetric Loadings.

Unit III: Characteristics Of Flexibility And Stiffness Matrices And Flexibility Method

Definition - Application of Principle of Superposition - Properties - Application to Two Degree of Freedom systems - Structure and element co-ordinates - Transformation of force and displacement - Structure flexibility in terms of element flexibility - Structure stiffness in terms of element stiffness.

Forces not acting at co-ordinates - Formulation of Structure Flexibility matrix - Determination of Displacements - Application to determinate and indeterminate trusses, beams, frames - Effect of Temperature, lack of fit.

Unit IV : Stiffness Method

Forces not acting at co-ordinates _ Formulation of Structure Stiffness matrix - Determination of Displacements - Application to determinate and indeterminate trusses, beams, frames - Effect of Temperature, lack of fit - Static Condensation Technique. - use of analysis software for application to the analysis of plane trusses and frames. *

Unit V : Beams On Elastic Foundation And Introduction To Structural Dynamics

Introduction - basic concepts -differential equation for a beam resting on elastic foundation - Infinite beam - concentrated load on infinite beam - concentrated moment on an infinite beam - uniformly distributed load of finite length on an infinite beam.

Free vibration - damped - undamped vibrations for single degree of freedom system - forced vibration - displacement and force isolation.

Text Book

1. Reddy C S, Basic Structural Analysis , Tata McGraw Hill Publishing Co., 1996.

Reference Books

1. Bhatt P, Problems in structural Analysis by Matrix Methods , Wheeler, 1989.
2. Flemming, J.F., Computer Analysis of Structural Systems , McGraw Hill, 1989.
3. Holzer S M, Computer Analysis of Structures , Elsevier, 1985.
4. Mukhopadhyay M , Matrix Finite Element Computer and Structural Analysis , Oxford & IBH, 1984.
5. McGuire W and Gallagher R H, Matrix Structural Analysis , John Wiley & Sons, 979.
6. Meek, J.L., Matrix Structural Analysis , McGraw Hill, 1971.
7. Przemieniecki,J. S, Theory of Matrix Structural Analysis , McGraw Hill, 1968.
8. Rubinstein M F, Matrix Computer Analysis , Prentice Hall, 1969.
9. Sack R C, Matrix Structural Analysis , PWS - Kent Pub. Co., 1989
10. Wang C K and Solomon C G, Introductory Structural Analysis , McGraw Hill Book cc, 1984.
11. Kanchi M B, Matrix Methods of Structural Analysis , Wiley Eastern Ltd., 1993.
12. Sack R L, Structural Analysis , McGraw-Hill Book Co., 1984.
13. Smith. J C , Structural Analysis , Harper and Row Pub., 1988.
14. Rajasekaran,S., Sankarasubramanian,G., Computational Structural Mechanics, Prentice Hall of India, 2000

* Software like ANSYS, SAP AND FEAST may be suggested depending on their availability.

CE229 CONCRETE & HIGHWAYS LABORATORY

Credit: 0:0:2
Marks: 50 +50

(a) **Concrete Lab**:

Tests On Cement : Specific gravity, Fineness, specific surface, soundness, consistency, initial and final setting time, compressive strength of cement mortar.

Tests On Fine Aggregate : Tests to find alkalinity, organic content, etc. - particle size distribution and fineness modulus - specific gravity and voids ratio - Bulking of sand.

Tests On Coarse Aggregate : Particle size distribution and fineness modulus - specific gravity - voids - absorption test - crushing and impact strength - abrasion test.

Concret'e Mix Design : A.C.I and I.S. Methods

Test On Fresh Concrete : Slump test, Vee-Bee test, compaction factor test.

Tests On Hardened Concrete : Compression test on cubes - Modulus of rupture test - splitting tension test - Determination of modulus of elasticity.

(b) **Highway Lab: Tests On Bituminous Materials And Mixes**:

(a) Penetration test on bitumen.
(b) Ductility test on bitumen
(c) Softening point test on bitumen or tar.
(d) Flash and fire point tests on bitumen/cutback bitumen
(e) Specific gravity test
(f) Viscosity test on cutback - bitumen or tar (using orifice Viscometer)
(g) Marshall stability test on bituminous mix and determination of density, voids, stability and flow values.

Text Books

1. Shetty, M.S., Concrete Technology, S.Chand and Company Ltd., New Delhi.
2. Khanna and Justo, Highway Material Testing Laboratory Manual, New Chand and Brothers, Roorkee.

Reference Book

1. Davis, H.F., Troxell, G.E and Hauck, G.R.H., The testing of Engineering Materials, Mc.Graw Hill International Book Co.

CE230 DESIGN AND DRAWING (IRRIGATION AND ENVIRONMENTAL ENGINEERING)

Credit 3:1:0
Marks 40+60

Part : A

Design of the following irrigation works are to be worked out and detailed drawings are to be drawn:

1. Earthen Dams - Sections of different types of earth dams, plan showing drainage systems.
2. Tank sluice - wing type
3. Tank surplus weir.
4. Canal Regulator (Head regulator)
5. Canal drop.
6. Syphon aqueducts

Part: B

Design of the following Environmental Engineering works are to be worked out and detailed drawings are to be drawn.

1. General layout of water supply scheme.
2. Mixing basin, flocculation and sedimentation tanks.
3. Slow and rapid filters - service and clear water reservoirs.
4. General layout for drainage scheme.
5. Manholes, pumping station, septic tank with dispersion trenches and imhoff tank.
6. Primary and secondary settling tanks - trickling filter and storm water separator.

Text Books

1. Krishnamoorthy, P., Structural. Design Drawing, CBS Publishers
2. Satyanarayanamurthy, C., Design of Minor Irrigation and Canal Structures, Wiley Eastern Limited, June 1994.

References

1. Ellis, W.M., College of Engineering Manual: Irrigation, The Textile Institute Publishers, 1955.
2. Gharpure, V.N., A Text Book of water supply Engineering, Allied Publishers limited.

Note:

Autonomous Examination is 4 hour duration. There will be two questions in part **A** and two in part B. Out of which the students will have to answer one in each.

CE231 CIVIL ENGINEERING DRAWING

Credit: 0:0:2
Marks: 50+50

Symbols and sign conventions related to Architecture - Traffic - Electrical Circuits - Plumbing & welding - Metric Brick - Bonds in Brick masonry, cross walls and corner walls.

Joinery in wood work - timber doors, windows and ventilators - panelled and glazed types. Planning and detailing of Stairs and Staircases.

Plan, Elevation, Section and Perspective Views of single storeyed residential and public buildings such as hospitals, restaurants and auditoriums - Use of AUTOCAD and CADPLUS 3D and other architectural software systems .

Text Book

1. Balgopal,T.S., Prabhu,T.S., Building drawing and detailing, Spades Publishing KDFA building Calicut, 1987.

Reference Book

1. AUTO CAD Tutorials and manual.- Autodesk work book on AUTO CAD Level I and II CAD/CAM centre, PSG College of Technology, Coimbatore

Note:

Autonomous Examination is for three hours duration and the students are required to answer one question out of two in Major part -A and two minor questions out of three in Minor Part – B

CE232 ESTIMATING, COSTING AND SPECIFICATIONS

Credit 0:0:2
Marks 50+50

Unit I : Procedure Of Estimating Quantities
Introduction – Main items of work – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C., Doors, Windows, Flooring, White Washing, colour washing, Distembering and their units.

Unit II : Rate Analysis
Factors affecting rates – importance – Materials for different items of work – Rates of materials and labour – analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works.

Unit III : Cost Estimate Of Buildings
Approximate methods – Plinth area estimate – Cubical Contents estimate.

Detailed estimate – Estimation of the cost of single storeyed buildings by individual wall method and centre line method.

Estimation of Roofs – R.C.C. slab roof, GI sheet roof, Tiled Roof, Roof Truss.

Estimation of R.C.C.works – Beam, T-beam and Slab, Column, Foundation, Stair case, Retaining wall etc.

Unit IV : Cost Estimate Of Other Structures
Estimation of roads – Earth work, Pitching of Slopes, Hill roads.
Estimation of R.C.C. slab culvert, Pier, Pipe culvert, R.C.C. T-beam bridge.
Estimation of Irrigation works like Canals, Aqueducts, Syphon, etc.
Estimation of Water supply and sanitary works like septic tank, Soak pit, Manhole, sewer line, etc.

Unit V : Specifications And Valuation
Specifications – Objectives – types of specifications – principles of specification - writing – typical specifications.

Valuation – Market value – Book value – Scrap value – Salvage value – annuity – Capitalized values – sinking fund – depreciation – Valuation of a building – Rent fixation – Mortgage – Lease – cash flow and cost control.

Text Books

1. Dutta, "Estimating and Costing", S Dutta & Co., Lucknow.
2. Rangawala..S.C., "Estimating and Costing", Charotar Anand.

Reference Book

1. Kohli, D.D.and Kohli R.C., "A Text book on Estimating, Costing and Accounts", S.Chand and Co., New Delhi, 1994.

CE233 COMPUTER APPLICATION LABORATORY – I

Credit 0:0:2
Marks 50+50

Unit I : Introduction

Main frame - Mini and Micro computers - system configuration - Functions – Hardware, Software, Operating System Basics - File Processing Techniques - High level languages – packages.

Unit II: Development and Implementation of Programs for the following in C Language

1. Solution of simultaneous equations by Gauss – Jordan method.
2. Solution of non-linear equations using Newton-Raphson technique.
3. Drawing the S.F and B.M. diagrams for simply supported beams and cantilever beams subject to point, udl and uniformly varying loads
4. Analysis of plane, pinjointed frames.
5. Deflection of cantilever and simply supported beams.
6. Limit state Design of R. C. Rectangular and T – beams.
7. Design of tension and Compression Steel Members.
8. Expert Systems for Classification of soil.
9. Water surface profiles.
10. Determination of friction factor
11. Stability of slopes

Unit III : Development and Implementation of Programmes for the following using Excel

1. Design of R.C. Retaining Walls
2. Design Profile of masonry dams
3. Design of Two-way slab and flat slab.

Note: *Examination is for four hours duration.*

Text Book

1. Balaguruswamy. E "Object – Oriented Programming in C", Tata Mc Graw Hill.

CE234 COMPUTER APPLICATION LABORATORY – II

Credit 0:0:2
Marks 50+50

1. Analysis of 2D Truss using STAAD-III
2. Analysis of 2D and 3D Rigid Frames using STAAD-III
3. Analysis of 3D pin jointed frames using ANSYS
4. Analysis of suspension cables using ANSYS
5. Design of Footings and Retaining Walls using STAAD-III
6. Structural Design of the following, using STAAD-III and detailing of the same using AUTO CAD
    a. R.C. Beams
    b. R.C. Slabs
    c. R.C. Columns and Footings
    d. Steel beams
    e. Steel columns
7. Design of circular water tanks using STAAD-III
8. Deflection and Stresses in beams using FEAST
9. Building Drawing, including perspective view using Floor Plan 3D
10. Concrete mix design and mathematical calculations using MATHCAD
11. Application to Transportation Engineering, Environmental Engineering, Estimation and Costing, Management, Science, etc.

Note

Examination will be of four hours duration and students will be examined in modeling and the application of general purpose packages.

CE 235 BASIC STRUCTURAL DESIGN

Credit: 3:1:0
Marks: 40 +60

Unit-I : Structure and Design Concepts

Classification of structures – function, material and shape – different structural systems – requirements of structures – basic structural requirements – stability, strength and stiffness – design process – codes of practice.

Working stress method – limit state method of Design – Probabilistic approach to design – load and resistance – design for strength, stiffness and stability considerations – choice between different structural materials – concrete, timber, Masonry and steel.

Structural Loads:

Dead load – live load – Wind load – Calculation of wind load for a Structure – Seismic load – buoyancy and thermal loads.

Unit II : Design of Masonry Walls and Columns
Axially loaded square and rectangular columns with uniaxial eccentricity – solid walls – load bearing walls – axially loaded – eccentrically loaded walls with openings – Non load bearing walls.

Laterally Loaded Masonry Structures:
Structures and loads – stability of masonry – middle third rule – Masonry dams – Trapezoidal dams – Retaining walls.

Unit III : Load Distribution Elements
Bed blocks – spread footings for walls and columns – area based on safe bearing capacity.

Design of Reinforced Masonry
Introduction – basic concepts – limit state design of reinforced brick masonry – lintels – axially loaded columns.

Unit IV : Timber: Flexural and Compression Members
Factors affecting the strength – permissible stresses – Design for bending, shear and bearing Flitched beams – solid and built up columns – combined bending and direct stress – application to form work.

Unit V : Bolted and Welded Joints
Bearing and friction type of bolts – splicing joint – joints subjected to moment and direct load and torsion – butt and fillet welds – joints subjected to shear, bending and torsion.

Text Book

1. Arya A.S., Structural Design in Steel, Masonry and Timber, Nemchand and Bros., Roorkee, 1987.

Reference Book

1. Dayarathnam P., Bricks and Reinforced Brick Structures, Oxford & IBH Publishing Co., (Pvt.)Ltd ., New Delhi.

CE236 ENGINEERING GEOLOGY AND CIVIL ENGINEERING MATERIALS

Credit: 4:0:0
Marks: 40 +60

Unit I : General Geology
Geology in Civil Engineering – branches of geology – Earth structure and composition – elementary knowledge on continental drift and plate tectonics. Earth processes – weathering - work of rivers, wind and sea and their Engineering importance – Causes of Earthquake – Earthquake belts in India. Groundwater – mode of occurrence – prospecting – importance in Civil Engineering.

Mineralogy

Elementary knowledge on symmetry elements of important crystallographic systems – physical properties of minerals – study of the following rock forming mineral – Quartz family, felspar family, augite, hornblende, biotite, muscovite, calcite, garnet, properties, behaviour and engineering significance of clay minerals – fundamentals of the process of formation of ore minerals – coal and petroleum – their origin and occurrence in India.

Unit II : Petrology

Classification of rocks – distinction between igneous, sedimentary and metamorphic rocks. Description, Occurrence, Engineering properties and Distribution of following rocks. Igneous rocks – granite, syenite, diorite, gabbro, pegmatite and basalt. Sedimentary rocks – sandstone, limestone, shale, conglomerate and Breccia. Metamorphic rocks - quartzite, marble, slate, thyllite, gneiss and schist.

Unit III : Structural Geology And Geophysical Methods

Attitude of beds – outcrops – geological maps – study of structures – folds, faults and joints – their bearing on Engineering investigations. Remote sensing techniques – study of air photos and satellite images – interpretation for Civil Engineering projects – Geological conditions necessary for construction of dams, tunnels, building and road cutting. Land slides – causes and prevention. Sea erosion and coastal protection.

Unit IV : Civil Engineering Materials

Cement and Concrete – raw material – manufacture – type and properties of cement – Concrete mixes – grades – steel – heat treatment process – alloy steels – plain and deformed bars – relative merits – strength specifications.

Unit V : Clay Products And Miscellaneous Materials

Manufacture and qualities of good bricks and tiles – tests and standards for bricks – uses of ceramics – refractories – terracota and glazed products- paints – varnishes – distempers – plastic emulsions – rubber – aluminium – glass – felts – Asbestos – Plastics.

Text Books

1. Parbin Singh, Engineering and general Geology, Katson publication House, 1987.
2. Krynine and Judd, Engineering Geology and Geotechniques, McGraw Hill Book Company 1970.
3. Duggal, S.K. "Building Materials", New Age International Publishers, New Delhi, 2003.

Reference Books

1. Legget, R.F., and Hatheway, A.W., Geology and Engineering, McGraw Hill Book Company. 1988.
2. Blyth, Geology for Engineers, BLBS, 1985.

CE 237 ELEMENTS OF TOWN PLANNING AND ARCHITECTURE

Credit : 4:0:0
Marks: 40 +60

Unit I : Introduction
General Planning concepts in Town Planning - History of Town Planning in India - Early settlements to New towns - elements of city plan - planning attributes and level of planning - survey for town planning – Importance of Climate, Topography, Drainage and Water Supply in selection of site for development.

Unit II : Contents Of Development Plans
Scope and Content of Master plan - Regional plan - Structure plan - Detailed development plan - Urban renewal - planning standards for Neighborhood - Basic Principles in planning various land uses – Residential – Commercial – Industrial – Transportation – Recreational – Agriculture – Utility and services.

Unit III : Planning Legislations
Evolution of planning legislation in India - Organisation and administration of planning agencies at National, State, Regional level and Metropolitan Level - Tamil Nadu Town and Country Planning Act - Building bye laws- function of local Authority - Provision of Building Regulations

Unit IV : Introduction To Architecture
Origin of Architecture - Definition - Influence of Nature - Climate - Topography- Building Materials – Socio-cultural Conditions - Economic and Technological Factors on Architecture – Principles of Building Planning – Aspect – Prospect – Furniture requirements – Roominess – Grouping – Circulation – Flexibility – Privacy – Sanitation – Elegance – Economy – Practical Consideration.

Unit V : Basic Elements Of Architecture
Principles of Architectural Composition – Unity – Contrast – Rhythm – Proportion – Scale – Balance and Symmetry – Character – Harmony – Colour – Light and Shade – Solids and Voids Principles relating to function - Strength – Appearance.
Interior planning and Treatment – Interior Decoration – Furniture and fittings – Thermal and Acoustic insulation.

Text Books

1. Rangwala,S.C., Town Planning, Charotar Publishing House, Anand, Gujarat, 1985.
2. Pramar V.S., Design Fundamentals in Architecture, Somaiya Publications Pvt. Ltd, New Delhi.

Reference Books

1. Rafciff, I., An Introduction to Town Planning and country planning, Hutchinson, London, 1987.
2. Gowda, S., Urban and Regional Planning Prasaranga, University of Mysore, Mysore, 1986
3. Hiraskar,G.K., Fundamentals of Town Planning , Danpat Rai an sons, Delhi, 1989.
4. Pickering,E., Architectural Design, John Wiley and Sons, London.
5. Hepler and Wallach, Architecture, Drafting and Design, McGraw-Hill Book Co, Newyork.

CE 238 IRRIGATION ENGINEERING

Credit: 4:0:0
Marks: 40 +60

Unit I : Introduction

General – crop seasons – Humid, arid and semiarid regions – necessity of irrigation – water requirements – Duty – Delta – irrigated area – Base period –crop period – water requirement calculation – consumptive use (evapo – transpiration) – Determination of consumptive use – irrigation efficiencies – factors affecting the duty of water - Methods of improving duty - Types of irrigation – Methods of Application of Water on Field – Protective and Productive irrigation works.

Unit II : Hydrology

Introduction – Hydrologic cycle and hydrological data – precipitation – Amount of precipitable water – different forms of precipitation – Types of rainfall measurements – variability of rain fall with respect to time and space – Interpretation of rainfall data – Maximum precipitable water.
Hydrologic Abstractions – Interception and depression storage – evaporation – Transpiration – infiltration – Infiltration Indices - Runoff - Factors affecting Runoff – Estimation of Run off – Empirical formulae – Unit Hydrograph method – Stream Gauging – Flood estimation by Empirical formulae – Unit Hydrograph - Statistical and Probability methods - Flood Frequency Analysis.

Unit III : Ground Water

Ground water hydrology – Aquifers – permeability and transmissibility – steady flow towards a well in confined and water table aquifer – measurement of yield of an open well - Well losses – Interference of wells - Typical cross section of open and tube well – comparison of well and flow irrigation.

Unit IV : Distribution System

Definition and importance of sediment transport – Mechanics of sediment transport – Estimation of transported sediments – suspended load and its measurement.
Alluvial and non – alluvial soil – Alignment of canals – Distribution systems for canal irrigation – Determination of required channel capacity – channel losses. Design of channels in India – Regime channels – Kennedy's theory - design procedure – use of Garrot's diagram – Lacey's

theory - Design procedures – use of Lacey's Diagram - comparison of the two theories. Design procedure for irrigation channel – cross section and components – balancing depth for excavating canals – fixing the longitudinal section of the canal – Classification of canals – canal lining – Maintenance of irrigation canals.

Unit V : Water Logging, Drainage And River Control
Salinity and water logging – causes and effect of water logging – Logging control – Reclamation of saline land – surface and subsurface drainage – Drainage design for agricultural areas – lay out of drainage system – classification of rivers in various ways – flood control and river training – Behaviour of river, control and training of rivers – methods of river training work.

Text Books

1. Garg,S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 1997.
2. Punmia, B.C., Pande and Lal, B.B. Irrigation and water power Engineering, Laxmi Publications pvt. Ltd., 1992.

Reference Books

1. Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand and Brothers.
2. Sahasrabudhe, S.R., Irrigation Engineering and Hydraulic Structures, Katson Publishers, 1994.

CE 239 STRENGTH OF MATERIALS LABORATORY

Credit : 0:0:1
Marks: 25 + 25

1. Tension test on mild steel
2. Double shear test on mild steel
3. Torsion test on rod
4. Torsion test on thin wire
5. Brinell, Rockwell and Vicker's Hardness tests
6. Charpy and Izod Impact test
7. Cold bend test
8. Tension, Compression (Parallel as well as perpendicular to the grains) and impact tests on timber specimens.
9. Test on springs (Both closed coil and open coiled springs)
10. Deflection tests on timber and steel beams
11. Studies on Fatigue test
12. Test on Bricks

Reference Book

1. The testing of engineering materials H.E Daris, G.E. Troxell, G.F.W. Hauck 4th edition, International Student Edition. Mc. Graw Hill International Book Company.

CE301 MATRIX COMPUTER METHODS OF STRUCTURAL ANALYSIS

Credit 3:1:0
Marks 40+60

Unit I : Review of Fundamental Concepts

Introduction - Forces and Displacement Measurements - Principle of Superposition - Force and Displacement Methods of Structural Analysis - Betti's law - Stiffness and Flexibility matrices of the elements - a review.

Transformation of Information

Indeterminate Structures - Transformation of system force to element force - Element flexibility to system flexibility - system displacement to element displacement - Transformation of forces and displacement in general - Normal and Orthogonal transformation.

Unit II : Flexibility Method

Choice of redundant - ill and well conditioned equations - Automatic choice of redundants - Rank technique - Transformation of one set of redundant to another set - Thermal expansion - Lack of fit - Application to pin jointed plane and space trusses - Continuous beams, single storeyed rigid frames and grids.

Unit III : Stiffness Method

Development of Stiffness method - Analogy between flexibility and stiffness - Analysis due to thermal expansion - lack of fit - Application to pin jointed plane and space trusses - continuous beams - frames and grids.

Unit IV : Matrix Displacement Methods - Special Topics

Static Condensation Technique - Substructure Technique - Transfer Matrix Method - Symmetry and Anti Symmetry of Structures - Reanalysis Technique - Analysis of non-prismatic and curved members.

Direct Stiffness Method

Discrete System - Direct Stiffness approach - Application to two and three dimensional pin-jointed trusses - plane frames - Grids - Three dimensional Space frames.

Unit V : Matrix Displacement Method To Influence Line

Introduction - Maxwell's law of reciprocal deflection - Generalized Maxwell's theorem - Muller Breslau's principle - Influence line for continuous beams and rigid frames.

Computer Application

Computer Applications - application and use of Computer packages such as SAP, STAAD, STARDYNE - solving problems by MATLAB and EXCEL.

Text Books

1. McGuire and Gallagher.R.H., "Matrix Structural Analysis", John Wiley, 1979.
2. Rubinstein M.F., "Matrix Computer Analysis of Structures", Prentice hall 1966.

3. Rajasekaran, S and Sankarasubramanian, G., "Computational Structural Mechanics", Prentice Hall of India, 2001.

Reference Books

1. Beaufait, F.W., "Computer Method of Structural Analysis, "Prentice Hall 1970.
2. Holzer, S.M., "Computational analysis of Structures", Elsevier Science publishing.
3. Meek, J.L., "Matrix Structural Analysis", McGraw Hill, 1971.
4. Prezemineicki, J.S., "Theory of Matrix Structural Analysis, "McGraw Hill Book Co.,1984.

CE302 APPLIED ELASTICITY AND PLASTICITY

Credit 3:1:0
Marks 40+60

Unit I : Analysis Of Stress And Strain In Cartesian Coordinates

Analysis of stress (two and three dimension)- Body force, surface forces - Uniform state of stress - Principal stresses - stress transformation laws - Differential equations of equilibrium. Analysis of strain (two and three dimension) Strain displacement relations - Compatibility equations - state of strain at a point - strain transformations - principal strain - principle of super-position.

Stress Strain Relations And Formulation of Elasticity Problems:

Stress - strain relations - generalized Hook's law - Lama's constants - methods of formulation of elasticity problems - Equilibrium equations in terms of displacements - compatibility equations in terms of stresses - Boundary Value problems.

Unit II : Two Dimensional Problems In Cartesian Coordinates

Introduction: Plane stress and Plane strain problems - Airy's stress function - polynomials - Direct method of determining Airy's polynomial stress function - solution of Biharmonic equation by Fourier series - St. Venant principle.

Application to:

a. Bending of a cantilever loaded at end.
b. Bending of a Beam by uniform load.
c. Bending of a cantilever with a moment at the end.

Unit III : Two Dimensional Problems In Polar Coordinates

General equations in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distribution – (Rotating Disc - Bending of a curved bar by force at the end - Effect of circular hole on stress distribution in a plate) - concentrated force at a point of a straight boundary - Forces on wedges - A circular disc with diametric loading.

Unit IV : Torsion Of Prismatic Bars
General solutions of the problem by displacement (St. Venant's warping function) and force (Prandtl's stress function) approaches - Membrane analogy-Torsion of shafts of circular and noncircular (elliptic, triangular and rectangular) cross sectional shapes - Torsion of thin rectangular section and hollow thin walled single and multicelled sections.

Unit V : Introduction To Plasticity
Introduction to stress-strain curve - Ideal plastic body - criterion of yielding - Rankine's theory - St.Venant's theory - Tresca's criterion - Beltramis theory - Von-mises criterion - Mohr's theory of yielding - yield surface - Flow rule (plastic stress- strain relation) Prandtl Reuss equations - Plastic work - Plastic potential - uniqueness of stress distribution - Elastoplastic problems of beams in bending - thick hollow spheres and cylinders subjected to internal pressure - General relations - plastic torsion - perfect plasticity - bar of circular cross section - Nadai's sand heap analogy.

Text Books
1. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, N.Delhi, 1995.
2. Sadhu Singh, "Theory of Plasticity", Khanna Publishers, N.Delhi, 1995.

Reference Books
1. Chow,P.C. and Pagano,N.J.,"Elasticity, Tensor, Dyadic and Engg. approaches", D.Vannostrard Co., New York, 1968.
2. Timoshenko, S and Goodier, J.N, "Theory of Elasticity", Mc Graw Hill Book Co., 1951.
3. Chakrabarthy, T., "Theory of Plasticity", Mc Graw Hill Book Co., New Delhi, 1988.
4. Mendelson, A., "Plasticity, Theory and Applications", MacMillan Co., New York, 1968.

CE303 STRUCTURAL DYNAMICS

Credit 3:1:0
Marks: 40 + 60

Unit I : Introduction And Principles Of Dynamics
Vibration studies and their importance to structural engineering problems - elements of vibratory systems and simple harmonic motion - Vibration with and without damping - constraints - generalized mass D'Alembert's principle - Hamilton's principle - Lagrange equations coupling.

Single Degree Of Freedom:
Degree of freedom - Equation of motion for S.D.O.F. - damped and undamped free vibrations - Undamped forced vibration - Critical damping - Logarithmic decrement Response to support motion - Response of one degree freedom system to harmonic excitation, damped or undamped - Evaluation of damping resonance - band width method to evaluate damping - force transmitted to foundation - vibration isolation.

Unit II : Response To General Dynamic Loading

Fourier series expression for loading-Response to general dynamic loading - (blast or earthquake) - Duhamel's integral - Numerical evaluation - Fast Fourier Transforms.

Generalized Distributed Flexibility:

Expression for generalized system properties Vibrational analysis with Rayleigh's variational method - Rayleigh - Ritz method.

Unit III : Multidegree Freedom System

Evaluation of structural property matrices- Natural vibrations - solution of the eigen value problem - vector interaction methods - Stodala and Subspace iteration techniques, Transformation methods - Jacobi and Given's method, Frequency search methods - Hozer and Transfer matrix methods Dunkery's equation and Rayleigh - Ritz methods - Orthogonality of natural modes.

Solution Of Equilibrium Equations In Dynamics:

Introduction - Direct integration methods - The central Difference method - The Houbolt method – Wilson -method and the Newmark method.

Unit IV : Distributed Parameter System

Differential equation of motion - analysis. of undamped free vibration of simply supported and cantilever beams - effect of axial loads - numerical evaluation of modes - frequencies and response system - vibration analysis using finite element method for beams and frames-component mode synthesis.

Unit V : Analysis Of Structures Subjected To Dynamic Loads

Idealisation of multi-storeyed frames for dynamic analysis - machine foundations -analysis of blast loading - earthquake response - elastic rebound theory; deterministic analysis of earthquake response - lumped S.D.O.F system - Design of earthquake resistant structures - I.S Code provisions-Dynamic interaction problems-Wind induced vibration of Structures.

Text Books

1. Clough, R., W., and Penzien, "Dynamics of Structures", McGraw Hill Book Co Ltd, 1986.
2. Paz Mario," Structural Dynamics - Theory and Computation", CBS publishers, 1999

Reference Books

1. Craig,R.R., "Structural Dynamics - An Introduction to computer Methods", John Wiley & Sons, 1989.
2. Hurty W.C and Rubinstein, M.F "Dynamics of Structures", Prentice Hall, 1967.
3. Biggs, 3.M., "Introduction to Structural Dynamics", McGraw-Hill, Co., 1964.
4. Thomson, W.T., "Theory of Vibration", Prentice Hall of India, 1975.
5. Manickaselvam, V.K., "Elementary Structural Dynamics", Dhanpat Rai & Sons, 1987.

CE304 FINITE ELEMENT METHODS IN ENGINEERING

Credit: 3:1:0
Marks: 40+60

Unit I : Introduction

Concept of an element - various element shapes - one, two and three dimensional elements - Finite Element procedure, variational principles and method of weighted residual - Principle of virtual work - Rayleigh Ritz method - Galerkin's method of weighted residual. Displacement, stress and hybrid models - principle of minimum potential energy - principle of minimum complementary energy - Reissner's principle. Convergence and compatibility requirements - Assumed displacement field - Pascal Triangle - Melosh criteria - Two dimensional Truss problem.

Solution Of Large Number Of Equations:

Review of Gaussian Elimination and Cholesky methods, Storage schemes - skyline, band forms - band solver, Frontal solver - Cholesky LU decomposition in skyline storage.

Unit II : Two Dimensional Elements

Triangular Elements - constant strain Triangle - Element stiffness matrix - various methods of evaluating element stiffness Higher order triangular elements - comparison of different elements. Rectangular Elements - Serendipity family - Lagrangian family - Hermitian family. Sub-Iso-Super Parametric elements - Shape function - Mapping - Linear isoparametric quadrilateral.

Unit III : Three Dimensional Elements

Numerical Integration using Gaussion Quadrature - Weights and Gauss points - Selective and reduced integration. Axisymmetric stress analysis - Tetrahedran element family - parallelopiped element - Hexahedran Element family - ZIB 8 and ZIB 20 elements.

Unit IV : Plate/Shell Elements And Finite Strip Method

Triangular and Rectangular elements - BFS Element - Faceted element for shells - Semi - loof elements - Degenerated shell elements - Axisymmetric shell elements. Finite strip method - Development of stiffness matrix and consistent load vector - Application to folded plates and bridge decks - Applications to Reinforced Concrete.

Unit V : Non-Linear Analysis And Computer Applications

Types of non-linearities - Stability analysis - Load deformation response - Solution techniques - Newton Raphson method - Modified Newton Raphson method, Alpha constant method, Riks Wempner method - classical Eigen Value analysis - programming organisation of Finite Element Schemes - Input / output plotting - Mesh generation aspects - software packages.

Text Book

1. Rajasekaran, S., "Finite Element Methods in Engineering Design", Wheeler, 1993.

Reference Books

1. Chandrakant, S.Desai and John F.Abel, "Introduction to the Finite Element method, A numerical Method for Engg. Analysis", Affiliated East West press Pvt.Ltd., Madras, 1972.
2. Tirupathi R.Chandrupatla and Ashok D., Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall of India Pvt.Ltd., New Delhi 1991.
3. Krishnamoorthy C.S., "Finite Element Method - Theory and Programming", Tata Mc Graw Hill Publishing Company", New Delhi 1994.
4. Bathe, K.J., "Finite Element Procedure", Prentice Hall of India, New Delhi 1997.
5. Zienkiewinz O.C., "The Finite Element method Vol. 1 & 2", Mc Graw Hill Book Company,New York 1991.
6. Mukhopadhyay.M., "Matrix, Finite Element Computer and Structural Analysis", Oxford & IBH publishing Co., Pvt. Ltd., New Delhi, 1993.
7. Rajasekaran, S., "Numerical Methods in science and Engineering - A practical approach", A.H. Wheeler & Co., 2nd Edn., 1999.

CE305 ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES

Credit 3:1:0
Marks: 40 + 60

Unit I : Limit State Design Of Beams For Flexure
Limit state design concepts - Statistical and probabilistic concepts of safety- Behaviour of reinforced concrete beam under gradually increasing flexural loads up to collapse - Limit state design of singly and doubly reinforced rectangular and flanged beams for flexure - Check for deflection and crack width as per I.S.456 code.

Unit II : Limit State Design of Beams For Shear, Torsion And Bond
Shear strength of beams - Interaction diagrams for combined bending and torsion - Design of members subjected to combined bending, shear and torsion - Skew bending theory - bond, anchorage and splicing of reinforcement.
Limit State Design Of Columns:
Behaviour, strength and design of axially loaded and eccentrically loaded short and long columns - Design of columns carrying axial load and biaxial moments.

Unit III : Limit Analysis And Design Of Slabs
Behaviour of R.C. slabs under gradually increasing loads - Assumptions made in yield - line theory of slabs - Analysis of isotropically and orthotropically reinforced slabs of various shapes under different edge conditions by virtual work method and equilibrium method - Application to practical design problems - Effect of corner levers - Hillerborg's simple strip method of analysis.

Unit IV : Design Of Multibay Multistorey Frames
Analysis for vertical loads adopting substitute frames - Analysis for wind forces using portal method - Design of plane frames - Detailing of joints - Joints of space frames - Shear Walls - Use of shear walls in high rise buildings - Types of shear walls - behaviour of cantilever walls -

interaction of shear walls and rigid jointed frames - Design for Earthquake forces.

Unit V : Limit Analysis And Design Of Statically Indeterminate Structures
Fundamental principles - Moment redistribution - limit analysis and design of continuous beams and simple portal frames - Check on rotation capacity.

Design Of Miscellaneous Structures:
Simply supported and continuous deep beams - Grid floors - Waffle slab - corbels

Text Books

1. Ashok K.Jain., "Reinforced Concrete - Limit state Design", Nemchand & Bros., Roorkee, 1983.
2. Park,R. and Paulay,T., "Reinforced Concrete Structures" John Wiley & Sons, New York 1975.

Reference Books:

1. Regan, P. D and Yu, C.W., "Limit state design of structural concrete", Chatto & Windus, London, 1973.
2. Purushotaman,P. "Reinforced concrete structural Elements", Tata McGraw Hill, Publishing Co., Pvt. Ltd., New Delhi, 1984.
3. Jones,L.L,and Wood,R.H., "Yield line Analysis of slabs", Chatto and Windus, London,1967.
4. Park R. and Gamble,W.L. 'Reinforced concrete slabs", John Wiley and Sons, New York, 1980.
5. Mac Gregor, G., 'Reinforced concrete Mechanics and Design", Prentice Hall, New Jersey 1988.
6. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice - Hall of India Ltd, New Delhi 1977.
7. Arthur H. Nilson et al, "Design of Concrete Structures", McGraw Hill Book Company, New York, 1986.
8. IS 456-2000 "Code of Practice for plain and reinforced concrete". BIS, New Delhi., 1978.
9. S.P. 16 (S & T) "Design Aids for Reinforced Concrete" to IS 456-1978. Indian Standard Institution, New Delhi, 1980.
10. SP24 (S&T) . "Explanatory handbook on Indian standard code of practice for plain and reinforced concrete (IS 456-1978)", BIS New Delhi, 1983.
11. IS 1893, "Criteria for Earthquake Design of Structures", BIS, New Delhi.,1984
12. SP 34, Hand Book on Concrete reinforcement and Detailing", BIS, New Delhi, 1987.
13. BS 110 (Part I) "Code of Practice for the structural use of concrete. Part I Design, materials and workmanship" ' British Standards Institution, London,1985.
14. ACI 318, "Building code of requirements for reinforced concrete", American concrete institute, Detroit, 1999.
15. Pasikh, S.K., "Automated Optimum Design of R.C.C. Skeletons", Tata McGraw-Hill Publishing Company Limited, New Delhi, 1995.

CE306 ANALYSIS AND DESIGN OF PLATE AND SHELL STRUCTURES

Credit 3:1:0

Marks: 40 + 60

Unit I : Classical Theory Of Plates

Differential equation of laterally loaded and thin rectangular plates- Levy and Navier solution of plates - small deflection theory of plates - analysis of laterally loaded (concentrically loaded) circular, thin plates with simply supported or clamped edge.

Unit II : Design of Folded Plate Roofs

Assumptions in the analysis of folded plates - Analysis of folded plate roofs as per the ASCE task committee recommendations -Design steps - Minimum thickness and reinforcements as per I.S. specifications for R.C. folded plates.

Unit III : Classical Theory of Shells

Structural behaviour of thin shells - Classification of shells - Translational and rotational shells Ruled surfaces - Methods of generating the surface of different shells like hyperbolic paraboloid, elliptic paraboloid, conoids etc - Membrane theory of doubly curved shells - Edge disturbances.

DESIGN OF SHELLS WITH DOUBLE CURVATURE:

Design of the following types of shells (a) Spherical shell, (b) Conical shell, (c) Paraboloid and Ellipsoid.

Unit IV : Design of Cylindrical Shells:

Design of R.C. cylindrical shell with edge beams using theory for long shells - Design of shells with ASCE manual coefficients.

Unit V : Design of Hyperbolic Paraboloid Shells

Surface definition - Determination of forces - Forces in the edge members - Buckling consideration - Design example - Detailing of reinforcement.

Design of R.C. Northlight Shells:

Analysis of stresses in northlight shells - Design example.

Text Books

1. Ramaswamy, G.S., “Design and Construction of Concrete Shell roofs”, Revised Ed. R.E.Kriegger, Malabar, Florida, 1984.
2. Timoshenko, S. “Theory of Plates and Shells, McGraw Hill Book Co., New York,1990.

Reference Books

1. Chatterjee, B.K., "Theory and design of concrete Shells", Oxford and IBH publishing co, 1971.
2. “Phase 1 - Report on Folded plate construction – Report of the Task Committee on Folded Plate Design, ASCE Structural Division” – Dec.1963, pp 365– 406.
3. Kelkar, V.S. and Sewell , R.T., "Fundamentals of the analysis and design of shell structures". Prentice Hall, Inc. New Jersey, 1987.

4. “Design of Cylindrical concrete shell roofs", Manual of Engineering Practice No.31 ASCE, New York, 1952.
5. Billington, D.F., "Thin Shell Concrete Structures” Mc Graw Hill Book Company, 1965.

CE307 ADVANCED DESIGN OF STEEL STRUCTURES

Credit 3:1:0
Marks: 40 + 60

Unit I : Structural Connections
Design of high strength function grip bolts - Design of riveted and bolted connections at the junctions of beams and columns in frames - Design of un-stiffened & stiffened seat connections - Welded connections - eccentric connections - Beam end connections - Direct web fillet welded connections - Direct web Butt welded connection - Double plate web connection - Double angle web connection - Un-stiffened and stiffened seat connection - Moment resistant connection - Behaviour of welded connections - problems.

Unit II : Beams
Design of beam to resist biaxial Bending moments - Design of sections to resist unsymmetrical bending - Beam splices - lattice beams - Elastic lateral torsional buckling.

Beam Columns
Differential Equations - Moment Magnification factor for end moments - side way - Nominal strength - Interaction equations - Biaxial bending.

Unit III : Industrial Building
Industrial building frames - General - Framing - Bracing - Crane girders and columns - Analysis of Trussed bents - Design example - Design of rigid joints knee for gable frames.
Structure of Multistoreyed Buildings - Bracing of Multistorey frames - Loads - Lateral load of Frames - Design.

Unit : IV
Design of steel bunkers and silos - Janssen's theory - Ary's theory - design parameters-design criteria - Analysis of Bins - Hopper bottom - Design of Bins.
Design and detailing of guyed steel chimneys.
Transmission line towers - Introduction, types of towers - tower configuration, load analysis and design of members.

Unit V : Light Gauge Section
Design of cold formed sections - concepts - effective width - stiffened sections - multiple stiffened sections - design for flexure – design of two span continuous beams - design of light gauge columns – Torsional – Flexural buckling – Tension Members - beam column - connections.

Plastic Analysis And Design
Plastic design of tension & compression members - Theory of plastic bending - Plastic hinge - redistribution of moments - failure mechanisms - plastic analysis and design of fixed beams, continuous beams and portal frames by mechanism method.

Text Books

1. Dayaratnam, P. "Design of steel structures", A.H. Wheeler & Co., Ltd, Allahabad, 1996.
2. Arya and Ajmani, "Design of steel Structures", Nemchand Brothers, Roorkee, 1989.
3. Punmia, B.C., Ashok Kumar Jain & Arunkumar Jain, "Design of Steel Structures", Vol I & II, Arhant Publications, Bombay, 1995.

Reference Book

1. Gray, C. S. Kent L.E Mitchell, W.A., and Godfey, W.B., "Steel Designer's manual", English Language Book Society and Granade Publishing, London, 1983.

CE308 ADVANCED COMPUTER APPLICATION LABORATORY

Credit 0:0:2
Marks 50 + 50

A. Program Using Fortran And C Languages:
1. Solution of Linear System of Equations by Cramer's Rule.
2. Solution of Linear System of Equations by Gaussian Elimination method
3. Solution of Linear System of Equations by Gauss Siedel Iteration.
4. Solution of Linear System of Equations using Band Solver technique.
5. Programs for Semi automatic Technique for Flexibility and Stiffness approach.
6. Program for Direct Stiffness Method

B. Finite Element Method:
1. Analysis of 2D Truss by FEM using 2D Truss Program

C. Finite Element Analysis Of Structures (Feast):
1. Analysis of Cantilever beam using FEAST Software package.
2. Analysis of Plates using FEAST Software package
3. Analysis of Shells using FEAST Software package

D. Analysis And Design Of Structures Using STAAD-III Package
1. Analysis of plane rigid jointed frame by STAAD-III package.
2. Analysis of continuous Beams using STAAD-III package
3. Analysis of Trusses using STAAD III-package.

E. Analysis Of Structures Using NISA
1. Analysis of Curved Beams using NISA package.
2. Analysis of plates using NISA package.

F. Modelling Using Auto Cad
1. Solid Modelling using Auto CAD.
2. Design of R.C. Beams, counterfort Retaining Walls using Excel.

G. Analysis Using Ansys Pacakage
1. Stress Analysis of Deep Beams.
2. Analysis of Folded Plates & Shells
3. Analysis of Grids

H. Drafting Using Auto Cad

I. Buckling And Dynamic Analysis Of Structures

Text Book

1. Balaguruswamy. E "Object – Oriented Programming C", Tata Mc Graw Hill.

Reference Books:

1. STAAD PACKAGE MANUAL
2. FEAST PACKAGE – Hand Book for Prewin
3. FEAST C Users Manual
4. ANSYS Package Manual.

CE309 DESIGN OF FOUNDATION STRUCTURES

Credit: 3:1:0
Marks: 40 + 60

Unit-I : Pile Foundation

Introduction - Bearing capacity of piles and pile groups - IS method - Settlement of piles - Negative skin friction - Lateral load resistance of individual piles and pile groups - Finite difference method, Non dimensional method.

Unit II : Sheet Pile Walls And Cofferdams

Sheet pile structures - cantilever sheet pile walls in granular soils and cohesive soils - Anchored Bulk head - Free earth support method - Fixed earth support method - lateral earth pressure on Braced sheet pile walls - Cofferdams - Types - Cellular cofferdams - components - Dimensions - Cell fill - stability of cellular cofferdams - cofferdams in Rock - Cofferdams on deep layers of sand or clay.

Unit III : Machine Foundations

Introduction - Types of machine foundation - Waves and wave propagation - Dynamic properties of soil - Vibration analysis of machine foundation - Natural frequency - Design of foundation for Reciprocating machines and Impact machines - Reinforcement and construction details - Vibration isolation - Codal provisions.

Unit IV : Marine Substructures

Introduction - Type of marine structures - Breakwaters, Wharves, Piers, seawalls, Docks, Quay walls, - Design loads - Wave action - Wave pressure on vertical wall - Ship impact on piled Wharf structure - Design of Rubble mount break water and Wall type break water.

Unit V : Special Foundation

Foundation in Expansive Soils:- Introduction - Identification of expansive soils Indian expansive soils - Swell potential and swelling pressure - Methods of foundation in expansive soils - Under reamed pile foundation.

Reinforced Earth:-Introduction - Basic Mechanism of reinforced earth - Choice of soil and Reinforcement - Reinforced earth retaining walls.

Text Books

1. Swamy Saran, "Analysis and Design of Substructures", Oxford and IBH Publishing Co., Pvt.Ltd., New Delhi.
2. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering - Vol.2 -Foundation Engg."
3. Srinivasulu.P and Vaidyanathan.C.V., "Hand Book of Machine Foundations", Tata McGraw Hill Co., Ltd., New Delhi.

Reference Books

1. Venkatramaiah.C, "Geotechnical Engineering", New Age International Ltd., New Delhi.
2. Manfred.R Hausmann, "Engineering Principles of Ground Modification", McGraw Hill Publishing Co., New York.
3. Joseph E. Boules, "Foundation Analysis & Design, "McGraw Hill Book Co., New York.

CE310 STABILITY OF STRUCTURES

Credit 3:1:0
Marks: 40 + 60

Unit I : Concepts of Stability

Introduction - Stability Criteria - Equilibrium, Energy and Dynamic approaches- South well Plot - Stability of Link models.

Compression Members:

Higher order Differential equations - analysis for Various boundary conditions- behaviour of imperfect column - initially bent column - eccentrically loaded column-Energy method-Rayleigh Ritz , Galerkin methods - Numerical techniques- NewMark's method - Finite element method- Effect of shear on buckling – Large deflection of columns.

Unit II : Inelastic Buckling

Introduction - Double modulus theory (reduced modulus) - tangent modulus theory - Shanley's theory - determination of double modulus for various sections.

Beam Columns:

Introduction - Beam-columns with concentrated lateral loads - distributed loads - effect of axial loads on bending stiffness - stability of frames - stability functions.

Unit III : Lateral Stability of Beams

Differential equations for lateral buckling - lateral buckling of beams in pure bending - lateral buckling of cantilever and simply supported beams

Buckling of Thin-Walled Open Sections:

Introduction - torsional buckling - torsional flexural buckling - Equilibrium and energy approaches.

Unit IV : Stability of Plates

Governing Differential equation-Equilibrium, energy concepts - Buckling of rectangular plates of various end conditions - Finite difference method - post-buckling strength

Unit V : Buckling of Shells

Symmetrical buckling of cylindrical shells under uniform axial compression – Buckling of cylindrical shell under uniform external lateral pressure – Buckling of uniformly compressed spherical shells.

Elements of Non Linear Theory Of Buckling:

Perfect Systems - Imperfect Systems - Imperfection in-sensitive and sensitive systems - Symmetric and Asymmetric Bifurcation - non linear analysis of shell and spatial structures - computational bifurcation theory -bifurcation and limit points - path tracing - point matching - path switching - simple examples

Text Books

1. Chajes, A., " Principles of Structural Stability Theory", Prentice Hall, 1974.
2. Iyengar, N.G.R., "Structural Stability of columns and plates", Affiliated East West press Pvt. LTD, New Delhi - 1986.

Reference Books

1. Brush, D.O., and Almorth,B.O., " Buckling of Bars, Plates and Shells", McGrawHill, 1975..
2. Timoshenko, S.P., and Gere,J.M., "Theory of Elastic Stability", 2nd Ed. McGraw-Hill, 1961.
3. El Naschie M.S., "Stress, Stability and Chaos in Structural Engineering: An Energy Approach", McGraw Hill International Editions, 1992.
4. Ashwini Kukar, "Stability of Structures ", Allied Publishers LTD, New Delhi, 1998.

CE311 ADVANCED BRIDGE ENGINEERING

Credit 3:1:0
Marks: 40 + 60

Unit I : Analysis And Design of Concrete Bridges
Loading standards: IRC and Railway loadings - Reinforced concrete bridge decks: slab, T-beam-and-slab, arch, bow string girder types - Prestressed concrete bridges: simple spans, continuous decks; cantilever construction; anchorage of tendons; grounting of tendons.

Unit II : Steel Bridges
Steel superstructure: Plate girder, box girder truss and arch types - Cable stayed bridges and suspension bridges; principles of design, aerodynamic stability and vibrations; simplified designs.

Unit III : Substructure And Foundations
Substructure design: piers and abutments of different types - Foundations: Shallow foundations, deep foundations, piles, wells and pneumatic caisons - River training works.

Unit IV : Construction And Maintenance
Bearing: metallic and elastometric types; fixed and movable bearings - Joints: expansion joints; Contraction joints; joint seals - Innovative construction methods: incremental push launching; cantilever construction; erection of precast elements - Bridge maintenance management: inventory, inspection and rehabilitation.

Unit V : Case Studies
Case studies of recently constructed major bridges – Critical studies of failure of major bridges

Text Book

1. Johnson Victor, D., "Essentials of Bridge Engineering", Oxford & IBH Publishing Co., New Delhi, Fourth Edition, 1991.

Reference Books

1. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, New Delhi, 1986.
2. Bakht, B. and Jaeger, L.G., "Bridge Deck Analysis Simplified", McGraw Hill International Edition, Singapore, 1987.
3. Krishna Raju, N., "Design of Bridges", Oxford & IBH Publishing Co., New Delhi, Third Edition, 1998.

CE312 MAINTENANCE AND REHABILITATION OF STRUCTURES

Credit 3:1:0
Marks: 40 + 60

Unit – I : Introduction
General consideration - Distresses monitoring- Causes of distresses - Quality assurance - Defects due to climate, chemicals, wear and erosion – Inspection - Structural appraisal - Economic appraisal.

Unit II : Building Cracks
Causes - diagnosis - remedial measures - Thermal and Shrinkage cracks - unequal loading - Vegetation and trees - Chemical action - Foundation movements - Techniques for repair - Epoxy injection.

Unit III : Moisture Penetration
Sources of dampness - Moisture movement from ground - Reasons for ineffective DPC - Roof leakage - Pitched roofs - Madras Terrace roofs - Leakage of Concrete slabs -Dampness in solid walls - condensation - hygroscopic salts- remedial treatments - Ferrocement overlay - Chemical coatings - Flexible and rigid coatings.

Unit IV : Concrete Structures
Introduction - Causes of deterioration - Diagnosis of causes - Flow charts for diagnosis - methods of repair - Repairing, spalling and disintegration - Repairing of concrete floors and pavements.
Steel Structures:
Types and causes for deterioration - preventive measures - Repair procedure- Brittle fracture - Lammelar tearing - Defects in welded joints - Mechanism of corrosion - Design to protect against corrosion - Design and fabrication errors - Distress during erection.
Masonry Structures:
Discoloration and weakening of stones - Biocidal treatments - Preservation -Chemical preservatives - Brick masonry structures - Distresses and remedial measures.

Unit V : Strengthening of Existing Structures
General principle - relieving loads - Strengthening super structures - plating-Conversion to composite construction - post stressing - Jacketing - bonded overlays- Reinforcement addition - strengthening the substructures - under pinning-Increasing the load capacity of footing- Design for rehabilitation.

Text Books

1. Johnson,S.M., "Deterioration, Maintenance and repair of Structures", McGraw-Hill Book Company, Newyork, 1965.
2. SP25-84 - Hand Book on Causes and Prevention of Cracks on Buildings, Indian Standards Institution, New Delhi, 1984.
3. Richardson,B.A., "Remedial Treatment of Buildings", Construction Press, London, 1980.

Reference Books

1. Dension,C Alien and Roper,H., "Concrete Structures, Materials, Maintenance and Repair" , Longman Scientific and Technical, UK, 1991.
2. Alien, R.T. and Edwards,S.C., "Repair of Concrete Structures", Blakie and Sons, UK,1987.
3. Guha R.K., " Maintenance and Repairs of Buildings", New Central Book Agency(P)Ltd, Calcutta, 1985.

4. Shetty,M.S., " Concrete Technology - Theory and Practice", S.Chand & co New Delhi, 1982
5. Santhakumar.A.R., "Training course notes on Damage Assessment and Repair in Low cost Housing " RHDC -NBO, Anna University, Madras. July, 1992.
6. Raikar, R.N., "Learning from failures - Deficiencies in Design , Construction and Service", - R & D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
7. N.Palaniappan, "Estate Management", Anna Institute of Management, Madras, Sep. 1987.
8. Garas,F.K.,Clarke,J.L. and Armer,G.S.T., "Structural Assessment", Butterworths, UK,April 1987.
9. Santhakumar,A.R., -"Concrete chemicals - Theory and Applications". Indian Society for construction Engineering and Technology, Madras, 1993.

CE313 SEISMIC ANALYSIS AND DESIGN OF STRUCTURES

Credit 3:1:0
Marks: 40 + 60

Unit I : Seismological Background
Introductory note – Seismicity – Earthquake faults and waves – Structure of the earth – Plate tectonics – Elastic rebound theory of earthquakes – Measures of earthquake size
Earth quake Response of Linear Systems:
Earth quake Excitation - Equation of motion – Response quantities - Response History - Response Spectrum Concept - Peak Structural Response from the response spectrum

Unit II : Earthquake Analysis of Linear Systems
Response History Analysis - Modal Analysis - Multistorey Buildings with Symmetric Plan – Multistorey Buildings with Unsymmetric Plan ; Response Spectrum Analysis - Peak Response from Earthquake Response Spectrum - Multistorey Buildings with Symmetric Plan – Multistory Buildings with Unsymmetric plan.
Earthquake response of Linearly elastic buildings:
Influence of fundamental period on response – influence of beam-column stiffness ratio on response – modal contribution factors – influence on higher mode response – heightwise variation of higher mode response

Unit III : Earth quake Response of inelastic System
Force- deformation Relations - Normalized Yield strength, Yield reduction Factor, and Ductility Factor- Equation of motion and controlling parameters - Effects of yielding - Response Spectrum for Yield deformation and Yield strength - Design strength and deformation from the Response spectrum - Design Yield Strength

Earthquake response of inelastic buildings:
Allowable ductility and ductility demand – Buildings with weak and soft first storey – Buildings designed with force distribution as per Indian Code

Unit IV : Earthquake dynamics of Base-Isolated Buildings
Soil - structure interaction - Isolation systems- Base isolated one-storey buildings – effectiveness of base isolation – base isolated multistorey buildings – application of base isolation – design of damper-isolation systems

Unit V : Structural Dynamics in Building Codes
Development of building codes – philosophy of seismic design – I S code provisions -base shear – storey shears and equivalent static forces - Ductility in reinforced concrete members - Designing for ductility - I S code provisions-

Practical applications:
Evaluation of earthquake vulnerability of existing structures and rehabilitation for seismic deficiencies

Text Book

1. Anil K. Chopra , " Dynamics of structures – Theory and applications to earthquake engineering', Prentice hall of India Pvt. Ltd., New Delhi

Reference Books

1. Ray W. Clough and Joseph Penzien , ' Dynamics of structures', Mc Graw Hill Inc, New Delhi
2. Mario Paz, " Structural dynamics – Theory and applications", CBS Publishers and distributors, New Delhi
3. David Key, " Earthquake design practice for buildings', Thomas Telford, London
4. I S 1893 – 1984 " Criteria for earthquake resistant design of structures"
5. I S 4326 – 1976 " Code of practice for earthquake resistant design and construction of buildings"
6. IS 13920-1993" Ductility detailing of reinforced concrete structures subjected to seismic forces "

CE314 ADVANCED CONCRETE TECHNOLOGY

Credit: 3:0:0
Marks: 40+60

UNIT I
CONCRETE MAKING MATERIALS
Composition and properties of portland cement - tests on physical properties - consistency - setting time - soundness - strength - cements of different types - composition - properties and uses with special emphasis for different constructional and weather conditions - IS code specifications.
AGGREGATES: Classification - Mechanical Properties - deleterious substances in aggregates - Bulking of sand - Alkali Aggregate reaction - Grading requirements - IS Code specifications
WATER: Requirements of water for concrete making - IS Code specifications.

ADMIXTURES: - Accelerators - Retarders - water reducing agents - Plasticisers - Air entraining agents – Water proofing admixtures.

UNIT II

FRESH CONCRETE AND HARDENING OF CONCRETE

Workability - Factors affecting workability - Tests for workability - Segregation - Bleeding - Mixing of concrete - Compaction of concrete - Ready mixed concrete - Pumped Concrete - Preplaced concrete - Shotcrete. Factors affecting strength of concrete - Curing of concrete Maturity of concrete - Micro cracking and autogeneous healing - Evolution of heat and expansion - Shrinkage of concrete - Factors affecting shrinkage of concrete.

UNIT III

DURABILITY OF CONCRETE AND TESTING OF HARDENED CONCRETE:

Permeability - Chemical attack - Sulphate attack - Quality of water - Marine atmosphere - Methods to improve durability - Thermal properties of concrete - Fire resistance - Resistance to Abrasion and Cavitation - Acoustic properties - Compression test - Split Tension test - Flexure Test - Test for Bond strength - IS Code provisions - Factors affecting strength test results - Accelerated strength tests - stress strain characteristics - Determination of modulus of elasticity - In site strength determination - variation in test results - Distribution of strength - standard deviation-creep of concrete and factors which influence it.

NONDESTRUCTIVE TESTING OF CONCRETE:

Ultrasonic pulse velocity method and rebound hammer method.

UNIT IV

MIX DESIGN

Basic considerations - Factors in the choice of mix proportions - Mix design methods - ACI method, IS method - Mix proportions for weigh batching and volume batching - correction for moisture content and bulking - yield of concrete - Design of high strength concrete mixes.

SPECIAL CONCRETES AND CONCRETE COMPOSITES:

Light weight concrete: Types - Light weight aggregate concrete-Aerated concrete, No fines concrete - High Strength concrete - Heavy weight concrete for radiation shield - Fibre reinforced concrete - Ferrocement - Polymer concrete - High Performance Concrete - Their properties and applications.

UNIT V

REHABILITATION OF CONCRETE STRUCTURES

Cracks in concrete - Types - Intrinsic cracking, structural cracking - causes and remedies - Plastic cracks - causes and remedies - Thermal contraction cracks - Long term drying shrinkage cracks - Crazing - Sulphate attack cracks - Alkali aggregate reaction cracks.

Repair techniques - Materials for repair - Epoxy adhesive injections and mortars - Repair and strengthening of concrete structures by bonded steel plates.

CE315 ADVANCED CONCRETE TECHNOLOGY LABORATORY

Credit: 0:0:2
Marks: 50+50

1. CONCRETE MIX DESIGN FOR M20 AND M50 GRADE
1.1 Indian Standard Method
1.2 ACI method
2. TESTS ON HARDENED CONCRETE
2.1 Determination of Modulus of Elasticity of Concrete
3. Tests on High Performance Concrete
4. Tests on the Behaviour and ultimate strength of Reinforced Concrete Beams.
5. Impact test on FRC specimens.
6. Demonstration of prestressing operations
7. Studies on Electrical Resistance Strain gauges using a Demonstration kit.
8. Non-Destructive Testing of Concrete

TEXT BOOKS

1. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, 1990.
2. Neville, A.M.., "Properties of Concrete", Longman Scientific & Technical, England, 1981.
3. Gambier, “Concrete Technology”, Tata McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Orchard, D.F., "Concrete Technology", Vols. 1 & 2, 1963.
2. Shetty, M.S., "Concrete Technology", S.Chand & Co., New Delhi, 1998.
3. Rixon, M.R., "Chemical Admixtures for Concrete", John Wiley & Sons, 1977.
4. Krishnaraju, N. "Design of concrete mixes", Sehgal Educational Consultants & Publishers Pvt.Ltd., Faridabad, 1988.
5. IS: 10262, "Recommended Guidelines for concrete Mix Design", 1982.

CE316 PRESTRESSED CONCRETE STRUCTURES

Credit: 3:1:0
Marks: 40+60

UNIT I

DESIGN FOR FLEXURE:

Definition of Type I, Type II and Type III structures - Basic assumptions - Permissible stresses in steel and concrete as per IS:1343 Code - Four basic requirements - Design and choice of sections of post-tensioned beams - Layout of cables - Check for limit state of collapse - Location of positions of wires in pre-tensioned beams.

UNIT II

DEFLECTION:

Short term deflections of uncracked members - Long term deflections - Deflection due to creep in members - Code requirements for the limit state of deflection.

DESIGN FOR SHEAR AND TORSION:

Shear and principal stresses - Limit state shearing resistance of cracked and uncracked sections - Design of Shear reinforcement by the limit state approach. Interaction diagrams under combined bending, torsion and transverse shear.

UNIT III

TRANSFER OF PRESTRESS:

Transmission of prestressing force by bond - Transmission length - Factors affecting transmission length - Check for transmission length - Anchorage zone stresses in post-tensioned members - Calculation of bearing stress and bursting tensile forces and reinforcement in anchorage zone based on I.S. 1343 code and Guyon's method.

COMPOSITE CONSTRUCTION OF PRESTRESSED & INSITU CONCRETE:

Types of composite construction - Analysis for stresses - Effect of Differential shrinkage - Design for flexure and shear.

UNIT IV

STATICALLY INDETERMINATE PRESTRESSED CONCRETE STRUCTURES:

Methods of achieving continuity - Assumptions in elastic analysis - Pressure line - Linear transformation - Concordant cables - Guyon's theorem - Analysis and design of continuous beams.

UNIT V

MISCELLANEOUS STRUCTURES:

Circular prestressing in liquid retaining tanks - Analysis for stresses - Design of tank wall incorporating the recommendations of IS:3370 Part III Code - Types of Prestressed concrete pipes - Design of pipes.

Methods of achieving partial prestressing - Advantages and disadvantages. Design of prestressed concrete columns, sleepers, poles and tension members - Use of non-prestressed reinforcement.

Text Books

1. Krishna Raju, N., "Prestressed Concrete" Tata McGraw Hill Publishing Company Ltd., New Delhi, 1995.
2. Lin, T.Y., and Ned H Burns., "Design of Prestressed Concrete Structures", John Wiley and sons, Newyork, 1982.

Reference Books

1. Guyon, Y. "Limit State Design of Prestressed Concrete Vols. I & II", Applied Science Publishers, London, 1974.

2. Ables, P.W. and Bardhan Roy, B.K., 'Prestressed Concrete Designers' Hand Book (3rd Edition) A View Point Publication, Cement and concrete Association, U.K. 1981. London, 1966.
3. Leonhardt,F., "Prestressed Concrete Design and Construction", Wilhelm Ernst and Soh, Berlin, 1964.
4. Nilson, A.H., "Design of Prestressed Concrete", John Wiley & sons, New York, 1978.
5. Mallik S.K., and Gupta A.P., "Prestressed Concrete", Oxford & IBH Publishing Company (P) Ltd, India, 1986.
6. "IS: 3370 (Part III and IV) Indian Standard Code of Practice for Concrete structures for the Storage of Liquids Part III"
7. "Prestressed Concrete Structures", Indian Standards Institution, New Delhi 1967.
8. "IS: 1343, Indian Standard code of Practice for Prestressed Concrete", Indian Standards Institution, New Delhi., 1980.
9. "IS: 784, Indian Standard Specification for Prestressed Concrete Pipes", Indian Standards Institution, New Delhi 1978.
10. "IS: 3935 - Code of Practice for composite construction", Indian Standards Institution, New Delhi,
11. "BS 110, Part I, Code of Practice for the Structural use of Concrete", British Standards Institution, London, 1985.

CE 317 ADVANCED CONSTRUCTION TECHNIQUES AND PROJECT MANAGEMENT

Credit: 4:0:0
Marks: 40+60

UNIT I

SUB-STRUCTURE CONSTRUCTION:

Box jacking – Pipe jacking – Under water construction of diaphragm walls and basement – Tunneling techniques – driving well and caisson – sinking cofferdam – cable anchoring and grouting – driving diaphragm walls, sheet piles – laying operations for built up offshore system – shoring for deep cutting large reservoir construction with membrance and earth system – well points – dewatering and stand by plant equipment for underground open excavation.

UNIT II

SUPER STRUCTURE CONSTRUCTION:

Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – insitu prestressing in high rise structures, aerial transporting, handling and erecting lightweight components on tall structures – erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrappers, bow string bridges, cable stayed bridges – launching and pushing of box decks – Advanced construction techniques in offshore construction practice – construction sequence and methods in RCC domes and prestress domes – support structure for heavy equipment and conveyor and machinery in heavy industries – erection of articulated structures, braced domes and space decks.

UNIT III

REPAIR CONSTRUCTION:

Mud jacking grout through slab foundation – micropiling for strengthening floor and shallow profile – pipeline laying – protecting sheet piles, screw anchors – sub grade – water proofing – under pinning advanced techniques – Sequence in demolition and dismantling.

UNIT IV

ORGANIZING PROJECT MANAGEMENT:

What is project Management? – Trends in Modern Management – Strategic Planning and Project Programming organization of project participants – Traditional Designer – Constructor sequence – Professional Construction Management – owner – Builder Operation – Turnkey operation – Leadership and Motivation for the project team – Interpersonal Behaviour in Project Organizations – Perception of Owners and Contractors. Innovation and Technological Feasibility – Innovation and Economic Feasibility – Geotechnical Engineering: Investigation – Construction Planning – Computer aided planning.

UNIT V

LABOUR, MATERIAL, EQUIPMENT AND FINANCIAL MANAGEMENT:

Factors affecting job-site productivity of labour – Labour relations in construction – Problems in collective bargaining – Materials procurement and Delivery – Inventory control – Tradeoffs of costs in Materials Management – Construction equipment – Choice of equipment and standard production rates – Equipments for industrial construction and pre-fabrication.

Type of construction cost estimates – Unit cost method of estimation – Application of cost indices to estimating – Estimate based on Engineer's list of quantities allocation of construction costs over time – Estimation of operating costs – Computer Aided Cost Estimation.

TEXT BOOKS

1. Jerry Irvine, Advanced Construction Techniques, CA Rocktr, 1984
2. Chitkara.K.K., Construction Project Management, Tata McGraw Hill Co., New Delhi, 1998
3. Seetharaman .S, 'Construction Engineering and Management', Umesh Publications, Nai Sarak, Delhi – 110 006.

REFERENCE BOOKS

1. Patrick Powers, J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.
2. Robertwade Brown, Practical Foundation Engineering Hand book, Mc Graw Hill Publications, 1995.
3. Chris Handrickson and Tung Au, Project Management for Construction – Fundamental Concepts for owners, Engineers, Architects and Builders, Prentice Hall, Pittsburg, 2000.
4. Choudhury, S, Project Management, Tata Mc Graw – Hill Publishing Company, New Delhi, 1998.

5. Ernest E. Ludwig, Applied Project Engineering and Management, Gulf Publishing Company, Houstan, Texas, 1988.
6. Harold Kerzner, Project Management – A system Approach to Planning, Scheduling and Controlling, CBS Publishers & Distributors, Delhi, 1998.
7. Joy, P.K., Total Project Management – The Indian Context, Macmillan India Ltd., New Delhi, 1992.

CE 318 THEORY OF PLATES

Credit : 4:0:0
Marks: 40+60

UNIT I : Introduction
Thin and thick plates – Plate behavior – Material behavior – Isotropic and orthotropic Materials.
Small Deflection Theory and Classical Methods
Differential equation of plates in Cartesian Coordinates system – boundary conditions – Rigorous solution – Naveir's method – Levy's method.

UNIT II : Symmetrical Bending of Circular Plates
Differential equation for symmetrical bending of laterally loaded circular plates – Simply supported edges – clamped edges – circular plate with a circular hole at the center – circular plate concentrically loaded.

UNIT III :Approximate Methods
Energy method – Galerkins Method – Ritz Method – Simultaneous bending and stretching.
Numerical Methods
Finite difference method – Introduction to Finite Element Method.

UNIT IV : Plate of Other Shapes
Triangular plates – Elliptic plates – Sector plates – Skew plates – Plates on elastic foundation – Continuous plates.

UNIT V : Advanced Topics
Large Deflection theory – Shear Deformation Theories – Mindlin's theory of plates – Flat plates – Engineering approach to design of Rectangular floor slabs.

Text Books:
1. Rudolph Szilard., "Theory and Analysis of Plates", Prentice Hall, 1974.
2. Timoshenko and Krieger., "Theory of Plates and Shells", Mc-Graw Hill Inc, New York, 1959.

Reference Books:
1. Donnel, L.H., "Beams, Plates and Shells", McGraw Hill Inc, 1976.
2. Mansfield., "The Bending and Stretching of Plates"
3. Pucker.A., "Influence Surfaces of Elastic Plates"
4. Bairagi. N.K., "A Text Book of Plate Analysis", Khanna Publishers", New Delhi.

CE 319 MECHANICS OF COMPOSITE MATERIALS

Credit : 4:0:0
Marks: 40+60

Unit I : Introduction
Classification – mechanical behavior – basic terminology – manufacture – advantages.

Unit II : Micro Mechanical Behavior of a Lamina
Determination of constants – elasticity approach to stiffness – comparison of approaches – mechanics of material approach.

Unit III : Macro Mechanical Behavior of a Lamina
Stress – Strain relation for anisotropic material – engineering constants – constitutive relation in plane stress – lamina in arbitrary – bi-axial strength theory.

Unit IV : Macro Mechanical Behavior of a Laminate
Equivalent single layer theory – classical laminate theory – continuum based theory – laminate stiffness – comparison – strength of laminates - stress design of laminates.
Failure Strength Of Laminates
Delamination Theory – Ply drops and Failure Theory – Tsai –Wu Theory.

Unit V : Bending, Buckling and Vibration of Laminate Plates
Governing equations – bending, buckling and vibration – design of simply supported plate under distributed lateral load – buckling under in-plane load – vibration of simply supported laminate plates.

Text Books

1. Jones, R.M., "Mechanics of Composite Materials II, McGraw – Hill Kogukush International students edition, 1975.

Reference

1. Bose.P., and Reddy. J.N., "Analysis of Composite plates using various plate theories – part I and II – formulation and analytical solution "Structural Engineering and Mechanics, Vol 6, No 6, & 7, Sept, Oct, 1998.
2. Reddy, J.N., "Mechanics of Laminated Composite Plates", CRC Press.

CE 320 DISCRETE STRUCTURAL OPTIMIZATION

Credit : 4:0:0
Marks: 40+60

Unit I : Introduction
Basic Concepts of minimum weight – minimum cost design – Objective function, constraints – Brief review of classical methods.

Unit II : Integer Programming
Introduction – Graphical representation – Gomory's cutting plane method – Balas' Algorithm for zero-one programming – Integer polynomial programming – Branch-and-Bound method – Sequential Linear Discrete Programming – Generalized penalty function method.

Unit III : Genetic Algorithm
Genetic Algorithms – Operators – Reproduction – Mutation – Cross Over – Evolution Strategies – Methods for optimal design of structures, continuous beams and single storeyed frames – minimum weight design for truss members.

Unit IV : Ant Colony Algorithm
Natural motivation – Ant algorithm – Network – The ant – Initial population – Ant movement – Ant tours – Pheromone – Evaporation – Introduction to TABU search – sample problem.

Unit V : Artificial Neural Network
Basic concepts – Biological systems – Artificial neural network – application characteristics – overview of learning methods – Review of probability concepts – Fuzzy set theory and logic.

Text Books

1. Rao. S.S. "Engineering Optimization, Theory and Practice", New age International (p) Ltd., New Delhi. Reprint 2002.
2. GoldBerg, D.E., "Genetic Algorithm in Search, Optimization and Machine Learning", Addison – Wesley, 1989.

Reference Books

1. Spunt, L, "Optimum Structural Design", Prentice Hall, New Jersey, 1971.
2. Gary Parker, R and Ronald L, Discrete Optimization", Academic press 1988.
3. David Corns, Marco Dorigo and Fred Gloves, "New Ideas in Optimization", The McGraw Hill Company, London, 1999.
4. Rajasekaran,S and Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm", Prentice Hall of India Pvt. Ltd, Delhi, 2003.

CE 321 DESIGN OF STRUCTURES FOR DYNAMIC LOADS

Credit : 4:0:0
Marks: 40+60

Unit I : Introduction
Factors affecting design against dynamic loads – Behavior of concrete, steel, masonry and soil under impact and cyclic loads – Recap of Structural dynamics with reference to SDOF, MDOF and continuum systems – Ductility and its importance.

Unit II : Design Against Earth-Quakes
Earth-quake characterisation – Response spectrum – seismic coefficient and response spectra methods of estimating loads – Response of framed, braced frames and shear wall buildings – Design as per BIS codes practice – Ductility based design.

Unit III : Design Against Blast and Impact
Characteristics of internal and external blast - Impact and impulse loads – Pressure distribution on buildings above ground due to external blast – underground explosion - Design of buildings for blast and impact as per BIS code of practice.

Unit IV : Design Against Wind
Characteristics of wind – Basic and design wind speeds – Effect of permeability of structure – pressure coefficient – Aeroelastic and Aerodynamic effect - Design as per BIS code of practice including Gust factor approach – tall buildings, stacks and chimneys.

Unit V : Special Considerations
Energy absorption capacity – Ductility of material and the structure – Detailing for ductility – Passive and active control of vibrations – New and favorable materials.

Text Book:

1. Bela Goschy, "Design of Buildings to withstand abnormal loading", Butterworhts, 1990.

Reference Books:

1. Paulay.T and Priestly. M.N.J, "A seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 1991.
2. Dowling. C.H, "Blast Vibration – Monitoring and Control", Prentice Hall Inc, Englewoods Cliffs, 1985.
3. Alan G. Daven Port, "Wind Effects on Buildings and Structures", Proceedings of the Jubileum Conference on Wind effects on Structures", Port Alegne, Brazil, pp 25-29, May 1998, Balkema A.A. Publishers, 1998.
4. Concrete Structures Under Impact and Impulsive loading, Synthesis Report, CEB. Lousanne, Germany, 1988.

CE 322 DIGITAL IMAGE PROCESSING

Credit : 4:0:0
Marks: 40+60

Unit I : Information system, encoding and decoding, modulation.
Satellite data – acquisition, storage and retrieval – generation of data products – CCT formats – Digital Image Processing systems, Different types, Hardware and software design considerations, Photo write systems.

Unit II : Introduction to VAX – 11/780 and PC based Image Processing Systems
Digital Image Processing – Principles, Color Concept and color combination, classification of operations, source of image degradation.
Correction processing – Atmospheric, Radiometric, Geometric corrections, interpolation methods and resampling techniques, Gamma correction, types of transformations.

Unit III

Pre –classification processing – Histograms, Density slicing, Grey level maps, Contrast stretching, filtering, band rationing, PC – analysis, edge detection . Basic pattern recognition concepts, Principles of spectral discrimination.

Unit IV

Supervised classification techniques – Training set – Statistical computation, Signature Bank, Baye's decision rule, minimum distance rule, parallelepiped algorithm, maximum likelihood method, classification analysis – confusion matrix, error analysis – unsupervised classification technique – clustering, fuzzy set concept, synthetic pattern recognition, Bhattacharya distance, texture analysis.

Unit V

Exercises based on image processing softwares.

Reference Books:

1. Introductory Digital Image Processing, John R Jensen, Prentice Hall of India, New Jersey – 1986.
2. Digital Image Processing – A systems Approach, W.B.Green Van – Nostrand Publications – 1983.
3. Digital Image Processing – R.M.Hard – Academic Press – 1982.
4. Pattern Classification and Scene Analysis, Dude R.D and P.Hart Wiley, Inter Science – 1973.
5. Techniques for Image Processing and Classification of Remote Sensing,Robert A.Schowengerdt , Academic Press ,1983.
6. Manual of Remote sensing Vol.I and Vol.II – Robert G.Reeves, American Society of Photogrammetry, Falls Church, USA 1983.

CE 323 GEOGRAPHIC INFORMATION SYSTEM FOR RESOURCE MANAGEMENT

Credit : 4:0:0
Marks: 40+60

Unit I : Introduction

Definition, map and map analysis, Automated cartography history and Development of GIS, Hardware requirement, system concepts, coordinate systems, Standard GIS Packages.

Unit II : Data entry, storage and maintenance

Type of data, spatial and non spatial data, Data structure, points, lines, Polygon, Vector and Raster, files and file organization, database, entering data in computer, Digitizer, scanner, Dbase, files and data formats, Data compression.

Unit III : Data analysis and modeling

Spatial analysis, Data retrieval, query, simple analysis, Recode, overlay, vector data analysis, Raster data analysis, Modeling in GIS, Digital elevation model, DTM, cost and path analysis, Artificial Intelligence – Expert Systems.

Unit IV : Data Output and error analysis

Types of output data, display in screen, printer, plotter, other output device, source of errors, types of errors, elimination, accuracies.

Unit V : GIS Applications

Application areas - resource management - water resources management, Cadastral records and LIS Integrated Remote Sensing application with GIS, Knowldege base techniques – Exercises based on ArcView Software.

Reference Books:

1. Burrough P.A., Principle of GIS for land resource assessment , Oxford Publication, 1990.
2. Jeffrey Star and John Estes, Geographical Information System- An Introduction, Prentice Hall, 1990.
3. Lillesand T.M and Kiefer R.W.,Remote sensing and image intepretation, John Wiley and Sons, New York, 1987.
4. Marble D.F and Calkins H.W.,Basic readings in Geographic Information System, New York 1984.

CE 324 TRAFFIC FLOW THEORY AND NETWORK ANALYSIS

Credit : 4:0:0
Marks: 40+60

Unit I : Traffic Flow

Relationship between the variables, fundamental diagram of traffic flow, relationship between speed and concentration, probabilistic aspects of traffic flow, spacing and headway characteristics, poisson distribution of vehicle arrivals, gap and headway distribution, shifted exponential distribution, Erlang distribution, gap acceptance.

Unit II : Traffic Delays

Simple delay problems, pedestrian delay blocks, delay to traffic at uncontrolled intersections.

Unit III : Lighthill and Whitham's Theory

Application of theory to signalised intersections, applications of theory in dealing bottlenecks, Greenberg's extension of law of continuity.

Unit IV : Micro Level Model

Car following theory, its application to traffic engineering problem, macro level traffic flow theory, simulation models traffic input, travel time, turning movements, simulation of road geometrics and intersection geometrics, simple simulation models.

Unit V : Transportation Network

Introduction to Traffic flow and traveling sales man problem and TABU search, Network representation, shortest path algorithms, equillibrium over urban transportation networks, assignment problem, review of optimisation algorithm, trip distribution and traffic assignment models, models of joint travel choices, probit, logit models.

Reference Books

1. Yosef Sheffi, Urban Transportation Networks; Equilibrium Analysis with Mathematical Programming Methods, Prentice-Hall Inc., New Jersey, 1985.
2. Adolf D. May, Traffic Flow Fundamentals, Prentice Hall, New Jersey, 1982.
3. Paul C.Box and Joseph C.Oppenlander, Manual of Traffic Engineering Studies, Institute of Transportation Engineers, Arlingthon, 1985.

CE 325 REMOTE SENSING APPLICATION TO ENVIRONMENTAL STUDIES

Credit : 4:0:0
Marks: 40+60

Unit I : Marine Environment

Sensors for environmental monitoring – Introduction to sensors – visible and outside visible wavelengths – absorption spectrometers – collecting insitu data – need – selection of ground truth sites – sea truth observations. Introduction – Radar techniques for sensing ocean surfaces – thermal measurements – application of multispectral sensing mapping of oil slicks – chlorophyll detection – Fisheries resources- Coastal marine studies – determination of temperature and sea state.

Unit II : Global Climatology

Remote sensing technique for weather forecasting and climatology – emissivity characteristics – measurement of atmospheric temperature – composition – constituent distribution and concentration – wind flows and air circulation – hurricane tracking – Air pollution and monitoring – meteorological satellite systems.

Unit III : Water in the Environment

Importance of water – Chemical composition of water – IR radiant flux reflected or emitted from water surfaces – spectrometric methods – Remote sensing of fluorescence – water quality – water pollution – surface and groundwater pollution – detection and identification of potential pollution sources – water run off – decomposition of practice of animals and plant materials water quality management – snow mapping – flood mapping – flood inundation – mapping with surface cover of bare soil, vegetative surface cover and snow surface cover – flood prediction – soils and land forms – mapping of soils – limitations to agricultural prediction – insects and disease – wind erosion – salinity – flood damage – soil limitation.

Unit IV : Urban Environment
General consideration - rural structure – urban areas –industrial complexes – industrial pollution – chemical effluents, land reclamation – solid waste disposal – mining pollution – demography and social changes.

Unit V
Ecology, Eco Systems, Different types of conservation and resource management. Introduction – Spectral reflectance from vegetated surface – phenological studies – conservation of national parks – resource management – wildlife studies – GIS for monitoring soil erosion – flood control – eco degradation – discussion of few case studies.

Reference Books:

1. Barrett E.C and Currtis I.F. Introduction to Environmental Remote Sensing , Chapman Hall, New York.
2. Lintz J and Simonet D.S, Remote Sensing of Environment, Addison Wesley, 1976.
3. Robert N. Colwell , Manual of Remote Sensing Volume 2, American society of Photogrammetry.

CE 326 REMOTE SENSING APPLICATION TO HYDROLOGY AND WATER RESOURCES

Credit : 4:0:0
Marks: 40+60

Unit I : Basics
Hydrologic Cycle, clouds, rainfall, evaporation, transpiration, evapotranspiration, depression, storage runoff, floods, estimation of various components of hydrologic Cycle, flood management – Spectral properties of water – case studies.

Unit II : Drainage Basin
Watershed divide, stream networks/ morphometric analysis linear/ aerial/ relief aspects, urban hydrology, qualitative and quantitative assessment – case studies.

Unit III : Aerial Assessment
Mapping of snow covered area, flood inundated area, soil moisture area, lakes/swamps, drought affected area – case studies.

Unit IV : Groundwater and Water Quality
Aquifers, surface water indicators, vegetation, geology, soil, aquifer parameters, well hydraulics, estimation of groundwater, Hydrologic budgeting, mathematical models – case studies. Water quality parameters, physical/ chemical/ Biological properties, sampling technique/problems, water quality mapping and monitoring – case studies.

Unit V : Irrigation and Watershed management
Project investigation, implementation, maintenance stages, location of storage/diversion work, capacity calibration, curve generation, canal alignment, irrigable land localization, conjunctive

use of surface and ground water – case studies. Mapping and monitoring the catchments and command area, sediment yield, reservoir siltation, use of Geographic Information System – case studies.

Reference Books:

1. Chow V.T. Handbook of applied Hydrology, McGrawHill, Newyork, 1964.
2. Engman,E.T &Gurney,R.J.Remote Sensing in Hydrology, Chapman & Hall Publishers, 1991.
3. Goodison, B.E., Hydrological Applications of Remote Sensing and Remote Data Transmission, LASH Publications No.145, 1985.
4. Leuder D.R., Aerial Photographic Interpretation, McGrawHill Co., NewYork, 1987.
5. Lillesand T.M and Kiefer R.W.,Remote sensing and image intepretation, John Wiley and Sons, New York, 1987.
6. Lintz J and Simonett D.S., Remote Sensing of Environment, Addison and Wesley Publishing Co, 1976.

CE 327 OPTIMIZATION

Credit : 4:0:0
Marks: 40+60

Unit I : Linear Programming

Introduction – Mathematical formulation of a problem graphical solutions general LPP. Canonical and standard forms, Simplex method, Dual simplex method, Application to management decisions.

Unit II : Transportation Problem

Introduction Initial basic feasible solution , NWC method , Least Cost method, Vogel's method, MODI moving towards optimality, solution procedure without degeneracy, multiple objective programming problems.

Assignment Problem: algorithm Hungarian method, Games and Strategies, Two person zero sum games, The Maxmin and Minmax principle and simple problems.

Unit III : Integer Programming

Algorithms, Applications Stochastic Programming, linear, non-linear and dynamic programming applications, introduction to linear programming

Unit IV : Non-linear Programming Techniques

One-dimensional minimization, elimination and interpolation methods, unconstrained optimization, direct research and descent methods, constrained optimization, direct and indirect methods

Unit V : Non traditional Optimization algorithm

Genetic algorithms, working Principle, Difference and Similarities between GAs and traditional methods, GAs for constrained optimization, Simulated annealing approach Introduction (only), Travelling sales man problem and TABU search.

Textbooks:

1. Rao S.S., Optimization, Wiley Eastern, New Delhi, 1995.
2. Kalyanmoy Deb, Optimization for Engineering Design, Prentice Hall of India, New Delhi, 2000.
3. H.A.Taha, Operations Research – An Introduction, Prentice Hall, 6th Edition , 1997.
4. S.D.Sharma, An Introduction Fundamentals of Operation Research, Kedarnath – Ramnath &Co., 1996.

Reference Books:

1. Kati Swarup, Gupta and Manmohan, Operations research, New Delhi, Sultan Chand and Sons.
2. Wild D.J, Globally Optimum design, John Wiley and Sons, New York, 1978.

DEPARTMENT

OF

CIVIL ENGINEERING

ADDITIONAL SUBJECTS

Code	Subject Name	Credits
CE102	Basic Civil Engineering	2:0:0
CE240	Mechanics of Deformable bodies-I	3:1:0
CE241	Mechanics of Deformable bodies-II	3:1:0
CE242	Engineering Mechanics	3:1:0
CE243	Surveying-I	3:1:0
CE244	Surveying-II	3:1:0
CE245	Mechanics of Fluids	3:1:0
CE246	Applied Hydraulics and Fluid Machines	3:1:0
CE247	Mechanics of Soils	3:1:0
CE248	Foundation Engineering	3:1:0
CE249	Reinforced Concrete Structures-I	3:1:0
CE250	Reinforced Concrete Structures-II	3:1:0
CE251	Design and Drawing (R.C.C & Steel)	3:1:0
CE252	Design of Steel Structures	3:1:0
CE253	Sanitary Engineering	4:0:0
CE254	Structural Analysis-I	3:1:0
CE255	Structural Analysis-II	3:1:0
CE256	Design and Drawing (Irrigation and Environmental Engg.)	3:1:0
CE257	Estimating, Costing and Specifications	0:0:2
CE258	Airports, Docks & Harbours	4:0:0
CE259	Construction Management	4:0:0
CE260	Earthquake Engineering & Design of Structures	3:1:0
CE261	Elements of Town Planning and Architecture	4:0:0
CE262	Engineering Geology And Civil Engineering Materials	4:0:0
CE263	Geographic Information System	4:0:0
CE264	Highway & Railways Engineering	4:0:0
CE265	Irrigation Engineering	4:0:0
CE266	Numerical Methods in Civil Engineering	3:1:0
CE267	Professional Practice & Entrepreneurship Development	4:0:0
CE268	Rehabilitation of Structures	4:0:0
CE269	Environmental Science and Engineering	3:0:0
CE328	Structural Dynamics	3:1:0
CE329	Advanced Design of R.C Structures	3:1:0
CE330	Analysis and Design of Plate and Shell Structures	3:1:0
CE331	Advanced Design of Steel Structures	3:1:0
CE332	Stability of Structures	3:1:0
CE333	Maintenance and Rehabilitation of Structures	4:0:0
CE334	Aseismic design of structures	3:1:0
CE335	Prestressed Concrete Structures	3:1:0
CE336	Design of Industrial Structures	4:0:0

Code	Name of the Subject	Credits
CE337	Design of Tall Buildings	4:0:0
CE338	Prefabricated Concrete Structures	4:0:0
CE339	Design of Offshore Structures	4:0:0
CE340	Space Structures	4:0:0
CE341	Advanced surveying	3:0:2
CE342	Geographic Information System I	4:0:0
CE343	Principles of Remote Sensing	4:0:0
CE344	Cartography	4:0:0
CE345	Computer Programming in C++	4:0:0
CE346	GIS I Lab	2:0:0
CE347	Digital image processing	3:0:2
CE348	Photogrammetry	4:0:0
CE349	Global Positioning System	3:0:2
CE350	Geographic Information System II	4:0:0
CE351	Database Management System	4:0:0
CE352	Microwave Remote Sensing	4:0:0
CE353	GIS Lab II	0:0:2
CE354	Land Information System	4:0:0
CE355	Digital Photogrammetry	4:0:0
CE356	Remote Sensing and GIS for Hydrology and Water Resources	4:0:0
CE357	Remote Sensing and GIS for Earth Sciences	4:0:0
CE358	Remote Sensing and GIS for Agriculture and Forestry	4:0:0
CE359	Remote Sensing and GIS for Environmental Engineering	4:0:0
CE360	Remote Sensing and GIS for Ocean Engineering & Costal Zone Management	4:0:0
CE361	Remote Sensing and GIS for Urban and Regional Planning	4:0:0
CE362	Remote Sensing and GIS for Disaster Mitigation & Management	4:0:0

CE102 BASIC CIVIL ENGINEERING

Credit : 2:0:0 **Marks : 40 + 60**

UNIT I

Introduction: Engineering - Civil Engineering

Construction Materials: Characteristics of good building materials such as stones, bricks, timber, cement and concrete.

Surveying: Definition and purpose - classification - Basic principles - Calculation of area of a plot

UNIT II

Selection of site - Major components of buildings.

Foundations: Purpose of a foundation - Bearing capacity of soils - types of foundations.
Proper methods of construction of: Brick masonry - Stone masonry - Beams - Lintels - Columns - Flooring - Roofing.
Valuation of buildings: Definition - Purpose of valuation - Valuation of a building by plinth area method - Valuation of old buildings.

UNIT III
Water supply Engineering: Sources of water supply - Quantity of water requirements - Purification of water involving sedimentation, filtration and disinfections.
Sanitary Engineering: Definition of terms - Collection and disposal of solid wastes - Sewage systems - Septic tanks - oxidation ponds.

UNIT IV
Transportation Engineering: Requirements of Highways - Cross sections of water bound macadam, bituminous and cement concrete roads.
Railways: Gauges - Components of a permanent way.
Bridges: Components of bridge-Types of Bridges.

UNIT V
Functions and general layout of an airport
Functions and general Layout of a harbour
Dams: Purpose of Dams - Types of dams - Selection of site for a dam.

Text Book
1. Johnson Victor, D and Esther Malini, 'Basic Civil Engineering', Allied Publishers Limited, Madras.

Reference Books
1. Arunachalam, N, 'Basic Civil Engineering', Pratheeba Publishers, Coimbatore, 2000.
2. Ramesh Babu, V 'Basic Civil Engineering', Anuradha Agencies, Kumbakonam, 2001.

CE240 MECHANICS OF DEFORMABLE BODIES - I

Credit 3:1:0 **Marks 40+60**

Unit-I : Stress, Strain and Deformation in Solids
Tension, compression and shear stresses – Hooke's law – Stress – Strain diagram for mild steel – Ultimate stress and working stress – Elastic constants and relationships between them –Material types-Homogeneous, isotropic, brittle elastic, strong and tough– Composite bars & Indeterminate systems– Thermal stresses – Strain energy due to axial load – Stress due to suddenly applied and impact load.

UNIT-II : Combined Stresses
Two dimensional state of stress at a point – Normal and shear stresses on any plane – Principal planes and principal stresses – Graphical treatment – two dimensional state of

strains at a point - Principal strains and their directions – Stresses and deformations in thin cylinders and spherical shells due to internal pressure.

UNIT-III : Beams and Bending

Types of beams – Types of supports – Shear force and bending moment at any cross section of a beam- Sketching of shear force and bending moment diagrams for cantilever, simply supported and over hanging beams for any type of loading – Relationship between rate of loading, shear force and bending moment.

UNIT – IV : Stresses in Beams

Theory of Simple Bending – Analysis of bending Stresses – Load Carrying capacity of beams – Proportioning sections – Flitched beams – Leaf springs – Strain energy due to bending moment – Shear stress distribution – Strain energy due to transverse shear force.

UNIT-V : Torsional Stresses

Elastic theory of torsion – Stresses and deformation in solid circular and hollow shafts – Stepped shafts – Composite shaft – Stress due to combined bending and torsion – Strain energy due to torsion. -Deformations and stresses in helical springs – Design of buffer springs

Text Books

1. Kazimi, S.M.A., Solid Mechanics, Tata McGraw –Hill Book co Ltd., 1998.
2. Punmia, B.C., etal. - "Strength of Materials", Laxmi Publications, 1992.

Reference Books

1. Popov, E.P, Engineering Mechanics of solids, Prentice – Hall of India, New Delhi, 1996.
2. Mott, M. L., Applied Strength of Materials,4th Edn., Prentice-Hall of India Pvt. Ltd., New Delhi, 2002.

CE241 MECHANICS OF DEFORMABLE BODIES II

Credit 3:1:0 **Marks 40+60**

UNIT I : Deflection of Determinate Beams

Governing differential equation- macaulay's method- moment area method- conjugate beam method- newmark's method.

UNIT II : Columns and Struts

Columns- Behaviour of Axially Loaded Short, Medium and Long Column Members- Buckling Load- Euler's Theory- Different End Conditions- Empirical Formulae- Rankine's Formula- Straight Line Formula- Secant Formula for Columns subjected to eccentric loading.

UNIT III : Thick Cylinders

Thick cylinders- lame's equation-hoop stress and radial stress distribution-compound cylinders-shrink fit.

Theories of Elastic Failure:
Maximum principal stress theory- Maximum shear stress theory- Maximum principal strain theory- strain energy theory- Mohr's theory- simple problems.

Unit IV : Shear Centre and Curved Beams
Shear Center:
Introduction to non-circular sections-Shear center for thin walled beam of mono- symmetric open sections- Shear flow in thin walled beams of open sections.
Curved Beams:
Curved beams-Stresses due to bending by Wrinkler back theory- Rectangular, trapezoidal and circular solid section-Crane hook problem

UNIT V : Unsymmetrical Bending of Straight Beams
Symmetrical And Unsymmetrical Bending-Bending Stresses in Beams Subjected to Unsymmetrical Bending- Change in Direction of Neutral Axis and Increase in Stress Compared to Symmetrical Bending.

Text Books

1. Bedi D.S., "Strength of Materials", S. Chand & Co. Ltd., 1984.
2. Punmia B.C, etal., "Strength of Materials", LaxmiPublications, 1992.

Reference Books

1. Boresi A.P., Side Bottom O.M., Seeli F.B & Smith J.P., "Advanced Mechanics of Materials", John Wiley & Sons, 1993.
2. Sadhu Singh., "Strength of Materials", Khanna Publishers,1988.

CE242 ENGINEERING MECHANICS

Credit 3:1:0 **Marks 40+60**

UNIT I
Basics – Units and Dimensions – Laws of Mechanics – Vectors – Introduction Static & Dynamics.
Force and force systems – parallelogram law of forces – resultant of a system of coplanar forces acting on a particle – equilibrium of a particle under coplanar forces – resultant of a system of spaces force acting on a particle – equilibrium of a particle under space forces – free body diagram.

UNIT II
Definition of a rigid body, Moment, Couple, Force-couple system – equilibrium of a rigid body under coplanar forces – types of supports – support reactions on beams and frames of determinate structures – problems involving equilibrium of rigid bodies – stable, unstable and neutral equilibrium

Friction – angle of friction and coefficient of friction – laws of dry friction – friction in wedges, ladders, screws and belts.

UNIT III

Analysis of cables – Analysis of roof trusses by method of joints and method of sections. Properties of plane sections – areas, centroid, first moment of area, moment of inertia, polar moment of inertia and radius of gyration – parallel and perpendicular axis theorem and its application bodies – mass moment of inertia of thin rectangular plates and solid rectangular prisms.

UNIT IV

Kinematics of particles – rectilinear motion of a particle – uniformly accelerated rectilinear motion – curvilinear motion of particles – rectangular components – motion of projectiles – curvilinear motion in terms of normal and tangential components – relative motion.

Kinetics – Introduction – Potential energy & Kinetic energy – Conservation of energy

UNIT V

Kinetics of particles – equation of motion for a particle in rectilinear motion – equations of motion for a particle in curvilinear motion in terms of x and y components and in terms of normal and tangential components principle of work and energy – principle of impulse and momentum – impact direct central impact – oblique central impact.

Text Book

1. Beer, F.P and Johnston, E.R, “Vector Mechanics for Engineers, Statics and Dynamics”, McGraw hill International Book co.

Reference Books

1. Meriam, J.L. and Kraige, L.S., “Engineering Mechanics (Statics and Dynamics)”, John Wiley & sons.
2. Meriam.,J.L. and Kraige, L.S., Irving H.shames, “ Engineering Mechanics (Statics and Dynamics)”, Prentice Hall of India Pvt. Ltd.
3. Rajasekaran, S and Sankarasubramanian, G., “Engineering Mechanics”, Vikas Publishing House Pvt. Ltd, 1999
4. Kottiswaran, “Engineering Mechanics”, Balaji Publication

CE243 SURVEYING – I

Credit 3:1:0 **Marks 40+60**

Unit I : Introduction and Chain Surveying

Definition, Principle and Classification of surveying – field and office works – conventional signs – equipments used in chain survey – ranging and chaining – reciprocal ranging – setting perpendicular offsets – well conditioned triangles – errors and obstacles – cross staff and optical square – traversing – plotting – Enlarging and reducing size of figures

Unit II : Compass Surveying
Prismatic Compass – Surveyor's Compass – bearing -systems and conversions – local attraction – magnetic declination – dip- traversing – plotting – adjustment of error by graphical method – Bowditch's rule
Plane table Surveying
Plane table instruments and accessories – advantages and disadvantages – methods – radiation and intersection – traversing – resection – two point and three point problems – errors and adjustments in plane tabling

Unit III : Levelling and Applications
Types of levels and staves – sensitivity of bubble – benchmarks – temporary and permanent adjustments – fly, check, profile and block levelling – booking – reduction – arithmetic checks –curvature and refraction correction – reciprocal levelling – difficulties and errors in levelling - longitudinal and cross sectioning – plotting – Calculation of areas and volumes – contouring – methods – characteristics and uses – plotting – earthwork volume – capacity of reservoirs.

Unit IV : Theodolite Surveying
Description and uses of vernier micrometer – microptic theodolites – temporary and permanent adjustments of vernier transit – measurement of horizontal and vertical angles – heights and distances – traversing – closing error and distribution – Gale's traverse table – omitted measurements

Unit V : Curves and Mine Surveying
Route surveys for highways, railways and waterways – Curve ranging – Horizontal and vertical curves – Simple curves –Setting out by chain and tape methods – By instrumental methods – Transition Curves – Functions and requirements – Setting out by offsets and angles – Vertical curves – Sight distances – Mine Surveying – Instruments – station and station marker – Tunnel alignment and setting out

Text Books

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and levelling parts 1 and 2, pune Vidyarthi Griha prakashan, 1968.
2. Punmia, B.C., Surveying and levelling Vol.I and II, Standard Publishers, 1968.

CE244 SURVEYING – II

Credit 3:1:0 **Marks 40+60**

Unit I : Tacheometric surveying
Principle of Stadia method – Distance and elevation formulae for staff held vertical – Instrumental constants – Anallactic lens – Tangential method – use of Subtense bar – tacheometric contouring

Unit II : Control surveying

Working from whole to part – Horizontal and Vertical control - Triangulation figures – Classification of triangulation systems – selection of triangulation stations – Intervisibility and height of stations – station marks – signals and Towers – Measurement of angles – reduction to centre – Field work and correction to baseline measurements – Extension of base – trignometric levelling – single and reciprocal observations

Introduction to GIS and GPS

Definition of GIS, necessity of GIS, Components of GIS, Sofware packages, Applications-GPS – Applications and Advantages.

Unit III : Theory of Errors and Triangulation Adjustments

Kinds of errors – laws of weights – principle of least squares – determination of most probable value of quantities – probable error – distribution of error to field measurements – Normal equation – Method of correlates – Level nets - Adjustment of simple triangulation networks.

Unit IV : Fundamentals of Field Astronomy

Spherical trignometry – latitude and longitude of a place – Definitions of astronomical terms – Coordinate systems to define the position of a heavenly body – Time systems – Conversion of time - determination of azimuth of a line by extra meridian observations on the sun

Unit V : Photogrammetry

Introduction – Terrestrial and aerial photographs – Platforms -Stereoscopy – Parallax – Electromagnetic distance measurement - Principle

Hydrographic Surveying

Introduction – Tides - Equipments – methods of locating soundings – Reduction and plotting of soundings – use of sextants and station pointer

Text Books

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and Levelling, Vol.II, Pune Vidyarthi Griha Prakashan, Pune, 1968.
2. Punmia, B.C., Surveying Vol.III, Standard Publishers, 1994.
3. GIS and GPS Notes.

CE245 MECHANICS OF FLUIDS

Credit 3:1:0 **Marks 40+60**

Unit I

Introduction - Fluid Properties – Newton's law of Viscosity - Classification of Fluids

Fluid Statics

Pressure – Pascal's law – Atmospheric, Absolute, Gauge and Vacuum pressures – Pressure measurement – Forces on plane and curved surfaces-Total pressure and Centre of pressure – Buoyancy and Metacentric height (Theory only).

Unit II : Fluid Kinematics

Types of flow – Stream line – Path line – Streak line - Stream tube – Control volume – Continuity equation – one dimensional and three dimensional flow – velocity potential and stream function free - and forced vortex flow

Equations of Motion

Euler's equation in one dimensional form – Bernoulli's equation

Unit III : Flow Measurements

Venturimeter – Orifice meter – Pitot tube – Mouthpiece and Orifice – Weirs and Notches – Rectangle , Triangular, Broad crested, Narrow Crested

Laminar flow

Definition – Reynold's Experiment – Reynold's Number – Hagen Poiseuille equation for a circular pipe

Turbulent flow

Definition – Darcy Weisbach's equation – Moody's diagram – Friction factor for Laminar and Turbulent flow – for smooth and rough pipes

Unit IV : Flow through pipes

Loss of energy in pipes – Hydraulic Gradient, Energy Gradient – Major energy loss – Minor energy losses – Pipes in series and parallel –Equivalent pipe - Power transmission through pipes – Syphon – Water hammer (Definition)

Unit V : Dimensional Analysis and Similitude

Fundamental and Secondary dimensions - Dimensional Homogeneity – Rayleigh and Buckingham Pi methods – Similitude – Significance of Dimensionless Numbers – Classification of hydraulic models – Scale effect .

Text Books

1. Modi, P.N., and Seth, S.N., "Textbook of Hydraulics and Fluid Machines, Standard Book House, New Delhi, 1995.
2. Rajput, R.K., Text book of Fluid Mechanics and Hydraulic Machines , S.Chand and Co., New Delhi, 1998.

Reference Books

1. Natarajan, M.K., Principles of Fluid Mechanics, Oxford and IBH publishing Co., New Delhi, 1994.
2. Jain,A.K., Fluid Mechanics, Khanna Publishers, New Delhi, 1996.
3. Som, S.K., and Biswas, G., Fluid Mechanics, Tata McGraw Hill Book Co., 1998.
4. Agarwal, S.K., Fluid Mechanics and Machinery, Tata Mc Graw Hill Co., 1997.
5. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 1998.

CE246 APPLIED HYDRAULICS AND FLUID MACHINES

Credit 3:1:0 **Marks 40+60**

Unit I : Uniform Flow In Open Channels
Types of Flow - Uniform flow – Chezy's and Manning's equations – Hydraulically best sections – Uniform flow Computations.
Varied Flow in Open Channels
Specific energy – critical flow – Mild and steep slopes – critical depth – Hydraulic jump – Gradually varied flow – Energy Equations and Solutions – Back water and drawdown curves – Study of flow profiles.

UNITII : Boundary Layer And Flow Around Submerged Bodies
Definition – Displacement, momentum, Energy thickness - Boundary layer equations – Boundary Layer Seperation – Laminar and Turbulent boundary layers – Forces on submerged bodies – Expression for drag and lift-Pressure drag – Friction drag – Stream lined and bluff bodies.

UNITIII : Momentum Principle
Impulse momentum equation – Application of Linear momentum principle – Impact of Jet - Force exerted by a jet on normal, Inclined and curved surfaces for stationary and moving cases only.

UNITIV : Water Turbines
Classification – Working principles and Design of Pelton wheel, Francis and Kaplan Turbine – Velocity Triangles - head and efficiency – Draft tube - Theory and types – Similarity laws – specific speed – Operating characteristics – Governing of Turbines – Selection of Turbines

UNITV : Pumps
Classification – Centrifugal pump – Components and working – Velocity triangles – priming – Head Losses and Efficiencies - Minimum starting speed – performance curves – specific speed – Cavitation – selection of pumps.
Positive Displacement Pump
Reciprocating pump – types – Components and working – slip – Indicator diagram – Air vessel.
Miscellaneous Pumps (Operating Principles Only)
Multistage pumps – submersible pumps –Jet pumps – Hydraulic ram.

Text Books

1. Rajput, R.K.A Text Book of Fluid Mechanics, S.Chand and Co., New Delhi, 1998.
2. Modi, P.N. and Seth, S.M., Hydraulic and Fluid Machines, Standard book house New Delhi, 1995.

Reference Books

1. Natarajan, M.K. Fluid Machines, Anuradha Agencies, 1987.

2. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 1998.
3. Agarwal, S.K., Fluid Mechanics and Machinery, Tata McGRaw- Hill Publishing Co. Lts., New Delhi., 1997. Som,S.K., and Biswas, G., Fluid Mechanics and Fluid Machines, Tata McGraw Hill book co., 1998.
4. Ven-Te-Chow, Open channel Hydraulics, Tata McGRaw- Hill Publishing Co.,1959.

CE247 MECHANICS OF SOILS

Credit 3:1:0 **Marks 40+60**

UNIT – I: Mechanical Properties

Objectives and importance of Geotechnical Engg. – Physical properties of soil – Phase relations – grain size distribution – Atterberg Limits – sensitivity and thixotropy of clays – Classification of soils as per BIS – Soil Structure and clay mineralogy.

UNIT – II: **Permeability and Seepage**

One – dimensional flow through soil – Permeability – Darcy's law – Factors affecting permeability – Constant head and falling head permeability tests – flow through stratified soil – Seepage pressure - quick sand phenomenon – two dimensional flow: Laplace equation – Flow net construction – Flow net by Electrical analogy – applications for sheet pile – Cut off and Earth dam- Pheriatic line– piping: exit gradient

UNIT – III: Compaction and Consolidation

Compaction – Proctor test – Moisture – density relations – factor affecting compaction – field compaction Methods

Consolidation - Primary consolidation concept – Definition of terms - void ratio pressure curve – Field curve – Laboratory test — consolidation settlement – pre – consolidation pressure – Terzaghi's theory of one – dimensional consolidation- Partial differential equation (no analytical solution) – Boundary condition – Time factor – Time rate of consolidation – Determination of Cv.'

UNIT – IV: Stress Distribution and settlement

Concept of effective and neutral stresses – soil water statics – capillary phenomenon – Vertical stress distribution in soil – Boussinesq equation – line load – uniformly distributed loads – Newmark's influence chart – approximate methods – Westergaard's analysis – Pressure bulb – Contact Pressure - Causes of settlement – Components of settlement- Immediate and consolidation settlement – methods of minimising settlement – Codal Provisions.

UNIT V: Shear Strength & Stability of slopes

Shear Strength of soil: Mohr-Coulomb Failure theory – Laboratory and field tests – Factors affecting shear strength – Importance of shear strength – direct shear test – triaxial compression test – unconfined compression test – vane shear test– shear strength of cohesive soils.

Stability of slopes: Stability analysis of infinite and finite slopes – types of failure – slip circle method – friction circle method – Taylor's Stability number and stability curves.

Text Books

1. Punmia, B.C., *Soil Mechanics and Foundations*, Punmia B.C., and Suara & Co., Madras 1988.
2. Arora, K.R., *Soil Mechanics and Foundation Engineering*, Standard Publishers Distributors, New Delhi 1987.

Reference Book

1. Venkatramiah C., *Geotechnical Engineering*, Wiley Eastern Ltd., 1993.

CE248 FOUNDATION ENGINEERING

Credit 3:1:0 **Marks 40+60**

UNIT – I : Soil Exploration and Selection of Foundation

Soil exploration: Introduction – Objectives of Soil exploration – disturbed and undisturbed sampling – depth of soil exploration – number and disposition of bore holes – penetration and sounding tests - geophysical methods

Foundation: Different types of foundation – requirement of a good foundation – choices of types of foundation – foundation in expansive soil - factors governing location and depth of foundation.

UNIT – II: Bearing Capacity

Definitions– types of failure – Terzaghi's analysis – Skempton's formula – IS formula – Effect of water table on bearing capacity - shape of foundation, inclination of load and eccentricity of load on bearing capacity – allowable bearing pressure –plate load test – standard penetration test – methods of improving bearing capacity.

UNIT – III: Earth Pressure, Sheet Pile Walls & Cofferdams

Introduction – plastic equilibrium in soil – Rankine's theory – Surcharge – inclined backfill – soil stratification – Coulomb's Wedge theory – Graphical methods (Rehbann's and Cullman's) – Drainage of backfill.

Sheet pile walls: Types – cantilever sheet pile walls in cohesionless and cohesive soil

Cofferdams: Introduction – types of cofferdams

UNIT – IV: Pile Foundation

Deep foundation – Introduction - functions of pile – classification of pile – relative merits – Load carrying capacity of piles: static and dynamic formula – pile load test – penetration tests - pile spacing and group action – design of pile group – settlement of pile group – negative skin friction – under reamed pile foundations: details of pile and bulb – Load carrying capacity of under-reamed piles - construction of under-reamed pile foundation – load test on under-reamed piles.

Unit – V : Well And Shallow Foundations

Well foundation: Introduction – Individual components of a well: well curb, cutting edge, steining and bottom plug – shapes of wells – grip length, depth and bearing capacity – forces

acting on well foundation – Banerjees and Gangopadhyay's analysis – IRC method –well sinking – rectification of tilts and shifts – pneumatic caissons: introduction.
Shallow foundations – Types of shallow foundations – stress distribution (theory only): rectangular combined footing – trapezoidal combined footing – Raft footing: IS code of practice.

Text Books

1. Punmia, B.C., *Soil Mechanics and Foundations*, Punmia B.C., and Suara & Co., Madras 1988.
2. Kasmalkar, B.J., Foundation Engineering, Pune, Vidyarthi Griha Prabakar, Pune, 1989.
3. Arora, K.R., *Soil Mechanics and Foundation Engineering*, Standard Publishers Distributors, New Delhi 1987.

Reference Books

1. Teng, W.C., Foundation Engineering, Prentice Hall of India (P) Ltd., 1984.
2. Peck, R.B., Hanson and Thornburn, Foundation Engineering, Wiley Eastern Ltd., 1980.
3. Venkatramiah C., *Geotechnical Engineering*, Wiley Eastern Ltd., 1993.

CE249 REINFORCED CONCRETE STRUCTURES – I

Credit 3:1:0 **Marks 40+60**

Unit–I
Introduction of RCC structures – Grades of concrete and characteristic strength – permissible stresses in concrete – steel reinforcements and their characteristics. Modular ratio, Neutral Axis, under, over reinforced & Balanced section, Flexure, Shear, Torsion, Bond & development length Design concept WSD, ULM & LSD- - Actual and idealized stress – strain diagrams of concrete and steel, LSD Rectangular beam, Flanged beams

Unit–II
LSD – Lintel beam – one way slab – sunshade - Continuous beams and slabs - Two way slab - for Flexure, Shear, Torsion & Anchorage

Unit–III
LSD –Short, Long Axially and eccentrically loaded columns, Isolated and combined rectangular footings for two columns.

Unit–IV
WSD – Rectangular, T & L beams for flexure and shear.

Unit–V
WSD – One-way slab – Two-way slab-Circular slab- Short, Long axially and eccentrically loaded columns.

Text Books

1. Krishna Raju, N., Design of Reinforced Concrete Structures, CBS Publishers and distributors, New Delhi, 1989.
2. Unnikrishna pillai and Devadass Menon, Reinforced Concrete Design, Tata McGraw-Hill Publishing Co ltd, 1998.
3. Varghese P.C., 'Limit State Design of Reinforced Concrete', Prentice of India, New Delhi, 1999.

Reference Books

1. Jain, A.K., Limit state Design of R.C. Structures , New Chand Publications.
2. Sinha, N.C and Roy, S.K., Fundamentals of Reinforced concrete, S.Chand & Company (Pvt.) Ltd. New Delhi, 1983.
3. I.S.456 2000 Published by B.I.S.
4. S.P-16 Published by B.I.S
5. Purushothaman, P., Reinforced Concrete Structural Elements, Tata Mc Graw- Hill Publishing Co., 1984.
6. Nilson, A.H., Design of Concrete Structures, McGraw Hill Co, 1997.
7. Leet, K.M., Bernal, D., Reinforced Concrete Design, Mc Graw Hill Publishing Co., 1997.
8. Software like STADD, STRUDS and STRAPS may be suggested depending on their availability.

CE250 REINFORCED CONCRETE STRUCTURES – II

Credit 3:1:0 **Marks 40+60**

Unit–I

Types of stair cases, Design of Dog Legged, Quarter & Half turn stair cases – Soil earth pressure - Types of retaining wall, Design of cantilever and counter-fort retaining walls

Unit–II

Design of circular and rectangular underground water tanks - Design of circular and rectangular tanks resting on ground - INTZ tank (Concept only) - Design of staging and foundations.

Unit–III

Design of slab bridge and T-beam & slab bridge for IRC loadings Class AA & Class A - Load distribution in interconnected girders by Courbon's method.

Unit–IV

Design of multibay, multistoreyed R.C.frames - substitute frames - preliminary design of members - Analysis for wind loads by the portal method and Cantilever method. Earthquake resistant Design Philosophy: Ductility, IS code1893-2002 provisions for earth quake effects

UNIT V
Assumptions - Guidelines for locating yield line patterns - virtual work and equilibrium methods of analysis - Application to square, rectangular, triangular and circular slabs – Introduction to Strip method of analysis.

Text Books

1. Krishnaraju,N., Design of R.C.Structures, CBS Publishers and Distributors, Delhi 1989.
2. Jaikrishna and O.P.Jain, Plain and Reinforced concrete, Vols. I &II, Nem Chand Publishers, 1959.

Reference Books

1. Krishnaraju.N, Bridge Engineering,
2. Jain, A.K., 'Limit State Deisign of R.C.Structures, Nem Chand Publications, 1985..

Note : Indian Standard Codes of Practice 456 & 3370 IRC Bridge Codes and Pigeand's charts are to be permitted for use in the Examinations.
Software like STAAD, STRUDS and STRAPS may be suggested depending on their availability.

CE251 DESIGN AND DRAWING (R.C.C AND STEEL)

Credit 3:1:0 **Marks 40+60**

PART-A
Detailed design and drawing of the following reinforced concrete structures.

1. Building floors consisting of slabs and beams.
2. Cantilever and counterfort retaining walls.
3. Circular and rectangular water tanks resting on the ground.
4. Circular and rectangular overhead water tanks.
5. Slab bridge.

PART-B

Detailed design and drawing of the following steel structures.

1. Columns, base plates and their foundations
2. Plate Girder (welded)
3. Gantry Girder
4. Simple roof trusses
5. Rectangular and circular overhead water tanks

Note :

1. Autonomous examination will be of four hours duration.

2. Indian Standard codes 456,800,3370 and I.R.C. codes are permitted for the use in the examination.
3. There will be two questions in part-A and two in Part-B out of which the students shall answer one in each.

CE252 DESIGN OF STEEL STRUCTURES

Credit 3:1:0 **Marks 40+60**

Unit – I : Design Of Tension Members

- Behaviour of Tension members
- Net Sectional Area
- Design of Tension Members
- Design of Compression Members
- Design Criteria
- Laced and Battened columns
- Column Bases

Unit – II : Design Of Laterally Supported Beams

- Design Considerations
- Bending, Shear and Deflection
- Web buckling and Web Crippling
- Built up Beams
- Curtailment of plates

Lateral Buckling Of Beams

- Effective lateral unbraced length
- Concept of Lateral Torsional Buckling
- Design of Beams subjected to Biaxial Bending

Unit – III : Welded Plate Girder

- Design of Web and Flanges
- Intermediate and Bearing Stiffeners
- Flange and Web splices
- Cost Calculation and economics of construction

Welded Connections

- Unstiffened Seat connection
- Stiffened seat connection
- Moment Resistant Connections

Unit – IV : Industrial Building

- Design of Purlin
- Design of Roof Trusses
- Crane girders
- Design of an Industrial Bent
- Design of Gable rafter and Gable Column

Unit – V : Light Gauge Steel Sections

- Design of stiffened and unstiffened columns
- Design of stiffened and unstiffened beams
- Self Supporting chimney

Text Books

1. Dayaratnam, P., “Design of Steel Structures”, A.H.Wheeler & Co. Ltd., Allahabad, 1996.
2. Arya and Ajmani, “Design of Steel Structures”, NemChand Brothers, Roorkee, 1989.

Reference Books

1. Ragupathy M, “Design of Steel Structures”, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1996.
2. Punmia B.C., Ashok kumar Jain and Arun kumar Jain, `Design of Steel Structures', Vol. 1, Arihant Publications, Bombay, 1995.
3. Explanatory notes published by M/S Institute of Steel Development and Growth

CE253 SANITARY ENGINEERING

Credit 4:0:0 **Marks 40+60**

UNIT-I : Sewage and Sewerage Engineering

Definition & Classification of Sewage - Quantity of Sanitary Sewage and Storm Water – Fluctuations in Flow Pattern – Design Flow of Sewage – Physio-chemical and Biological Characteristics – Assessment of Organic Solids by BOD, COD, TOC, ThOD, & TOD – Microbiology of Sewage – Systems and Layouts of Sewerage – Analysis and Design of Sewers under Different Flow Situations - Sewer Sections – Materials for Sewers – Laying, Jointing, and Testing of Sewers – Appurtenances and Maintenance - Pumping of Sewage and Pumping Stations.

UNIT-II : Preliminary and Primary Treatments of Sewage

Principles and Objectives of Sewage Treatment – Operation and Design of Bar Rack and Grit Chamber with Velocity Control Devices – Principles of Primary Treatment and Design of Primary Sedimentation Tank – Disposal of Rackings, Gritty Materials, and Sludge Solids.

UNIT –III : Biological Treatment Processes

Objectives of Biological Treatment – Path Ways of Decomposition – Aerobic, Anaerobic, and Anoxic Processes – Operation and Design of Conventional Activated Sludge Process with Diffuser and Mechanical Aerators – Process Modifications – Operation and Design of

Trickling Filter – High rate and Standard Rate Filters – Low Cost Waste Water Treatments – Principles and Design of Stabilization Ponds, Oxidation Ponds and Aerated Lagoons – Rural Sanitation – Operation and Design of Septic and Imhoff Tanks – Excreta Disposal Schemes.

UNIT-IV : Engineering Methods of Sludge Disposal
Objectives of Sludge Disposal – Types and Characteristics of Sludges in a Typical Treatment Plant – Operation and Design of sludge Digestion – Energy recovery aspects regarding Methane Production – Sludge Lagooning, - Unconventional Methods of Disposal - Disposal of Sewage by Dilution in Streams, Rivers, and Estuaries – Self-purification and Oxygen Sag-curve Analysis – Trophic Status of Aquatic Bodies.

UNIT-V : House Drainage Works
Sanitary Fittings – One Pipe and Two Pipe Systems - General Layout of House Drainage Works – Street Connections.
Recycling of Waste Water
Necessity & Objectives-Suitability & State-of-art-techniques in waste water conservation.

Text Books

1. Steel.E.W.and McGhee, T.J., "Water Supply and Sewerage", 5th Edn., McGraw Hill International Editions, New York, 1988.

Reference Books

1. Metcalf and Eddy, Inc., "Waste Water Engineering – Treatment, Disposal and Reuse", 3rd Edn., McGraw Hill Book Co., N.Y. 1985.
2. Raju, B.S.N., "Water Supply and Waste Water Engineering", Tata McGraw-Hill Co., New Delhi, 1995.

CE254 STRUCTURAL ANALYSIS –I

Credit 3:1:0 **Marks 40+60**

UNIT-I : Fundamental Concepts In Structures
Definition and Determination of Static and Kinematic Indeterminacy – Beams, Trusses and Frames – Degree of Freedom – Equillibrium and Kinematic Stability – Principle of Superposition – Basic Methods of Structural Analysis.
Energy Methods
Work – Energy principles – Principle of Stationary Potential Energy – Principle of Virtual Displacements – Complementary Energy – Principle of virtual Forces – Castigliano's First Theorem – Castigliano's Second Theorem – Betti Maxwell's law – Theorem of least work – Application to simple problems of Statically determinate beams, trusses and frames.

UNIT-II : Moving Loads and Influence Lines
Effect of moving load – Description of Influence line – Influence line for Reaction, Shear Force and Bending Moment – Load position – Absolute maximum bending moment – Muller Breslau's Principle – Application to beams with one degree of indeterminacy

UNIT-III : Arches

Three hinged arch – Two hinged arch – parabolic and semi circular arches – Concentrated loads – Uniform loads – Temperature effects – Determination of Reaction, Normal Thrust, Radial shear and Bending Moment – Influence line for Stress Resultants in two hinged and three hinged arches – load position for maximum values.

UNIT-IV : Three Dimensional Frames (determinate)

Analysis of pin jointed Space frames – forces in various members – Analysis of Rigid jointed space frames – Determination of stress resultants – Application to Simple problems – Analysis of Suspension Bridges(determinate).

UNIT-V : Force Method

Consistent Deformation Method – General Concept – Application to Truss subjected to Loads – Application of Clapeyron's Theorem of Three Moments to fixed and continuous beams – Temperature, Lack of fit, Settlement of Support – effects in structures.

Text Book

1. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co., 1996.

References

2. Armenakas A.E., Classical Structural Analysis, McGraw Hill Book Co., 1988.
3. Au T and Christiano, P, Structural analysis, Prentice Hall, 1982.
4. Hibbeler R.C, Structural Analysis, Macmillan Pub.Co., 1985.
5. Laible J.P, Structural Analysis, Mc Graw Hill Book Co., 1984.
6. Smith J.C., Structural Analysis, Harper and Row Pub., 1988.
7. Software like ANSYS, SAP, FEAST may be suggested depending on their availability.

CE255 STRUCTURAL ANALYSIS-II

Credit 3:1:0 **Marks 40+60**

UNIT-I : Slope Deflection Method

Displacement method concept -Slope deflection equations -Fixed End moments -Applications to Statically indeterminate beams and frames-Effect of temperature,settlement-Deformed shape, Bending Moment and Shear Force Diagrams and axial force diagrams.

UNIT-II : Moment Distribution Method

Basic concepts- Stiffness factor, distribution factor and carry over factors-Single span beams with different support conditions - Fixed End Moments - Moment Distribution in Continuous beams - Portal frames with and without side sway - Deflected shape, bending moments, shear force and Thrust diagrams.- Symmetric Structure subjected to Symmetric and Anti-symmetric Loading.

UNIT-III : Characteristics of Flexibility and Stiffness Method

Definition- Application of Principle of Superposition-Properties -Application to Two Degree of Freedom Systems-Structure and Element Coordinates - Transformation of force and displacement - Structure Flexibility in terms of element flexibility-Structure stiffness in terms of element Stiffness.

Flexibility Method

Forces not acting at co-ordinates - Formulation of Structure Flexibility matrix - Determination of Displacements and Bending Moments - Application to determinate and indeterminate trusses beams and frames - Effect of Temperature, Lack of Fit

UNIT IV : Stiffness Method

Forces not acting at co-ordinates - Formulation of Structure Stiffness matrix - Determination of Displacements - Application to determinate and indeterminate trusses beams frames - effect of Temperature, Lack of fit - Static Condensation Technique - Use of analysis software for application to analysis of Plane trusses and frames

UNIT V : Introduction to Structural Dynamics

Free Vibration damped - undamped vibrations for Single degree of freedom system - Forced vibration - displacement and force isolation.

Text Book

1. Reddy C S, Basic Structural Analysis , Tata McGraw Hill Publishing Co., 1996.

Reference Books

1. Bhatt P, Problems in structural Analysis by Matrix Methods , Wheeler, 1989.
2. Flemming, J.F., Computer Analysis of Structural Systems , McGraw Hill, 1989.
3. Holzer S M, Computer Analysis of Structures , Elsevier, 1985.
4. Mukhopadhyay M , Matrix Finite Element Computer and Structural Analysis , Oxford & IBH, 1984.
5. McGuire W and Gallagher R H, Matrix Structural Analysis , John Wiley & Sons, 1979.
6. Meek, J.L., Matrix Structural Analysis , McGraw Hill, 1971.
7. Przemieniecki,J. S, Theory of Matrix Structural Analysis , McGraw Hill, 1968.
8. Rubinstein M F, Matrix Computer Analysis , Prentice Hall, 1969.
9. Sack R C, Matrix Structural Analysis , PWS - Kent Pub. Co., 1989
10. Wang C K and Solomon C G, Introductory Structural Analysis , McGraw Hill Book cc, 1984.
11. Kanchi M B, Matrix Methods of Structural Analysis , Wiley Eastern Ltd., 1993.
12. Sack R L, Structural Analysis , McGraw-Hill Book Co., 1984.
13. Smith. J C , Structural Analysis , Harper and Row Pub., 1988.
14. Rajasekaran,S., and Sankarasubramanian,G., Computational . Structural Mechanics, Prentice Hall of India, 2000

CE256 DESIGN AND DRAWING
(Irrigation and Environmental Engineering)

Credit 3:1:0 **Marks 40+60**

PART : A

Design of the following irrigation works are to be worked out and detailed drawings are to be drawn:

1. Earthen Dams - Sections of different types of earth dams, plan showing drainage systems.
2. Tank sluice - wing type
3. Tank surplus weir.
4. Canal Regulator (Head regulator)
5. Canal drop.
6. Syphon aqueducts

PART: B

Design of the following Environmental Engineering works are to be worked out and detailed drawings are to be drawn.

1. General layout of water supply scheme.
2. Mixing basin, flocculation and sedimentation tanks.
3. Slow and rapid filters - service and clear water reservoirs.
4. General layout for drainage scheme.
5. Manholes, pumping station, septic tank with dispersion trenches and imhoff tank.
6. Primary and secondary settling tanks - trickling filter

Text Books

1. Satyanarayanamurthy, C., Design of Minor Irrigation and Canal Structures, Wiley Eastern Limited, June 1994.
2. Ellis, W.M., College of Engineering Manual: Irrigation, The Textile Institute Publishers, 1955.
3. Gharpure, V.N., A Text Book of water supply Engineering, Allied Publishers limited.

Note:

Autonomous Examination is 4 hour duration. There will be two questions in part A and two in part B. Out of which the students will have to answer one in each.

CE257 ESTIMATING, COSTING AND SPECIFICATIONS

Credit 0:0:2 **Marks 50+50**

UNIT – I : Procedure of Estimating Quantities

Introduction – Main items of work – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C., Doors, Windows, Flooring, White Washing, colour washing, Distembering and their units.

UNIT – II : Rate Analysis

Factors affecting rates – importance – Materials for different items of work – Rates of materials and labour – analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works.

UNIT – III : Cost Estimate of Buildings

Approximate methods – Plinth area estimate – Cubical Contents estimate.

Detailed estimate – Estimation of the cost of single storeyed buildings by individual wall method and centre line method.

Estimation of Roofs – R.C.C. slab roof, GI sheet roof, Tiled Roof, Roof Truss.

Estimation of R.C.C.works – Beam, T-beam and Slab, Column, Foundation, Stair case, Retaining wall etc.

UNIT – IV : Cost Estimate of Other Structures

Estimation of roads – Earth work, Pitching of Slopes, Hill roads.

Estimation of R.C.C. slab culvert, Pier, Pipe culvert, R.C.C. T-beam bridge.

Estimation of Irrigation works like Canals, Aqueducts, Syphon, etc.

Estimation of Water supply and sanitary works like septic tank, Soak pit, Manhole, sewer line, etc.

UNIT – V : Specifications and Valuation

Specifications – Objectives – types of specifications – principles of specification writing – typical specifications.

Valuation – Market value – Book value – Scrap value – Salvage value – annuity – Capitalized values – sinking fund – depreciation – Valuation of a building – Rent fixation – Mortgage – Lease.

Text Books

1. Dutta, "Estimating and Costing", S Dutta & Co., Lucknow.
2. Rangawala..S.C., "Estimating and Costing", Charotar Anand.

Reference Book

1. Kohli, D.D.and Kohli R.C., "A Text book on Estimating, Costing and Accounts", S.Chand and Co., New Delhi, 1994.

CE258 AIRPORTS, DOCKS AND HARBOURS

Credit 4:0:0 **Marks 40+60**

Unit - I : Introduction to Planning

Air transportation in India - Categories of airports and air services - agencies controlling national and international aviation and their functions- airport regional planning - Factors to be considered for proper planning of airport - airport capacity - various survey to be conducted - airport site selection

Unit – II : Elements of Airport and Design

Landing and terminal areas and their components - standard for planning airports as per ICAO- Typical layout of an airport and its components- Runways - taxiways and aprons - different types - pattern and layout - general principle of design - loading apron - holding apron - parking aircrafts

Unit - III : Navigational Aids

Traffic aids and airport marking - lighting airports - runway lighting - taxiway lighting - air traffic control - Visual and instrument landing systems - airport drainage - typical layout of existing airport teminal and service blocks - Chennai , Coimbatore, Calcutta, New Delhi and Mumbai

Unit - IV : Docks and Management

Dock - different types of wet and dry docks - functional design and various types and their usage- navigational aids - necessity and type of signals - fixed and floating signals - buoys-beacons - different types of dredges and their application.

Unit -V : Harbours

Classification and requirements of harbours - choice of site and general principles governing their design - entrance to harbour - Breakwaters - classification and construction - wharves - piers and Bulkheads - Dolphins - Fender and other mooring devices- Typical layout of Existing harbours - Chennai - Cochin – Tuticorin - Mumbai.

Text Books

1. Rangwala,P.S., Airport Engineering, Charotar publishing house, Anand - 1992.
2. Srinivasan R and Rangwala, S.C., Harbour Dock and Tunnel engineering, Charotar Publishing House, Anand, 1991.

Reference Books

1. Bindra, S.P., Docks and Harbour Engineering, Dhanpat Rai and sons, New Delhi, 1992.
2. Shahani, Aiport Techniques,Oxford and IBH Publishing CO, PVT, LTD, 1995.

CE259 CONSTRUCTION MANAGEMENT

Credit 4:0:0 **Marks 40+60**

UNIT I : Principles Of Management

Definition - Importance - Functions of management - relevance to Govt., Quasi Govt. Departments - Private contractors, and contracting firms – Organisation - Basic Economic concepts - Economic decisions, fixed, variable costs -Break Even Analysis and Chart pricing policies - Methods of evaluating capital expenditure - probabilistic estimates.

Unit II : Civil Engineering Management

Construction Planning:

Collection of field data - preliminary estimates - approval and sanction of estimates - Budget provision - Construction stages - Scheduling methods - progress reports and charts.

Resource Planning:

Planning for materials, machines, men and organisation - resource allocation.

Labour And Labour Welfare:

Relationship between management and labour – Labour problems - labour legislation - minimum wages act - settlement of disputes - industrial psychology.

UNIT III : Management Methods

Concepts of network - network planning method - CPM/PERT - management by network analysis and control - principles of cost control - control by graphical representation, by bill of quantities and by network analysis.

UNIT IV : Execution of Work

Departmental Works:

Procedure - departmental labour - quality control, inspection and duties of personnel - safety requirements.

Contractors:

Contract system - types of contracts - specifications, documents, procedures, condition, taxes, law of constructions, Legal implications and penalities.

Tender and Tender Documents:

Definition - calling of tenders - tender documents - submission of tenders - processing of tenders - negotiations and settlement of contracts.

UNIT V

Accounts And Stores:

Measurements of work - recording - checking - types of bills - mode of payment - budget estimate - revised estimates - completion reports and certificates - claims and transfer classifications of transactions - ledger accounts - Imprest Account - Cash book.

Suspense classification - stores - maintenance and inspection- inventories – Accounting of surplus and of shortage of stores - procedures adopted in P.W.D. and C.P.W.D.

Introduction to Computer Application in Construction Management

Planning – Scheduling and Resource Analysis - Recording and Operations – Project Accounting, Costing and Finance.

Text Books

1. Seetharaman,S., Construction Engineering and Management, Umesh Publications, 1997.
2. Sengupta,B., and Guha,H., Construction Management and Planning, Tata McGraw-Hill Book cc, 1995.

Reference Books

1. Sanga Reddy,S., and Meyyappan, PL., construction management, Kumaran publications, Coimbatore, 1995..
2. Rana,V.K., Construction Management Practice, Tata McGraw-Hill publishing CO,1998
3. Chitkara,K.K., Construction Project Management, Tata McGraw-Hill publishing COM1998.
4. Joseph L.Massie, Essentials of Management, prentice Hall of India
5. Cholt and Dhir - construction management
6. C.P.W.D. Manual
7. Public works Accounts code, PWD, Tamil Nadu.

CE260 EARTHQUAKE ENGINEERING AND DESIGN OF STRUCTURES

Credit 3:1:0 **Marks 40+60**

Unit I : Introduction

Elements of engineering seismology – causes of earthquakes, seismic waves, magnitude , intensity and energy release – Indian seismology – earthquake history – catastrophies – failures - lessons learnt from past earthquakes – seismic zone map of India – strong motion characteristics

Unit II : Theory of Vibration

Free vibration – single degree of freedom system – with and without damping – Multi degree of freedom system – fundamental period – power method – forced vibration of SDOF system – with and without damping – Response spectrum characteristics

Unit III : **Seismic Design of Buildings**

Idealization of building frames -Introduction to methods of seismic analysis –
Equivalent static analysis IS 1893 provisions – Design horizontal seismic coefficient- design base shear – distribution - seismic resistant design of building –

Unit IV : Earthquake Resistant Construction

Earthquake resistant properties of materials – lateral force resisting systems – strong column weak beam – guidelines for seismic resistant construction building configuration requirements – ductile detailing of reinforcements in RC buildings- behaviour and design of masonry structures

Unit V : Repairs And Retrofitting

Code of practices for repairs and retrofitting - retrofitting of RC buildings and structural elements – techniques of retrofitting - improving structural integrity of masonry buildings – retrofitting by seismic isolation – case studies

Text Books

1. David Key, " Earthquake design practice for building ", Thomas Telford, London

2. Chopra, A.K.," Dynamics of structures _ Theory and applications to earthquake engg", Prentice hall of India, New Delhi, 2002

References

1. IS 1893- 2002
2. IS 4326
3. IS 13920

CE261 ELEMENTS OF TOWN PLANNING & ARCHITECTURE

Credit 4:0:0 **Marks 40+60**

Unit – I : Basics of Town Planning

Town planning : Definition, Objectives, Necessity & Principles adopted-.
Types of Urban Growth : Their advantages and disadvantages.
Town planning Surveys : Necessity, Objectives and Classification.
Urban road patterns : Types, and specific advantages & disadvantages.

Unit – II : Landuse Planning

Scope and Content of Master plan, Regional plan, Structure plan, Detailed development plan Urban renewal -Planning standards for Neighbourhood -Basic principles in planning various land uses: Residential, Commercial, Industrial, and Recreational.

Unit – III : Planning Legislations

Evolution of planning legislation in India Organisation and administration of planning agencies at National, State, Regional level and Metropolitan Level.-Tamil Nadu Town and Country Planning Act.-Building bye laws, Function of local Authority, Provision of Building Regulations

Unit – IV : Introduction To Architecture

Definition of the term 'Architecture' – Key factors influencing the architecture of any region : Culture, Climate, Topography, Building materials, Economic & Technology.-Prominent World Architecture styles during various periods in history.-Anthropometrics – Human Scale in Architecture. -Space requirements for Human activity

Unit – V : Architecture Principles & Landscaping

Principles of Architectural Composition: Unity, Contrast, Rhythm, Proportion, Scale, Character, Harmony, Colour, Light and Shade, Solids and Voids, Balance and Symmetry.
Landscape Architecture: Concept – Necessity – Study of trees, plants & Shrubs for landscaping.

Text Books

1. Rangwala,S.C., *Town Planning*, Charotar Publishing House, Anand, Gujarat, 1985.
2. Pramar V.S., *Design Fundamentals in Architecture*, Somaiya Publications Pvt. Ltd, New Delhi.

3. Gurcharan Singh & Jagdish Singh, *Building planning, Designing and Scheduling*, Standard Publishers Distributors, Nai Sarak , Delhi 1999.
4. M.S. Ramaswami, *The Tamil Nadu Town and Country planning act, 1971*, C.Sitaraman and Co., Publishers, Booksellers and Distributors., 1987.
5. S.P. Arora, S.P. Bindra, *A textbook of Building Construction*, Dhanpat Rai and Sons, 1992.
6. Michael Young, *Architectural and Building Design*, Heinemann ltd. 1986.
7. Hiraskar.G.K., *The Great ages of World architecture*, Dhanpat Rai and Sons, Delhi

Reference Books

1. Rafciff, I., *An Introduction to Town Planning and Country planning*, Hutchinson, London, 1987.
2. Gowda, S., *Urban and Regional Planning*, Prasaranga, University of Mysore, Mysore, 1986
3. Hiraskar,G.K., *Fundamentals of Town Planning,*Dhanpat Rai and Sons, Delhi, 1989.
4. Pickering,E., *Architectural Design*, John Wiley and Sons, London.
5. Hepler and Wallach, *Architecture, Drafting and Design*, McGraw-Hill Book Co, New York.
6. Abir Bandyopadhyay, *Textbook of Town planning*, Books and Allied publishers Ltd. 2000.

CE262 ENGINEERING GEOLOGY & CIVIL ENGINEERING MATERIALS

Credit 4:0:0 **Marks 40+60**

Unit I : General Geology

Geology in Civil Engineering – branches of geology – Earth structure and composition – elementary knowledge on continental drift and plate tectonics. Earth processes – weathering - work of rivers, wind and sea and their Engineering importance – Causes of Earthquake – Earthquake belts in India.

Groundwater – mode of occurrence – prospecting – importance in Civil Engineering.

Unit II : Mineralogy

Elementary knowledge on symmetry elements of important crystallographic systems – physical properties of minerals – study of the following rock forming minerals – Quartz family, felspar family, augite, hornblende, biotite, muscovite, calcite, garnet

Properties, behaviour and engineering significance of clay minerals.

Fundamentals of the process of formation of ore minerals – coal and petroleum – their origin and occurrence in India.

Unit III : Petrology

Classification of rocks – Distinction between igneous, sedimentary and metamorphic rocks. Description, Occurrence, Engineering properties and distribution of following rocks.

Igneous rocks – granite, syenite, diorite, gabbro, pegmatite and basalt.

Sedimentary rocks – sandstone, limestone, shale, conglomerate and Breccia

Metamorphic rocks - quartzite, marble, slate, thyllite, gneiss and schist.

Unit IV : Structural Geology
Attitude of beds – outcrops – geological maps – study of structures – folds, faults and joints – their bearing on Engineering investigations. – Geological conditions necessary for construction of dams, tunnels, building and road cutting. Land slides – causes and prevention. Sea erosion and coastal protection.

Unit V : Civil Engineering Materials
Cement and Concrete – raw material – manufacture – type and properties of cement – Concrete mixes – grades – steel – heat treatment process – alloy steels – plain and deformed bars – relative merits – strength specifications.-Uses of ceramics – refractories – terracotta and glazed products –Pants – varnishes – distempers,-Plastic emulsions-Rubber, Aluminium, Glass, Felts, Plastics

Text Books

1. Parbin Singh, Engineering and general Geology, Katson publication House, 1987.
2. Krynine and Judd, Engineering Geology and Geotechniques, McGraw Hill Book Company 1970.

Reference Book

1. Legget, R.F., and Hatheway, A.W., Geology and Engineering, McGraw Hill Book Company. 1988.
2. Blyth, Geology for Engineers, BLBS, 1985.

CE263 GEOGRAPHIC INFORMATION SYSTEM

Credit 4:0:0 **Marks 40+60**

UNIT I : Introduction
Definition – map and map analysis, Automated Cartography history and development of GIS, Hardware requirement, System concepts, Coordinate concepts, Standard packages

UNIT II : Data Entry, Storage and Maintenance
Type of data, spatial and non spatial data, data structure, Points, lines, polygon, vector and raster, File, file organisation, Database, Digitiser, scanner, dbase, files and data formats, data compression

UNITIII : Data Analysis and Modelling
Spatial Analysis, Data retrieval, Query, simple analysis, Recode, overlay, Vector data analysis, raster data analysis, Modelling in GIS, Digital Elevation Model, DTM, Artificial intelligence, Expert system

UNIT IV : Data Output and Analysis
Types of output data, display on screen, printer and other output devices, Sources of errors, Types of errors, Elimination, accuracies

UNIT V : GIS Application
Application areas, Case studies will be down load from internet, Water resources management, environmental analysis, Network analysis, Remote sensing applications, Monitoring of urban sprawl, Cadastral record and LIS

References

1. Principle of Geographical Information System Peter R. Burrough
2. Remote Sensing and Image Interpretation Thomas M. Lillisand

CE264 HIGHWAYS AND RAILWAYS ENGINEERING

Credit 4:0:0 **Marks 40+60**

HIGHWAY ENGINEERING:

Unit – 1 Highway Planning And Alignment
Role of transportation in National Development – Objectives and achievements of organizations such as IRC and CRRI.-Factors controlling selection of Highway alignments. Modern methods of conducting Engineering surveys.-Rural & Urban Road classification in India.-Cross-sectional elements of road – Definition and Significance.

Unit – 2 Highway Geometric Design
Design of horizontal alignment :
Sight distance – PIEV theory – Problems in S.S.D.-Super elevation – Theory & Problems. Highway widening on horizontal curves – Theory & Problems.-Transition curves - Theory & Problems.
Design Of Vertical Alignment:
Terrain classification - Categories of Gradient – Grade compensation – Types of vertical curves - Theory and problems.

Unit - 3- Pavement Design
Highway pavement types and their individual components – Comparison between RIGID & Flexible pavements - Design factors -Flexible Pavement design using C.B.R method (based on IRC: 37 – 2001) -Rigid pavement design using IRC method (Based on IRC: 58 – 2002)

RAILWAY ENGINEERING:

Unit - 4 Railway Engineering Basics
Comparison of Highway & Railway transportation -
Railway track (permanent way):
Cross-sections of railway tracks – Coning of wheels-Gauges: Classification, Selection & Uniformity -Rails: Functions, Types of rail sections, Length of rails, Rail Joints, Welding of rails & Creep of rails.-Sleepers: Functions, Requirements, Classification & Sleeper density.-Ballast: Functions, Requirements, Types & Quantity of ballast

UNIT -5 Advanced Railway Engineering:
Factors in selection of Good Alignment – Gradients – Grade compensation – Speed of trains Necessity of Points and Crossings – Turnouts. -Railway Stations: Requirements, Classifications.-Station Yards: Types-Signalling: Objects, Engineering principles and Types.-Control Systems: Control of train movement – Track Circuiting
Interlocking of signals and points: Necessity and Methods.

Text Books

1. Khanna, S.K., and Justo C.E.G., Highway Engineering, Nem Chand and Bros. 1998.
2. Vazirani and Chandola, S.P., Transportation Engineering Vol. 1 Khanna Publishers, 1996.
3. S.C.Saxena & S.P.Arora, A Text book of Railway Engineering, Dhanpat Rai Publishers 2001
4. K.P.Subramaniam, Transportation Engineering – I, SCITECH Publishers 2003
5. S.P.Bindra, A Course in Highway Engineering, Dhanpat Rai Publishers 1999

NB: The following codes are permitted for use in examinations:
1.IRC: 37 – 2001
2.IRC: 58 – 2002.

CE265 IRRIGATION ENGINEERING

Credit 4:0:0 **Marks 40+60**

UNIT I : Introduction
General – crop seasons – Humid, arid and semiarid regions – necessity of irrigation – water requirements – Duty – Delta – irrigated area – Base period –crop period – water requirement calculation – consumptive use (evapo – transpiration) – Determination of consumptive use – irrigation efficiencies – factors affecting the duty of water - Methods of improving duty - Types of irrigation – Methods of Application of Water on Field – Protective and Productive irrigation works.

UNITII : Hydrology
Introduction – Hydrologic cycle and hydrological data – precipitation – Amount of precipitable water – different forms of precipitation – Types of rainfall measurements – variability of rain fall with respect to time and space – Interpretation of rainfall data – Maximum precipitable water.
Hydrologic Abstractions – Interception and depression storage – evaporation – Transpiration – infiltration – Infiltration Indices - Runoff - Factors affecting Runoff – Estimation of Run off – Empirical formulae – Unit Hydrograph method – Stream Gauging – Flood estimation by Empirical formulae – Unit Hydrograph - Statistical and Probability methods - Flood Frequency Analysis.

UNIT III : Ground Water
Ground water hydrology – Aquifers – permeability and transmissibility – steady flow towards a well in confined and water table aquifer – measurement of yield of an open well -

Well losses – Interference of wells - Typical cross section of open and tube well – comparison of well and flow irrigation.

UNITIV : Distribution System

Definition and importance of sediment transport – Mechanics of sediment transport – Estimation of transported sediments – suspended load and its measurement.

Alluvial and non – alluvial soil – Alignment of canals – Distribution systems for canal irrigation – Determination of required channel capacity – channel losses. Design of channels in India – Regime channels – Kennedy's theory - design procedure – use of Garrot's diagram – Lacey's theory - Design procedures – use of Lacey's Diagram - comparison of the two theories. Design procedure for irrigation channel – cross section and components – balancing depth for excavating canals – fixing the longitudinal section of the canal – Classification of canals – canal lining – Maintenance of irrigation canals.

UNIT V : Water Logging, Drainage And River Control

Salinity and water logging – causes and effect of water logging – Logging control – Reclamation of saline land – surface and subsurface drainage – Drainage design for agricultural areas – lay out of drainage system – classification of rivers in various ways – flood control and river training – Behaviour of river, control and training of rivers – methods of river training work.

Text Books

1. Garg,S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 1997.
2. Punmia, B.C., Pande and Lal, B.B. Irrigation and water power Engineering, Laxmi Publications pvt. Ltd., 1992.

Reference Books

1. Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand and Brothers.
2. Sahasrabudhe, S.R., Irrigation Engineering and Hydraulic Structures, Katson Publishers, 1994.

CE266 NUMERICAL METHODS IN CIVIL ENGINEERING

Credit 3:1:0 **Marks 40+60**

UNIT I : Simultaneous Linear Algebric Equations

Gaussian Elimination – Gauss Jordan Method – Jacobi and Gauss Seidel iterative methods – solution of ill conditioned equations – Errors and approximations – Round off and truncation errors – computer application to truss analysis problems.

Eigen Values And Eigen Vectors

Power method – Sweeping Techniques – Jacobi iteration – Computer application to stability and Dynamics Problems.

UNIT II : Solution of Transcedental And Polynomial Equations
Graffe's root squaring method – Bairstow's method – Newton and Modified Newton Raphson methods – Iterative methods – computer applications to the calculation of back water curve in open channel flow.

Numerical Differentiation and Integration
Numerical differentiation – Numerical integration – Open and Closed Quadrature – Gaussian quadrature – Trapezoidal and Simpson's rule – Computer application to the calculation of deflection for a nonprismatic beam – Computation of earth volume and surveying

UNIT III : Interpolation
Newton's forward and backward interpolation – Long range interpolation – curve fitting method of least squares – computer application to fit stress and strain curve of concrete.

Newmark's Method
Deflected shape of statically determinate beams – prismatic – nonprismatic beams – concentrated load – udl varying loads using Newmark's method.

UNITIV : Ordinary First Order Differential Equations
Taylor's series method – Euler's method – Modified Euler's method – Runge Kutta's method – Milne's predictor corrector method – Adams predictor corrector method – Computer application to dynamics-water tank to blast loading.

UNIT V : Boundary Value Problems using Finite Difference Approach
Finite Difference operators – Application to deflection of beams – Buckling of columns – Partial differential equations – Elliptic equations – Explicit method computer application to temperature distribution and seepage problems – Crank Nicholson method for parabolic equations – Application to consolidation problems – Explicit method to Hyperbolic equation – Application to vibration of a string and water hammer problems

Text Books

1. Rajasekaran, S, Numerical methods in Science and Engineering – A practical Approach, Edition 2, Wheeler Publishing, 1999.

Reference Books

1. Bathe, K.J., Finite element Procedures in Engineering Analysis, Prentice Hall, Inc, Englewood Cliffs, New Jersey 1982.
2. Hamming, R.W.,Numerical Method for Scientists and Engineers, Mc Graw Hill Book Co., 1973.
3. James, M.L., Smith, G.M., and Wolford, J.C., Applied Numerical Methods for Digital computation with Fortran and CSMP, Harper and Row Publishers, New York, 1977.
4. Krishnamoorthy, E.V., and Sen, S.K., Computer Based Numerical Algorithms, Affilliated East West Press, 1976.
5. Mc Cormick, J.M., and Scarborough, J.B., Numerical Mathematical Analysis, IBH Publishing co, New York, 1974.
6. Stanton, R.C., Numerical Methods for Science and Engineering, Prentice Hall of India, 1976

CE267 PROFESSIONAL PRACTICE AND ENTREPRENEURSHIP DEVELOPMENT

Credit 4:0:0 **Marks 40+60**

UNIT I

Definition and concept of enterprising-profile of an entrepreneur-need, scope and characteristics of entrpreneurship. Individual, psychological and sociological. Globalization – WTO, WB, IWF. Exposure to demand based, resource based, import substitute and export promotion industries.

UNIT II

Market survey techniques: need, scope and approaches for project formulation. Criteria for principles of product selection and development: Structure of project report – choice of technology, plant and equipment. Project feasibility analysis: Marketing, technical and financial feasibility – project report preparation. Elements of marketing and sales management: Nature of project and market strategy, after sales service.

UNIT III

Interest and time value of money: simple interest, compound interest, present value, future value, pay back period – accounting rate of return, net present value. Financial management: Capaital-working capital-financial institutions, RBI and commercial banks. Banking procedures and foreign exchanges regulations act, letter of credit and its importance.

UNIT IV

Starting a small-scale industry – steps involved-role of financial institutions. Tax factors: Income tax, sales tax, excise duty, customs duty. Legal factors: Factories act, pollution act and labour act.

UNIT V

A need for Organisation, formulizing the organisational structure. Employee selection, training, personnel relations. Professional practice as applicable to Civil Engineers.

Text Book

1. Prasanna Chandra, "Project Preparation, appraisal and implementation", Tata Mc Graw Hill, New Delhi, 1990.
2. Saravanavel.P, "Entrepreneurship Development", ESS Pee Kay Publishing House, Madras, 1987

Reference Book

1. Philip Kotler, "Marketing Management", Prentice Hall, 1990.
2. Prasanna Chandra, "Fundamentals of financial management", Tata McGraw Hill publications, 1995
3. John J.Mampton, "Financial decision making concepts, problems and cases", Prentice Hall of India, 1990.

CE268 REHABILITATION OF STRUCTURES

Credit 4:0:0 **Marks 40+60**

Unit I-Introduction

Causes of Distresses-Distress Monitoring-Defects due to Climate, Chemicals, Wear And Erosion-Inspection

Unit II-Materials For Repair & Non-Destructive Testing

Special Concretes and Mortar -Concrete Chemicals- Ferro Cement- Fibre Reinforced Concrete-Non Destructive Testing

Unit III-Influence on serviceability and durability

Steel structures

Causes of deterioration -preventive measures- repair procedure- corrosion mechanism-methods of corrosion protection-**Concrete Structures-**Causes of Deterioration- Diagnosis of Causes- Flow Charts for Diagnosis-Repair Techniques

Masonry Structures-Discoloration and weakening of stones-biocidal treatments-Brick masonry structures-distresses and remedial Measures

UNIT IV-Strengthening Of Existing Structures

Special repairs, maintenance, inspection and planning-Repairs to overcome low strength member, deflection, cracking, landslides, chemical disruption, weathering, wear, fire, leakage, and marine exposures [with case studies]

UNIT V-Retrofitting Of Structures

Seismology-Seismic risk and hazard-Retrofitting and strengthening of Structures

Concept of base isolation-Structural control-Case studies

Text Books

1. Johnson .S.M., " Deterioration, Maintenance and Repair of Structures", Mc Graw Hill Book Company, New York,1965.
2. Dension Campell, Alienand Harold Roper," Concrete Structures, Materials,Maintenance and Repair", Longman Scientific and Technical,U.K.1991
3. SP-25-84-Hand book on Causes and Prevention of Cracks on Buildings, Indian Standards.
4. IS:13935- Repair on seismic design of buildings

Reference Books

1. Alien, R.T., and Sc Edwards, Repair of concrete structures, Blakle and sons, U.K. 1987.
2. Neville, A.M., Properties of Concrete, The English Language book society and pitman publishing.
3. Shetty, M.S., "Concrete Technology – Theory and Practice", S. Chand & co., New Delhi, 1982

CE269 ENVIRONMENTAL SCIENCE AND ENGINEERING

Credit 3:0:0 **Marks 40+60**

UNIT I : Introduction to Environmental Studies and Natural Resources

Definition, scope and importance – Need for public awareness – Forest resources. Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.-Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT II : Ecosystems and Biodiversity

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession - Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, steams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Bio geographical classification of India – Value of biodiversity – consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.-Field study of common plants, insection, birds-Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT III : Environmental Pollution

Definition – Causes, effects and control measures of : (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site: Urban / Rural / Industrial / Agricultural

UNIT IV : Social Issues and the Environment

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies – Wasteland reclamation – Consumerism and waste products – Environment production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V : Human Population and the Environment

Population growth, variation among nations – Population explosion – Family Welfare programme – Environment and human health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies

Text Books

1. Clark, R.S. 10989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
2. Mhaskar A.K., Matter Hazardous, techno-Science Systems Publications
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co.
4. Twonsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science.
5. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno-science Publications.

References

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India.
2. Down to Earth, center for Science and Environment
3. Hawkinds R.E., Encyclopedia of India Natural History, Bombay Natural History, Bombay Natural History Society, Bombay.
4. Trivedi R.K., Handbook of Environmental Laws, Rules, guidelines, Compliances and Standards, Vol. I and II, Enviro Media.

CE328 STRUCTURAL DYNAMICS

Credit 3:1:0 **Marks 40+60**

UNIT – I : Introduction and Principles of Dynamics

Vibration studies and their importance to structural engineering problems elements of vibratory systems and simple harmonic motion - Vibration with and without damping - constraints - generalized mass D'Alembert's principle - Hamilton's principle - Lagrange equations coupling.

Single Degree of Freedom:

Degree of freedom - Equation of motion for S.D.O.F. - damped and undamped free vibrations - Undamped forced vibration - Critical damping - Logarithmic decrement Response to support motion - Response of one degree freedom system to harmonic excitation, damped or undamped - Evaluation of damping resonance - band width method to evaluate damping - force transmitted to foundation - vibration isolation.

UNIT – II : Response to General Dynamic Loading
Fourier series expression for loading-Response to general dynamic loading - (blast or earthquake) - Duhamel's integral - Numerical evaluation - Fast Fourier Transforms.
Generalized Distributed Flexibility
Expression for generalized system properties – Vibrational analysis with Rayleigh's variational method - Rayleigh - Ritz method.

UNIT – III : Distributed Parameter System
Differential equation of motion - analysis. of undamped free vibration of simply supported and cantilever beams - effect of axial loads - numerical evaluation of modes - frequencies and response spectrum - vibration analysis using finite element method for beams and frames- component mode synthesis.

UNIT – IV : Multidegree Freedom System
Evaluation of structural property matrices- Natural vibrations - solution of the eigen value problem - vector interaction methods - Stodala and Subspace iteration techniques, Transformation methods - Jacobi and Given's method, Frequency search methods - Hozer and Transfer matrix methods Dunkerlay's equation and Rayleigh - Ritz methods - Orthogonality of natural modes.

UNIT – V: Solution of Equilibrium Equations in Dynamics
Introduction - Direct integration methods - The central Difference method - The Houbolt method - Wilson-θ-method and the Newmark method.
Analysis of Structures Subjected to Dynamic Loads:
Idealisation of multi-storeyed frames for dynamic analysis - analysis for blast loading - Wind induced vibration of Structures.

Text Books

1. Clough, R.,W., and Penzien, "Dynamics of Structures", McGraw Hill Book Co Ltd, 1986.
2. Paz Mario," Structural Dynamics - Theory and Computation", CBS publishers, 1999

Reference Books

1. Craig,R.R., "Structural Dynamics - An Introduction to computer Methods", John Wiley & Sons, 1989.
2. Hurty W.C and Rubinstein, M.F "Dynamics of Structures", Prentice Hall, 1967.
3. Biggs, 3.M., "Introduction to Structural Dynamics", McGraw-Hill, Co., 1964.
4. Thomson, W.T., "Theory of Vibration", Prentice Hall of India, 1975.
5. Manickaselvam, V.K., "Elementary Structural Dynamics", Dhanpat Rai & Sons, 1987.

CE329 ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES

Credit 3:1:0 **Marks 40+60**

UNIT – I :
Introduction to design Philosophy- Working stress design, limit state design, ultimate load design

Limit State Design of Beams for Shear, Torsion and Bond
Shear strength of beams - Interaction diagrams for combined bending and torsion - Design of members subjected to combined bending, shear and torsion - Skew bending theory - bond, anchorage and splicing of reinforcement; Calculation for deflection and crack width

Precast Construction
Principle of precast construction, advantages,-brief description of methods of precasting

UNIT II : Bunkers and Silos
Design of square bunker-Design of circular silo- Jenssen's theory- Principles of Airy's theory (No derivation for problems)
Shear Walls
Types of shear walls - behaviour of cantilever walls - interaction of shear walls and rigid jointed frames - Design for Earthquake forces.

UNIT-III : Limit Analysis and Design of Slabs
Behaviour of R.C. slabs under gradually increasing loads - Assumptions made in yield line theory of slabs - Analysis of isotropically and orthotropically reinforced slabs of various shapes under different edge conditions and equilibrium method - Application to practical design problems - Effect of corner levers - Hillerborg's simple strip method of analysis.
Design of flat slabs according to ACI method

UNIT IV Limit Analysis and Design of Statically Indeterminate Structures
Fundamental principles - Moment redistribution - limit analysis and design of continuous beams and simple portal frames - Check on rotation capacity.

UNIT – V: Design of Miscellaneous Structures
Simply supported and continuous deep beams - Grid floors – Orthotropic plate theory- Waffle slab - corbels

References

1. Regan, P. D and Yu, C.W., "Limit state design of structural concrete", Chatto & Windus, London, 1973.
2. Purushotaman,P. "Reinforced concrete structural Elements", Tata McGraw Hill, Publishing Co., Pvt. Ltd., New Delhi, 1984.
3. Jones,L.L,and Wood,R.H., "Yield line Analysis of slabs", Chatto and Windus London,1967.

4. Park R. and Gamble,W.L. 'Reinforced concrete slabs", John Wiley and Sons, New York, 1980.
5. Mac Gregor, G., 'Reinforced concrete Mechanics and Design", Prentice Hall, New Jersey 1988.
6. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice - Hall of India Ltd, New Delhi 1977.
7. Arthur H. Nilson et al, "Design of Concrete Structures", McGraw Hill Book Company, New York, 1986.
8. IS 456-2000 "Code of Practice for plain and reinforced concrete". BIS, New Delhi., 1978.
9. S.P. 16 (S & T) Design Aids for Reinforced concrete" to IS 456-1978. Indian Standard Institution, New Delhi, 1980.
10. SP24 (S&T) . "Explanatory handbook on Indian standard code of practice for plain and reinforced concrete (IS 456-1978)", BIS New Delhi, 1983.
11. IS 1893, "Criteria for Earthquake Design of Structures", BIS, New Delhi.,1984
12. SP 34, Hand Book on Concrete reinforcement and Detailing", BIS, New Delhi, 1987.
13. BS 110 (Part I) "Code of Practice for the structural use of concrete. Part I Design, materials and workmanship" ' British Standards Institution, London,1985.
14. ACI 318, "Building code of requirements for reinforced concrete", American concrete institute, Detroit, 1989.
15. Pasikh, S.K., "Automated Optimum Design of R.C.C. Skeletons", Tata McGraw-Hill Publishing Company Limited, New Delhi, 1995.

Note : Reference and Text book prescribed are inadequate

CE330 ANALYSIS AND DESIGN OF PLATE AND SHELL STRUCTURES

Credit 3:1:0 **Marks 40+60**

Unit I : Classical Theory of Plates

Differential equation of laterally loaded and thin rectangular plates - Levy and Naviers solution of plates - small deflection theory of plates - analysis of laterally loaded (concentrically loaded) circular, thin plates with simply supported or clamped edges.

Unit II : Design of Folded Plate Roof

Assumptions in the analysis of folded plates - Analysis of folded plate roof as per the ASCE task committee recommendations - Design steps - Minimum thickness and reinforcements as per IS specifications for RC folded plates.

Unit III : Classical Theory of Shells

Structural behavior of thin shells - Classification of shells - Translational and rotational shells - Ruled surfaces - Methods of generating the surface of different shells like hyperbolic paraboloid, elliptic paraboloids conoids etc Membrane theory of doubly curved shells -Edge disturbance

Design of Shells with Double Curvature

Design of the following type of shells a) Spherical shell, b) Conical shell, c) Paraboloid and ellipsoid.

Unit IV : Design of Cylindrical Shells

Design of R.C. Cylindrical shell with edge beams using theory for long shells - Design of shell with ASCE manual coefficients, Prestressed Cylindrical Shells

Unit V : Design of Hyperbolic Paraboloid Shells

Surface definition - Determination of forces - Forces in the edge members - Buckling consideration -Design examples - Detailing of reinforcement

Design of R.C Northlight Shells

Analysis of stresses in northlight shells - Design examples

Text Books

1. Ramaswamy, G.S., "Design and Construction of Concrete Shell roofs", Revised Ed. R.E.Kriegger, Malabar, Florida, 1984.
2. Timoshenko, S., "Theory of Plates and Shells", McGraw Hill Book Co., New York, 1990.

Reference Books

1. Chatterjee, B.K., "Theory and design of concrete Shells", Oxford and IBH publishing co, 1971.
2. "Phase 1 - Report on Folded plate construction – Report of the Task Committee on Folded Plate Design – ASCE Structural Division" – Dec. 1963, pp 365 – 406.
3. Kelkar, V.S. and Sewell , R.T., "Fundamentals of the analysis and design of shell structures". Prentice Hall, Inc. New Jersey, 1987.
4. "Design of Cylindrical concrete shell roofs", Manual of Engineering Practice No.31 ASCE, New York, 1952.
5. Billington, D.F., "Thin Shell Concrete Structures" Mc Graw Hill Book Company, 1965.

CE331 ADVANCED DESIGN OF STEEL STRUCTURES

Credit 3:1:0 **Marks 40+60**

Unit – I : BEAMS

- Design of Beams subjected to biaxial bending moment
- Design of sections subjected to unsymmetrical bending
- Elastic lateral torsional buckling

Beam Columns

- Short Beam-Columns
- Long Beam-Columns
- Beam-Columns at Ultimate Load

- Effects of Slenderness Ratio and Axial force on Modes of Failure
- Beam-Column under Biaxial bending
- Differential Equations and Moment Magnification Factors

Unit – II : Industrial Building

- Industrial building Frames
- Crane girders and columns
- Analysis of industrial bents
- Sway and non-sway frames
- Design of Gable frames
- Design of knee bracing, vertical bracing
- Design of Gable wind girder

UNIT – III : Transmission Towers

- Basic Structural Configurations
- Loads on Towers
- Wind Load
- Computer Program for Tower Design

Space Frames

- Introduction
- Method of Tension Coefficients applied to space frames
- Design with examples

Unit IV : Multistoreyed Buildings

- Structure of Multistoreyed buildings
- Bracing of Multistoreyed frames
- Loads
- Lateral Load analysis of frames
  - Portal Method
  - Cantilever Method
  - Factor method
- Design of members

Unit – V : Learning From Failures

- Introduction
- Need for Forensic Studies
- Poor Conceptual Design
- Design Inadequacy
- Poor Detailing
- Poor Judgment
- Poor Inspection and Maintenance
- Poor Construction
- Poor construction Practices

- Case study on Restoration of a factory building
- Lessons Learnt from Gujarat Earthquake of Jan 26, 2001

Plastic Theory

- Introduction - Shape factor - Moment redistribution - Static, Kinematic and Uniqueness theorems
- Combined mechanism - Analysis of single bay and two bay portal frames - Methods of plastic moment distribution
- Effect of axial force and shear force on plastic moments - Connections Moment resisting connection
- Design of continuous beams.

Text Books

1. Dayaratnam, P. "Design of steel structures", A.H. Wheeler & Co., Ltd, Allahabad, 1996.
2. Arya and Ajmani, "Design of steel Structures", Nemchand Brothers, Roorkee, 1989.
3. Punmia, B.C., Ashok Kumar Jain & Arunkumar Jain, "Design of Steel Structures", Vol I & II, Arhant Publications, Bombay, 1995.

Reference Book

1. Gray, C. S. Kent L.E Mitchell, W.A., and Godfey, W.B., "Steel Designer's manual", English Language Book Society and Granade Publishing, London, 1983.

CE332 STABILITY OF STRUCTURES

Credit 3:1:0 **Marks 40+60**

Unit I : **Concepts Of Stability**
Introduction - Stability Criteria - Equilibrium, Energy and Dynamic approaches- South well Plot - Stability of Link models.
Compression Members
Higher order Differential equations - analysis for Various boundary conditions- behaviour of imperfect column - initially bent column - eccentrically loaded column-Energy method-Rayleigh Ritz , Galerkin methods - Effect of shear on buckling – Large deflection of columns.

Unit II : Inelastic Buckling
Introduction - Double modulus theory (reduced modulus) - tangent modulus theory - Shanley's theory - determination of double modulus for various sections.
Beam Columns
Introduction - Beam-columns with concentrated lateral loads - distributed loads - effect of axial loads on bending stiffness - stability of frames - stability functions.

Unit III : Lateral Stability Of Beams
Differential equations for lateral buckling - lateral buckling of beams in pure bending - lateral buckling of cantilever and simply supported I beams

Buckling of Thin-Walled Open Sections

Introduction - torsional buckling - torsional flexural buckling - Equilibrium and energy approaches.

Unit IV : Stability of Plates

Governing Differential equation-Equilibrium, energy concepts - Buckling of rectangular plates of various end conditions - Finite difference method - post-buckling strength

Unit V : Buckling of Shells

Donnels Equation – Symmetrical Buckling of Cylinder under uniform axial Compression – Cylinder under uniform external lateral pressure – Cylinder subjected to torsion.

Elements of Nonlinear theory of buckling: Perfect systems – Imperfect systems – Imperfection insensitive and sensitive systems – Symmetric and Asymmetric bifurcation – Computational bifurcation theory – Bifurcation and limit points – Path tracing – Point matching – Path switching – simple examples.

Text Books

1. Chajes, A., " Principles of Structural Stability Theory", Prentice Hall, 1974.
2. Iyengar, N.G.R., "Structural Stability of columns and plates", Affiliated East West press Pvt. LTD, New Delhi - 1986.

Reference Books

1. Brush, D.O., and Almorth,B.O., " Buckling of Bars, Plates and Shells", McGrawHill, 1975..
2. Timoshenko, S.P., and Gere,J.M., "Theory of Elastic Stability", 2nd Ed. McGraw-Hill, 1961.
3. El Naschie M S., "Stress, Stability and Chaos in Structural Engineering: An Energy Approach", McGraw Hill International al Editions, 1992.
4. Ashwini Kukar, "Stability of Structures ", Allied Publishers LTD, New Delhi, 1998.

CE333 MAINTENANCE AND REHABILITATION OF STRUCTURES

Credit 3:1:0 **Marks 40+60**

Unit I: General

Distress monitoring, Causes for distress, Defects due to climate, chemicals, wear, Quality assurance, Quality audit, Quality Management system and Quality control, Structural Appraisal, Concrete floors and pavements

Non Destructive Testing:

Ultrasonic and sonic test- Rebound hammer Test- Strength evaluation of existing structures.

Unit II : Building Cracks

Causes – Diagnosis – Thermal and Shrinkage cracks –Vegetation and trees – Foundation movements – Techniques for Repair – Epoxy injection.

Moisture Penetration
Sources of Dampness – Moisture movement from ground – Reasons for ineffective damping –Leakage in concrete slabs – Pitched roofs – Dampness in solid walls – Condensation – Remedial treatments – Chemical coatings

Unit III : Steel Structures
Types and causes of deterioration – Preventive measures – Repair Procedure – Brittle Failure – Defects in welded joints – Test for defects; – Mechanism of Corrosion – Design and fabrication errors – Distress during erection.

Masonry Structures
Discolouration and weakening of stones – Preservation – Chemical preservatives – Brick masonry structures – Distress and remedial measures

Unit IV : Special Materials for Repair
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferrocement overlay, Fibre reinforced concrete.
Techniques for repair: Polymer coating for rebars, Mortar and dry pack, Vacuum concrete, Gunite and Shotcrete, Shoring and underpinning, plating.

Unit V : Strengthening of Existing Structures
General principle – relieving loads – Strengthening super structures –Conversion to composite construction – Post stressing – Jacketing – Bonded overlays – reinforcement addition – strengthening the substructures– Increasing the load capacity of footing.

Text books

1. **Johnson. S.M.** ,*"Deterioration, maintenance and repair of structures", McGraw-Hill book company, New York, 1965.*
2. **R. T. Allen and S. C. Edwards**, *" Repair of concrete structures", Blakie and Sons, UK, 1987.*
3. **Denison Campbell, Allen and Harold Roper**, "*Concrete structures", Materials, Maintenance and Repair, Longman Scientific and technical UK, 1991.*
4. **SP25-84**, *"Hand book on causes and prevention of cracks on buildings", Indian standards.*

Reference books

1. **1.M. S. Shetty, "***Concrete Technology- Theory and Practice***",** *S. Chand and Company, New Delhi, 1992.*
2. **2.Gambhir***, " Concrete Technology".*

CE334 ASEISMIC DESIGN OF STRUCTURES

Credit 3:1:0 **Marks 40+60**

Unit I : Introduction

Elements of Engg Seismology-Indian Seismology-Earthquake vibration-Catastrophes-Failures-Lessons learnt in past Earthquakes-theory of Vibration-Single Degree of Freedom System- Without and with Damping-Two and three degrees of Freedom-Mass and Stiffness coupling-Normalised modes-Orthogonal properties-Power method-Sweeping technique-Approximate methods-Rayleigh method-Dunkerley method to find fundamental frequency.

Unit II : Forced Vibration

Forced vibration-Single degree of freedom system-Undamped and Damped system-Duhamel's Integral-Dynamic response factors-Resonant frequency-Resonant response-Base excited motion-Multi-degree freedom system-Damped and Undamped system-Modal analysis-earthquake response to linear systems – Response spectrum characteristics-Ground motion parameters-Lumped mass system-Shear building-Symmetrical and unsymmetrical buildings.

Unit III : IS Code Provisions

Modal response contribution-Modal participation factor-Response history-Spectral analysis-Multiple support excitation-Introduction to deterministic earthquake response to continuous systems on rigid base-Approximate methods for lateral load analysis-Is 1893-2002 provisions-Is 4326 provisions-Behavior and design of masonry structures-Discussion of codes Is 13827 and 13828.

Unit IV : Behavior of Structures

Capacity design-Deatailing as per Is 13920-Behavior of RC Structures-Cyclic Load-Shear Wall Frame Systems-Khan and Saboronis Method-Coupled Shear Wall System-Rosmans Method-Ductility requirements in Concrete Structures-Beam Column Junctions

Unit V : Behavior of Steel Structures

Behavior of steel structures- Design-Cyclic load behavior-Different bracing systems-Compact and non compact sections-Buckling-Beam column joints-Push over analysis-Introduction-Modern concepts-Base isolation-Soil structure interaction-Adaptive structures-Case studies-Retrofitting-Case studies-Reconstruction-Rehabilitation

Computer aided analysis and design (for Internal Assessment only)
(not for Theory Examination)–
Computer aided analysis and design of building systems for earthquake loads-Response spectrum and time history methods-Hands on session using STAADPro.

Text Book

1. Chopra, A.K., "Dynamics of Structures – Theory and applications to earthquake engineering ", prentice hall of india pvt ltd .,new delhi,2002.

Reference books

1. Clough,r.w., and Penzien,j., "Dynamics of Structures" ,mcgraw-hill,inc,1993.

2. Taranath,b.s.,"Structural Analysis and Design of Tall Buildings",mcgraw-hill book company new york,1999.
3. Naeim,f.,"The Seismic Design Hand Book", second edition,kluwer academic publishers,london,2001.

CE335 PRESTRESSED CONCRETE STRUCTURES

Credit 3:1:0 **Marks 40+60**

UNIT I : Introduction

Prestress system –Losses of prestress

Design For Flexure

Definition of Type I, Type II and Type III structures - Basic assumptions - Permissible stresses in steel and concrete as per IS:1343 Code - Four basic requirements - Design and choice of sections of post-tensioned beams - Layout of cables - Check for limit state of collapse - Location of positions of wires in pre-tensioned beams.

UNIT II : Deflection

Short term deflections of uncracked members - Long term deflections - Deflection due to creep in members - Code requirements for the limit state of deflection .- Factors influencing deflection

Design For Shear And Torsion

Shear and principal stresses - Limit state shearing resistance of cracked and uncracked sections - Design of Shear reinforcement by the limit state approach. Interaction diagrams under combined bending, torsion and transverse shear.

UNIT III : Transfer of Prestress

Transmission of prestressing force by bond - Transmission length - Factors affecting transmission length - Check for transmission length - Anchorage zone stresses in post-tensioned members - Calculation of bearing stress and bursting tensile forces and reinforcement in anchorage zone based on I.S. 1343 code and Guyon's method.

Composite Construction of Prestressed & Insitu Concrete

Types of composite construction - Analysis for stresses - Effect of Differential shrinkage - Design for flexure and shear.

UNIT IV : Statically Indeterminate Prestressed Concrete Structures

Methods of achieving continuity - Assumptions in elastic analysis - Pressure line - Linear transformation - Concordant cables - Guyon's theorem - Analysis and design of continuous beams.

UNIT V

Circular prestressing in liquid retaining tanks - Analysis for stresses - Design of tank wall incorporating the recommendations of IS:3370 Part III Code - Types of Prestressed concrete pipes - Design of pipes.

Other Structures

Methods of achieving partial prestressing - Advantages and disadvantages. Design of prestressed concrete columns, sleepers, poles and tension members - Use of non-prestressed reinforcement- Methods of prestressing concrete shell structures.

Text Books

1. Krishna Raju, N., "Prestressed Concrete" Tata McGraw Hill Publishing Company Ltd., New Delhi, 1995.
2. Lin, T.Y., and Ned H Burns., "Design of Prestressed Concrete Structures", John Wiley and sons, Newyork, 1982.

References

1. Guyon, Y. "Limit State Design of Prestressed Concrete Vols. I & II", Applied Science Publishers, London, 1974.
2. Ables, P.W. and Bardhan Roy, B.K., Prestressed Concrete Designers' Hand Book (3rd Edition) A View Point Publication, Cement and concrete Association, U.K. 1981. London, 1966.
3. Leonhardt,F., "Prestressed Concrete Design and Construction", Wilhelm Ernst and Soh, Berlin, 1964.
4. Nilson, A.H., "Design of Prestressed Concrete", John Wiley & sons, New York, 1978.
5. Mallik S.K., and Gupta A.P., "Prestressed Concrete", Oxford & IBH Publishing Company (P) Ltd, India, 1986.
6. "IS: 3370 (Part III and IV) Indian Standard Code of Practice for Concrete structures for the Storage of Liquids Part III
7. Prestressed Concrete Structures", Indian Standards Institution, New Delhi 1967.
8. "IS: 1343, Indian Standard code of Practice for Prestressed Concrete", Indian Standards Institution, New Delhi., 1980.
9. "IS: 784, Indian Standard Specification for Prestressed Concrete Pipes", Indian Standards Institution, New Delhi 1978.
10. "IS: 3935 - Code of Practice for composite construction", Indian Standards Institution, New Delhi,
11. "BS 110, Part I, Code of Practice for the Structural use of Concrete", British Standards Institution, London, 1985.

CE336 DESIGN OF INDUSTRIAL STRUCTURES

Credit 4:0:0 **Marks 40+60**

UNIT I : General

Classification of Industries and industrial structures - Specific requirements for industries like Engineering, Textiles, Chemicals, etc - Site layout and external facilities required.

UNIT II : Functional Requirememnts

(i)Natural and artificial lighting - protection from the sun sky light (ii) Services - electrical wiring fixtures - cable and pipe bridge - electrical installations - substations - Effluent disposal and (iii) Heating and ventilation - air conditioning - fire expanse and chutes - fire alarm, extinguishers and hydrants - Guidelines from factories act.

UNIT III : Industrial R.C. Structures

Design and detailing of r.c. gable frames, corbels, bunkers, silos and chimneys - North light shell roofs and folded plates - cooling towers - Application of prefabrication techniques.

UNIT IV : Industrial Steel Structures

Design of gantry girders, steel bunkers, silos and chimneys - High pressure boilers and piping design.

UNIT V : Miscellaneous

i. Design of Nuclear containment structures.
ii. Design of Power Transmission Structures: cables, Transmission line towers - substation structures - Tower foundations.
iii. Design of machine foundations.

Text Book

1. Proceedings of Advanced Course on Industrial Structures, Structural Engineering Research Centre, Madras, 1982.

Reference Books

1. Manohar, S.N., "Tall chimneys - Design and Construction", Tata Mc Graw Hill, 1985.
2. Santhakumar, A.R. and Murthy, S.S., "Transmission Line Structures", Tata Mc Graw Hill 1992.
3. Srinivasulu, P and Vaidyanathan, C., "Handbook of Machine Foundations", Tata Mc Graw Hill 1976.
4. Jaikrishna and Jain, O.P, Plain and Reinforced Concrete, Vol-II - Nemchand and brothers, 1958.
5. Handbook on Fundamental Requirements of Industrial Buildings (Lighting and Ventilation), BIS.
6. I.S. 9178 Parts I & II
7. I.S. 3483
8. I.S. 6060
9. Dayaratnam, P., "Design of Steel Structures", A.H. Wheeler & Co., Ltd., Allahabad,1996.

CE337 DESIGN OF TALL BUILDINGS

Credit 4:0:0 **Marks 40+60**

UNIT – I : Introduction

History - advantages and disadvantages - economics - essential amenities - lifts (elevator) - fire safety - water supply - drainage and garbage disposal - miscellaneous services - systems - structural and foundation systems.

Loads:
Loads on High Rise buildings - code recommendations - wind and earthquake forces - gust factors - Karman vortices - fire-quality assurance.

UNIT II : Structural System In Steel And Concrete
Steel: Beam column frames - vertical shear truss - framed tubes - column diagonal truss tube - bundled tube systems. Concrete: Shear walls - coupled shear walls-framed tubes - tube in tube systems - effects of torsional loads on shear walls.

UNIT III : Static Analysis
Static analysis - High Rise structural systems in steel- analysis of braced and unbraced frames - approximate analysis of framed and bundled tube systems - High Rise structures in concrete - Rosman's analysis of shear wall frame interaction- simplified method of analysis of frame wall systems.
Stability Analysis
Stability consideration of unbraced tall buildings- laterally loaded asymmetric shear buildings - approximate methods of stability analysis – $P – \Delta$ method.

UNIT IV : Dynamic Analysis
Dynamic response of braced tall buildings - buildings with shear walls - Rosman's analysis - Analysis to earthquakes - lateral drift limitations in tall buildings - Design of Chimneys, TV towers and tall towers.

UNIT V: Foundation Systems
Deep foundations - Caissons and High Capacity piles - Soil Structure Interaction.

Text Book

1. Taranath,B.S., " Analysis & Design of Tall Building ",McGraw-Hill Book Co, 1988.

Reference Books

1. Ramaswamy, S.D. and Yam,C.T., " Proceedings of the International Conference on Tall buildings", Singapore, 1984.
2. Fintel,M., "Hand Book of Concrete Engineering". Van Nostrand Reinhold co., 1974.
3. Mehta B., "High Rise Buildings" M/S Skyline, 1978

CE338 PREFABRICATED CONCRETE STRUCTURES

Credit 4:0:0 **Marks 40+60**

UNIT I : Introduction
General principles of prefabrication - Types of prefabrication - specific requirements for planning and layout of prefabrication plant - I.S. Code specifications - Modular coordination - Transportation - Erection - Stages of loading and codal provisions - Material properties - Deflection control - Lateral load resistance.

UNIT II : Floors, Stairs And Roofs
Types of floor slabs - analysis and design of cored and panel types and two-way systems - staircase slab system and design - Types of roof slabs and insulation requirements - Description of joints, their behaviour and reinforcement requirement - short term and long term deflection control.

UNIT III : Walls
Types of wall panels - Blocks and large panels - curtain, partition and load bearing walls - load transfer from floor to wall panels - Vertical loads - Eccentricity and stability of wall panels - Design curves, types of wall joints, their behaviour and design - Leak prevention, joint sealant and sandwich wall panels.

UNIT IV : Design of Industrial Buildings
Components of single storey industrial sheds with crane gantry systems - Design of R.C. roof trusses and roof panels - Design of R.C. crane - gantry girders, corbels, columns and wind bracing design - joints between columns and foundations.

UNIT V : Prefabricated Shell Roof for Industrial Sheds
Hand book based design of cylindrical and bypar prefabricated shells - folded plates - Erection and jointing - Joint design.
Hoisting Technology
Equipments for hoisting and erection - Techniques for erection of different types of members such as beams, slabs, wall panels and columns - Design for handling and erection stresses - Methods of minimizing erection stresses.

Text Book

1. Lasslo Mokk, "Prefabricated concrete for Industrial and Public sectors," Akademiai Kiado, Budapest, 1964.

CE339 DESIGN OF OFFSHORE STRUCTURES

Credits: 4:0:0 **Marks 40+60**

UNIT I : Theories of Periodic Wave Motion
Small amplitude wave theory - Basic equations of hydrodynamics - Integration of equations of motion - Mathematical formulation of wave problem - characteristics of small amplitude waves - Deep and shallow water waves - wave energy - Group velocity of wave trains - Transformation of small amplitude waves - Reflection - reflection and deflection of waves breaking of wave and its importance.

UNIT II : Forces Due to Ocean Waves on Structures
Finite amplitude wave theories - Wave forces on a circular cylinder - coefficient of drag and inertia - Wave forces on breakwaters and sea walls due to non- breaking and broken waves - wave forces on piles.

UNIT III : Shore Protection Works
Sea walls and bulkheads - Groins - Offshore breakwaters - Artificial nourishment - Functional aspects of break waters - Design of breakwaters.

UNIT IV : Piers, Wharves and Quaywalls
General - Functional aspects - Design of wharves, piers and quay walls.

UNIT V : Other Structures
Functional aspects and design of Graving dry docks - Floating dry docks - Dolphines - Fenders - Offshore mooring buoys - Offshore marine platform.

Text Book

1. Keddy, D.V. and Arockiasamy, M., "Offshore Structures, Vol.I" Krieger Publishing Company, Malabar, Florida, 1991.

Reference Books

1. Chakrabarti, S.K., "Hydrodynamics of Offshore Structures", Computational Mechanics Publications, 1987.
2. Thomas H.Dawson, "Offshore Structural Engineering", Prentice Hall Inc. Englewood Cliffs, N.J.1983.
3. API Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RPZA, Dalls, Tex.
4. Wiegel, R.L., "Oceanographical Engineering", Prentice Hall Inc, Englewood Cliffs, N.J.1964.
5. Brebia, C.A., Walker, S., "Dynamic Analysis of Offshore structures, New-nes Butterworths, U.K.1979.

CE340 SPACE STRUCTURES

Credits: 4:0:0 **Marks 40+60**

UNIT I : Introduction
Space Structures - Single and Multi-layer grids - barrel vaults- domes – towers- tension structures -pneumatic structures - patterns - notable structures in India and abroad - Material - steel - aluminum - plastics - protection coats for the members.
Practical Construction Methods
Cladding - cambering - drainage- Transportation problem- lifting technique corrosion protection - maintenance and fire protection

UNIT II : Behaviour
Different forms of space structures - tensegrity frame work - tensile structures- pneumatic structures
Prefabricated Space Structural Systems
Mero, Space Deck, Nodus, Unistrut, Triodetic, Unibat, and NS truss

UNIT III : Node Connectors
Mero - Octatube - Nodus System – Triodetic- Modular System-Tomo Unit Truss.

UNIT IV : Analysis
Finite Element Method – Linear – Nonlinear-Collapse-Dynamic and Stability Analysis.
Design of Members
Joints - support systems- foundations
Computer Aided Design
Expert system

UNIT – V : Configuration Processing
Formian Algebra

Case Studies
Failures

Reference Books

1. Nooshin,H., "Formex Configuration Processing in Structural Engineering", Elsevier Applied Science Publishers, London, 1984.
2. All Bulletins of the International Association of Shell and Spatial Structures
3. Proceedings of the First, Second , Third and Fourth International Conferences on Space Structures, University of Surrey, Guidford, England, 1975, 1985, 1993
4. Davies,R.M. (eds), "Space Structures", Blackwell Scientific Publications, Oxford, 1967.
5. Makowski,Z.5. " Steel Space Structures", Michael loseph Ltd., London, 1965.
6. Subramanian,N., "Principles of Space Structures", A.H.Wheeler co., 1983.

CE341 ADVANCED SURVEYING

Credits: 3:0:2 **Marks 60+40**

Note:

- Since this is a Lab integrated course, the lab will be evaluated on part of Internal Assessment and there will be end semester exam in theory only.
- 12 experiments will be notified by HOD from time to time

Unit I : Basics
Definition, historical development, methods of measuring distance, basic principles, classifications, applications and comparisons with conventional surveying, fundamentals of electronics, resonant circuits, semiconductors, integrated circuits, Laser, LED, LCD, gundoide, photodiode, transducers, oscillators, frequency mixing, modulation and demodulation, measurement of phase differences, reflectors (prism, antenna) and power sources.

Unit II : Electromagnetic Waves
Definition, classification, applications, propagation properties, wave propagation at lower and higher frequencies, refractive index, factors affecting RI, computation of group RI for light and near infrared waves at standard conditions and ambient conditions, reference refractive index, first velocity correction, computation of refractive index for micro waves, measurements of atmospheric parameters, mean refractive index, real time application of velocity correction, second velocity correction and total atmospheric correction.

Unit III : Electro Magnetic Distance Measuring System
Electro optical system, measuring principle, working principle, sources of errors, Infrared EDM instruments, laser EDM instruments and total station. Microwave system, measuring principle, working principle, sources of error, microwave EDM instruments, comparison with electro optical system, care and maintenance of EDM instruments, modern positioning systems.

Unit IV : Field Work
1. Study of different EDM instruments, computation of area, setting out works, base line measurements
2. EDM traversing, Preparation of contour maps

References:

1. Burnside, C. D., Electromagnetic Distance Measurement, Crosby Lock Wood Staples, UK., 1971
2. Rueger, J. M., Electronic Distance Measurement, Springer – Verlag, Berlin, 1990
3. Laurels, S.H., Electronic Surveying in Practice, John Wiley & Sons, Inc, 1983.
4. Soastamoinen, J.J., Surveyor's Guide to Electromagnetic Distance Measurement, Adam Hilger Ltd., 1967

CE342 GEOGRAPHIC INFORMATION SYSTEM I

Credit 4:0:0 **Marks 60 + 40**

Unit I : Introduction
Definition, automated cartography, map analysis, system concepts – geographic data model, map characteristics – projections, coordinate system, thematic maps, standard mapping and GIS packages.

Unit II : GIS Data Structures
Types of data, data structure, data types – raster and vector; file and file organization, database structure; semantics – objects, surfaces; spatial data organization; other aspects of spatial data – input devices.

Unit III : Geometry of Spatial Data
Geometry – position, representation, dimension, topology, graphs areas & ordering; spatial resolution – cells, quad trees and region.

Unit IV : Spatial Data Analysis & Modeling
Interpolation, geometric operation, transformation, spatial analysis, attribute data, integration, vector data analysis – network analysis, DEM & DTM generation and application, cost and path analysis, line, area & column entities, spatial object modeling.

Unit V : Data Representation
Representation issues – design of information system; output – type, medium, tools and devices, data quality, error.

References
1. Burrough P.A., Principles of Geographical Information Systems for Land Resources Assessment, Oxford Publications, 1980
2. Marble D.F., Calkim H.W and Penguest, Basic Readings in Geographical Information System, Spad System Ltd. New York, 1984.
3. Robert Laurini & Derek Thompson, Fundamentals of Spatial Information Systems, Academic Press, 1996.
4. Paul A. Longley, Michael F Good Child, David J. Magazine, David W Rhind, Geographical Information Systems, Vol – I & II, John Wiley & Sons Inc, 1999.

CE343 PRINCIPLES OF REMOTE SENSING

Credit 4:0:0 **Marks 60 + 40**

Unit I : Physics Of Remote Sensing
Introduction of remote sensing, Electromagnetic spectrum, physics of remote sensing, effects of atmosphere, atmospheric windows, spectral reflectance of earth's surface features in different wave length regions of EM spectrum, Atmospheric influences on spectral response patterns, multi concept of remote sensing.

Unit II : Data Acquisition
Platforms, various types of platforms, importance of remote sensing data for natural resources management, different types of aircraft, manned and unmanned space craft used for data acquisition, characteristics of different types of platforms, LANDSAT, SPOT, IRS, ERS,INSAT, JERS IKONOS and other platforms.

Unit III : Data acquisition sensors (Visible and Infrared)
Photographic products, B&W, Colour and Colour Infrared films and their characteristics, resolving power of lenses and films, optomechanical, Electro optical sensor, spatial, spectral and radiometric resolution, thermal sensors, geometric characteristics of thermal imagery, calibration of thermal scanner, signal to noise ratio.

Unit IV : Data Acquisition sensors (Microwave)
Concepts of microwave remote sensing, SLAR, SAR, Scaterometers, Altimeter, Satellite and Airborne Sensors, characteristics of microwave imageries.

Unit V : Data Analysis
Different types of data products and their characteristics, basic principles of digital analysis.

References

1. Paul Curran P.J., "Principles of remote Sensing", 1983.
2. Sabins F.F. Jr., "Remote sensing principles and Image Interpretation", W.H. Freeman and Company, 1978.
3. Lintz J.Jr & D.S. Simonett, "Remote Sensing of Environment", Addison Wesley Publishing Company, Massachusetts, 1976.
4. Swain Phillips H. "Remote sensing of Environment: The Quantitative approach", Mc Graw Hill International Book Company, 1978.
5. Lillesand, T.M. and Kiefer R.W. "Remote sensing and Image Interpretation", II edition of john Wiley and sons 1993.

CE344 CARTOGRAPHY

Credit 4:0:0 **Marks 60 + 40**

Unit I : Basics
Cartography, definition, scope and content. The spheroid, map scale, co-ordinate system and reckoning, methods of mapping, relief maps, thematic maps.

Unit II : Map projections
Map projections, classification, principles of construction of common projections, cylindrical, conical, azimuthal and globular projections, properties and uses, choice of projection, plane co-ordinates UTM system, projection used in Survey of India topographic sheets.

Unit III : Map Design
Processing and generalizing geographic data, graphic perception and design, colour and pattern, typography and lettering the map.

Unit IV : Data Processing
Remote sensing and Data sources, simplification and classification, computer assisted cartographic processes, symbolization, mapping with point, line and area symbols portraying the land surface form.

Unit V : Digital Cartography
Compilation and credits, map production and map reproduction, Digital cartography storage formats, Geographic Information System.

References

1. R.W Anson & F.J. Ormeling Ica, Basic Cartography for Students and Technicians -Vol-I, Vol-II, & Vol- III – Elsevier Scientific Publications: 2nd Edition, 1995.
2. Arthur H. Robinson & Et Al, Elements of Cartography, Wiley, John & Sons 6th Edition – 1995

3. Advances in Cartography, Muller ISBN: 1851666036 Elsevier Science Publications
4. Bordon D. Dent Cartography ISBN: 0697 384950 Mc Graw Hill Publishers.
5. Erin J. Raisz Principles of Cartography ISBN: 0070511519

CE345 COMPUTER PROGRAMMING IN C++

Credit 4:0:0 **Marks 60 + 40**

Unit I : Unit 1 The Object Oriented Approach
Objects, classes, inheritance, reusability, creating new data base types, polymorphism and overloading. Basic program construction, data types: integer, character, float, double, and Boolean. Input output statement: cin, cout, comments, escape, sequence, manipulators, type conversion, arithmetic logical and relational operators, and library function.

Unit II : Loops and Definitions
For loop, while loop& do loop and if, if ……else, switch & other control statements. Structures, Enumeration, Functions: passing arguments to functions, returning values from functions, references arguments, overload functions inline functions, default arguments variables and storage class and returning by reference

Unit III : Objects and Classes
A simple class, C++ objects as physical objects, C++ objects and data types, object as function argument, constructors, as function argument, overload constructors, copy constructors, returning objects from functions, structures and classes, static class data, const and classes, Arrays and strings.

Unit IV
Overlaying unary and binary operator, data conversion, and pitfalls, Inheritance: derived class and base class, derived class constructors, overloading member functions, class hierarchies, public and private inheritance, level of inheritance, multiple inheritance Pointers: address and pointers, pointers and arrays, pointer and c-type strings, new and delete operator, pointers to pointer

Unit V
Virtual functions, friend functions, static functions, this pointer. Streams and files: stream classes, stream classes, stream errors, disk file I/O with streams, file pointers, error handling in file I/O. Templates and exception: function templates, class templates, exception

Text Book
1. Robert Lafore, Object Oriented Programming In C++, Third Edition, Galgotia, 1999

Reference Book
1. Herbert Schildt, C++ The Complete reference, Third Edition, McGraw Hill, 1999

CE346 GIS LAB I

Credit 0:0:2 **Marks 50+50**

12 experiments will be notified by HOD from time to time

CE347 DIGITAL IMAGE PROCESSING

Credit 3:0:2 **Marks 60 + 40**

Note:

- Since this is a Lab integrated course, the lab will be evaluated on part of Internal Assessment and there will be end semester exam in theory only.
- 12 experiments will be notified by HOD from time to time

Unit I : Digital Data

Satellite data acquisition, storage & retrieval, data formats, data compression, satellite system, data products, image display system, current remote sensing systems.

Unit II : Sensor and Data Models

Introduction- sensor model – resolution, spectral and spatial response; image formation; geometric and radiometric distortion and correction – univariate and multi variable image statistics, spatial statistics, Histogram – noise models, image quality, image processing

Unit III : Image Enhancements

Spectral signatures – image characteristics, feature space, scatterogram, spectral transform – contrast transform – filters, Fourier transform, scale – space transform, wavelet transform.

Unit IV : Information Extraction

Image registration and fusion – area correlation, ortho rectification, resembling, multi- image fusion, spatial and spectral domain fusion, examples, classification – feature extraction, training – supervised, unsupervised and hybrid training, non – parametric, parametric and sub- pixel classification, hyper spectral image analysis.

Unit V : Image Analysis and Understanding

Pattern recognition, shape analysis, textural and contextual analysis, decision concepts – fuzzy sets and evidential reasoning, Expert system, artificial neural network; integration to IS.

References:

1. John R. Jenson, Introducing Digital Image Processing – Prentice Hall, New Jersey 1986.
2. Robert A. Schowengergt, Techniques for Image Processing and Classification in Remote Sensing, 1983.
3. Robert A. Schowengergt, Remote Sensing – Models and Methods for Image Processing, Academic Press 1997. Hord. R.M., Academic Press, 1982.

CE348 PHOTOGRAMMETRY

Credit 4:0:0 **Marks 60 + 40**

Unit I : Basic Photogrammetry
History and development, principles, classification; Aerial cameras – Basic optics, photographic process, Cameras and Imaging System.

Unit II : Aerial Photographs and Geometry
Stereoscopy, concepts, tools, viewing and measuring systems; Geometry, image and object coordinates, scale, displacement; Characteristics, scale, measurement, tilt effects, rectification, overlap, stereo pair.

Unit III : Orientation Procedures
Concepts of interior, relative and absolute orientation, object, Image relation, linearization, effect of elements, Scaling & leveling, analytical procedures, 3D information and mapping.

Unit IV : Photogrammetric mapping & planning
Planimetric mapping, radial line triangulation, aerial mosaics, types, control, material, 3D information, overlap, floating mark parallax equation, height information, project information, project planning, photo control, planning, cost estimate.

Unit V : Aerotriangulation & Special system
Elements of Aerotriangulation and analytical method, strip deformation, strip and block adjustment; oblique, title and terrestrial Photogrammetry, Geometry & products information, Automated system, Image correlation, matching and Orientation, mapping.

References

1. Wolf Paul. P., "Elements of Photogrammetry, " McGraw hill International Book Company
2. Franics. H. Moffit and Mikali, Edward m., "Photogrammetry." Harper and Row Publishers, 3rd Edition, 1980.
3. Karl Krans, Photogrammetry, Vol I & Vol II, Ferd Dummler Verlag, 4th Edition 1997.
4. American Society of Photogrammetry, 4th edition, 1980.

CE349 GLOBAL POSITIONING SYSTEM

Credit 3:0:2 **Marks 60 + 40**

Note:

- Since this is a Lab integrated course, the lab will be evaluated on part of Internal Assessment and there will be end semester exam in theory only.
- 12 experiments will be notified by HOD from time to time

Unit I : Introduction
Definition – basics of geodesy – classification and basic concepts of satellite geodesy – historical development and applications of satellite geodesy.
Historical techniques
Photographic determination of directions – electronic distance measurements (SECOR) – other early observation techniques.

Unit II : Doppler techniques and Basics of Global Positioning System ◇ Doppler Effect and basic positioning concept – development and status of the navy navigation satellite systems (TRANSIT). Fundamentals – introduction space, control segments – observation principles – signal structure, broad cast ephimerides, orbit representation, structure of GPS data, GPS receivers – concepts & Receiver components. Navigation receivers

Unit III : GPS Data processing and errors
GPS observables and data processing – parameter estimation – solution ambiguities – data handling – cycle slips – RINEX data – software concepts. Static, kinematic surveys. Error budget correction – satellite geometry and accuracy measures – multipath effect.

Unit IV : GPS Applications
Software modules and data processing – possible applications – geodetic control survey – cadastral surveying and GIS, engineering and monitoring, geodynamics, marine geodesy and hydrography – Photogrammetry and remote sensing – GLONASS – comparison with NAVSTARGPS.
Laser Ranging
Overview of laser ranging – basic concepts of satellite altimetry – planned missions and spatial methods.

Unit V : Field work
Study on GPS instruments, static and kinematic surveying using DGPS

References

1. Seeber, G., Satellite Geodesy, Walter De Gruyter, Berlin, 1993.
2. Alfred leick, GPS Satellite Surveying, John Wiley and Sons, 1995.
3. Hofmann Wellenhof, B. Lichtenegger, H. and Collins, j., Global Positioning System, Springer – Verlag, New York, 1994

CE350 GEOGRAPHIC INFORMATION SYSTEM II

Credit 4:0:0 **Marks 60 + 40**

Unit I : Natural resources management application
GIS application in natural resources management – case studies – water resourses – environmental science – application in disaster mitigation and management – case studies – demographic, health applications.

Unit II : Am/fm applications
GIS applications in Automated Mapping (AM) / Facility Management (FM) – case studies – Land Information System – case studies.

Unit III : MCE & KB tools
Multi criteria evaluation using GIS - techniques – case studies – use of knowledge based tools with GIS – expert systems, artificial neural network.

Unit IV : Data quality
Data quality – error, accuracy, precision – components of data quality – positional accuracy, attribute accuracy, logical consistency, completeness, lineage – meta data – need for meta data – spatial data transfer standards.

Unit V : Miscellaneous topics
Object oriented GIS, web based GIS 3D GIS – web based GIS applications

References

1. Burrough P.A., Principles of Geographical Information Systems for Land Resources Assessment, Oxford Publications, 1980
2. Paul A. Longley, Michael F Good Child, David J. Magazine, David W Rhind, Geographical Information Systems, Vol – I & II, John Wiley & Sons Inc, 1999.
3. Robert Laurini & Derek Thompson, Fundamentals of Spatial Information Systems, Academic Press, 1996.

CE351 DATA BASE MANAGEMENT SYSTEM

Credit 4:0:0 **Marks 60 + 40**

Unit I : Data Base Management Systems
Data – information – types – database models – data encoding – hardware and software requirements - data base management systems – types of DBMS – hierarchical, network, relational models – E-R diagram – modern DBMS – distributed databases – client server databases – knowledge based systems – geographic databases – GIS

Unit II : File Organization and Normalization
File organization – sequential, indeed sequential, random, multikey file organization – advantages and disadvantages – relational DBMS – relational algebra – normalization – first, second, third, Boy-Codd, fourth and fifth normalizations – case study for normalization using a geographic data.

Unit III : ORACLE
Oracle internal data types – data definition language – integrity constraints – DML – data manipulation commands – operators – arithmetic, comparison, logical operators – operator precedence – privilege commands – transaction control language – SQL functions – single

row, data, character and numeric functions – group functions –count functions. Set operators – relating data through join concept – subquries – database objects – view – index – partitioning – locks – triggers – formatting commands – column commands – compute commands – title commands – setting page dimensions – storing and printing query results – integration of oracle with GIS software – interfaces – DB concept.

Unit IV : Developer 2000
Oracle forms – object navigator – oracle forms objects – layer editor – property palette – event triggers – items – alerts – windows – record groups – LOV – reports – quires – groups – column – forms layout – graphs – display – layout – queries.

References

1. Bipin C. Desai, An Introduction to Database Systems, Galgotia Publications Pvt. Ltd, First Edit. 1993.
2. Michael Abbey and Michael J Corey, ORACLE 8 – A Beginner's Guide, Tata MC. Graw Hill, 1998
3. C,J. Date, An Introduction To Database Systems, Addison Wesley, sixth edition, 1995
4. Ivan Bayross, Commercial Application Development Using ORACLE Developers 2000, BPB Publications, First Edition, 1997.

CE352 MICROWAVE REMOTE SENSING

Credit 4:0:0 **Marks 60 + 40**

Unit I : Introduction
Fundamentals – EMR – band designation – microwave interaction with atmospheric constituents, earth's surface, vegetation, and ocean.

Unit II : Passive Microwave Remote Sensing
Basics – theory of radiometry – Sensors application in atmosphere, ocean and land.

Unit II : Radar
System parameters, target parameters, radar equation measurement and discrimination, radargrammetry, image processing, SAR Inteferrometry.

Unit III : Radar Systems
Real and synthetic aperture radar – principles – different platforms and sensors

Unit IV : Application
Interpretation of microwave data – physical mechanism and empirical models for scattering and emission, volume scattering. Geological interpretation of RADAR images, application in forestry, landuse, and other disciplines.

References

1. Fawaz. T. Ulaby, Richard k. Moore and Adrin K. Fung, Microwave Remote Sensing Active and Passive, Vol.1, 2 And 3 Addison-Wesley Publication Company 1981,1982 And 1986.
2. Philip.N.Slater, Remote Sensing, Optics and Optical Systems, 1980.
3. Robert M. Haralick and Simmonett, Image Processing for Remote Sensing 1983.
4. Robert n. Colwell. Manual of Remote Sensing Volume 1, American Society of Photogrammetry 1983
5. Travett. J. W Imaging Radar for Resources Surveys. Chapman And Hall , London 1989

CE353 GIS LAB II

Credit 0:0:2 **Marks 50+50**

12 experiments will be notified by HOD from time to time

CE354 LAND INFORMATION SYSTEM

Credit 4:0:0 **Marks 60 + 40**

Unit I : Introduction

Definition LIS, GIS. History of LIS. Information requirements for effective land management: the LIS concept; the multi purpose cadastre. Importance of cadastral records and Land Information Systems.

Unit II : Land Records in GIS Context

Introduction to digital spatial data models, data acquisition for LIS, data storage for LIS, data processing for LIS. Geo referencing: geography, geometry& geodesy; grideling considerations with an LIS; data models; terrain classification. Spatial representation; vector & raster formats; review of infological modeling. Geo processing: classification of LIS process; transformation and analysis.

Unit III : Cadastral Studies

Property rights, evolution/review of cadastral systems. Concept of boundaries, the boundaries laws in common law jurisdiction, maritime boundaries / international boundaries. Land and survey laws: role of Law in society, legal aspects of land registration. Survey documents legal tools. Multi purpose cadastral: LIS/GIS. Land reform, current issues.

Unit IV : Land Tenure and Land Records

Rights and obligation in land, system for defining and governing, definition of rights, rules and procedures, responsibilities, land taxation,, environmental protection

Unit V : Modern LIS

Document imaging system, digital parcel map, online parcel index, access to all pertinent, records fro the government functions, public access interface

References
1. Bernhardson, Tor., Geographic Information System. Viak IT, Norway,1992.
2. Brown, P.M and D.D. Moyer Multi Purpose Land Information Systems: The Guide Book. Federal Geodetic Control Committee(NOAA),1990-1996.
3. Dale, R.F. and J.D. McLaughlin Land Information Management. Clarendon Press, Oxford, 1998.

CE355 DIGITAL PHOTOGRAMMETRY

Credit 4:0:0 **Marks 60 + 40**

Unit I : Introduction
Evolution of Digital Photogrammetry – analog, analytical, digital – advantages – automation – accuracy – representation of digital images- B/W, RGB, CMYK, HLS.

Unit II : Data Acquisition – Direct
Digital cameras – CCD camera - full frame CCD, frame transfer CCD, CCD cameras with piezo shift, interline transfer CCD, time delay integration CCD sensor – spectral sensitivity of CCD sensor, geometric problems of CCD images – line jitter, blooming, warm up effect, tailing – typical CCD systems, line scanners – SPOT, MOMS Data.

Unit III : Data Acquisition – Indirect
Analog to digital conversion – scanner – flat bed, drum type – sensor characteristics – scanner resolutions – scanner calibration – video cameras – frame grabber – typical scanner systems and video cameras.

Unit IV : Digital Photogrammmetric Work Station
Merits, demerits – stereo viewing – spatial, spectral and temporal methods – image measurement – coordinate system – image movement – fixed image, moved image – image transformation – geometric transformation, radiometric transformation – concepts of interior, relative and absolute orientation.

Unit V : Applications
DTM generation – image correlation – image matching – digital ortho photo generation-automated aero triangulation – link between GIS and digital Photogrammetry.

References
1. Krauss, j., Photogrammetry, Vol. I, IV Edition, Springler – Verlag Publishers, 1993.
2. International Achieves of Photogrammetry and Remote Sensing, ISPRS, Volume XXIX, B5, Commission 5, 1995.
3. Proceedings of Annual Convention of ASPRS, 1993-96

CE356 REMOTE SENSING AND GIS FOR HYDROLOGY AND WATER RESOURCES

Credit 4:0:0 **Marks 60 + 40**

Unit I : Basics

Hydrologic cycle, estimation of various components of hydrologic cycle – clouds, rainfall, runoff, evaporation, transpiration, evapo–transpiration, interception, depression storage, runoff, floods – flood management – case studies – spectral properties of water.

Unit II : Drainage Basin

Watershed divide – stream networks – morphometric analysis – linear, areal, relief aspects – urban hydrology – case studies.

Unit III : Aerial Assessment

Mapping of snow-covered area, flood inundated area, soil moisture area, drought affected area – case studies.

Unit IV : Ground Water and Water Quality

Surface water indicators – vegetation, geology, soil – aquifers, aquifer parameters – well hydraulics – estimation of ground water – hydrological budgeting – mathematical models – seawater intrusion – water quality parameters physical, chemical, biological properties. Water quality mapping and monitoring – case studies.

Unit V : Irrigation and Watershed Management

Project investigation – implementation – maintenance stages – location of storage / diversion works / canal alignment – depth – area capacity curve generation – conjunctive use of surface and ground water – mapping and monitoring the catchments and the command area – water harvesting structures – sediment yield – reservoir siltation – sustainable development – case studies.

References

1. Chow, V. T., Handbook of Applied Hydrology, McGraw Hill, New York, 1964
2. Goodson, B.E., Hydrological Applications of Remote Sensing and Remote Data transmission, LASH publication no.145, 1985.
3. Robert N. Cowell, Manual of Remote Sensing, Vol II American Society of Photogrammetry – 1983.

CE357 REMOTE SENSING AND GIS FOR EARTH SCIENCES

Credit 4:0:0 **Marks 60 + 40**

Unit I : Spectra Of Rocks and Minerals

Reflectance properties of geologic features in visible, NIR, MIR, SWIR and microwave regions of EMS. Role of minerals and elemental composition, nature of spectra of rocks and minerals – optimal spectral windows for geologic remote sensing – significance in geologic mapping.

Unit II : Lithology and Structure

Rocks and minerals – introduction. Image characters of igneous, sedimentary and metamorphic rocks – lithology mapping.

Structural geology – introduction- significance of folds, faults and joints image characters of folds, faults, joints, lineaments.

Image processing for lithologic and structural mapping – case studies. Limitation of remote sensing for geologic mapping.

Unit III : Geomorphological Applications

Introduction to geomorphology. Significance of landforms – role of aerial photographs and satellite images in geomorphic mapping. Role of geomorphic mapping in civil engineering projects. Ground water studies and coastal zone management.

Unit IV : GIS for Geologic and Geomorphological Studies

Thermal presentation of geologic and geomorphic details – ground data, raster and vector formats. Incorporating geophysical, gravity, seismic, magnetic and electrical resistively data in a geographical information system.

Assigning ranks and weightage for applied geologic fields.

Unit V : Integration of Remote Sensing and GIS

Integrated surveys using geophysical, geological, geotechnical, Geomorphological and remote sensing based data for mineral exploration, ground water studies, coastal zone management, coastal erosion and accretion.

Remote sensing and GIS for geotechnical studies – foundation for dams. Reservoirs, tunnels landslides, earthquakes.

References

1. Burrough, P.A, Principles of Geographic Information Systems. Clarendon Press, UK. 1986
2. Pandey, S.N. Principles and Applications of Photogeology, Wiley Eastern. 1987
3. Drury, S.A. Image Interpretation in Geology, 1993. Chapman and Hall, London.
4. Mather, P.M Computer Processing of Remotely Sensed Images, Second Edition, 1999.

CE358 REMOTE SENSING AND GIS FOR AGRICULTURE AND FORESTRY

Credit 4:0:0 **Marks 60 + 40**

Unit I : Crops

Spectral properties of vegetation- identification of crops- acreage estimation- vegetation indices- production forecasting – command area monitoring – condition assessment – case studies

Unit II : Soils
Introduction-soil survey and soil classification-characters of saline, alkali soils-soil mapping using RS data- problem soils identification and mapping- soil erosion-case studies

Unit III : Damage Assessment
Assessment of damages due to floods, droughts, pests and disease attacks, water logging and salinity through remote sensing – crop stress detection.

Unit IV : Forestry
Forest taxonomy- forest type and density mapping and forest stock mapping using RS technique – factors for degradation of forests- deforestation/ afforestation /encroachment mapping through multi-temporal data- case studies

Unit V : Integrated Analysis (GIS
Agriculture and forest development through GIS- action plan for sustainable agriculture-wasteland development- change detection in forests – case studies.

References

1. Steven M.D And Clark, J.A., " Applications of Remote Sensing in Agriculture", Butterworth, London 1990
2. Remote Sensing Applications Group, Space Applications Centre, Crop Average and Production Estimation (Cape): An Anthology from January 1986-June1996. (Publications In Journals, Seminars/Symposium Proceedings), Ahmedabad, August 1996
3. Negi, S.S A Handbook Of Forestry. International Book Distributors, Dehradun, 1986. Pace Applications Centre.
4. Manual of Procedure for Forest Mapping and Damage Detection Using Satellite Data, Ahmedabad, 1990.

CE359 REMOTE SENSING AND GIS FOR ENVIRONMENTAL ENGINEERING

Credit 4:0:0 **Marks 60 + 40**

Unit I : Water in the Environment
Importance of water – chemical composition and physical characteristics of water-water quality - Classification of water quality for various purposes surface and ground water pollution. Use of GIS in water supply and sewage management.

Unit II : Satellite for Environmental Monitoring
GOES, NOAA, AVHRR, CZCR Monitoring land, water atmosphere and ocean using remote sensing data- principles and case studies.

Unit III : Ground Water Pollution
Aquifer vulnerability – Intrinsic & Specific Vulnerability – DRASTIC, SINTACSMODELS- case studies. NPS pollution- case studies

Unit IV : Soil Degradation study
Soil classification suitability study for housing, industrial and agriculture purposes engineering properties of soils, impact of agriculture and industrial activities on soil properties. Soil salinity/alkalinity, erosion studies. NPS pollution case studies.

Unit V : Air quality Monitoring
Atmosphere: chemicals, Particulate matters present in the atmosphere- allowable limits, remote sensing technique to monitor atmosphere constituents – air pollution due to industrial activity, monitoring of modeling using GIS.

References

1. World in Transition: The Threat to Soils (1994) Annual Report of the German Advisory Council on Global Change. Publ. Economical Verlag Bonn, Germany.
2. Sabins, F (1987), "Remote Sensing Principles And Interpretation", W.H. Freeman And Company, New York
3. Ground Water Vulnerability Assessment: Predicting Relative Contamination Potential Under Conditions Of Uncertainty, National Academic Press, 1993
4. Savinny, D.De and Wijeyaratne. P, "GIS For Health And Environment", Stylus Publication ISBN 0889367663

CE360 REMOTE SENSING AND GIS FOR OCEAN ENGINEERING AND COASTAL ZONE MANAGEMENT

Credit 4:0:0 **Marks 60 + 40**

Unit I : Ocean Engineering
Coastal processes- Oceanic circulation- Upwelling and sinking –Current Measurement – Waves – Surface waves – Water motion in waves reflection, diffraction and refraction – wave generated currents – Tides _Tidal forces _sediment drift _ Remote Sensing Application for coastal erosion and accretion

Unit II : Ocean general Studies
Study of physical properties of sea water and Parameters –Chemistry of sea water Oceanographic instruments – water samples –Current measuring devices –Deep sea coring devices – dredges.

Unit III : Coastal Engineering
Coastal Hydrodynamic – Coastal erosion and protection. Estuaries and their impact on coastal Process –Design of Breakwaters.

Unit IV : Satellite and airborne sensors

Use of microwave data – OCR, CZCS studies - Chlorophyll production index – sea surface temperature (SST) sensors – NIMBUS, RADARSAT, CASI etc., Messr, OCTSATSR – Sensors – Ocean SAT ATSR on ERS.

Unit V : Coastal Zone Management

Introduction – Major issues / Problem, Thematic maps on coastal resources Wetland mapping / Mappings of Mangroves – Modeling on sea water Intrusion -conflict among the resources – Integrated coastal Zone Management.

References

1. Deepak, A. Remote Sensing of Atmospheres of Oceans. Academic press, San Francisco, 1986. Re (SST), - Mangroves Coral Reefs Mapping.
2. Michael Hord, R. Remote sensing methods and application, John Wiley and sons, New York, 1986.
3. Alasdair J. Edwards, Remote Sensing Handbook for Tropical Coastal Management, UNESCO Publication 2000.

CE361 REMOTE SENSING AND GIS FOR URBAN AND REGIONAL PLANNING

Credit 4:0:0 **Marks 60 + 40**

Unit I : Introduction

Relevance of remotely sensed data for Urban & Regional Analysis and Planning – Identification of settlement features from aerospace images –Visual and digital analysis techniques – Scale and resolution concepts – Scope and limitations.

Unit II : Urban and Regional Mapping

Regional Mapping –City Mapping – Intra-city Mapping – Methodology – Base map preparation –Delineation of area – Change Detection and Mapping –Classification – Urban fringe –CBD – Urban Sprawl - case Studies

Unit III : Urban and Regional Plans

Regional Plan, master plan, detailed development plan – Objectives and contents – Delineation of planning area, methodology – Integrated plans –Case studies

Unit IV : Urban Analysis

Urban growth analysis –Slum development –House typology –Site selection for urban development – Density analysis –Population estimation _ Transportation network analysis-Case Studies

Unit V : GIS in Urban planning

GIS- Data Input –Storage –Retrieval –Suitability of a GIS software for Urban analysis – Modeling with GIS- Decision support systems for Urban and Regional analysis.

References:

1. Brenth M.C., City Planning & Aerial Information, Harvard University, Cambridge, 1971.
2. Margaret Roberts, An Introduction to Town Planning Techniques, Hutchinson, London 1980.
3. N.C. Gautam, Urban Landuse Interpretation through Aerial photograph Interpretation, NRSA.
4. IRS, RS Applications to Urban Planning and Development, Institute of Remote Sensing

CE362 REMOTE SENSING AND GIS FOR DISASTER MITIGATION AND MANAGEMENT

Credit 4:0:0 **Marks 60 + 40**

Unit I : Disaster Principles
Basic concepts and principles – Hydrological and geological disasters, Characteristics crisis and consequences –Role of Government administration, University research organization and NGO's – International disaster assistance – Sharing technology and technical expertise.

Unit II : Long Term Mitigation Measures
Needs and approach towards prevention – Principles and components of mitigation. Disaster legislation and policy – Insurance-Cost effective analysis-Utilization of resources – training – Education –Public awareness –Roles of media

Unit III : Safety Rating of Structure
Dams, Bridges, Hospitals, Industrials Structures, Ghat roads –Disaster resistant structures – Low cost housing for disaster prone areas –Cyclone shelter projects and their implications – Reconstruction after disaster: Issues of practices.

Unit IV : Remote Sensing Application
Hazard evaluation - Zonation –Risk assessment –Damage assessment –Land use planning and regulation for sustainable development – Use of internet – communication Network – Warning system – Post disaster – Case studies

Unit V : Emergency Planning & GIS
Information systems management – Spatial and non- spatial data bank creation – operational emergency management- Vulnerability analysis of infrastructure and settlements- Pre-disaster and Post disaster planning for relief operations- Potential of GIS application in development planning and disaster management plan- Case studies.

References

1. Bell, F.G. Geological Hazards: Their Assessment, Avoidance and Mitigation. E& FN SPAN Routledge, London. 1999
2. David Alexander, Natural Disaster, UCL Press London, Research Press, New Delhi, 1993.
3. Nick Carter. W. Disaster Management –A disaster Manager's Handbook. Asian Development Bank, Philippines.1991

4. Mitigating Natural Disasters, Phenomena, Effects and Options, A Manual for Policy Makers and Planners, United Nations. New York, 1991
5. George G. Penelis and Andras J. Kappos – Earthquake Resistant Concrete Structures. E& FN SPAN, London, 1997.

DEPARTMENT
OF
CIVIL ENGINEERING

ADDITIONAL SUBJECTS

Code No.	Subject Name	Credits
CE270	Pollution and Control Engineering	4:0:0
CE271	Industrial Waste Treatment and Disposal	4:0:0
CE272	Construction Technology	4:0:0
CE273	Interior Design	4:0:0
CE274	Concrete Technology	4:0:0
CE363	Advanced Concrete Technology	4:0:0

CE270 POLLUTION AND CONTROL ENGINEERING

Credit : 4:0:0 **Marks: 40 + 60**

Unit - I : Water & Noise Pollution and Control
Natural processes - Pollution due to industrial, agricultural and municipal wastes - limitations of disposal by dilution - BOD consideration in streams - Oxygen sag curve - water pollution control legislation.
Noise pollution - Sources and effects - Control measures.

Unit -II : Air Pollution and Control
Pollution and their sources - Effects of pollution on human health, vegetation and climate - Prevention and control of air pollution - Control of particulates – Industry and air pollution - Air pollution surveys and sampling - Air quality monitoring - Air pollution control legislation.

Unit -III : Solid Wastes Management
Sources - Characteristics - Quantitites - Collection methods and disposal techniques – Source Reduction - Sanitary land fill - Incineration and pyrolysis - Composting - Aerobic and anaerobic Economics of composting - Recyling and reuse.
Hazardous Waste Management: Nuclear waste, Biomedical waste, Chemical wastes – sources and effects – Disposal techniques.

Unit -IV : Ecology and Ecosystems
Impact of development - Relationships of environmental quality – Land use and natural resources management - Causes and effects of Environmental pollution.
Elements of Environmental Impact Analysis: Environmental impact analysis of urbanisation & industrialization – Environmental impacts of thermal power plants, mining and radioactivity.

Unit – V : Environmental Health

VECTOR CONTROL:- Fundamentals of epidemiology - Vector borne diseases - Types of vectors - Mosquitoes, flies, rodents - Rationale of control and naturalistic methods of control. Uses and limitations of pesticides - Engineering measures of vector control.

FOOD AND MILK SANITATION:- Relation of food to disease - Principles of food sanitation - Sanitation of kitchens, restaurants and other catering establishments - Quality changes in milk - milk as carrier of infection - Pasteurisation of milk HTST and LTLT processes – Cattle shed sanitation.

Text Book

1. Salvato, Environmental Sanitation, John Wiley & Sons, New York 1982

Reference Books

1. Eulers,V.M., and Steel,E.W., Municipal Rural Sanitation, Mc Graw Hill Book Co. New York. 1964.
2. Park. I.E. and Park K. Text Book of Preventive and Social Medicine, Messrs. Banarsidas Bhanot, Latest Edition.

CE271 INDUSTRIAL WASTE TREATMENT AND DISPOSAL

Credit : 4:0:0 **Marks: 40 + 60**

Unit -I Disposal Effects on Environment

Effects of industrial wastes on streams, land, air - wastewater treatment plants - water quality criteria. Effluent standards - Process modification - Bioassay studies – Environmental legislation.

POLLUTANTS REDUCTION

Waste minimisation - House keeping - Volume and strength reduction - Material and process modifications - recycle, reuse and by-product recovery - Environmental audit.

Unit -II : Effluent Treatment

Conventional methods of treatment and disposal of industrial wastes - Equalisation and Neutralisation - Separation of solids - Sedimentation and filtration. Coagulation and flocculation, absorption, chemical precipitation, chemical oxidation, Physiochemical treatment methods - Removal of dissolved impurities - Residue management - Combined treatment of industrial and municipal wastes.

Unit – III : Biological Treatment Methods

Principles and methods for removal of suspended impurities and organics – aerobic and anaerobic decomposition of organic matter, Stabilization ponds, activated sludge process, Oxidation ditch.

Advanced Waste Water Treatment:

Nitrogen removal – Phosphorous removal – Removal of refractory Organics – Removal of dissolved inorganic substances – Chemical precipitation – ion exchange – Reverse Osmosis – Electro dialysis.

Unit – IV : Industrial Process and Waste Treatment – I
Manufacturing process, waste water characteristics, composition, effects and appropriate treatment - flow sheets for chemical industries – Petro-chemical industries, Refineries, Pharmaceutical, Textiles – Apparel industries – Metallurgical industries - Steel plants, mines – Power industries – Fertilizer plants – Cement industry.

Unit -V : Industrial Process and Waste Treatment - II
Manufacturing process, waste water characteristics, composition effects and appropriate treatment flow sheets for Pulp and paper industry – Agro-industries, Sugar - Distilleries, Food processing industry – meat packing, pickles, poultry dairy – Leather tanning.

Text Books

1. Rao.M.N. and Dutta Waste Water Treatment, Oxford and IBH Publishing Ltd., Calcutta, 1979.
2. Eckenfelder, W.W., Industrial Waste Pollution Control, McGraw Hill Book Co., New Delhi, 1989.

Reference Books

1. Nemerow, N.L., Theory and Principles of Industrial Waste Treatment, AddisonWesley, Reading Mass, 1963.
2. Gurnham, C.F., Principles of Industrial Waste Treatment, Wiley & Sons, New York, 1965.

CE272 CONSTRUCTION TECHNOLOGY

Credit : 4:0:0 **Marks: 40 + 60**

Unit-I : Site Planning
Precautions in selection of sites – the situations and surroundings of site for various types of building – elements of building planning, requirements, orientation, ventilation and lighting, concept of green buildings.
Foundation: Setting out foundation plan on ground – concept of foundation – Bearing capacity of a good foundation – types of foundation and their construction – suitability – Foundation in black cotton soil – Methods of timbering of trenches – Foundation failures and remedial measures.

Unit-II : Brick And Stone Masonry
Types of bond in brickwork and their suitability – General principles and precautions in brick masonry – factors affecting thickness of walls - construction of brick masonry – methods of bonding new brick work with old brick work. Comparison of brick and stone masonry - Strength of Brick Masonry – Classifications as per IS code – Classification of Stone masonry – General principles and precautions in stone masonry – specification and construction of stone masonry – composite masonry – lifting appliances – Concrete Hollow block masonry.

Unit-III : Roofs And Floors
Roof covering materials – Specifications for laying Mangalore Tiles, Asphalt roofing sheets, Asbestos cement sheets – Aluminium sheets and GI sheets. Accessories for drainage works

– shapes of gutters and their sizes. Different types of supporting trusses for the roofing sheets – Timber and concrete roofs – Different types of floors, suitability and construction of floors and floor finishes – Anti-termite Treatment.

Unit – IV : Doors, Windows And Staircases:
Different types of doors and windows and their suitability , Timber, steel, Aluminium and synthetic. Stair and staircases: Concepts – requirements of a good stair – principles to be observed for planning and layout of stairs – classification of stairs according to their layout and materials of construction.

Water Proofing and Damp Proofing:
Techniques of plastering – types of rendering – types of pointing and their suitability – Application of paints for new and old work of timber, steel and plaster – preparation and application of white washing and distempering – weathering course.

Damp proofing – causes of dampness – Ill effects – Methods of preventing dampness – Types and classification of damp proofing materials – Requirements of an ideal material for damp proofing – Methods of providing DPC under different situations.

Unit – V : R.C.C. Work:
Methods of Construction of R.C.C. slabs, Beams & Columns

Miscellaneous Construction Features:
Construction sequences: Construction sequence and procedure for RC framed structures with masonry panel walls, load bearing wall structures, industrial shed type building.

Expansion joints: Types and provision of expansion joints for foundations, floors, walls, roofs, beams and slabs. Shoring, Scaffolding and Underpinning: Methods, uses and suitability of different types and precautions for safety – Selection of equipment for earth work, concreting, material handling and erection of Structures.

Text Book:

1. Rangwala S.C., Building Construction, Charotar Book Stall, Anand, 1993.

Reference Books

1. Arora N.L. and Gupta B.R., A Text Book of Building Construction, Satya Prakashan, New Delhi.
2. Punmia B.C., A Text Book of Building Construction, A Saurabh & Co (P) Ltd., New Delhi, 1993
3. Relevant IS Codes and National Building Code of India.
4. Sushil Kumar, "Building Construction", Standard Publishers, New Delhi, 1997.

CE273 INTERIOR DESIGN

Credit : 4:0:0 **Marks: 40 + 60**

Unit - I : Introduction

Definition of the term “Interior Design” – Necessity and application, basic principles of architecture.

Principles of Aesthetic Composition : Form, shape & Configuration. Size, Scale and proportion, Equilibrium (Symmetry & Balance). Axis & Alignment, Repetition & Rhythm, Contrast & Opposition. Vista & View, Texture, Pattern & colour, Light (Natural & Artificial)

Unit - II : Circulation and Human Scale

Components of building orientation - building entrance - configuration of path & path-space relationships. Form of circular space with building examples. Human scale and movement with reference to function and furniture

Unit - III : Interior Design in Current Practice

Function and planning - working space - living spaces, public spaces and special purpose interiors - space requirement of various purposes such as hotel, restaurant, office, auditorium, banks, schools with reference to IS codes.

Interior layout: Living room, dining room, bed room, kitchen, toilet, office, library and show room.

Unit - IV : Colours and Interior

Effect of colour in interiors – Colour circle and its applications – Colour schemes – Emotional effect on colour.

Components & Materials For Interiors:

Architectural components: Fixed furniture components; Movable furniture components: Furnishings.

Unit -V : Lighting, Ventilation and Acoustics

Classification of lighting - general and load lighting. Artificial light sources - spectral energy distribution colour temperature - colour reading. Study of lighting accessories and their choice- Design of modern lightings: Lightings of stores, offices, schools, hospitals and houses. Electrical and plumbing layout of a residential building.

Acoustics : Materials, reverberation time, Sabine formula

Text Books

1. Allen Tate & C Ray Smith, Interior Design in the 20th Century. Harper & Row Publishers.

Reference Books

1. Geoffrey, H., Baaker, Design strategies in Architecture - an aproach to analysis fo form , Van Nostrand Publications, London, 1989.
2. Pickering, E., Architectural Design, John Wiley andsons, London.

3. Heepler and Wallach, Architecture Drafting and design, McGraw Hill Book cc, NewYork
4. Phillips, Lighting in Architecture, McGraw-Hill co, NewYork, 1981.
5. Suri, S.L.,Accoustic Design and Practice, Asia Publishing house, New York, 1963.
6. Interiors: perspective in Architectural design Graphics - SMA publishing cc, Ltd., Japan, 1967.
7. Neufet Architect's data, Dudolf Herg, Crosby Lockwood and sons Ltd, 1970.
   IS 3646 ~ 1965 code of practice for illumination

CE274 CONCRETE TECHNOLOGY

Credit : 4:0:0 **Marks: 40 + 60**

Unit – I: Concrete Making Materials :– Part – 1

Cement : Composition, properties and manufacture of Portland Cement – tests on physical properties: sieve test, standard consistency test, setting time test, strength test, soundness test – different types of cement: composition, properties and application with emphasis for different constructional use and weather conditions – IS code specifications.

Water : Requirement of water for concrete making – IS code specifications

Unit – II : Concrete Making Materials : Part – 2

Aggregates : General – source – classification – size – shape – texture – Tests on mechanical properties of aggregates: Aggregate crushing value, aggregate impact value – Absorption and moisture content – Bulking of aggregates – Deleterious substances in aggregates – Alkali aggregate reaction and factors promoting alkali aggregate reaction – Grading of aggregate, requirements – thermal properties – codal requirements

Admixtures : Plasticizers – super-plasticizers – Retarders – Accelerators – Air entraining admixtures – supplementary cementitious materials: silica fume, fly ash, metakaolin, ground granulated blast furnace slag – water proofing admixtures: Properties, advantages, dosage and application

Unit – III : Fresh Concrete and Hardening of Concrete

Workability: Definition, factor affecting workability, measurement of workability: slump test, K – slump test, compacting factor test – segregation – bleeding – steps of manufacture of concrete: batching, mixing, transporting, placing, compacting – curing of concrete

Factors affecting strength of concrete: water / cement ratio, maturity of concrete, micro – cracking and autogeneous healing – evolution of heat and expansion – shrinkage of concrete and factors affecting it.

Unit – IV : Durability Of Concrete And Testing Of Hardened Concrete

Durability : Definition, significance – permeability – chemical attack, sulphate attack – methods of controlling – thermal properties of concrete – chloride attack – concrete in sea water – resistance to abrasion and cavitation – acoustic properties – corrosion of steel

Testing on hardened concrete: Compression test, flexural strength of concrete, indirect tension test methods – factors influencing strength results – Accelerated strength tests –

determination of modulus of elasticity – in situ strength determination – variation in test results – non destructive strength tests: ultra sonic pulse velocity tests, rebound hammer test.

Unit – V: Mix Design & Special Concretes

Mix design : Introduction, concept of mix design – various mix design methods – batching of ingredients: volume batching, weigh batching – correction for moisture content, bulking – yield of concrete – sample and acceptance criteria – IS method and ACI method of mix proportioning

Special concretes: Ready mix concrete – Pumped concrete – Pre-placed concrete – Shotcrete – Lightweight concrete – No-fines concrete – High strength concrete – Fibre reinforced concrete – Ferrocement – High Performance Concrete – Polymer Concrete: Definition, types, properties and applications.

Text Books:

1. Neville, A. M., `Concrete Technology', Longman Scientific & Technical, 1990.
2. Gambhir, `Concrete Technology', Tata McGraw Hill, New Delhi.

References:

1. Orchard, D. F., `Concrete Technology', Vol. 1 & 2, 1963.
2. Shetty, M. S., `Concrete Technology', S. Chand & Co., New Delhi, 1998.
3. Krishnaraju, N., `Design of Concrete Mixes', Sehgal Educational Consultants & Publishers Pvt. Ltd., Faridabad, 1988.
4. IS: 10262 – `Recommended Guidelines for Concrete Mix Design', 1982.

CE363 ADVANCED CONCRETE TECHNOLOGY

Credit : 4:0:0 **Marks: 40 + 60**

Unit – I : Concrete Making Materials

Composition and properties of portland cement - tests on physical properties - consistency - setting time - soundness - strength - cements of different types - composition - properties and uses with special emphasis for different constructional and weather conditions - IS code specifications.

AGGREGATES: Classification - Mechanical Properties - deleterious substances in aggregates - Bulking of sand - Alkali Aggregate reaction - Grading requirements - IS Code specifications

WATER: Requirements of water for concrete making - IS Code specifications.

ADMIXTURES: - Accelerators - Retarders - water reducing agents - Plasticisers - Air entraining agents.

Unit-II: Fresh Concrete and Hardening of Concrete

Workability - Factors affecting workability - Tests for workability - Segregation - Bleeding - Mixing of concrete - Compaction of concrete - Ready mixed concrete - Pumped Concrete - Preplaced concrete - Shotcrete. Factors affecting strength of concrete - Curing of concrete Maturity of concrete - Micro cracking and autogeneous healing - Evolution of heat and expansion - Shrinkage of concrete - Factors affecting shrinkage of concrete.

Unit-III: Durability of Concrete and Testing of Hardened Concrete

Permeability - Chemical attack - Sulphate attack - Quality of water - Marine atmosphere - Methods to improve durability - Thermal properties of concrete - Fire resistance - Resistance to Abrasion and Cavitation - Acoustic properties - Compression test - Split Tension test - Flexure Test - Test for Bond strength - IS Code provisions - Factors affecting strength test results - Accelerated strength tests - stress strain characteristics - Determination of modulus of elasticity - Electrodynamics determination method - In site strength determination - variation in test results - Distribution of strength - standard deviation - creep of concrete and factors which influence it.

Unit-IV : Mix Design

Basic considerations - Factors in the choice of mix proportions - Mix design methods - ACI method, Mix design with fly-ash - IS method – Rapid Method: Steps of design - Mix proportions for weigh batching and volume batching - correction for moisture content and bulking - yield of concrete - Design of high strength concrete mixes – Inspection and Testing of structures: core test, Load test for flexural members, ready mix concrete.

Special Concretes and Concrete Composites: Light weight concrete: Types - Light weight aggregate concrete-Aerated concrete, No fines concrete - High Strength concrete - Heavy weight concrete for radiation shield - Fibre reinforced concrete - Ferrocement - Polymer concrete - High Performance Concrete : properties and applications.

Unit – V: Rehabilitation of Concrete Structures

Cracks in concrete - Types - Intrinsic cracking, structural cracking - causes and remedies - Plastic cracks - causes and remedies - Thermal contraction cracks - Long term drying shrinkage cracks - Crazing - Sulphate attack cracks - Alkali aggregate reaction cracks.

Repair techniques - Materials for repair - Epoxy adhesive injections and mortars - Repair and rehabilitation of concrete structure.

Text Books

1. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, 1990.
2. Neville, A.M., "Properties of Concrete", Longman Scientific & Technical, England, 1981.

Reference Books:

1. Orchard, D.F., "Concrete Technology", Vols. 1 & 2, 1963.
2. Shetty, M.S., "Concrete Technology", S.Chand & Co., New Delhi, 1998.
3. Rixon, M.R., "Chemical Admixtures for Concrete", John Wiley & Sons, 1977.
4. Design of Concrete Mixes", Sehgal Educational Consultants & Publishers Pvt.Ltd., Faridabad, 1988.
5. IS: 10262, "Recommended Guidelines for Concrete Mix Design", 1982.
6. Krishnaraju N., “Design of Concrete Mixes”, Sehgal Educational Consultants & Publishers Pvt. Ltd., Faridabad, 1988.

SCHOOL

OF

CIVIL ENGINEERING

ADDITIONAL SUBJECTS

Code	Subject Name	Credits
CE275	Mechanics of Deformable Bodies II	3:1:0
CE364	Advanced Design of Reinforced Concrete Structures	3:1:0

CE275 MECHANICS OF DEFORMABLE BODIES II

Credit: 3:1:0 **Marks: 40 + 60**

UNIT I : Deflection of Determinate Beams
Governing differential equation- Macaulay's method- moment area method- conjugate beam method – Newmark method.

UNIT II : Columns and Struts
Columns- Behaviour of axially loaded short, medium and long Column members- Buckling Load- Euler's Theory- Different end conditions- Empirical formulae - Rankine's formula - Straight line formula- Secant formula for columns subjected to eccentric loading.

UNIT III : Thick Cylinders
Thick cylinders- lame's equation-hoop stress and radial stress distribution-compound cylinders-shrink fit.

Elastic Theories of Failure:
Maximum principal stress theory- Maximum shear stress theory- Maximum principal strain theory- strain energy theory- Mohr's theory- simple problems.

Unit IV : Shear Centre and Curved Beams
Shear Center:
Introduction to non-circular sections-Shear center for thin walled beam of mono- symmetric open sections- Shear flow in thin walled beams of open sections.
Curved Beams:
Curved beams-Stresses due to bending by Wrinkler back theory- Rectangular, trapezoidal and circular solid section-Crane hook problem

UNIT V : Unsymmetrical Bending of Straight Beams
Symmetrical and unsymmetrical bending - Bending stresses in beams subjected to unsymmetrical bending - Change in direction of Neutral axis and Increase in stress compared to Symmetrical Bending.

Text Books

1. Bedi D.S., "Strength of Materials", S. Chand & Co. Ltd., 1984.
2. Punmia B.C., etal., "Strength of Materials", Laxmi Publications, 1992.

Reference Books

1. Boresi A.P., Side Bottom O.M., Seeli F.B & Smith J.P., "Advanced Mechanics of Materials", John Wiley & Sons, 1993.

2. Sadhu Singh., "Strength of Materials", Khanna Publishers,1988.

CE364 ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES

Credits 3:1:0 **Marks 40+60**

UNIT – I :

Introduction to design Philosophy- Working stress design, limit state design, ultimate load design

Limit State Design of Beams for Shear, Torsion and Bond

Shear strength of beams - Interaction diagrams for combined bending and torsion - Design of members subjected to combined bending, shear and torsion - Skew bending theory - bond, anchorage and splicing of reinforcement; Calculation for deflection and crack width

Precast Construction

Principle of precast construction, advantages,-brief description of methods of precasting

UNIT II : Bunkers and Silos

Design of square bunker-Design of circular silo- Jenssen's theory- Principles of Airy's theory (No derivation for problems)

Limit State Analysis and Design of Column:

Behaviour and design of axially, eccentrically loaded short and long columns including biaxially bent columns -. comparison of various codal provisions - Composite column and Tubular column behavioural study

UNIT-III : Limit Analysis and Design of Slabs

Behaviour of R.C. slabs under gradually increasing loads - Assumptions made in yield - line theory of slabs - Analysis of isotropically and orthotropically reinforced slabs of various shapes under different edge conditions and equilibrium method - Application to practical design problems - Effect of corner levers - Hillerborg's simple strip method of analysis.
Design of flat slabs according to Equivalent frame method

UNIT IV Limit Analysis and Design of Statically Indeterminate Structures

Fundamental principles - Moment redistribution - limit analysis and design of continuous beams and simple portal frames - Check on rotation capacity.

UNIT – V: Design of Miscellaneous Structures

Simply supported and continuous deep beams - Grid floors – Orthotropic plate theory- Waffle slab - corbels

Text Books:

1 Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice – Hall of India Ltd, New Delhi 1977.
2. Varghese, P.C., "Advanced Design of Reinforced Concrete Structures", Prentice - Hall of India Ltd, New Delhi 1977.

References

1. Regan, P. D and Yu, C.W., "Limit state design of structural concrete", Chatto & Windus, London, 1973.
2. Purushotaman,P. "Reinforced concrete structural Elements", Tata McGraw Hill, Publishing Co., Pvt. Ltd., New Delhi, 1984.
3. Jones,L.L,and Wood,R.H., "Yield line Analysis of slabs", Chatto and Windus London,1967.
4. Park R. and Gamble,W.L. 'Reinforced concrete slabs", John Wiley and Sons, New York, 1980.
5. Mac Gregor, G., 'Reinforced concrete Mechanics and Design", Prentice Hall, New Jersey 1988.
6. Arthur H. Nilson et al, "Design of Concrete Structures", McGraw Hill Book Company, New York, 1986.
7. IS 456-2000 "Code of Practice for plain and reinforced concrete". BIS, New Delhi., 1978.
8. S.P. 16 (S & T) Design Aids for Reinforced concrete" to IS 456-1978. Indian Standard Institution, New Delhi, 1980.
9. SP24 (S&T) . "Explanatory handbook on Indian standard code of practice for plain and reinforced concrete (IS 456-1978)", BIS New Delhi, 1983.
10. IS 1893, "Criteria for Earthquake Design of Structures", BIS, New Delhi.,1984
11. SP 34, Hand Book on Concrete reinforcement and Detailing", BIS, New Delhi, 1987.
12. BS 110 (Part I) "Code of Practice for the structural use of concrete. Part I Design, materials and workmanship" ' British Standards Institution, London,1985.
13. ACI 318, "Building code of requirements for reinforced concrete", American concrete institute, Detroit, 1989.
14. Pasikh, S.K., "Automated Optimum Design of R.C.C. Skeletons", Tata McGraw-Hill Publishing Company Limited, New Delhi, 1995.

SCHOOL
OF
CIVIL ENGINEERING

ADDITIONAL SUBJECTS

Code	Subject Name	Credits
CE276	Basic Structural Design	3:1:0
CE277	Mechanics of Fluids	3:1:0
CE278	Irrigation Engineering	4:0:0
CE365	Advanced Design of Steel Structures	3:1:0
CE366	Design of Industrial Structures	4:0:0
CE367	Intelligent Transportation Systems	4:0:0
CE368	Remote Sensing and Applications	4:0:0
CE369	GIS in Transportation Engineering	4:0:0
CE370	Remote Sensing & GPS for Transportation Engineering	4:0:0
CE371	Traffic Analysis	4:0:0
CE372	Land Use and Transportation Modelling	4:0:0
CE373	Experimental Techniques	4:0:0
CE374	Design of Masonry Structures	4:0:0
CE375	Research Methodology	4:0:0

CE276 BASIC STRUCTURAL DESIGN

Credits: 3:1:0 **Marks: (40 + 60)**

Unit-I : Structure and Design Concepts

Classification of structures – function, material and shape – different structural systems – requirements of structures – basic structural requirements – stability, strength and stiffness – design process – codes of practice.

Working stress method – limit state method of Design – Probabilistic approach to design – load and resistance – design for strength, stiffness and stability considerations – choice between different structural materials – concrete, timber, Masonry and steel.

Structural Loads

Dead load – live load – Wind load – Calculation of wind load for a Structure – Seismic load – buoyancy and thermal loads.

Unit II : Design of Masonry Walls and Columns

Axially loaded square and rectangular columns with uniaxial eccentricity – solid walls – load bearing walls – axially loaded – eccentrically loaded walls with openings – Non load bearing walls.

Laterally Loaded Masonry Structures:

Structures and loads – stability of masonry – middle third rule – Masonry dams – Trapezoidal dams – Retaining walls.

Earthquake resistant design of masonry buildings – General planning and design – Recommendation for masonry wall – Design of bands – Free standing wall – Design of shear wall.

Unit III : Load Distribution Elements
Bed blocks – spread footings for walls and columns – area based on safe bearing capacity. Design of Reinforced Masonry Introduction – basic concepts – limit state design of reinforced brick masonry – lintels – axially loaded columns.

Unit IV : Timber: Flexural and Compression Members
Factors affecting the strength – permissible stresses – Design for bending, shear and bearing Flitched beams – solid and built up columns – combined bending and direct stress – application to form work.

Unit V : Bolted and Welded Joints
Bearing and friction type of bolts – splicing joint – joints subjected to moment and direct load and torsion – butt and fillet welds – joints subjected to shear, bending and torsion.

Text Book

1. Arya A.S., Structural Design in Steel, Masonry and Timber, Nemchand and Bros., Roorkee, 1987.

Reference Book

1. Dayarathnam P., Bricks and Reinforced Brick Structures, Oxford & IBH Publishing Co., (Pvt.)Ltd ., New Delhi.

CE277 MECHANICS OF FLUIDS

Credit: 3:1:0 **Marks : 40 + 60**

Unit I:
Introduction - Fluid Properties – Newton's law of Viscosity - Classification of Fluids
Fluid Statics
Pressure – Pascal's law – Atmospheric, Absolute, Gauge and Vacuum pressures – Pressure measurement – Forces on plane and curved surfaces-Total pressure and Centre of pressure – Buoyancy and Metacentric height (Theory only).

Unit II : Fluid Kinematics
Types of flow – Stream line – Path line – Streak line - Stream tube – Control volume – Continuity equation – one dimensional and three dimensional flow – velocity potential and stream function - free and forced vortex flow.
Equations of Motion
Euler's equation in one dimensional form – Bernoulli's equation

Unit III : Flow Measurements
Venturimeter – Orifice meter – Pitot tube – Mouthpiece and Orifice – Weirs and Notches – Rectangular, Triangular, Broad crested, Narrow Crested – End Contractions.

Unit IV : Flow through pipes
Laminar flow
Definition – Reynold's Experiment – Reynold's Number – Hagen Poiseuille equation for a circular pipe

Turbulent flow

Definition – Darcy Weisbach's equation – Moody's diagram – Friction factor for Laminar and Turbulent flow – for smooth and rough pipes

Loss of energy in pipes – Hydraulic Gradient, Energy Gradient – Major energy loss – Minor energy losses – Pipes in series and parallel –Equivalent pipe - Power transmission through pipes – Syphon – Water hammer (Definition)

Unit V : Dimensional Analysis and Similitude

Fundamental and Secondary dimensions - Dimensional Homogeneity – Rayleigh and Buckingham Pi methods – Similitude – Significance of Dimensionless Numbers – Classification of hydraulic models.

Text Books

1. Modi, P.N., and Seth, S.N., "Textbook of Hydraulics and Fluid Machines, Standard Book House, New Delhi, 1995.
2. Rajput, R.K., Text book of Fluid Mechanics and Hydraulic Machines , S.Chand and Co., New Delhi, 1998.

Reference Books

1. Natarajan, M.K., Principles of Fluid Mechanics, Oxford and IBH publishing Co., New Delhi, 1994.
2. Jain,A.K., Fluid Mechanics, Khanna Publishers, New Delhi, 1996.
3. Som, S.K., and Biswas, G., Fluid Mechanics, Tata McGraw Hill Book Co., 1998.
4. Agarwal, S.K., Fluid Mechanics and Machinery, Tata Mc Graw Hill Co., 1997.
5. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 1998.

CE278 IRRIGATION ENGINEERING

Credits: 4:0:0 **Marks: 40+60**

Unit I : Introduction

General – crop seasons – Humid, arid and semiarid regions – necessity of irrigation – water requirements – Duty – Delta – irrigated area – Base period –crop period – water requirement calculation – consumptive use (evapo transpiration) – Determination of consumptive use – irrigation efficiencies – factors affecting the duty of water - Methods of improving duty - Irrigation scheduling and advantages.

Unit II : Sources, Conveyance and Distribution of Water

Sources of Water – Quality of Irrigation water – Precipitation – Types of precipitation – Rainfall measurement – Rivers – Streams – Reservoirs and Tanks – Lift Irrigation – Devices and Equipments – Tank Irrigation – Components – Methods of Application of water on Field – Surface Irrigation – Subsurface Irrigation.

Unit III : Ground Water, Water logging and Drainage

Ground water hydrology – Aquifers – permeability and transmissibility – steady flow towards a well in confined and water table aquifer – measurement of yield of an open well - Typical cross section of open and tube well - Salinity and water logging – causes and effect of water logging – Waterlogging control – Reclamation of saline land – surface and subsurface drainage – Drainage design for agricultural areas – lay out of drainage system.

Unit IV : Channel design

Alluvial and non – alluvial soil – Alignment of canals – Distribution systems for canal irrigation – Determination of required channel capacity – channel losses. Design of channels in India – Regime channels – Kennedy's theory - design procedure – use of Garrot's diagram – Lacey's theory - Design procedures – use of Lacey's Diagram - comparison of the two theories. Design procedure for irrigation channel – cross section and components – balancing depth for excavating canals – fixing the longitudinal section of the canal – Classification of canals – canal lining – Maintenance of irrigation canals.

Unit V : Control Structures, River Training and Control

Dams – types – Canal Regulation works – Canal fall – Head and Cross regulator – Canal escapes – Cross drainage works – Diversion Head works – Weirs and Barrages – Causeways and Culverts – Classification of rivers – River training – Groynes and Spurs – Bank protection.

Text Books

1. Garg,S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 1997.
2. Punmia, B.C., Pande and Lal, B.B. Irrigation and water power Engineering, Laxmi Publications pvt. Ltd., 1992.

Reference Books

1. Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand and Brothers.
2. Sahasrabudhe, S.R., Irrigation Engineering and Hydraulic Structures, Katson Publishers, 1994.

CE365 ADVANCED DESIGN OF STEEL STRUCTURES

Credits: 3:1:0 **Marks: 40+60**

Unit I: Beams

- Design of Beams subjected to biaxial bending moment
- Design of sections subjected to unsymmetrical bending
- Elastic lateral torsional buckling

Beam Columns

- Short Beam-Columns
- Long Beam-Columns
- Beam-Columns at Ultimate Load
- Effects of Slenderness Ratio and Axial force on Modes of Failure
- Beam-Column under Biaxial bending
- Differential Equations and Moment Magnification Factors

Unit II: Industrial Building

- Industrial building Frames
- Crane girders and columns
- Analysis of industrial bents

- Sway and non-sway frames
- Design of Gable frames
- Design of knee bracing, vertical bracing
- Design of Gable wind girder

Unit III: Transmission Towers & Chimneys

- Basic Structural Configurations
- Loads on Towers
- Wind Load
- Computer Program for Tower Design
- Chimneys
- Vertical load analysis
- Design of connections(in members)

Unit IV: Multi-storeyed Buildings

- Structure of Multi-storeyed buildings
- Bracing of Multi-storeyed frames
- Loads
- Lateral Load analysis of frames
    - Portal Method
    - Cantilever Method
    - Factor method
- Design of members

Unit V: Plastic Theory

- Introduction - Shape factor - Moment redistribution - Static, Kinematic and Uniqueness theorems
- Combined mechanism - Analysis of single bay and two bay portal frames - Methods of plastic moment distribution
- Effect of axial force and shear force on plastic moments - Connections Moment resisting connection
- Design of continuous beams.

Text Books

1. Dayaratnam, P. "Design of steel structures", A.H. Wheeler & Co., Ltd, Allahabad, 1996.
2. Arya and Ajmani, "Design of steel Structures", Nemchand Brothers, Roorkee, 1989.
3. Punmia, B.C., Ashok Kumar Jain & Arunkumar Jain, "Design of Steel Structures", Vol I & II, Arhant Publications, Bombay, 1995.

Reference Books

1. Gray, C. S. Kent L.E Mitchell, W.A., and Godfey, W.B., "Steel Designer's manual", English Language Book Society and Granade Publishing, London, 1983.
2. Handbook in Structural Steel Detailing – INS/021
3. INSDAG Guide for the Structural use of Steelwork in Building - - INS/050

CE366 DESIGN OF INDUSTRIAL STRUCTURES

Credit 4:0:0 **Marks 40+60**

Unit I : General

Classification of Industries and industrial structures - Specific requirements for industries like Engineering, Textiles, Chemicals, etc - Site layout and external facilities required.

Unit II : Functional Requirements

(i)Natural and artificial lighting - protection from the sun sky light (ii) Services - electrical wiring fixtures - cable and pipe bridge - electrical installations - substations - (iii) Heating and ventilation - air conditioning - fire expanse and chutes - fire alarm, extinguishers and hydrants - Guidelines from factories act – underground air/service trenches

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Unit III : Industrial R.C. Structures

Design and detailing of R.C. gable frames, corbels, bunkers, silos and chimneys - North light shell roofs and folded plates - cooling towers - Application of prefabrication techniques.

Unit IV : Industrial Steel Structures

Design of gantry girders, steel bunkers, silos - High pressure boilers and piping design.

Unit V : Design of Composite Structures:

Composite action – Partial and complete Interaction – Composite floors – profile decking – shear connectors – composite column – concrete in-filled tubular column – confinement effect.

Text Book

1. Proceedings of Advanced Course on Industrial Structures, Structural Engineering Research Centre, Madras, 1982.

Reference Books

1. Manohar, S.N., "Tall chimneys - Design and Construction", Tata Mc Graw Hill, 1985.
2. Santhakumar, A.R. and Murthy, S.S., "Transmission Line Structures", Tata Mc Graw Hill 1992.
3. Srinivasulu, P and Vaidyanathan, C., "Handbook of Machine Foundations", Tata Mc Graw Hill 1976.
4. Jaikrishna and Jain, O.P, Plain and Reinforced Concrete, Vol-II - Nemchand and brothers, 1958.
5. Handbook on Fundamental Requirements of Industrial Buildings (Lighting and Ventilation), BIS.
6. I.S. 9178 Parts I & II
7. I.S. 3483
8. I.S. 6060
9. Dayaratnam, P., "Design of Steel Structures", A.H. Wheeler & Co., Ltd., Allahabad,1996.

CE367 INTELLIGENT TRANSPORTATION SYSTEMS

Credits: 4:0:0 **Marks: 40 + 60**

Unit I:
System Architecture, Standards, Database – Tracking Database - Commercial Vehicle Operations – Intelligent Vehicle Initiative - Metropolitan ITS – Rural ITS – ITS for Rail network.

Unit II:
ITS Travel Management –Autonomous Route Guidance System – Infrastructure based systems – Telecommunications – Vehicle – Road side communication – Vehicle Positioning System – Electronic Toll Collection – Electronic Car Parking

Unit III:
ITS Designs - Modeling and Simulation Techniques - Peer – to – Peer Program – ITS for Road Network – System Design – Mobile Navigation Assistant – Traffic Information Center – Public Safety Program -

Unit IV:
Automated Highway Systems - Evolution of AHS and Current Vehicle Trends - Vehicles in Platoons – Aerodynamic Benefits - Integration of Automated Highway Systems – System Configurations - Step by Step to an Automated Highway System.

Unit V:
Spacing and Capacity for Different AHS Concepts – Communication Technologies for AHS - The Effects of AHS on the Environment – Regional Mobility Impacts Assessment of Highway Automation.

References:

1. Kan Paul Chen, John Miles,: Recommendations for World Road Association (PIARC) ITS Hand Book 2000
2. Roger R. Stough, Intelligent Transport Systems – Cases and Policies, Publisher: Edward Elgar, 2001.

CE368 REMOTE SENSING AND APPLICATIONS

Credits: 4 : 0 : 0 **Marks: 40 + 60**

Unit I:
Fundamentals of GIS - Functions and features of components- Data type- Analysis and modelling - Role of GIS and Applications.

Unit II:
Concepts and foundations of remote sensing - electromagnetic spectrum, energy - Basic principles of photogrammetry – geometrical characteristics of aerial photographs, relief displacement of vertical features, image parallax, Remote sensing platforms and sensors

Unit III:
Satellite system parameters, sensor parameters, imaging sensor systems, earth resources and meteorological satellites, microwave sensors, Data Acquisition and interpretation

Unit IV:
Visual Image Interpretation – Fundamentals - Visual Image Interpretation Equipment - Digital Image Processing

Unit V:
Applications of remote sensing in survey, mapping, natural resources management, land use and transportation planning, water resources engineering, geology and environment.

References:

1. Thomas. M. Lillesand and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons,
2. M. Anji Reddy, Text Book of Remote Sensing and Geographical Information Systems, B.S. Publications.

CE369 GIS IN TRANSPORTATION ENGINEERING

Credits: 4 : 0 : 0 **Marks: 40 + 60**

Unit I: Introduction to GIS:
Introduction, GIS over view, use of GIS in decision making, data processing, Components of GIS, the GIS and the organization.
Data Input and Output:
Data input - Key board entry, manual digitizing, scanning, remotely and sensed data, existing digital data, census related data sets, data output - Hard copy and soft copy devices.

Unit II: Data Quality:
Components of data quality - Micro level, Macro level components, sources of error, a note about data accuracy.
Data Management:
The data base approach, 3 classic data models, nature of geographic data, spatial data models, databases for GIS.

Unit III: GIS Analysis and Functions:
Organizing geographic data for analysis, maintenance and analysis of the spatial data and non-spatial attribute data and its integration output formatting.

Unit IV: Implementing GIS:
Awareness, developing system requirements, evaluation of alternative systems, system justification and development of an implementation plan, system acquisition and start up, operation of the system.

Unit V: Application of GIS in Transportation Engineering:
Intelligent information system for road accessibility study, GIS data base design for physical facility planning, decision support systems for land use planning, GIS applications in environment impact assessment, GIS based Highway alignment, GIS based road network planning, GIS based traffic congestion analysis and accident investigation.

References:

1. Scholten & Stillwen , GIS for Urban & Regional Planning, 1990, Kulwer Academie Publisher.
2. Perspenfi Stan Aronoff , GIS A Management, , WDL Publisher.
3. Stonffer, GIS.

CE370 REMOTE SENSING & G.P.S. FOR TRANSPORTATION ENGINEERING

Credits: 4 : 0 : 0 **Marks: 40 + 60**

Unit I: Remote Sensing:
Basic Principles - Introduction, Electromagnetic and its properties, interactions with Earth surface materials, recent developments in Remote sensing, Social and legal implications of Remote Sensing, status of Remote Sensing.

Unit II: Remote Sensing Platforms & Sensors:
Introduction, Characteristics of imaging remote sensing instruments, satellite remote sensing system - a brief over view, other remote sensing satellites.
Pre-Processing of Remotely Sensed Data:
Introduction, cosmetic operation, geometric connection and registration, atmospheric correction.

Unit III: Enhancement Technique:
Introduction, human visual system, contrast enhancement, Pseudo colour enhancement.
Image Transforms:
Introduction, arithmetic operations, empirically based image transforms, Principal component analysis, Multiple discriminant analysis etc.

Unit IV: Filtering Technique and Classification:
Low-pass (smoothing filters), High pass (sharpening) filters, edge detection, frequency domain filters, geometrical basis, classification. Unsupervised and supervised classification, classification accuracy.

Unit V: G.P.S :
Introduction, elements of satellite surveying, the global positioning system, GPS satellites, adjustment computations, GPS observables, application of GPS technology in Highway alignment, Network planning.

References:

1. Alfred Leick , GPS Satellite Surveys, Willey & Sons
2. Paul Jumani , Principles of Remote Sensing, ELBS, 1985

3. Paul M.Mather , Computer Processing of Remotely sensed Images An introduction John Willey & Sons 1989.

CE371 TRAFFIC ANALYSIS

Credits: 4: 0: 0 **Marks: 40 + 60**

Unit I: Traffic Flow Description:
Statistical Distributions to explain Traffic Flow - Poisson Distribution, Exponential Distribution, Erlang Distribution, Composite distribution.

Unit II: Delay Models:
Intersection delays; Pedestrian Delays; Gap acceptance Concepts

Unit III: Queuing Models:
Demand service characteristics; Single channel queuing systems; M/M/1 and D/D/1 system analysis.

Unit IV: Traffic Flow Analogies:
Car following theory; Fluid-flow analogy; Shock wave theory.

Unit V: Simulation:
Introduction to simulation modelling; Analog and Digital simulation; Random number operation; Random variates; Arrival times; Validation of models.

References:
1. T.R.B. Special Report, 165, TRB - Traffic Flow Theory ; Washington.
2. Wohl & Martin , Traffic System Analysis ; Mc Graw Hill.
3. A.D. May ,Traffic Flow Fundamentals
4. C.S.Papa Costas, Fundamentals of Transportation Engineering .
5. F.L. Mannering & W.P. Kilareski, Principles of Highways Engineering and Traffic Analysis.

CE372 LAND USE AND TRANSPORTATION MODELLING

Credits: 4 : 0 : 0 **Marks: 40 + 60**

Unit I: Land Use And Transportation Engineering:
Transportation modelling in Planning; Models and their role, characteristics of transport demand and supply, Equilibration of supply and demand, Modelling and decision making, issue in transportation modelling and structure of the classic transport model.

Unit II: Land Use Transportation Models:
Introduction to Land Use Planning; Relation between Transportation and Land Use Planning; The economic base mechanism and allocation mechanism; Spatial allocation and employment inter-relationship; Garin Lowry models.

Unit III: General Travel Demand Models I :
Aggregate, Disaggregate models; Behavioural models; Recursive and direct demand models; Linear, Non-Linear models;

Unit IV: General Travel Demand Models II :
Logit, discriminant and probit models; Mode split models - Abstract mode and mode specific models.

Unit V: Regional Transport Models:
Factors affecting goods and passenger traffic; Prediction of traffic; Growth factor models; time function iteration models; internal volume forecasting models.

References:

1. Jhan De Diosortuzar, Luis E.Willumsen , Modelling transport, John Invey & Sons, 1970/1975.
2. R.Baxter, M.Echenique and J.Owers , Urban Development Models, The Institute of Transportation Engineering; University of California.
3. Robert S, Pindyek, Daniel L.Rubin Fielld , Economic Models and Economic Forecast; Mc. Graw Hill.
4. A.G.Wilson; Pion Regional and Urban Models, London.
5. NCHRPL Reports 177 and 178 ; Freight Data requirements for State wide Transport System Planning TRB; Washington.
6. Michael Batty - Urban Modelling.
7. Peter R.Stopher ARNIM.H.MEYBURG Behavioural travel demand models. 1998.

CE373 EXPERIMENTAL TECHNIQUES

Credit : 4:0:0 **Marks : 40+60**

Unit I: Non-Destructive Testing Methods
Rebound Hammer Test – Penetration Techniques – Pullout Tests – Dynamic or vibration methods – Resonant Frequency Methods – Pulse Velocity Methods – Radio Active Methods – Nuclear Methods – Electrical Methods – Tests on Composition of Hardened Concrete – Determination of Cement Content – Determination of original w/c ratio – Physical Method – Accelerated Curing test

Unit II: Strain Measurement:
Introduction – electrical resistance strain gauges – strain gauge circuits – recording instruments – strain analysis methods – Strain Rosettes - Photo elastic experiments on disc, beam frames and other structural models. Demonstration of Moiré' and stress freezing techniques

Unit III: Tests on Beams & Structures:
Modulus of rupture of plain beams – slope & deflection of beams – shear studies in RC beams – Creep Test – Model analysis for concrete structures – Determination of reactions of a two hinged parabolic arch with variable moment of inertia – Load tests on actual structures

Unit IV: Equipment & Instrumentation:
Principles of operations of UTM, hydraulic loading systems, force measuring devices, etc. used in the experiments planned in the laboratory - Transducers – types – Linear Variable Displacement Transducers (LVDT) – working principles – Demountable mechanical strain gauges - Load Testing of bridges.

Unit V: Testing of Earthquake Resistant Structures
Shake table – working principles – applications - accelerometers – types – Oscilloscope – types - Data acquisition systems – Amplifiers – Vibration generators

References:

1. Chopra, A.K.," Dynamics of structures _ Theory and applications to earthquake engg", Prentice hall of India, New Delhi, 2002
2. Paz Mario," Structural Dynamics - Theory and Computation", CBS publishers, 1999
3. M.S. Shetty, "Concrete Technology- Theory and Practice", S. Chand and Company, New Delhi, 1992

CE374 DESIGN OF MASONRY STRUCTURES

Credit : 4:0:0 **Marks : 40+60**

Unit I: Brick Masonry in Building:
Material properties, masonry units, clay and concrete blocks, mortar, grout and reinforcement, bonding patterns, shrinkage, and differential movements - Brick walls – Brick columns - Stresses – Shape Factor – Slenderness ratio – type of loading

Unit II: Laterally Loaded Masonry Structures:
Structures and loads – Masonry under lateral loads, in-plane and out plane loads, analysis of perforated shear walls, lateral force distribution for flexible and rigid diaphragms - Stability of Masonry – Masonry Dams – Retaining walls – Problems -

Unit III: Foundations, Piers, Walls and Abutments:
Wall and column footing in buildings – Bridge foundation – the substructure – loads on substructure- Allowable stresses in Masonry – combination of load and permissible increase in working stress – limiting eccentricity – determination of safe bearing capacity – Lateral load resistance of well foundations – problems

Unit IV: Masonry Arches and Domes:
Arches in buildings – stability of masonry arches – design of masonry arches by elastic theory – analysis of masonry domes – stability of masonry domes – problems

Unit V: Earthquake resistant design of masonry buildings:
Behavior of different construction in past earth quakes – General planning and details – recommendations for masonry walls – Structural action of elements of a building – masonry, cyclic loading, ductility of masonry walls for seismic design, infill masonry - Design of bands – Free standing walls – Partition walls – Roofs and floors – Gable ends of walls – Design of shear walls – vertical projecting parts – framing of thin, load bearing walls – Reinforcing details for hollow block masonry.

Text books

1. Arya A.S., Structural Design in Steel, Masonry and Timber, Nemchand and Bros, Roorkee, 1987

Reference books

1. Dayarathnam P., Bricks and Reinforced Brick structures, Oxford & IBH, Publishing Co.(Pvt) Ltd., New Delhi.
2. IS: 1905-1987 Code of Practice for Structural use of Un reinforced masonry
3. IS 4326 – 1993 – Earthquake Resistant Design of Construction of Buildings
4. IS 1893 – 2002 – Criteria for Earthquake Resistant Design of Structures

CE375 RESEARCH METHODOLOGY

Credit : 4:0:0 **Marks : 40+60**

Unit I:

Philosophy of Research - Research Theories - Types of Research - Literary research and Linguistic research – Topic and Problem Identification - Research Method – Data Collection -Classification and Organisation – Data analysis – Tools of Analysis – Sources including Electronic Media – Forms and functions of Documentation.

Unit II: Experimental designs

The laboratory and the field experiment – internal and external validity – factors affecting internal validity. Measurement of variables – scales and measurements of variables. Developing scales: rating scale and attitudinal scales. Validity testing of scales developed. Reliability concept in the scales being developed. Stability measures

Unit III: Data collection methods

Interviewing questionnaires etc. secondary sources of data collection. Guidelines for questionnaire design – electronic questionnaire design and surveys. Special date sources: focus groups, static and dynamic panels. Review of the advantages and disadvantages of various data collection methods and when to use each. Sampling techniques. Probabilistic and non – probabilistic samples. Issues of precision and confidence in determining sample size. Hypothesis testing. Determination of optimal sample size. Data relevance to intellectual property rights (IPR), bookkeeping.

Unit IV::

The Forms of Discourse and the Main Intention – Exposition and Its Methods – Argument – Description – Narration – Effective Writing(Diction-Sentence-Paragraph) – Sources of Information – Primary Source and Secondary Source – Review of Earlier Researches – Preparation of a Working Bibliography – Note Taking(on Cards).

Unit V:

Text of a Thesis: Introduction – Body of a thesis – Summation – Appendix(if any) – Works cited or consulted – Thesis Typing: Paper – Margin and Spacing – Pagination – Title page – Certificate – Abstract – Preface or Acknowledgement – Contents – Punctuation –Spelling-Grammar – Using quotations – Revising – Proof reading – Parenthetical documentation(MLA style sheet) – Other systems of documentation.

Text Books:

1. Donald R. Cooper and Remela S. Schindler, Business Research Methods, Tata McGraw Hill publishing company limited, New Delhi, 2000.
2. Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc., New York, 2000.
3. C.R. Kothari, Research Methodology, Wishva Prakashan, New Delhi, 2001.

References:

1. Donald H. McBurney, research methods, Thomson Asia Pvt. Ltd. Singapore, 2002
2. G.W. Ticehurst and A.J. Veal, Business research methods, Longman, 1999.
3. Ranjit Kumar, Research methodology, Sage Publications, London, New Delhi, 1999.
4. Raymond – Alain Thie' tart, et. Al., Doing Management research, Sage publications, London, 1999.

SCHOOL OF

CIVIL ENGINEERING

ADDITIONAL SUBJECTS

Code	Subject Name	Credits
CE279	Water Supply and Sanitary Engineering	4:0:0
CE280	Surveying	3:1:0
CE281	Computer Application Laboratory	0:0:2
CE282	Design of Masonry and Steel Structures	4:0:0
CE283	Advanced Design of Steel Structures	4:0:0
CE284	Economics and Business Finance for Engineers	4:0:0
CE285	Industrial Safety and Industrial Psychology	4:0:0
CE286	Surveying Lab	0:0:2
CE376	Construction Planning, Scheduling and Control	3:0:0
CE377	Estimating and Quantity Surveying	0:0:2
CE378	Civil Engineering Drawing	0:0:2
CE379	Project Formulation and Appraisal	3:0:0
CE380	Contract Laws and Regulations	3:0:0
CE381	Building Materials and Construction Technology	3:0:0
CE382	Fundamentals of Civil Engineering	3:0:0
CE383	Estimating & Quantity Surveying Lab	0:0:2
CE384	Quality Control Lab	0:0:2
CE385	Computer Applications in Construction Engineering and Planning Lab	0:0:2
CE386	Shoring, Scaffolding and Formwork	3:0:0
CE387	Construction Project Management	3:0:0
CE388	Project Safety Management	3:0:0
CE389	Construction Equipment	3:0:0

CE279 WATER SUPPLY AND SANITARY ENGINEERING

Credit 4:0:0

Unit - I : Water Quality and Perspectives
Water Quality Parameters and Analysis – Physical, Chemical, and Biological – MTFT and MFT Methods – Water Quality Standards and Planning Factors in India – Objectives of Public Water Supply Scheme – Health, Acceptability, Adequacy, Convenience and Economy Aspects – Population Forecasts – Per capita Demand and Variation in Demand Pattern – Rural Water Supply Scheme – Necessity and State -of -art Methods. Rain water harvesting.

Unit - II : Water Treatment Processes
Characteristics of Surface and Ground Waters – Conventional and Un-conventional Treatment Schemes – Principles, Functions, and Design of Flash Mixer, Flocculator, Sedimentation Tank, Slow and Rapid Sand Filters, and Disinfection Process – Principles of

Ion Balancing Bar Graph, Water Softening, Aeration , Iron and Manganese Removal, and Fluoride Removal.

Unit - III : Distribution and Storage Systems
Types, Functions and Requirements of Distribution System – Pressure Requirements and Surveys – Analysis of Distribution Systems – Method of Sections, Equivalent Pipe Method, and Hardy-Cross Method of Balancing Network – Operation and Maintenance of Distribution Systems – Leak Detection, Corrosion Control and Langelier Index, and Lining of Pipes – Storage Reservoirs – Types, Functions, Location, and Capacity – House Connections and Appurtenances.

Unit - IV : Preliminary and Primary Treatments of Sewage
Definition of Sewage - Quantity of Sanitary Sewage and Storm Water Classification Principles and Objectives of Sewage Treatment – Operation and Design of Bar Rack and Grit Chamber with Velocity Control Devices – Principles of Primary Treatment and Design of Primary Sedimentation Tank – Disposal of Rackings, Gritty Materials, and Sludge Solids.

Unit -V : Biological Treatment Processes
Objectives of Biological Treatment – Path Ways of Decomposition – Aerobic, Anaerobic, and Anoxic Processes – Operation and Design of Conventional Activated Sludge Process with Diffuser and Mechanical Aerators – Process Modifications – Operation and Design of Trickling Filter – High rate and Standard Rate Filters – Low Cost Waste Water Treatments – Principles and Design of Stabilization Ponds, Oxidation Ponds and Aerated Lagoons – Rural Sanitation – Operation and Design of Septic and Imhoff Tanks – Excreta Disposal Schemes.

Text Book:

1. Raju, B.S.N., "Water Supply and Waste Water Engineering", Tata McGraw-Hill Book Co., New Delhi, 1995.

Reference Books:

1. Hammer, M.J., "Water and Waste Water Technology", 2nd Edn. (SI Version), John Wiley and Sons, N.Y. 1986.
2. Birdie, G.S., and Birdie, J.S., "Water Supply and Sanitary Engieneering", 8th Edn., Dhanpat Rai Publications.
3. B.C.Punmia, "Water Supply Engineering", Laxmi Publications.

CE280 SURVEYING

Credit : 3:1:0

Unit – I Introduction to Surveying
Definition, Principle and Classification of surveying – field and office works.

Leveling and Applications:
Types of levels and staves – sensitivity of bubble – benchmarks – temporary and permanent adjustments – fly, check, profile and block leveling – booking – reduction – arithmetic checks –curvature and refraction correction – reciprocal leveling – difficulties and errors in leveling - longitudinal and cross sectioning – plotting – Calculation of areas and volumes –

contouring – methods – characteristics and uses – plotting – earthwork volume – capacity of reservoirs.

Unit II : Theodolite Surveying

Description and uses of vernier micrometer – microptic theodolites – temporary and permanent adjustments of vernier transit – measurement of horizontal and vertical angles – heights and distances – traversing – closing error and distribution – Gale's traverse table – omitted measurements

Unit III : Tacheometric surveying:

Principle of Stadia method – Distance and elevation formulae for staff held vertical – Instrumental constants – Anallactic lens – Tangential method – use of Subtense bar – tacheometric contouring

Plane Table Surveying:

Plane table instruments and accessories – advantages and disadvantages – different methods – radiation – intersection – traversing – resection – two point and three point problems – errors and adjustments in plane tabling.

Unit IV : Curves

Route surveys for highways, railways and waterways – Curve ranging – Horizontal and vertical curves – Simple curves –Setting out by chain and tape methods – By instrumental methods – Transition Curves – Functions and requirements – Setting out by offsets and angles – Vertical curves – Sight distances

Unit V : Control surveying

Working from whole to part – Horizontal and Vertical control - Triangulation figures – Classification of triangulation systems – selection of triangulation stations – Intervisibility and height of stations – station marks – signals and Towers – Measurement of angles – reduction to centre – Field work and correction to baseline measurements – Extension of base – trigonometric leveling – single and reciprocal observations

Text Books:

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and Levelling, Vol. I & II, Pune Vidyarthi Griha Prakashan, Pune, 1968.
2. Punmia, B.C., Surveying Vol. I & II, Standard Publishers, 1994.

Reference Books:

1. S.K.Duggal, Textbook of Surveying –Vol I&II, Tata McGraw Hill & Co., New Delhi

CE281 COMPUTER APPLICATION LAB

Credit : 0:0:2

1. Analysis of 2D Truss using STAAD-Pro
2. Analysis of 2D and 3D Rigid Frames using STAAD-Pro
3. Analysis of 3D pin jointed frames using ANSYS
4. Analysis of suspension cables using ANSYS
5. Design of Footings and Retaining Walls using STAAD-Pro
6. Structural Design of the following, using STAAD-Pro and detailing of the same using AUTO CAD

a. R.C. Beams
b. R.C. Slabs
c. R.C. Columns and Footings
d. Steel beams
e. Steel columns

7. Design of circular water tanks using STAAD-Pro
8. Deflection and Stresses in beams using ANSYS
9. Concrete mix design and mathematical calculations using MATHCAD
10. **Development and Implementation of Programs for the following in C Language**
    1) Drawing the B.F and B.M. diagrams for simply supported beams and cantilever beams subject to point, udl and uniformly varying loads
    2) Limit state Design of R. C. Rectangular and T – beams.
    3) Design of tension and Compression Steel Members.

Note
Examination will be of four hours duration and students will be examined in modeling and the application of general purpose packages.

CE282 DESIGN OF MASONRY AND STEEL STRUCTURES

Credit 4:0:0

Unit - I: Structure and Design Concepts
Classification of structures – function, material and shape – different structural systems – requirements of structures – basic structural requirements – stability, strength and stiffness – design process – codes of practice.

Design of Masonry Walls and Columns
Axially loaded square and rectangular columns with uniaxial eccentricity – solid walls – load bearing walls – axially loaded – eccentrically loaded walls with openings – Non load bearing walls. Laterally Loaded Masonry Structures: Structures and loads – stability of masonry – middle third rule – Masonry dams – Trapezoidal dams – Retaining walls.

Unit - II: Load Distribution Elements
Bed blocks – spread footings for walls and columns – area based on safe bearing capacity – Design of Reinforced Masonry - Introduction – basic concepts – limit state design of reinforced brick masonry – lintels – axially loaded columns.

Unit - III: Bolted, Welded Joints and Tension Members
Bearing and friction type of bolts – splicing joint – joints subjected to moment and direct load and torsion – butt and fillet welds – joints subjected to shear, bending and torsion. Design of Tension Members - Net area - effective area - design of tension members - tension rods.

Unit - IV: Design of Compression Members & Beams
Design criteria - simple members - laced columns - battened columns- Simple bases - gussetted base - column bases subjected to moment - design of hold down bolts- column splices.

Design of Laterally Supported Beams
Design considerations - bending - shear - bearing - web buckling and crippling - deflection - compound beams - curtailment of plates.

Unit - V Lateral Buckling of Beams & Design of welded plate girders
Effective laterally unbraced length - concept of lateral torsional buckling - biaxial bending of doubly symmetric sections - design of gantry girders.

Welded Plate Girders
Design of flanges and webs - intermediate stiffeners -bearing stiffeners - design of web and flange splices.

Text Books

1. Arya A.S., Structural Design in Steel, Masonry and Timber, Nemchand and Bros., Roorkee, 1987.
2. Punmia B.C., Ashok kumar Jain and Arun kumar Jain, `Design of Steel structures' Arihant Publications, Bombay, 1995.

Reference Books

1. Dayarathnam P., Bricks and Reinforced Brick Structures, Oxford & IBH Publishing Co., (Pvt). Ltd., New Delhi
2. Ragupathy M, “Design of Steel Structures”, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1996.
3. Explanatory notes published by M/s. Institute of Steel Development and Growth.
4. Code Books: IS 800 (Code of practice for General Construction in Steel), IS 1905 – 1987(IS Code of Practice for Structural Use of unreinforced masonry).

CE283 ADVANCED DESIGN OF STEEL STRUCTURES

Credit 4:0:0

Unit - I: Welded Beam Connections
Types of welded beam connections – Direct web fillet welded connections – Welded double plate framed connection - welded double angle framed connection – unstiffened welded seat connection – stiffened welded seat connection – moment resistant connections

Unit - II: Industrial Structures
Types of roof trusses - Load Calculation - Design of purlins, trusses and lattice girders - Design of Industrial Buildings – planning and structural framing – Major components of an industrial building – bracing of industrial bents in transverse direction – Analysis of braced bents.

Unit – III: Light Gauge Steel Sections
Introduction – Forms of light gauge sections – local buckling of thin elements – effective design width - Design of light gauge steel section for compression and flexural members – connections – Self supporting Chimney – Introduction – Design considerations and Design

Unit – IV: Plastic Analysis and Design
Introduction – ductility of steel – ultimate load carrying capacity of members carrying axial tension – plastic bending of beams – basic theorems – plastic moment – shape factor – Analysis and design of Continuous beams – Analysis of portal frames

Unit – V: Multistoried Buildings
Structure of Multistoreyed buildings - Bracing of Multistoreyed frames – Loads - Lateral Load analysis of frames - Portal Method - Cantilever Method - Factor method

Text Books:

1. Dayaratnam, P., "Design of Steel Structures", A.H.Wheeler & Co. Ltd., Allahabad, 1996
2. Arya and Ajmani, "Design of Steel Structures", NemChand Brothers, Roorkee, 1989.

Reference Books:

1. Ragupathy M, "Design of Steel Structures", Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1996.
2. Punmia B.C., Ashok kumar Jain and Arun kumar Jain, `Design of Steel structures', Arihant Publications, Bombay, 1995.
3. Explanatory notes published by M/s. Institute of Steel Development and Growth.
4. Code Books: IS 801- 1975(Code of Practice for Cold formed light gauge steel structural members), IS 811 – 1987 (Cold formed light gauge structural steel sections).

CE284 ECONOMICS AND BUSINESS FINANCE FOR ENGINEERS

Credit 4:0:0

Unit – I : Economics
Role of civil engineering in industrial development - Advances in civil engineering and engineering economics - Support matters of economy as related to engineering Market demand and supply choice of technology and quality control and quality production - Audit in economic, Law of returns governing production.

Unit – II : Land and Construction Economics
Urban land use and values - Construction development in housing, transport and other infrastructures –Economics of ecology, environment, energy resources, local material selection, form and functional designs –Construction workers - Urban problems - Poverty - Migration -Unemployment - Pollution.

Unit – III : Financing
The need for financial management - Types of financing - Short term borrowing - Long term borrowing –Leasing - Equity financing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations - analysis of financial statement – Balance Sheet - Profit and Loss account - Funds flow statement - Ratio analysis - Investment and financing decision –Financial control, Job control and centralized management.

Unit – IV : Accounting Method
General overview - Cash basis of accounting - Accrual basis of accounting - Percentage - Completion method - Completed contract method - Accounting for tax reporting purposes and financial reporting purposes.

Unit – V: Lending to Contractors
Loans to contractors - Interim construction financing - Security and risk aspects.

Text Books:

1. Warneer Z, Hirsch, Urban Economics, Macmillan, New York, 1993.
2. Prasanna Chandra, " Project Management ", TMH 1997.

References:

1. Kwaku A, Tenah and jose M.Guevara, "Fundamental of Construction Management and organisation", Prentice - Hall of India, 1995.
2. Engineering Economic Analysis.
3. K K Chitkara, Construction Project Management, Tata McGraw Hill.

CE285 INDUSTRIAL SAFETY AND INDUSTRIAL PSYCHOLOGY

Credit 4:0:0

Unit – I : Introduction
Safety definition Hazard identification, General hazards of plant operation Toxic hazards, Fire & Explosions - Hazards Transport of Chemicals with safety Unforeseen deviations Emergency management, Planning for safety, Selecting a basics of safety Preventive and protective measures, Safety based on emergency, Relief systems, Safety based on containment Operational safety procedural instructions Sla-Routine checks, Process and product changes, Safety Checks, Checklist for safety, Leaks and detection.

Unit – II : Risk Analysis
Risk Analysis, Evaluation, Mitigation, Hazop, Hazan, Definition, Probability, Quantification-Risk, Engineering, Clean technology, Initiatives, Standards, Emergency Handling, Accident Investigation, Legisiation, Nil Risk Quantification methods, Case histories of accidents, Examples of hazards assessment, Examples of use of Hazan, Explosion hazards in Batch units, Technical process, Documentation for Hazardous Chemicals, Format and methods.

Unit – III : Common Stress Factors Time

Understanding stress - Meaning-Symptoms-Work Related Stress-Individual Stress – Reducing Stress – Burnout - Time Management – Techniques – Importance of planning the day – Time management schedule – developing concentration – Organising the Work Area - Prioritizing – Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say 'No'.

Unit – IV : Career Plateauing

Career Plateauing – Identifying career plateaus – Structural and content plateauing – Making a fresh start – Importance of sabbaticals – Counseling out – Executive leasing – Sustaining a marketable career.

Unit – V : Self Development

Improving Personality – Leading with Integrity – Enhancing Creativity – Effective Decision Making – Sensible Communication – The Listening Game – Managing Self - Meditation for Peace – Yoga for Life.

References:

1. Rohatgi.A.K. " Safety handling of Hazardous Chemicals Enterprises ", Bombay (1986).
2. Shukla.S.K. - " Enviro hazards and Techno Legal aspects ", Shashi Publications, Jaipur India (1993).
3. Wells G.L. and R.M.C. " Seagrave-Flow sheeting for safety ", I.Ch.E. London.K. (1977).
4. " Learning from accidents " - Trevur Kletz Butterworths London U.K. (1988).
5. Chemical reaction Hazards - " A guide to safety ", Institution of Chemical Engineering London U.K. Ed. by John Barton and Richard Rogers (1997).
6. Bhatia R.L., The Executive Track: An Action Plan for Self Development, Wheeler Publishing, New Delhi, 1996.
7. Charavarthy S.K., Human Values for Managers, Wheeler Publishing, New Delhi, 1996.
8. Frances A Clark, Total Career Management, McGraw-Hill/Henley Management Series, 1995.
9. Jeff Davidson, Managing Stress, Prentice Hall of India, New Delhi, 1998.
10. Swami Ranganathananda, Eternal Values for a changing society, Bharatiya Vidya Bhavan, 1995.

CE286 SURVEYING LAB

Credit : 0:0:2

12 experiments will be notified by the HoD from time to time

CE376 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL

Credit 3:0:0

Unit I: Construction Planning
Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities - Coding Systems

Unit II: Scheduling Procedures and Techniques
Relevance of Construction Schedules - The Critical Path Method - Calculations for Critical Path Scheduling - Activity Float and Schedules - Presenting Project Schedules - Critical Path Scheduling for Activity-on-Node and with Leads, Lags, and Windows - Calculations for Scheduling with Leads, Lags and Windows - Resource Oriented Scheduling - Scheduling with Resource Constraints and Precedences - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Scheduling in Poorly Structured Problems - Improving the Scheduling Process.

Unit III: Cost Control, Monitoring and Accounting
The Cost Control Problem - The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

Unit IV: Quality Control and Safety During Construction
Quality and Safety Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality Control - Quality Control by Statistical Methods - Statistical Quality Control with Sampling by Attributes - Statistical Quality Control with Sampling by Variables - Safety

Unit V: Organization and Use of Project Information
Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in Databases - Relational Model of Databases - Other Conceptual Models of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow.

References:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.

4. Moder, J., C. Phillips and E. Davis, Project Management with CPM, PERT and Precedence Diagramming, Van Nostrand Reinhold Company, Third Edition, 1983.
5. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.
6. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

CE377 ESTIMATING AND QUANTITY SURVEYING

Credit: 0:0:2

Unit I : Procedure Of Estimating Quantities
Introduction – Main items of work – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C., Doors, Windows, Flooring, White Washing, colour washing, Distempering and their units.

Unit II : Rate Analysis
Factors affecting rates – importance – Materials for different items of work – Rates of materials and labour – analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works.

Unit III : Cost Estimate of Buildings
Approximate methods – Plinth area estimate – Cubical Contents estimate. Detailed estimate – Estimation of the cost of single storeyed buildings by individual wall method and centre line method. Estimation of Roofs – R.C.C. slab roof, GI sheet roof, Tiled Roof, Roof Truss. Estimation of R.C.C.works – Beam, T-beam and Slab, Column, Foundation, Stair case, Retaining wall etc.

Unit IV : Cost Estimate of Other Structures
Estimation of roads – Earth work, Pitching of Slopes, Hill roads. Estimation of R.C.C. slab culvert, Pier, Pipe culvert, R.C.C. T-beam bridge. Estimation of Irrigation works like Canals, Aqueducts, Syphon, etc. Estimation of Water supply and sanitary works like septic tank, Soak pit, Manhole, sewer line,etc.

Unit V : Specifications and Valuation
Specifications – Objectives – types of specifications – principles of specification - writing – typical specifications. Valuation – Market value – Book value – Scrap value – Salvage value – annuity – Capitalized values – sinking fund – depreciation – Valuation of a building – Rent fixation – Mortgage – Lease – cash flow and cost control.

Text Books:
1. Dutta, “Estimating and Costing”, S Dutta & Co., Lucknow.
2. Rangawala..S.C., “Estimating and Costing”, Charotar Anand.

Reference Book:
Kohli, D.D.and Kohli R.C., “A Text book on Estimating, Costing and Accounts”, S.Chand and Co., New Delhi, 1994

CE378 CIVIL ENGINEERING DRAWING

Credit: 0:0:2

Symbols and sign conventions related to Architecture - Traffic - Electrical Circuits - Plumbing & welding - Metric Brick - Bonds in Brick masonry, cross walls and corner walls. Joinery in wood work - timber doors, windows and ventilators - paneled and glazed types. Planning and detailing of Stairs and Staircases. Plan, Elevation, Section and Perspective Views of single storeyed residential buildings

Text Book

1. Balgopal,T.S., Prabhu,T.S., Building drawing and detailing, Spades Publishing KDFA building Calicut, 1987.

CE379 PROJECT FORMULATION AND APPRAISAL

Credit 3:0:0

Unit I: Project Formulation

Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required

Unit II: Project Costing

Project Cash Flows – Time Value of Money – Cost of Capital

Unit III: Project Appraisal

NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice

Unit IV: Project Financing

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators

Unit V: Private Sector Participation

Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer

References:

1. Prasanna Chandra, Projects – Planning Analysis Selection Implementation & Review Fourth Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi., 1995
2. Joy P.K., Total Project Management - The Indian Context (Chapters 3 - 7), New Delhi, Macmillan India Ltd., 1992

3. United Nations Industrial Development Organisation (UNIDO) Manual for the preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987
4. Barcus, S.W. and Wilkinson. J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.

CE380 CONTRACT LAWS AND REGULATIONS

Credit 3:0:0

Unit I : Construction Contracts
Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts

Unit II : Tenders
Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.

Unit III : Arbitration
Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Arbitration Act - Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs

Unit IV : Legal Requirements
Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations

Unit V : Labour Regulations
Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws

References:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M. Tripathi Private Ltd., Bombay, 1982
2. Tamilnadu PWD Code, 1986
3. Jimmie Hinze, Construction Contracts, 2nd Edition, McGraw-Hill, 2001
4. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, 6th Edition, McGraw-Hill, 2000

CE381 BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY

Credit 3:0:0

Unit I : Building Materials:
Types and properties of cement – cement mixes – rolled steel sections – types of reinforcement rods – terracotta and glazed products

Unit II: Brick and Stone Masonry:
Types of Bricks – Bonds (English & Flemish), Tools for Brick Laying Brick laying – Comparison of brick and stone masonry – defects in Brick masonry – Definition of terms used in stone masonry – materials - classification of stone masonry – supervision of stone masonry – safe loads on stone masonry.

Unit III: Types of Floors and Roof
Selection of Floor materials – Mud – Brick – cement Concretes – Terrazzo – Mosaic – tiled Asphalt flooring – R.C.C. Floors – Types of pitched roofs

Unit IV: Plastering and Painting
Types of mortars for plastering – Tools for plastering – method of plastering – types of plaster finishes – defects in plastering – paints and painting – constituents of a paint – types of paint – painting on different surfaces – defects in painting.

Unit V: Stairs, Form-work and Scaffolding
Technical terms – requirement of stair – dimensions of stair – classification of stair - Requirements of formwork – loads on form work – shuttering for columns – beams and floors – scaffolding

Text Book:
1. Punmia. S.C, Building Construction, Lakshmi Publication (P) Ltd. ,2006

References:

1. Rangwala, S.C., " Engineering Materials ", Charotar Publishing House, Anand, 1997.
2. Surendra Singh, " Building Materials ", Vikas Publishing Company, New Delhi, 1996.
3. Arora S.P. and Bindra S.P., " Building Construction Planning Techniques and method of Construction " , Dhanpat Rai and Sons, New Delhi, 1997.

CE382 FUNDAMENTALS OF CIVIL ENGINEERING

Credit:3:0:0

Unit I
Introduction : Engineering – Civil Engineering – History and development of Civil Engineering – Scope of Civil Engineering – Functions of Civil Engineers - General concepts relating to Buildings - Selection of site – Basic functions of buildings – Major components of buildings – Foundations - Purpose of a foundation – Bearing capacity of soils – types of foundations.

Unit II
Surveying : Definition and purpose – classification – Basic principles – Measurement of length by chains and tapes – Calculation of area of a plot – Measurement of bearings and angles using a prismatic compass – Leveling – longitudinal and Cross-sectioning – calculation of areas and volumes - Contours and their applications – Use of transit theodolite.

Unit III
Water supply Engineering : Sources of water supply – Quantity of water requirements – Purification of water involving sedimentation, filtration and disinfection. Sanitary Engineering : Definition of terms – Collection and disposal of solid wastes – Sewage systems – Septic tanks – Oxidation ponds.

Unit IV
Transportation Engineering : Importance of roads – Classification of Highways – Cross sections of water bound macadam, bituminous and cement concrete roads – Traffic signs and signals.
Railways : Importance of railways – Gauges – Components of a permanent way. Bridges : Components of Culverts – Causeways, Slab Bridge, T-beam and slab bridge, Suspension bridge.

Unit V
Functions and general layout of an airport.
Functions and general layout of a harbour.
Dams : Purpose of Dams – Types of dams – Earth, masonry and concrete, arch and buttress dams – Selection of site for a dam.
Irrigation Engineering : Definition of irrigation – Types of irrigation – Canal irrigation system.

Text Book

1. Johnson Victor D. and Esther Malini, 'Basic Civil Engineering', Allied Publishers Limited, Madras

Reference Books

1. Arunachalam N., 'Basic Civil Engineering', Pratheeba Publishers, Coimbatore, 2000
2. Ramesh Babu V., 'Basic Civil Engineering', Anuradha Agencies, Kumbakonam, 2001

CE383 ESTIMATING AND QUANTITY SURVEYING LAB

Credit: 0:0:2

12 experiments will be notified by the HOD from time to time

CE384 QUALITY CONTROL LAB

Credit: 0:0:2

12 experiments will be notified by the HOD from time to time

CE385 COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING LAB

Credit: 0:0:2

12 experiments will be notified by the HOD from time to time

CE386 SHORING, SCAFFOLDING AND FORMWORK

Credit 3:0:0

Unit I : Planning, Site Equipment and Plant for Form Work
Overall Planning – Detailed Planning – Standard units – Corner units – Schedule for column formwork – Formwork elements – Planning at Tender stage – Development of basic system – Planning for maximum reuse – Economical form construction – Planning examples – Crane size, effective scheduling estimate – Recheck plan details – Detailing the forms.

Crane arrangement – Site layout plan – Transporting plant – Formwork beams – Formwork ties – Wales – Scaffold frames - Form accessories – Vertical transport table form work.

Unit II : Form Materials and Pressures on Formwork
Lumber – Types – Finish – Sheathing boards - Working stresses – Repetitive member stress – Plywood – Types and grades – Textured surfaces and strength – Reconstituted wood – Steel – Aluminum Form lining materials – Hardware and fasteners – Nails in Plywood – Bolts lag screw and connectors – Bolt loads.

Pressures on Formwork - Concrete density – Height of discharge – Temperature – Rates of Placing – Consistency of concrete – Live loads and wind pressure – Vibration Hydrostatic Adjustment for non standard condition.

Unit III : Shores and Form Design
Simple wood stresses – Slenderness ratio – Allowable loads – Tubular steel shores - Patented shores – Site Preparation - Size and spacing – Steel Tower Frames – Safety practices – Horizontal shores shoring for multistories – More concentrated shore loads - T-heads – Two tier wood shores – Ellis shores – Dayton sure grip and Baker Roos shores – Safway Symons shores – Beaver Advance shores - Dead shores – Raking and Flying shores

Basic simplification – Beam formulas – Allowable stresses – Deflection bending lateral stability – Shear, Bearing – Examples in wall forms – Slab forms – Beam form – Ties, Anchors and Hangers – Column forms – DOKA forms - Examples in each.

Unit IV: Formwork for Buildings and Failures
Location of job mill – Storage – Equipment – Footings – Wall footing – Column footings Sloped footings – Slab on grade and paving work – Highway and airport paving – Curb and Gutter forms – Wall forms – External vibration – Prefabricated panel systems – Giant forms curved wall forms – wall openings joints – Tolerance for walls – Erection practices – Column heads – Beam or girder forms – Beam pockets – Suspended forms – Suggested Tolerances – Flying system forms – CECO Meyer flange and long forms.

Causes of failures – Inadequate shoring - Inadequate bracing of members – Improper vibration – Premature stripping – Errors in design – Failure to follow codes – How formwork affects concretes quality – ACI – Case studies – Planning for safety - Achieving economy – Finish of exposed concrete surface - Design deficiencies - Safety factors – Reshore installation – Prevention of rotation – Stripping sequence – Advantage of reshoring.

Unit V: Dome Forms, Tunnel Forms, Slipforms and Safety Practices for Scaffolds
Shells of translation and revolution - Hemispherical – Parabolic - Barrel vaults - Hyperbolic Paraboloid Shells – Conoidal Shells - Folded plates – Shell form design – Building the form – Placing concrete – Strength requirements – Tunnel forming components – Curb and Invert forms – Arch and Wall forms - Telescopic forms – Concrete placement methods – Cut and Cover construction – Continuous Advancing slope method - Bulk head method – General design considerations influence of placing equipment – Tolerances – Form construction for Shafts.

Slipforms – Principles – Types – Advantage – Functions of various components – Planning of Slipform operations – Desirable characteristics of concrete – Common problems faced – Safety in slip forms - Special structures built with Slipform Technique – Codal provisions – Types of scaffolds – Putlog and Independent scaffold – Single pole scaffolds – Fixing ties – Spacing of ties - Plan Bracing – Knots – Safety nets – General safety requirements – Precautions against particular hazards – Truss, Suspended – Gantry and system scaffolds.

References:

1. Robert L. Peurifoy and Garold D. Oberlender, "Formwork for Concrete Structures", Third Edition McGraw-Hill, 1996.
2. Hurd, M.K., "Formwork for Concrete", Special Publication No. 4 Sixth Edition, American Concrete Institute, Detroit, 1995.
3. Michael P. Hurst, "Formwork", Construction Press, London and New York, 1997.
4. Austin, C.K., "Formwork for Concrete", Cleaver – Hume Press Ltd., London 1996.
5. Tudor Dinescu and Constantin Radulescu, "Slipform Techniques", Abacus Press, Turn Bridge Wells, Kent, 1992.
6. "Guide for Concrete Formwork", American Concrete Institute Detroit, Michigan, 1996.
7. "Safety Requirements for Scaffolding", American National Standards Institute, New York, 1994.

CE387 CONSTRUCTION PROJECT MANAGEMENT

Credit 3:0:0

Unit I : The Owners' Perspective
Introduction - Project Life Cycle - Types of Construction - Selection of Professional Services - Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - Changing Environment of the Construction Industry - Role of Project Managers

Unit II : Organizing for Project Management
Project Management - Trends in Modern Management - Strategic Planning and Project Programming - Effects of Project Risks on Organization - Organization of Project Participants - Traditional Designer-Constructor Sequence - Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team - Interpersonal Behavior in Project Organizations - Perceptions of Owners and Contractors

Unit III: Design and Construction Process
Design and Construction as an Integrated System - Innovation and Technological Feasibility - Innovation and Economic Feasibility - Design Methodology - Functional Design - Physical Structures-Geo-technical Engineering Investigation - Construction Site Environment - Value Engineering - Construction Planning - Industrialized Construction and Pre-fabrication - Computer-Aided Engineering

Unit IV: Labour, Material and Equipment Utilization
Historical Perspective - Labour Productivity - Factors Affecting Job-Site Productivity - Labour Relations in Construction - Problems in Collective Bargaining - Materials Management - Material Procurement and Delivery - Inventory Control - Tradeoffs of Costs in Materials Management. - Construction Equipment - Choice of Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks

Unit V: Cost Estimation
Costs Associated with Constructed Facilities - Approaches to Cost Estimation - Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Cost Indices - Applications of Cost Indices to Estimating - Estimate Based on Engineer's List of Quantities - Allocation of Construction Costs Over Time - Computer Aided Cost Estimation - Estimation of Operating Costs.

References:

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
3. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.

4. Choudhury, S, Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
5. Ernest E. Ludwig, Applied Project Engineering and Management, Gulf Publishing Company, Houstan, Texas, 1988.
6. Harold Kerzner, Project Management – A Systems Approach to Planning, Scheduling and Controlling, CBS Publishers & Distributors, Delhi, 1988.
7. Joy, P.K., Total Project Management – The Indian Context, Macmillan India Ltd., New Delhi, 1992.

CE388 PROJECT SAFETY MANAGEMENT

Credit 3:0:0

Unit I: Construction Accidents
Accidents and their Causes – Human Factors in Construction Safety - Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications

Unit II : Safety Programmes
Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives

Unit III : Contractual Obligations
Safety In Construction Contracts – Substance Abuse – Safety Record Keeping

Unit IV: Designing for Safety
Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Subcontractual Obligation – Project Coordination and Safety Procedures – Workers Compensation

Unit V : Owners' and Designers' Outlook

References:
1. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001
3. Tamilnadu Factory Act

CE389 CONSTRUCTION EQUIPMENT

Credit 3:0:0

Unit I : Construction Equipment Management
Identification – Planning - Equipment Management in Projects - Maintenance Management – Replacement – Unit Operating Cost - Cost Control of Equipment - Depreciation Analysis – Safety Management

Unit II: Equipment for Earthwork
Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers

Unit III : Other Construction Equipment
Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment

Unit IV: Materials Handling Equipment
Forklifts and related equipment - Portable Material Bins – Conveyors - Hauling Equipment

Unit V: Equipment for Production of Aggregate and Concreting
Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment – Transporters

References:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, 5th Edition, McGraw-Hill, Singapore, 1995
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 1988.
3. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
4. Dr.Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi. 1983.

SCHOOL

OF

CIVIL ENGINEERING

ADDITIONAL SUBJECTS

Code	Subject Name	Credit
09CE101	Basic Civil Engineering	2:0:0
09CE201	Civil Engineering Drawing	0:0:2
09CE202	Mechanics of Fluids	3:1:0
09CE203	Engineering Geology	4:0:0
09CE204	Computer Application Laboratory – I	0:0:2
09CE205	Mechanics of Deformable Bodies – I	3:1:0
09CE206	Mechanics of Deformable Bodies Ii	3:1:0
09CE207	Surveying	3:1:0
09CE208	Structural Analysis –I	3:1:0
09CE209	Highways And Railways Engineering	4:0:0
09CE210	Reinforced Concrete Structures – I	3:1:0
09CE211	Theories and Practices of Water and Wastewater Engineering	3:0:0
09CE212	Geotechnical Engineering	3:1:0
09CE213	Design of Masonry and Timber Structures	3:1:0
09CE214	Estimating, Costing and Specifications	0:0:2
09CE215	Construction Management	4:0:0
09CE216	Applied Hydraulics and Fluid Machines	3:1:0
09CE217	Reinforced Concrete Structures – II	3:1:0
09CE218	Structural Analysis-II	3:1:0
09CE219	Design of Steel Structures (limit state method)	3:1:0
09CE220	Design and Drawing (irrigation and environmental engineering)	0:0:2
09CE221	Foundation Engineering	3:1:0
09CE222	Design and Drawing (r.c.c and steel)	0:0:2
09CE223	Computer Application Laboratory – II	0:0:2
09CE224	Strength of Materials Laboratory	0:0:2
09CE225	Surveying Practical	0:0:2
09CE226	Fluid Mechanics and Machinery Laboratory	0:0:2
09CE227	Soil Mechanics Laboratory	0:0:2
09CE228	Concrete & Highways Laboratory	0:0:2
09CE229	Environmental Engineering Laboratory	0:0:2
09CE230	Elements of Town Planning & Architecture	4:0:0
09CE231	Earthquake Engineering and Design Of Structures	3:1:0
09CE232	Geographic Information System	3:0:0
09CE233	Rehabilitation of Structures	4:0:0
09CE234	Airports, Docks and Harbours	4:0:0
09CE235	Irrigation Engineering	3:1:0
09CE236	Professional Practice and Entrepreneurship Development	4:0:0
09CE237	Pollution and Control Engineering	4:0:0
09CE238	Industrial Waste Treatment and Disposal	3:0:0
09CE239	Construction Technology	4:0:0

09CE240	Interior Design	4:0:0
09CE241	Concrete Technology	4:0:0
09CE242	Fluid Mechanics and Machinery	3:1:0
09CE243	Fluid Mechanics Laboratory Credits	0:0:1
09CE244	Theories and Practices Of Pollution Engineering	4:0:0
09CE245	Mechanics of Solids	3:1:0
09CE246	Strength of Materials Laboratory	0:0:1
09CE247	Engineering Mechanics	3:1:0
09CE248	Building Acoustics	3:0:0
09CE301	Computer Aided Methods of Structural Analysis	3:1:0
09CE302	Applied Elasticity and Plasticity	3:1:0
09CE303	Advanced Design of Reinforced Concrete Structures	3:1:0
09CE304	Advanced Design of Steel Structures	3:1:0
09CE305	Design of Foundations	3:1:0
09CE306	Stability of Structures	3:1:0
09CE307	Advanced Computer Application Laboratory	0:0:2
09CE308	Structural Dynamics	3:1:0
09CE309	Finite Element Methods in Engineering	3:1:0
09CE310	Advanced Bridge Engineering	3:1:0
09CE311	Prestressed Concrete Structures	3:1:0
09CE312	Seismic Design of Structures	3:1:0
09CE313	Advanced Concrete Technology Laboratory	0:0:2
09CE314	Maintenance and Rehabilitation of Structures	3:1:0
09CE315	Analysis and Design of Plate and Shell Structures	3:1:0
09CE316	Advanced Concrete Technology	4:0:0
09CE317	Advanced Construction Techniques and Project Management	4:0:0
09CE318	Theory of Plates	4:0:0
09CE319	Mechanics of Composite Materials	4:0:0
09CE320	Design of Structures for Dynamic Loads	4:0:0
09CE321	Discrete Structural Optimization	4:0:0
09CE322	Design of Industrial Structures	4:0:0
09CE323	Design of Tall Buildings	4:0:0
09CE324	Prefabricated Concrete Structures	3:1:0
09CE325	Design of Offshore Structures	4:0:0
09CE326	Space Structures	4:0:0
09CE327	Environmental Chemistry	4:0:0
09CE328	Environmental Microbiology	4:0:0

09CE329	Physio-chemical Treatment of Water and Waste Water	3:1:0
09CE330	Biological Treatment of Waste Water	3:1:0
09CE331	Air Pollution Control	4:0:0
09CE332	Water and Waste Water Analysis Laboratory	0:0:2
09CE333	Industrial Water Pollution Control	4:0:0
09CE334	Environmental Impact Assessment	4:0:0
09CE335	Solid Waste Engineering	4:0:0
09CE336	Environmental Microbiology Laboratory	0:0:2
09CE337	Water and Waste Water Conveyance	4:0:0
09CE338	Remote Sensing and GIS Application in Env. Engg	4:0:0
09CE339	Air and Water Quality Modelling	4:0:0
09CE340	Environmental Biotechnology	4:0:0
09CE341	Indoor Air Pollution	4:0:0
09CE342	Instrumental Methods in Environmental Management	4:0:0
09CE343	Contaminant Transport Modelling for Ground Water	4:0:0
09CE344	Structural Design of Environmental Structures	3:1:0
09CE345	Ecological Engineering	4:0:0
09CE346	Ground Water Hydrology	3:1:0
09CE347	Environmental Rules and Legislation	4:0:0
09CE348	Mass Transfer In Air-Water Soil Interaction	4:0:0
09CE349	Coastal Pollution Monitoring and Management	4:0:0
09CE350	Unit Operations and Unit Processes Laboratory	0:0:2
09CE351	Construction Equipment	3:0:0
09CE352	Energy Conservation Techniques in Building Construction	3:0:0
09CE353	Building Bye laws	3:0:0
09CE354	Construction Personal Management	3:0:0
09CE355	Construction Planning, Scheduling and Control	3:0:0
09CE356	Estimating and Quantity Surveying	0:0:2
09CE357	Building Drawing	0:0:2
09CE358	Project Formulation and Appraisal	3:0:0
09CE359	Contract Laws and Regulations	3:0:0
09CE360	Building Materials and Construction Technology	3:0:0
09CE361	Fundamentals of Civil Engineering	3:0:0
09CE362	Quality Control Lab	0:0:2

09CE363	Computer Applications in Construction Engineering and Planning Lab	0:0:2
09CE364	Construction Project Management	3:0:0
09CE365	Project Safety Management	3:0:0
09CE351	Construction Equipment	3:0:0
09CE313	Advanced Concrete Technology Laboratory	0:0:2
09CE366	Advanced Building Drawing (Using Auto CADD & Archi CAD)	0:0:2
09CE367	Building Services	3:0:0
09CE368	Modern Construction Materials	3:0:0
09CE369	Behaviour, Analysis and Design of RCC Elements	3:1:0
09CE370	Global Positioning System	3:0:0
09CE371	Principles of Remote Sensing	3:0:0

09CE101 BASIC CIVIL ENGINEERING

Credits: 2:0:0

Objectives:

- To know about the history, scope, functions and components of buildings
- To get knowledge about surveying
- To know about importance of water supply and sanitation
- To know about the transportation systems
- To get exposed to airport, harbour and docks

UNIT I: Engineering Materials and Survey
Introduction: Engineering - Civil Engineering
Construction Materials: Characteristics of good building materials such as stones, bricks, timber, cement and concrete.

Surveying: Definition and purpose - classification - Basic principles - Calculation of area of a plot.

UNIT II: Components of Building and Valuation
Selection of site - Major components of buildings.
Foundations: Purpose of a foundation - Bearing capacity of soils - types of foundations.
Proper methods of construction of: Brick masonry - Stone masonry - Beams - Lintels - Columns - Flooring - Roofing.
Valuation of buildings: Definition - Purpose of valuation - Valuation of a building by plinth area method - Valuation of old buildings.

UNIT III: Water Supply and Sanitary Engineering
Water supply Engineering: Sources of water supply - Quantity of water requirements - Purification of water involving sedimentation, filtration and disinfections.
Sanitary Engineering: Definition of terms - Collection and disposal of solid wastes - Sewage systems - Septic tanks - oxidation ponds.

UNIT IV: Highways, Railways and Bridges
Transportation Engineering: Requirements of Highways - Cross sections of water bound macadam, bituminous and cement concrete roads.
Railways: Gauges - Components of a permanent way.
Bridges: Components of bridge-Types of Bridges.

UNIT V: Airports and Harbours
Functions and general layout of an airport
Functions and general Layout of a harbour
Dams: Purpose of Dams - Types of dams - Selection of site for a dam.

Text Book:

1. Johnson Victor, D and Esther Malini, 'Basic Civil Engineering', Allied Publishers Limited, Chennai, 2002.

Reference Books:

1. Arunachalam, N, 'Basic Civil Engineering', Pratheeba Publishers, Coimbatore, 2000.
2. Ramesh Babu, V 'Basic Civil Engineering', Anuradha Agencies, Kumbakonam, 2001.

09CE201 CIVIL ENGINEERING DRAWING

Credits: 0:0:2

Objectives:

- To introduce the fundamentals of Civil Engineering drawing
- To impart basic knowledge on Symbols, Traffic Signs, Electrical Circuits, Joinery, Plumbing items and Staircases
- To impart knowledge on drafting softwares such as AutoCAD.
- To impart knowledge on drawing of plan, section and elevation of buildings

Symbols and sign conventions related to Architecture – Traffic – Electrical Circuits - Plumbing & welding – Metric Brick – Bonds in Brick masonry, cross walls and corner walls.
Joinery in wood work – timber doors, windows and ventilators – panelled and glazed types. Planning and detailing of Stairs and Staircases.

Plan, Elevation, Section and Perspective Views of single storeyed residential and public buildings such as hospitals, restaurants and auditoriums - Use of AUTOCAD and CADPLUS 3D and other architectural software systems .

Text Book:

1. Balgopal,T.S., Prabhu,T.S., Building drawing and detailing, Spades Publishing KDFA building Calicut, 1987.

Reference Book :

1. AUTO CAD Tutorials and manual.- Autodesk work book on AUTO CAD Level I and II CAD/CAM centre, PSG College of Technology, Coimbatore

Note:

Autonomous Examination is for three hours duration and the students are required to answer one question out of two in Major part –A and two minor questions out of three in Minor Part – B

09CE202 MECHANICS OF FLUIDS

Credits: 3:1:0

Objectives:

- The purpose of this subject is to introduce the fundamental concepts of fluid statics, kinematics and dynamics
- To introduce the concepts of flow measurements, flow through pipes

- To introduce the concepts of dimensional analysis and model analysis

Unit I:
Introduction – Fluid Properties – Newton's law of Viscosity – Classification of Fluids
Fluid Statics
Pressure – Pascal's law – Atmospheric, Absolute, Gauge and Vacuum pressures – Pressure measurement – Forces on plane and curved surfaces-Total pressure and Centre of pressure – Buoyancy and Metacentric height (Theory only)

Unit II: Fluid Kinematics
Types of flow – Stream line – Path line – Streak line – Stream tube – Control volume – Continuity equation – one dimensional and three dimensional flow – velocity potential and stream function free – and forced vortex flow
Equations of Motion
Euler's equation in one dimensional form – Bernoulli's equation

Unit III: Flow Measurements
Venturimeter – Orifice meter – Pitot tube – Mouthpiece and Orifice – Weirs and Notches – Rectangle , Triangular, Broad crested, Narrow Crested
Laminar flow
Definition – Reynold's Experiment – Reynold's Number – Hagen Poiseuille equation for a circular pipe
Turbulent flow
Definition – Darcy Weisbach's equation – Moody's diagram – Friction factor for Laminar and Turbulent flow – for smooth and rough pipes

Unit IV : Flow through pipes
Loss of energy in pipes – Hydraulic Gradient, Energy Gradient – Major energy loss – Minor energy losses – Pipes in series and parallel –Equivalent pipe – Power transmission through pipes – Syphon – Water hammer (Definition)
Unit V : Dimensional Analysis and Similitude
Fundamental and secondary dimensions – Dimensional Homogeneity – Rayleigh and Buckingham Pi methods – Similitude – Significance of Dimensionless Numbers – Classification of hydraulic models – Scale effect

Text Books:
1. Modi, P.N. & Seth, S.M., "A Text book of Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi, 2007.
2. Rajput, R.K.," A Text book of Fluid Mechanics and Hydraulic Machines" , S.Chand and Co., New Delhi,1998.

Reference Books :
1. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 2005.
2. Som,S.R, & Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, 1998.

3. Agarwal, S.K., Fluid Mechanics and Machinery, Tata Mc Graw Hill Co., 1997.

09CE203 ENGINEERING GEOLOGY

Credits: 4:0:0

Objectives:

- The purpose of this course is to impart the basics and application of general geology, mineralogy, petrology and engineering geology

Unit I: General Geology

Geology in Civil Engineering – branches of geology – Earth structure and composition – elementary knowledge on continental drift and plate tectonics. Earth processes – weathering – work of rivers, wind and sea and their Engineering importance – Causes of Earthquake – Earthquake belts in India.
Groundwater – mode of occurrence – prospecting – importance in Civil Engineering

Unit II: Mineralogy

Elementary knowledge on symmetry elements of important crystallographic systems – physical properties of minerals – study of the following rock forming minerals – Quartz family, 8ehavior family, augite, hornblende, biotite, muscovite, calcite, garnet – Properties, 8ehavior and engineering significance of clay minerals – Fundamentals of the process of formation of ore minerals – coal and petroleum – their origin and occurrence in India.

Unit III: Petrology

Classification of rocks – Distinction between igneous, sedimentary and metamorphic rocks - Description, Occurrence, Engineering properties and distribution of following rocks – Igneous rocks – granite, syenite, diorite, gabbro, pegmatite and basalt – Sedimentary rocks – sandstone, limestone, shale, conglomerate and Breccia – Metamorphic rocks – quartzite, marble, slate, thyllite, gneiss and schist.

Unit IV: Structural Geology

Attitude of beds – outcrops – geological maps – study of structures – folds, faults and joints – their bearing on Engineering investigations –Land slides – causes and prevention. Sea erosion and coastal protection

Unit V: Geology of Dams and Tunnels

DAMS: Types of dams and bearing of Geology of site in their selection, Geological Considerations in the selection of a dam site. Analysis of dam failures of the past. Factor's Contributing to the success of a reservoir.
TUNNELS: Purpose, Effects of Tunneling on the ground Role of Geological Considerations (ie. Lithological, structural and ground water) in tunneling over break and lining in tunnels.

Text Books:

1. Parbin Singh, Engineering and general Geology, Katson publication House, 2007.

Reference Book:

1. Principles of Engineering Geology K.V.G.K. Gokhale . BS Publications , 2005
2. Fundamentals Of Engineering Geology, F G Bell 2005

09CE204 COMPUTER APPLICATION LABORATORY – I

Credits: 0:0:2

Objectives:

- To give hands on training on C-Programming language
- To develop programs for design of beams, steel members etc.
- To introduce the concepts of excel programming

Introduction:

Main frame – Mini and Micro computers – system configuration – Functions – Hardware, Software, Operating System Basics – File Processing Techniques – High level languages – packages.

Development and Implementation of Programs for the following in C Language:

1. Solution of simultaneous equations by Gauss – Jordan method.
2. Solution of non-linear equations using Newton-Raphson technique.
3. Drawing the S.F and B.M. diagrams for simply supported beams and cantilever beams subject to point, udl and uniformly varying loads
4. Analysis of plane, pinjointed frames.
5. Deflection of cantilever and simply supported beams.
6. Limit state Design of R. C. Rectangular and T – beams.
7. Design of tension and Compression Steel Members.
8. Expert Systems for Classification of soil.
9. Water surface profiles.
10. Determination of friction factor
11. Stability of slopes

Development and Implementation of Programmes for the following using Excel:

1. Design of R.C. Retaining Walls
2. Design Profile of masonry dams
3. Design of Two-way slab and flat slab.

Note: Examination is for four hours duration.

Text Book:

1. Balaguruswamy. E "Object – Oriented Programming in C", Tata Mc Graw Hill, 2008.

09CE205 MECHANICS OF DEFORMABLE BODIES – I

Credits: 3:1:0

Objectives:

- To explore the state of stress (two dimensional) and evaluate the principal stresses and principal planes by analytical and graphical methods
- To study the behavior of determinate beams
- To learn the theory of torsion and stresses developed in solid, hollow shafts and helical springs

Unit I: Stress, Strain and Deformation in Solids
Tension, compression and shear stresses – Hooke's law – Stress – Strain diagram for mild steel – Ultimate stress and working stress – Elastic constants and relationships between them –Material types-Homogeneous, isotropic, brittle elastic, strong and tough– Composite bars & Indeterminate systems– Thermal stresses – Strain energy due to axial load – Stress due to suddenly applied and impact load.

Unit-II: Combined Stresses
Two dimensional state of stress at a point – Normal and shear stresses on any plane-Principal planes and principal stresses- Graphical treatment- two dimensional state of strains at a point- Principal strains and their directions- Stresses and deformations in thin cylinders and spherical shells due to internal pressure.

Unit-III : Beams and Bending
Types of beams – Types of supports – Shear force and bending moment at any cross section of a beam- Sketching of shear force and bending moment diagrams for cantilever, simply supported and over hanging beams for any type of loading – Relationship between rate of loading, shear force and bending moment.

Unit – IV : Stresses in Beams
Theory of Simple Bending – Analysis of bending Stresses – Load Carrying capacity of beams – Proportioning sections – Flitched beams – Leaf springs – Strain energy due to bending moment – Shear stress distribution – Strain energy due to transverse shear force.

Unit-V : Torsional Stresses
Elastic theory of torsion – Stresses and deformation in solid circular and hollow shafts – Stepped shafts – Composite shaft – Stress due to combined bending and torsion – Strain energy due to torsion. -Deformations and stresses in helical springs – Design of buffer springs

Text Books:

1. Bansal R.K "Strength of Materials", Laxmi Publications, 2004

Reference Books:

1.Subramaniam.R.,"Strength of Materials", Oxford university Press, 2005
2.Prakash Rao.D " Strength of Materials", University Press, 2002

09CE206 MECHANICS OF DEFORMABLE BODIES II

Credits: 3:1:0

OBJECTIVES:

- The purpose of studying this subject is to understand the concepts of deflection, energy principles, stability criteria, theories of failure, unsymmetrical bending, behaviour of curved bars and shear centre

Unit I : Deflection of Determinate Beams
Governing differential equation- macaulay's method- moment area method- conjugate beam method- newmark's method.

Unit II : Columns and Struts
Columns- Behaviour of Axially Loaded Short, Medium and Long Column Members- Buckling Load- Euler's Theory- Different End Conditions- Empirical Formulae- Rankine's Formula- Straight Line Formula- Secant Formula for Columns subjected to eccentric loading.

Unit III : Thick Cylinders
Thick cylinders- lame's equation-hoop stress and radial stress distribution-compound cylinders-shrink fit. Theories of Elastic Failure- Maximum principal stress theory- Maximum shear stress theory- Maximum principal strain theory- strain energy theory- Mohr's theory- simple problems.

Unit IV : Shear Centre and Curved Beams
Shear Center-Introduction to non-circular sections-Shear center for thin walled beam of mono- symmetric open sections- Shear flow in thin walled beams of open sections. Curved Beams-Curved beams-Stresses due to bending by Wrinkler back theory- Rectangular, trapezoidal and circular solid section-Crane hook problem.

Unit V: Unsymmetrical Bending of Straight Beams
Symmetrical and Unsymmetrical Bending-Bending Stresses in Beams Subjected to Unsymmetrical Bending- Change in Direction of Neutral Axis and Increase in Stress Compared to Symmetrical Bending.

Text Books:

1. Bansal R.K "Strength of Materials", Laxmi Publications, 2004
2. Ramamurtham .S "Strength of Materials", Dhanpat Rai Publishing co, New Delhi, 2008.

Reference Books:

1. Jindal.U.C" Strength of Materials", Asian Books Pvt.Ltd, 2004

2. Hartog.J.P" Strength of Materials", Doverr Publications Ltd, 2001

09CE207 SURVEYING

Credit : 3:1:0

Objectives:

- To give an introduction about principle of surveying and levelling
- To give an introduction about tacheometric survey
- To give an introduction about Curves and curve setting
- To give an introduction about Control Surveying

Unit – I

Introduction to Surveying
Definition, Principle and Classification of surveying – field and office works.

Leveling and Applications:
Types of levels and staves – sensitivity of bubble – benchmarks – temporary and permanent adjustments – fly, check, profile and block leveling – booking – reduction – arithmetic checks – difficulties and errors in leveling - longitudinal and cross sectioning – plotting – Calculation of areas and volumes – contouring – methods – characteristics and uses – plotting – earthwork volume – capacity of reservoirs.

Unit II : Theodolite Surveying
Description and uses of vernier micrometer – microptic theodolites – temporary and permanent adjustments of vernier transit – measurement of horizontal and vertical angles – heights and distances – traversing – closing error and distribution – Gale's traverse table – omitted measurements

Unit III : Tacheometric surveying:
Principle of Stadia method – Distance and elevation formulae for staff held vertical – Instrumental constants – Anallactic lens – Tangential method – use of Subtense bar – tacheometric contouring

Unit IV : Curves
Route surveys for highways and railways – Curve ranging – Horizontal and vertical curves – Simple curves –Setting out by chain and tape methods – By instrumental methods – Transition Curves – Functions and requirements – Setting out by offsets and angles – Vertical curves – Sight distances

Unit V : Control surveying:
Working from whole to part – Horizontal and Vertical control - Triangulation figures – Classification of triangulation systems – selection of triangulation stations – Intervisibility and height of stations – station marks – signals and Towers – Measurement of angles – reduction to centre – Field work and correction to baseline measurements – trigonometric leveling – single

and reciprocal observations

Text Books:

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and Levelling, Vol. I & II, Pune Vidyarthi Griha Prakashan, Pune, 1968.
2. Punmia, B.C., Surveying Vol. I & II, Standard Publishers, 1994.

Reference Books:

1. S.K.Duggal, Textbook of Surveying –Vol I&II, Tata McGraw Hill & Co., New Delhi

09CE208 STRUCTURAL ANALYSIS –I

Credits: 3:1:0

Objectives:

- The purpose of this course is to introduce the fundamentals of energy and force methods for the analysis of structures
- To introduce the concepts of rolling loads and influence lines
- To introduce the fundamentals of analysis of arches, suspension bridges and space frames

Unit I: Fundamental Concepts in Structures
Definition and Determination of Static and Kinematic Indeterminacy – Beams, Trusses and Frames – Degree of Freedom – Equilibrium and Kinematic Stability – Principle of Superposition – Basic Methods of Structural Analysis
Energy Methods: Work – Energy principles – Principle of Stationary Potential Energy – Principle of Virtual Displacements – Complementary Energy – Principle of virtual Forces – Castigliano's First Theorem – Castigliano's Second Theorem – Betti Maxwell's law – Theorem of least work – Application to simple problems of Statically determinate beams, trusses and frames

Unit II: Moving Loads and Influence Lines
Effect of moving load – Description of Influence line – Influence line for Reaction, Shear Force and Bending Moment – Load position – Absolute maximum bending moment – Muller Breslau's Principle – Application to beams with one degree of indeterminacy

Unit III: Arches
Three hinged arch – Two hinged arch – parabolic and semi circular arches – Concentrated loads – Uniform loads – Temperature effects – Determination of Reaction, Normal Thrust, Radial shear and Bending Moment – Influence line for Stress Resultants in two hinged and three hinged arches – load position for maximum values.

Unit IV: Three Dimensional Frames (determinate)
Analysis of pin jointed Space frames – forces in various members – Analysis of Rigid jointed space frames – Determination of stress resultants – Application to Simple problems – Analysis of Suspension Bridges (determinate)

Unit-V: Force Method

Consistent Deformation Method – General Concept – Application to Truss subjected to Loads – Application of Clapeyron's Theorem of Three Moments to fixed and continuous beams – Temperature, Lack of fit, Settlement of Support – effects in structures.

Text Book:

1. Ramamurtham..S., "Theory of Structures", Dhanpat Rai Publishing Company Pvt limited, 2006

Reference books:

1. Sujit Kumar Roy and Subatra Chakrebarty., "Fundamentals of Structural Analysis" S.Chand & Co. Ltd., 2004

2. Vaidyanathan. R and Perumal. P, "Comprehensive Structural Analysis Vol. I & II", Laxmi Publications (P) Ltd., 2003

3. Kenneth M.Leet and Chia-Ming Uang., "Fundamentals of Structural Analysis" McGraw Hill Book Co., 2003.

09CE209 HIGHWAYS AND RAILWAYS ENGINEERING

Credits: 4:0:0

OBJECTIVES:

- To introduce the concepts of highway alignments, engineering survey for roads, geometric design of highways and pavement design
- To introduce the concepts of permanent way design
- To introduce the concepts of signals, interlocking, points and crossings

Unit – I: Highway Planning and Alignment

Role of transportation in National Development – Objectives and achievements of organizations such as IRC and CRRI - Factors controlling selection of Highway alignments
Modern methods of conducting Engineering surveys.-Rural & Urban Road classification in India.-Cross-sectional elements of road – Definition and Significance

Unit – II: Highway Geometric Design

Design of horizontal alignment

Sight distance – PIEV theory – Problems in S.S.D.-Super elevation – Theory & Problems - Highway widening on horizontal curves – Theory & Problems.-Transition curves - Theory & Problems.

Design of Vertical Alignment:

Terrain classification - Categories of Gradient – Grade compensation – Types of vertical curves - Theory and problems.

Unit – III: Pavement Design

Objects and requirements of pavements, types of pavement structure and functions of pavement components, factors to be considered in Design of pavements, Design of Flexible pavement using CBR method- (based on IRC: 37 – 2001), Design of Rigid pavement using Westergaard's modulus of subgrade Reaction and Westergaard's stress equation for wheel loads(Interior, Edge and Corner loading) - (Based on IRC: 58 – 2002), Comparison between Rigid & Flexible pavements.

Unit – IV: Railway Engineering Basics

Comparison of Highway & Railway transportation

Railway track (permanent way)

Cross-sections of railway tracks – Coning of wheels-Gauges: Classification, Selection & Uniformity -Rails: Functions, Types of rail sections, Length of rails, Rail Joints, Welding of rails & Creep of rails.-Sleepers: Functions, Requirements, Classification & Sleeper density.-Ballast: Functions, Requirements, Types & Quantity of ballast

Unit – V: Advanced Railway Engineering:

Factors in selection of Good Alignment – Gradients – Grade compensation – Speed of trains - Necessity of Points and Crossings – Turnouts. -Railway Stations: Requirements, Classifications.-Station Yards: Types - Signalling: Objects, Engineering principles and Types.- Control Systems: Control of train movement – Track Circuiting - Interlocking of signals and points: Necessity and Methods.

Text Books:

1. Khanna, S.K., and Justo C.E.G., Highway Engineering, Nem Chand and Bros. 2005.
2. S.C.Saxena & S.P.Arora, A Text book of Railway Engineering, Dhanpat Rai Publishers 2001

Reference Books:

1. Vazirani and Chandola, S.P., Transportation Engineering Vol. 1 Khanna Publishers, 2005.
2. K.P.Subramaniam, Transportation Engineering – I, SCITECH Publishers 2003

09CE210 REINFORCED CONCRETE STRUCTURES – I

Credits: 3:1:0

OBJECTIVES:

- The purpose of this study is to impart comprehensive knowledge on the design of reinforced concrete structural elements such as beams, columns, slabs and footings
- To bring about an understanding of the behaviour of reinforced concrete and the design philosophies

Unit–I: Introduction to WSD, ULM and LSD

Introduction of RCC structures – Grades of concrete and characteristic strength – permissible stresses in concrete – steel reinforcements and their characteristics. Modular ratio, Neutral Axis, under, over reinforced & Balanced section, Flexure, Shear, Torsion, Bond & development length Design concept WSD, ULM & LSD- - Actual and idealized stress – strain diagrams of concrete and steel, LSD Rectangular beam, Flanged beams.

Unit–II: Lintel, Slabs and Beams
LSD – Lintel beam – one way slab – sunshade - Continuous beams and slabs - Two way slab - for Flexure, Shear, Torsion & Anchorage

Unit–III: Columns
LSD –Short, Long Axially and eccentrically loaded columns, Isolated and combined rectangular footings for two columns.

Unit–IV: T & L Beams
WSD – Rectangular, T & L beams for flexure and shear.

Unit–V: Working Stress Design of Slabs and Columns
WSD – One-way slab – Two-way slab-Circular slab- Short, Long axially and eccentrically loaded columns

Text Books:

1. Punmia.B.C., Ashok kumar Jain and Arun Kumar Jain , "R.C.C. Design {Reinforced Concrete Structures}", Laxmi Publications (P) Ltd., 2006
2. Varghese P.C., 'Limit State Design of Reinforced Concrete', Prentice of India, New Delhi, 1999

Reference Books:

1. Unnikrishna pillai and Devadass Menon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Co ltd, 2008.
2. Sinha, N.C and Roy, S.K., "Fundamentals of Reinforced concrete", S.Chand & Company (Pvt.) Ltd. New Delhi, 2001.

09CE211 THEORIES AND PRACTICES OF WATER AND WASTEWATER ENGINEERING

Credits: 3:0:0

Objectives:

- To know the basics, importance, and methods of water supply and wastewater
- To study the various sources and properties of water
- To understand the various methods of conveyance of water and waste water
- To know the basics of sewage, types of sewers and sewer material
- To learn the features of various sewer appurtenances

Unit- I: Quantity and Quality of water

Objectives of water supply systems - quantity of water - estimating requirements - Design period - per capita consumption - fluctuations in demand pattern – factors affecting per capita demand - population forecasting methods. Sources of water - surface and ground water sources -properties of water - physical, chemical and biological aspects - analysis of water - water quality standards

Unit – II: Quantity and Quality of waste water

Definition & Classification of waste water - Quantity of Sanitary Sewage and Storm Water – Estimation of peak runoff using rational and other empirical formulas –Fluctuations in Flow Pattern – Physio-chemical and Biological Characteristics and analysis - Assessment of Organic Solids by BOD, COD, TOC, ThOD, & TOD

Unit III: Water conveyance system

Hydraulics and Design of Pressure Pipes – Analytical Methods and Nomograms – flow in pipes - Series and Parallel Pipes - Different Materials of Pipes - Jointing and Testing of Commonly used Pipes – Appurtenances of Pipes – Pumps and their selection

Unit IV: Water distribution

Methods of distributing water – Layouts of distribution networks -storage and distribution reservoirs - analysis of distribution system Hardy-cross method of balancing - equivalent pipes - House Connections

Unit V: Wastewater Conveyance and Sewerage system

Methods of collection - conservancy system, water carriage system - types of sewers - Analysis and Design of Sewers under Different Flow Situations - Sewer Sections – Materials for Sewers – Laying, Jointing, and Testing of Sewers – Appurtenances and Maintenance - Pumping of Sewage and Pumping Stations. House Drainage Works - Sanitary Fittings – One Pipe and Two Pipe Systems - General Layout of House Drainage Works – Street Connections.

Text Books:

1. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi, 1994.
2. Punmia B.C., "Environmental Engineering Vol. I & II", Lakshmi Publications (P) Ltd., New Delhi, 2002.

References:

1. Peavy H.S, Rowe D.R. and Tchobanoglous G ,"Environmental Engineering" Tata McGraw Hills, New Delhi, 1985
2. Metcalf & Eddy, M.C., "Wastewater Engineering – Treatment & Reuse", Tata McGraw Hill Publications, New Delhi, 2003

09CE212 GEOTECHNICAL ENGINEERING

Credits: 3:1:0

Objectives:

- The purpose of this course is aimed to develop analytical skills in dealing with soil as a medium of water flow, a medium for structural support and a primary building material.
- Provide the description and classification of soil and analysis of stresses in soils under different loading conditions
- To develop an understanding of the principles of effective stress in saturated soils, and its application to one dimensional compression and consolidation
- Familiarize the students an understanding of permeability and seepage of soils

Unit I:Introduction
Geotechnical engineering: Scope – Historical landmarks – Soil formation – Clay mineralogy – Surface activity – Volume-weight relationships – Tests for specific gravity and water content.

Unit II:Index Properties and Soil Classification
Grain size distribution – Sieve analysis and Hydrometer analysis – Consistency limits and their determination – Soil classification systems – Triangular chart – Plasticity chart.

Unit III:Permeability, Effective Stress and Seepage
Darcy's law – Hydraulic gradient - Coefficient of permeability – Constant and variable head permeability tests.
Intergranular and pore water pressures – Critical hydraulic gradient – Quick sand.
Seepage – Flow nets – Equipotential and flow lines – Uplift pressures – Seepage forces – Piping – Protective filters – Pumping test.

Unit IV:Consolidation and Settlement
Spring analogy for consolidation – Terzaghi's theory of one-dimensional consolidation – Degree of consolidation and Time factor – Consolidation test – Coefficient of consolidation – Compression index – Consolidation settlement

Unit V:Shear Strength and Stability of Slopes
Cohesion and Internal Friction – Mohr's Circle – Mohr-Coulomb theory – Shear strength and effective stress – Shear strength and drainage – Shear strength tests – Direct shear test – Triaxial compression test – Unconfined compression test – Vane shear test – Shear strength of sand – Critical void ratio – Shear strength of clays.
Infinite and finite slopes – Stability analysis – Total and effective stress analysis – Method of slices – Bishop's method – Friction circle method – Taylor's method.

Text books:
1.Gulhati, S.K. and Dutta, M. (2005), Geotechnical Engineering, Tata McGraw-Hill, New Delhi

Reference books:

1.Venkataramaiah, C. (2005), Geotechnical Engineering (3rd edn.), New Age International (P) Ltd., New Delhi

09CE213 DESIGN OF MASONRY AND TIMBER STRUCTURES

Credits: 3:1:0

Objectives:

- To introduce the concepts of design principles
- To introduce the concepts of structural design of masonry and timber structures

Unit I: Structure and Design concepts
Classification of structures-function, material and shape – different structural systems – requirements of structures – stability, strength and stiffness – design methods- working stress method – limit state method of Design – Probablistic approach to design – load and resistance – codes of practice – choice between different structural materials – concrete, timber, masonry and steel.
Structural loads: Dead load – live load – wind load – calculation of wind load for a structure – seismic load – buoyancy and thermal loads.

Unit II: Design of Masonry column and walls:
Brick works – Classification of masonry walls - Axially loaded square and rectangular columns with uni-axial eccentricity – solid walls – load bearing walls – axially loaded – eccentrically loaded walls with openings – Non load bearing walls.

Unit III: Laterally loaded masonry structures:
Structures and loads – stability of masonry – middle third rule – masonry dams – Trapezoidal dams – retaining walls
Load distribution Elements: Bed blocks – spread footings for wall and column – area based on safe bearing capacity.

Unit IV: Earthquake resistant design of Masonry structures
General planning and design – recommendation for masonry wall – behaviour of unreinforced masonry and reinforced masonry walls – limit state design of reinforced brick masonry – lintel band – Free standing walls – Design of shear wall.

Unit V: Timber: Flexural and Compression members
Factors affecting the strength – permissible stresses – Design for bending, shear and bearing – Flitched beams – solid and built up columns – combined bending and direct stress – wood wall construction

Text Books:

1. Anand. S. Arya, "Masonry and Timber Structures including Earthquake Resistant Design", Nemchand & Bros.,Roorkee.(U.P).2006
2. Dayaratnam, P., "Brick and Reinforced Brick Structures", Oxford & IBH Publishing House, 1997

Reference Books:

1. S. Unnikrishna Pillai & Devadass Menon "Reinforced concrete Design", Tata McGraw – Hill Publishing Co., Ltd., Delhi (2007)
2. S.K.Duggal, "Earthquake resistant design of structures", Oxford University press, Delhi (2007)

09CE214 ESTIMATING, COSTING AND SPECIFICATIONS

Credits: 0:0:2

Objectives:

- The purpose of this course is to impart the techniques of estimation of buildings, roads, and irrigation structures.
- To introduce the concepts of rate analysis and tendering
- To inculcate the concepts of valuation and their application to building

Unit I: Procedure of Estimating Quantities

Introduction – Main items of work – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C., Doors, Windows, Flooring, White Washing, colour washing, Distembering and their Units.

Unit II: Rate Analysis

Factors affecting rates – importance – Materials for different items of work – Rates of materials and labour – analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works.

Unit III: Cost Estimate of Buildings

Approximate methods – Plinth area estimate – Cubical Contents estimate.Detailed estimate – Estimation of the cost of single storeyed buildings by individual wall method and centre line method Estimation of Roofs – R.C.C. slab roof, GI sheet roof, Tiled Roof, Roof Truss.Estimation of R.C.C.works – Beam, T-beam and Slab, Column, Foundation, Stair case, Retaining wall etc.

Unit IV: Cost Estimate of Other Structures

Estimation of roads – Earth work, Pitching of Slopes, Hill roads Estimation of R.C.C. slab culvert, Pier, Pipe culvert, R.C.C. T-beam bridge. Estimation of Irrigation works like Canals, Aqueducts, Syphon, etc. Estimation of Water supply and sanitary works like septic tank, Soak pit, Manhole, sewer line, etc.

Unit V: Specifications and Valuation

Specifications – Objectives – types of specifications – principles of specification writing – typical specifications. Valuation – Market value – Book value – Scrap value – Salvage value – annuity – Capitalized values – sinking fund – depreciation – Valuation of a building – Rent fixation – Mortgage – Lease.

Text Books:

1. Dutta.B.N "Estimating and Costing", Ubs Publications,2005.

2. Rangawala..S.C., "Estimating and Costing", Charotar Anand,2002.

Reference Books:

1.Kohli, D.D.and Kohli R.C., "A Text book on Estimating, Costing and Accounts", S.Chand and Co., New Delhi, 2003.

09CE215 CONSTRUCTION MANAGEMENT

Credits: 4:0:0

Objectives:

- To introduce the concepts of management, resources and construction planning
- To introduce the labour laws, principle of accounting
- To introduce fundamentals concepts of computer applications in construction management

Unit I: Principles of Management

Definition - Importance - Functions of management - relevance to Govt., Quasi Govt. Departments - Private contractors, and contracting firms – Organisation - Basic Economic concepts - Economic decisions, fixed, variable costs -Break Even Analysis and Chart pricing policies - Methods of evaluating capital expenditure - probabilistic estimates.

Unit II: Civil Engineering Management

Construction Planning:

Collection of field data - preliminary estimates - approval and sanction of estimates - Budget provision - Construction stages - Scheduling methods - progress reports and charts

Resource Planning:

Planning for materials, machines, men and organisation - resource allocation

Labour And Labour Welfare:

Relationship between management and labour – Labour problems - labour legislation - minimum wages act - settlement of disputes - industrial psychology.

Unit III: Management Methods

Concepts of network - network planning method - CPM/PERT - management by network analysis and control - principles of cost control - control by graphical representation, by bill of quantities and by network analysis.

Unit IV: Execution of Work

Departmental Works:
Procedure - departmental labour - quality control, inspection and duties of personnel - safety requirements

Contractors:
Contract system - types of contracts - specifications, documents, procedures, condition, taxes, law of constructions, Legal implications and penalities.
Tender and Tender Documents:
Definition - calling of tenders - tender documents - submission of tenders - processing of tenders - negotiations and settlement of contracts.

Unit V Accounts and Stores:

Measurements of work - recording - checking - types of bills - mode of payment - budget estimate - revised estimates - completion reports and certificates - claims and transfer classifications of transactions - ledger accounts - Imprest Account - Cash book.
Suspense classification - stores - maintenance and inspection- inventories – Accounting of surplus and of shortage of stores - procedures adopted in P.W.D. and C.P.W.D.
Introduction to Computer Application in Construction Management
Planning – Scheduling and Resource Analysis - Recording and Operations – Project Accounting, Costing and Finance.

Text Books:

1. Seetharaman,S., Construction Engineering and Management, Umesh Publications, 2007.
2. Sengupta,B., and Guha,H., Construction Management and Planning, Tata McGraw-Hill Book cc, 2000.

Reference Books:

1. Rana,V.K., Construction Management Practice, Tata McGraw-Hill publishing CO,2000
2. Chitkara,K.K., Construction Project Management, Tata McGraw-Hill publishing COM,2000.

09CE216 APPLIED HYDRAULICS AND FLUID MACHINES

Credits: 3:1:0

Objectives:

- The purpose of this course is to learn the fundamentals of Uniform and Non-Uniform flow in open channels
- To introduce the concepts of boundary layer theory and flow around submerged objects
- To introduce the concepts of momentum principles
- To impart the knowledge on pumps and turbines

Unit I : Uniform Flow In Open Channels

Types of Flow - Uniform flow – Chezy's and Manning's equations – Hydraulically best sections – Uniform flow Computations.

Varied Flow in Open Channels

Specific energy – critical flow – Mild and steep slopes – critical depth – Hydraulic jump – Gradually varied flow – Energy Equations and Solutions – Back water and drawdown curves – Study of flow profiles.

Unit II: Boundary Layer and Flow around Submerged Bodies

Definition – Displacement, momentum, Energy thickness - Boundary layer equations – Boundary Layer Separation – Laminar and Turbulent boundary layers – Forces on submerged bodies – Expression for drag and lift-Pressure drag – Friction drag – Stream lined and bluff bodies.

Unit III: Momentum Principle

Impulse momentum equation – Application of Linear momentum principle – Impact of Jet - Force exerted by a jet on normal, Inclined and curved surfaces for stationary and moving cases only

Unit IV: Water Turbines

Classification – Working principles and Design of Pelton wheel, Francis and Kaplan Turbine – Velocity Triangles - head and efficiency – Draft tube - Theory and types – Similarity laws – specific speed – Operating characteristics – Governing of Turbines – Selection of Turbines

Unit V: Pumps

Classification – Centrifugal pump – Components and working – Velocity triangles – priming – Head Losses and Efficiencies - Minimum starting speed – performance curves – specific speed – Cavitation – selection of pumps.

Positive Displacement Pump

Reciprocating pump – types – Components and working – slip – Indicator diagram – Air vessel.
Miscellaneous Pumps (Operating Principles Only)
Multistage pumps – submersible pumps –Jet pumps – Hydraulic ram.

Text Books:

1.Modi, P.N. & Seth, S.M., "A Text book of Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi, 2007.
2.Rajput, R.K.," A Text book of Fluid Mechanics and Hydraulic Machines" , S.Chand and Co., New Delhi,1998.

Reference Books :

1.Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 2005.

2.Som,S.R, & Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, 1998.
3.Agarwal, S.K., Fluid Mechanics and Machinery, Tata Mc Graw Hill Co., 1997.

09CE217 REINFORCED CONCRETE STRUCTURES – II

Credits: 3:1:0

OBJECTIVES:

- The purpose of this study is to impart comprehensive knowledge on the design of staircases, retaining walls and water tanks
- To impart the knowledge on the design of slab bridge and T beam bridges for IRC loadings
- To impart the knowledge on the methods of analysis and design of multistoreyed frames
- To give an exposure to yield line theory and

Unit I:Staircases and Retaining Walls
Types of stair cases, Design of Dog Legged, Quarter & Half turn stair cases – Soil earth pressure - Types of retaining wall, Design of cantilever and counter-fort retaining walls

Unit II:Water Tanks
Design of circular and rectangular underground water tanks - Design of circular and rectangular tanks resting on ground - INTZ tank (Concept only) - Design of staging and foundations

Unit III: Bridges
Design of Slab Bridge and T-beam & Slab Bridge for IRC loadings Class AA & Class A - Load distribution in interconnected girders by Courbon's method

Unit IV: Design of R.C Frames
Design of multibay, multistoreyed R.C.frames - substitute frames - preliminary design of members - Analysis for wind loads by the portal method and Cantilever method. Earthquake resistant Design Philosophy: Ductility, IS code1893-2002 provisions for earth quake effects

Unit V: Yield Line Theory
Assumptions - Guidelines for locating yield line patterns - virtual work and equilibrium methods of analysis - Application to square, rectangular, triangular and circular slabs – Introduction to Strip method of analysis

Text Books:

1. Krishnaraju,N., Design of R.C.Structures, CBS Publishers and Distributors, Delhi 2003.
2. Punmia.B.C., Ashok kumar Jain and Arun Kumar Jain , R.C.C. Design {Reinforced Concrete Structures}, Laxmi Publications (P) Ltd., 2006.

Reference Books:

1. Krishnaraju.N, "Design of Bridges", Oxford & IBH publishing Co. Ltd., 1988.
2. Punmia.B.C., Ashok kumar Jain and Arun Kumar Jain , "Limit State. Design of Reinforced Concrete", Laxmi Publications (P) Ltd., 2008

09CE218 STRUCTURAL ANALYSIS-II

Credits: 3:1:0

OBJECTIVES:

- The purpose of this course is to introduce the concepts of slope deflection method, moment distribution methods, Flexibility and Stiffness methods of analysis
- To introduce the fundamentals of Structural Dynamics

Unit I: Slope Deflection Method
Displacement method concept -Slope deflection equations -Fixed End moments -Applications to Statically indeterminate beams and frames-Effect of temperature, settlement-Deformed shape, Bending Moment and Shear Force Diagrams and axial force diagrams.

Unit II: Moment Distribution Method
Basic concepts- Stiffness factor, distribution factor and carry over factors-Single span beams with different support conditions - Fixed End Moments - Moment Distribution in Continuous beams - Portal frames with and without side sway - Deflected shape, bending moments, shear force and Thrust diagrams.- Symmetric Structure subjected to Symmetric and Anti-symmetric Loading.

Unit III: Characteristics of Flexibility and Stiffness Method
Definition- Application of Principle of Superposition-Properties -Application to Two Degree of Freedom Systems-Structure and Element Coordinates - Transformation of force and displacement - Structure Flexibility in terms of element flexibility-Structure stiffness in terms of element Stiffness.

Flexibility Method
Forces not acting at co-ordinates - Formulation of Structure Flexibility matrix - Determination of Displacements and Bending Moments - Application to determinate and indeterminate trusses beams and frames - Effect of Temperature, Lack of Fit

Unit IV: Stiffness Method
Forces not acting at co-ordinates - Formulation of Structure Stiffness matrix - Determination of Displacements - Application to determinate and indeterminate trusses beams frames - effect of Temperature, Lack of fit - Static Condensation Technique - Use of analysis software for application to analysis of Plane trusses and frames

Unit V: Introduction to Structural Dynamics
Free Vibration damped - undamped vibrations for Single degree of freedom system - Forced vibration - displacement and force isolation.

Text Books:

1. V.K. Manickaselvam, “Elements of matrix and stability analysis of structures methods of Structural Analysis”, Khanna Publishers, Delhi -06, 5th Edition -2001

2. Reddy C S, Basic Structural Analysis, Tata McGraw Hill Publishing Co., 1996.

Reference Books:

1. Dr.Vaidhyanathan & Dr.P.Perumal , “Comprehensive structural Analysis Vol I & II” Lakshmi Publications, Delhi 110 002

2. Dr.A.S.Meghre, S.K.Deshmukh “Matrix methods of Structural Analysis” Chortar Publishers, Anand (2003)

3. G.S. Pandit, S.P. Gupta, “Structural Analysis”, Tata McGraw-Hill Publishing Company Limited, New Delhi (2002)

4. Rajasekaran, S., and Sankarasubramanian, G., “Computational Structural Mechanics”, Prentice Hall of India, 2000.

09CE219 DESIGN OF STEEL STRUCTURES
(Limit state method)

Credits: 3:1:0
Objectives:

- The purpose of this course is to impart knowledge for the design of bolted and welded joints
- To impart the knowledge in the design of tension, compression members, beams, roof trusses, beam columns and beam-columns connections as per IS 800-2007

Unit I:Introduction & Design of bolts and welds
Design Loads and Load Combinations, Working Stress Design, Plastic Design, LRFD Methods, Introduction to Steel and Steel Structures, Design of structural fasteners: bolts and welds

Unit II:Limit state design of tension and compression members
Design of tension members – Net Sectional Area: Plates and Angles – permissible stresses – tension splices – lug angle - Design of compression members – Design of laced and battened compression members

Unit III:Limit state design of beams
Design of flexure members: Beams rolled sections, built-up sections, Design of eccentric connections: bolted and welded.

Unit IV:Limit state design of plate girders & beam columns
Design of welded Plate Girders, Design of beam columns and column bases,

Unit V :Design of roofs

Design of steel roofs – Dead Load – Live load - Wind Load – Design of purlin – Types of roof trusses - Analysis and design of Trusses

Text Book:

1. Design of Steel Structures - N. Subramanian, Oxford University Press, USA, 2008

Reference Books:

1. Dayaratnam, P., "Design of Steel Structures", A.H.Wheeler & Co. Ltd., Allahabad, 2008
2. Arya and Ajmani, "Design of Steel Structures", NemChand Brothers, Roorkee, 2007
3. Punmia B.C., Ashok kumar Jain and Arun kumar Jain, `Design of Steel Structures', Arihant Publications, Bombay, 2008
4. Gray, C. S. Kent L.E Mitchell, W.A., and Godfey, W.B., "Steel Designer's manual", English Language Book Society and Granade Publishing, London, 2003
5. Teaching Resource Materials on Steel – SERC, INSDAG, Anna University and IIT Madras, 2000

09CE220 DESIGN AND DRAWING
(Irrigation and Environmental Engineering)

Credits: 0:0:2 **Marks 50+50**

Objectives:

- The purpose of this course is to impart the knowledge about the design of irrigation and environmental engineering structures
- To get hand-on experience in drawing of irrigation and environmental engineering structures

PART: A

Design of the following irrigation works are to be worked out and detailed drawings are to be drawn:

1. Tank sluice - wing type
2. Tank surplus weir.
3. Canal Regulator (Head regulator)
4. Canal drop.
5. Syphon aqueducts

PART: B

Design of the following Environmental Engineering works are to be worked out and detailed drawings are to be drawn.

1. Flash mixer, flocculation and sedimentation tanks.
2. Slow sand filter
3. Rapid sand filter
4. Septic tank with dispersion trenches
5. Imhoff tank.
6. Trickling filter

Additional drawings to be made without design (only for internal evaluation)

1. General layout of water supply scheme.

2. Service and clear water reservoirs.
3. General layout for drainage scheme.
4. Manholes, pumping station
5. Earthen Dams - Sections of different types of earth dams, plan showing drainage systems.

09CE221 FOUNDATION ENGINEERING

Credits: 3:1:0 **Marks 50+50**
Objectives:

- The purpose of this study is to develop an understanding of the behaviour of foundations for engineering structures and to gain knowledge of the design methods that can be applied to practical problems
- To Provide the students with a basic understanding of the essential steps involved in a geotechnical site investigation
- Introduce to the students, the principle types of foundations and the factors governing the choice of the most suitable type of foundation for a given solution
- Familiarize the student with the procedures used for: a) bearing capacity estimation, b) end bearing capacity, c) skin friction

Unit I:Stress Distribution in Soils and Bearing Capacity
Soil elasticity – Homogeneity and Isotropy – Semi-infinite mass – Stress distribution by dispersion – Boussinesq’s theory – Newmark’s influence chart – Westergaard’s theory – Bulb of pressure – Elastic settlement
Plate bearing test – Codal values for presumptive safe bearing pressures – Prandtl’s theory – Terzaghi’s theory – Terzaghi’s bearing capacity factors – Brinch Hansen’s shape, depth and inclination factors – Meyerhof’s theory – Effect of water table on bearing capacity – Settlement and differential settlement.

Unit II:Subsoil Exploration and Sampling, Field Tests
Trenches – Auger boring – Helical and Posthole augers – Wash boring – Percussion drilling – Rotary drilling – Sampling methods – Sample disturbances – Geophysical methods – Static and Dynamic cone penetration tests – Standard penetration test.

Unit III :Foundation Classification, Shallow Foundations, Deep Foundations
Types of foundations and their classifications – Choice of foundation – Net load – Geotechnical design – Footings, Combined footings and Rafts – Compensated rafts – Classification of piles based on different criteria – Mechanics of load transfer through piles – negative skin friction – Underreamed piles – Pile load tests – Construction of piles – Piers – Caissons – Types and construction.

Unit IV:Earth Pressures and Retaining Structures

Active, Passive and At-rest pressures – Rankine's theory of earth pressure – Coulomb's theory of earth pressure – Graphical methods by Rebhan/Poncelet and Culmann – Influence of surcharges – Earth pressure under submergence – Layered backfills
Gravity retaining structures – Masonry and RC cantilever retaining walls – Stability analysis – Drainage provisions – Sheet pile walls.

Unit V:Compaction and Soil Stabilization
Wet and Dry densities – Proctor compaction test – Optimum moisture content and Maximum dry density – Field compaction tests – Core-cutter method - Sand replacement method – Proctor needle.
Field compaction of soils by rollers – Mechanical stabilization – Lime and Cement stabilization.

Text books:
1. Gulhati, S.K. and Datta, M. (2005), Geotechnical Engineering, Tata McGraw-Hill, New Delhi
2. Kurian, N.P. (2005), Design of Foundation Systems – Principles and Practices, (3rd rev.and enl. edn.), Narosa Publishing House, New Delhi

Reference book
1.Venkataramaiah, C. (2005), Geotechnical Engineering (3rd edn), New Age International (P) Ltd., New Delhi

09CE222 DESIGN AND DRAWING (R.C.C AND STEEL)

Credits: 0:0:2

Objectives:

- The purpose of this study is to impart the knowledge about the design of reinforced and steel structures
- To give hands-on experience in detailing of structures

PART-A

Detailed design and drawing of the following reinforced concrete structures.
1. Building floors consisting of slabs and beams.
2. Cantilever and counterfort retaining walls.
3. Circular and rectangular water tanks resting on the ground.
4. Circular and rectangular overhead water tanks.
5. Slab bridge.

PART-B

Detailed design and drawing of the following steel structures
1. Columns, base plates and their foundations
2. Plate Girder (welded)
3. Gantry Girder
4. Simple roof trusses
5. Rectangular and circular overhead water tanks

Text Book:
1.Krishna Raju.N.,"Structural Design & Drawing (R.C.C & Steel)",Universities Press , Second Edition,2004

Reference Book:
1.Krishnamoorthy.," Structural Design & Drawing",Cbs Publishers & Distributeres,2006
Note :
1. Autonomous examination will be of four hours duration.

Note:
There will be two questions in part-A and two in Part-B out of which the students shall answer one in each.

09CE223 COMPUTER APPLICATION LABORATORY – II

Credits: 0:0:2

Objectives:

- To introduce the basics of STAAD Pro Software
- To make the students to analyze and design various structural elements using STAAD Pro
- To introduce the basics of ANSYS Software

1. Analysis of 2D Truss using STAAD Pro
2. Analysis of 2D and 3D Rigid Frames using STAAD Pro
3. Analysis of 3D pin jointed frames using ANSYS
4. Analysis of suspension cables using ANSYS
5. Design of Footings and Retaining Walls using STAAD Pro
6. Structural Design of the following, using STAAD Pro and detailing of the same using AUTO CAD
   a. R.C. Beams
   b. R.C. Slabs
   c. R.C. Columns and Footings
   d. Steel beams
   e. Steel columns
7. Design of circular water tanks using STAAD Pro
8. Deflection and Stresses in beams using FEAST
9. Building Drawing, including perspective view using Floor Plan 3D
10. Concrete mix design and mathematical calculations using MATHCAD
11. Application to Transportation Engineering, Environmental Engineering, Estimation and Costing, Management, Science, etc.

Note:
Examination will be of four hours duration and students will be examined in modeling and the application of general purpose packages.

09CE224 STRENGTH OF MATERIALS LABORATORY

Credits: 0:0:2

Objectives:

- To give hands on training on testing of materials

1. Tension test on mild steel
2. Double shear test on mild steel
3. Torsion test on a rod
4. Torsion test on thin wire
5. Brinell, Rockwell and Vicker's Hardness tests
6. Charpy and Izod Impact tests
7. Cold bend test
8. Ductility test
9. Tension, compression (Parallel as well as perpendicular to the grains) and impact tests on timber specimens
10. Test on springs (Both closed coil and open coiled springs)
11. Deflection tests on timber and steel beams.
12. Studies on Fatigue test

(Note: All the above tests shall be carried out based on all the relevant I.S Codes.)

Text Book:

1.Ramamurtham .S "Strength of Materials", Dhanpat Rai Publishing co, New Delhi, 2008.

09CE225 SURVEYING PRACTICAL

Credits: 0:0:2

Objectives:

- To give hands on Chain survey, Compass, Plane Tabling and Levelling
- To know the usage of theodolites and tacheometers
- To introduce the Concepts of Curves and Contouring

1. Observations and plotting the salient features in an area by chain survey.
2. Measurement of bearing of survey lines by prismatic compass.
3. Running a closed compass traverse – plotting and adjustments.
4. Plotting the salient features in an area by plane table survey.

5. Two point problem
6. Three point problem
7. Fly levelling
8. Measurement of horizontal angles using a theodolite by the method of repetition
9. Measurement of horizontal angle using a theodolite by the method of reiteration.
10. Solution to problems on heights and distances by observations using a theodolite.
11. Stadia Tacheometry
12. Tangential tacheometry
13. Subtense bar method
14. Tacheometric contouring (Radial)
15. Setting out a simple circular curve by ordinates from long chord
16. Setting out a circular curve by Rankine's method of tangential angles.
17. Setting out transition curves.
18. Setting out works – Foundation marking.

Text Books:

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and Levelling, Vol.II, Pune Vidyarthi Griha Prakashan, Pune, 2004.
2. Punmia, B.C., Advanced Surveying , Standard Publishers, 2005.
3. Punmia, B.C., Vols. I & II , Standard Publishers, 2008

09CE226 FLUID MECHANICS AND MACHINERY LABORATORY

Credits: 0:0:2

Objectives:

- To give hands on training on Flow measurement, Losses due to friction and pipe fittings
- To give hands on training on working of different types of Pumps and Turbines.

Fluid Mechanics

1. Determination of Darcy's Friction Factor.
2. Calibration of Flow Meters.
3. Flow over Notches.
4. Flow through Mouth orifice.
5. Determination of Minor Losses in pipes
6. Impact of jet on vanes.
7. Reynolds' Experiment.

Fluid Machinery

1. Performance of Centrifugal Pump.
2. Performance of Submersible Pump.
3. Performance of Reciprocating pump.
4. Performance of Gear Oil pump

5. Performance of Jet pump
6. Performance of Vertical Turbine pump.
7. Load Test on Pelton Wheel.
8. Load Test on Francis Turbine
9. Load Test on Kaplan Turbine
10. Performance test on Turgo Turbine

Examination should be conducted to cover both Fluid Mechanics and Fluid Machinery experiments.

Text Books :

1. Modi,P.N and Seth, S.M., Fluid Mechanics & Fluid Machines, Standard Book House, New Delhi,2007.
2. Rajput, R.K.," A Text book of Fluid Mechanics and Hydraulic Machines" , S.Chand and Co., New Delhi,1998.

09CE227 SOIL MECHANICS LABORATORY

Credits: 0:0:2

Objectives:

- To give hands on training on determination of Soil properties
- To give hands on training on field tests.

1. Moisture content determination (Oven, Infrared Moisture meter)
2. Specific gravity and relative density test for sand (Pycnometer, relative density test apparatus)
3. Sieve analysis for coarse grained soil (Set of Sieves)
4. Hydrometer analysis for fine grained soil (Hydrometer)
5. Consistency limits and Indices (Liquid Limit, Plastic Limit, Shrinkage limit apparatus)
6. Standard Proctor's compaction test. (Compaction Test Apparatus)
7. Field Density test (sand replacement test apparatus and core cutter)
8. Permeability tests – Constant head and variable Head (Permeameter)
9. Unconfined compression test for Cohesive Soil. (Load frame, Samplers)
10. Vane Shear test
11. Direct Shear test (Direct Shear Test apparatus)
12. Triaxial Compression Test (Triaxial test apparatus)
13. Consolidation Test (Consolidometer)
14. California Bearing Ratio Test

Text Books:

1. Punmia, B.C., Soil Mechanics and Foundations, Punmia B.C., and Suara & Co., Madras 2005

09CE228 CONCRETE & HIGHWAYS LABORATORY

Credits: 0:0:2

Objectives:

- To give hands on training on testing of cement and aggregates
- To give hands on training on testing of concrete
- To impart knowledge on mix design of procedures
- To impart knowledge on testing of highways materials

(a) **Concrete Lab**:

Tests On Cement : Specific gravity, Fineness, specific surface, soundness, consistency, initial and final setting time, compressive strength of cement mortar.

Tests On Fine Aggregate : Tests to find alkalinity, organic content, etc. - particle size distribution and fineness modulus - specific gravity and voids ratio - Bulking of sand.

Tests On Coarse Aggregate : Particle size distribution and fineness modulus - specific gravity - voids - absorption test - crushing and impact strength - abrasion test.

Concret'e Mix Design : A.C.I and I.S. Methods

Test On Fresh Concrete : Slump test, Vee-Bee test, compaction factor test.

Tests On Hardened Concrete : Compression test on cubes - Modulus of rupture test - splitting tension test - Determination of modulus of elasticity.

(b) **Highway Lab: Tests On Bituminous Materials And Mixes**:

(a) Penetration test on bitumen.
(b) Ductility test on bitumen
(c) Softening point test on bitumen or tar.
(d) Flash and fire point tests on bitumen/cutback bitumen
(e) Specific gravity test
(f) Viscosity test on cutback - bitumen or tar (using orifice Viscometer)
(g) Marshall stability test on bituminous mix and determination of density, voids, stability and flow values.

Text Books:

1. Shetty, M. S., `Concrete Technology’, S. Chand & Co., New Delhi, 1998.
2. Khanna, S.K., and Justo C.E.G., Highway Engineering, Nem Chand and Bros. 2005.

Reference Book:

1. Davis, H.F., Troxell, G.E and Hauck, G.R.H., The testing of Engineering Materials, Mc.Graw Hill International Book Co.,1995.

09CE229 ENVIRONMENTAL ENGINEERING LABORATORY

Credits: 0:0:2

Objectives:

- To give hands on training on testing of water samples
- To give hands on training on testing of sewage samples

I. Analysis of Water Quality Parameters:-

1. Determination of pH
2. Determination of Acidity and Alkalinity
3. Determination of Chlorides
4. Determination of Dissolved Oxygen
5. Determination of Fluorides
6. Estimation of Iron and Manganese
7. Estimation of Phosphates
8. Estimation of Sulphates
9. Estimation of Total Dissolved Solids.
10. Estimation of Conductivity
11. Determination of Turbidity and Optimum Coagulant Dose by Jar Test Apparatus
12. Determination of Available Chlorine in Bleaching Powder, Residual Chlorine, Break Point Chlorination and Chlorine Demand.
13. Determination of MPN Index for Coliforms+

II. Analysis of Waste Water Characteristics:-

1. Determination of Total Solids, Settlable Solids, Dissolved Solids, Suspended Solids and Volatile Solids.
2. Determination of BOD and COD
3. Determination of Ammonia–nitrogen and Nitrates.

Text Book:

1. Sawyer, N.C., and McCarty, P.L., “Chemistry for Environmental Engineering”, 5th Edn., McGraw-Hill Book Co., New York., 1994.

Reference Book:

1. “Standard Methods for the Examination of Water and Waste Water”, APHA-AWWA-WPCF, 25th Edn., Washington (D.C), 1995.

09CE230 ELEMENTS OF TOWN PLANNING & ARCHITECTURE

Credits: 4:0:0

OBJECTIVES:

- The purpose of this course is to impart the knowledge on the basics of town planning, use of land, planning legislations, Architecture and landscaping

Unit I: Basics of Town Planning

Town planning - Definition, Objectives, Necessity & Principles adopted - Types of Urban Growth: Their advantages and disadvantages - Town planning Surveys: Necessity, Objectives and Classification - Urban road patterns: Types, and specific advantages & disadvantages.

Unit II: Land use Planning

Scope and Content of Master plan, Regional plan, Structure plan, Detailed development plan - Urban renewal -Planning standards for Neighbourhood -Basic principles in planning various land uses: Residential, Commercial, Industrial, and Recreational.

Unit III: Planning Legislations

Evolution of planning legislation in India Organisation and administration of planning agencies at National, State, Regional level and Metropolitan Level -Tamil Nadu Town and Country Planning Act - Building bye laws, Function of local Authority, Provision of Building Regulations

Unit IV: Introduction to Architecture

Definition of the term 'Architecture' – Key factors influencing the architecture of any region: Culture, Climate, Topography, Building materials, Economic & Technology -Prominent World Architecture styles during various periods in history - Anthropometrics – Human Scale in Architecture -Space requirements for Human activity

Unit V: Architectural space and mass & Landscaping

Mass & space, visual & emotional effects of geometric forms and their derivatives-The sphere, the cube, the pyramid, the cylinder and cone

Landscape Architecture: Concept – Necessity – Study of trees, plants & Shrubs for landscaping

Text Books:

1. Rangwala,S.C., Town Planning, Charotar Publishing House, Anand, Gujarat, 2007.
2. Gurcharan Singh & Jagdish Singh, Building planning, Designing and Scheduling, Standard Publishers Distributors, Nai Sarak , Delhi 1999.

Reference Books:

1. Hiraskar,G.K., Fundamentals of Town Planning,Dhanpat Rai and Sons, Delhi, 2005.
2.Abir Bandyopadhyay, Textbook of Town planning, Books and Allied publishers,2000.
3. Francis D.K.Ching,Architecture - Form, Space and Order, Van Nostrand Reinhold Company, NewYork,1979.

09CE231 EARTHQUAKE ENGINEERING AND DESIGN OF STRUCTURES

Credits: 3:1:0

OBJECTIVES:

- The objective of this course is to introduce the fundamentals of seismology, theory of vibrations and seismic design of buildings
- To introduce the concepts of seismic resistant design of buildings
- To introduce the concepts of repair and rehabilitation

Unit I: Introduction
Elements of engineering seismology – causes of earthquakes, seismic waves, magnitude, intensity and energy release – Indian seismology – earthquake history – catastrophics – failures – lessons learnt from past earthquakes – seismic zone map of India

Unit II: Theory of Vibration
Free vibration – single degree of freedom system – with and without damping – Multi degree of freedom system – fundamental period – power method – forced vibration of SDOF system – with and without damping – Response spectrum characteristics.

Unit – III: Seismic Design of Buildings
Idealization of building frames – Introduction to methods of seismic analysis – Equivalent static analysis IS 1893 provisions – Design horizontal seismic coefficient – design base shear distribution – seismic resistant design of building.

Unit – IV: Earthquake Resistant Construction
Earthquake resistant properties of materials – lateral force resisting systems – strong column weak beam – guidelines for seismic resistant construction building configuration requirements – ductile detailing of reinforcements in RC buildings – behaviour and design of masonry structures.

Unit V: Repairs and Retrofitting
Code of practices for repairs and retrofitting – retroffing of RC buildings and structural elements – techniques of retrofitting – improving structural integrity of masonry buildings – retrofitting by seismic isolation – case studies.

Text Books:

1. Pankaj Aggarwal, Manish Shrikande, “Earthquake resistant design of structures”, Prentice Hall of India, Delhi- 01 (2007)
2. S.K.Duggal, “Earthquake resistant design of structures”, Oxford University Press – Delhi 01 (2007) David Key “Earthquake design practice for building”, Thomas Telford, London
3. Aggarwal “Earthquake resistant design of structures”, Nem chand, New Delhi

Reference Books:

1. Anil K. Chopra, "Dynamics of structures- Theory and applications to earthquake engineering", Prentice hall of India, New Delhi , 2002
2. Earthquake tips – Indian Concrete Journal

09CE232 GEOGRAPHIC INFORMATION SYSTEM

Credits: 3:0:0

OBJECTIVES:

- The purpose of this course is to introduce the concepts of GIS, Spatial Analysis DEM and DTM
- To introduce the concepts of Remote Sensing
- To impart knowledge on application of GIS for land information system, water resources management, environmental analysis, Network analysis and urban sprawl analysis,

Unit I: Introduction
Definition – map and map analysis, Automated Cartography history and development of GIS, Hardware requirement, System concepts, Coordinate concepts, Standard packages

Unit II: Data Entry, Storage and Maintenance
Type of data, spatial and non spatial data, data structure, Points, lines, polygon, vector and raster, File, file organisation, Database, Digitiser, scanner, dbase, files and data formats, data compression

Unit III: Data Analysis and Modelling
Spatial Analysis, Data retrieval, Query, simple analysis, Recode, overlay, Vector data analysis, raster data analysis, Modelling in GIS, Digital Elevation Model, DTM, Artificial intelligence, Expert system

Unit IV: Data Output and Analysis
Types of output data, display on screen, printer and other output devices, Sources of errors, Types of errors, Elimination, accuracies

Unit V: GIS Application
Application areas, Case studies will be down load from internet, Water resources management, environmental analysis, Network analysis, Remote sensing applications, Monitoring of urban sprawl, Cadastral record and LIS

Text Books:

1. Peter A. Burrough, Principle of Geographical Information System ,Oxford University Press,2000

2. Thomas M. Lillisand,Remote Sensing and Image Interpretation, Wiley India (p) Ltd., 2007

Reference Books:

1. Ian Heywood, An introduction to Geographical Information systems, Pearson Education Limited, 2003.
2. M.Anji Reddy, Textbook of Remote Sensing and Geographical Information Systems, BS Publications, 2001.

09CE233 REHABILITATION OF STRUCTURES

Credits: 4:0:0

OBJECTIVES:

- The purpose of this course to impart the knowledge of causes of distress, materials for repair, serviceability, durability, strengthening, retrofitting of structures

Unit I: Introduction

Causes of Distresses-Distress Monitoring - Defects due to Climate, Chemicals, Wear and Erosion-Inspection- visual examination.

Unit II:Non-Destructive Testing

Liquid penetration test-Magnetic particle testing-Eddy current test-radiography-Ultrasonic testing-Acoustic emission testing-Thermography-Leak testing-Codes ,Standards

Unit III :Influence on serviceability and durability

Steel structures :Causes of deterioration -preventive measures- repair procedure- corrosion mechanism- methods of corrosion protection**.** Concrete Structures-Causes of Deterioration-Diagnosis of Causes- Flow Charts for Diagnosis-Repair Techniques. Masonry Structures-Discoloration and weakening of stones-biocidal treatments-Brick masonry structures-distresses and remedial Measures

Unit IV : Strengthening of Existing Structures

Special repairs, maintenance, inspection and planning-Repairs to overcome low strength member, deflection, cracking, landslides, chemical disruption, weathering, wear, fire, leakage, and marine exposures [with case studies]

Unit V: Retrofitting of Structures

Seismology-Seismic risk and hazard-Retrofitting and strengthening of Structures - Concept of base isolation-Structural control-Case studies.

Text Books:

1. Repair and rehabilitation of structures , A state of art-Proceedings of the International Seminar, Workshop and Exhibition held in Maracaibo,Venezuela, April 28-May 1, 2002.

2. Johnson .S.M., " Deterioration, Maintenance and Repair of Structures", Mc Graw Hill Book Company, New York, 2001.

Reference Books:

1. Alien, R.T., and Sc Edwards, Repair of concrete structures, Blakle and sons, U.K.2003.
2. Dension Campell, Alienand Harold Roper," Concrete Structures, Materials,Maintenance and Repair", Longman Scientific and Technical,U.K.2002
3. Baldev Raj et al "Practical Non-destructive testing "Narosa publishing, New Delhi,2002

09CE234 AIRPORTS, DOCKS AND HARBOURS

Credits: 4:0:0

OBJECTIVES:

- The purpose of this course is to introduce the concepts of planning and design of airports,
- To introduce the concepts of navigational aids
- To introduce the concepts of planning and design of docks and harbours

Unit I: **INTRODUCTION TO PLANNING**
Air transportation in India – Categories of airports and air services – agencies controlling national and International aviation and their functions – airport regional planning – Factors to be considered for proper planning of airport – airport capacity – various survey to be conducted – airport site selection

Unit II: **ELEMENTS OF AIRPORT AND DESIGN**
Landing and terminal areas and their components- standard for planning airports as per ICAO- Typical layout of an airport and its components – Runways – taxiways and aprons – different types – pattern and layout – general principle of design – loading apron – holding apron – parking aircrafts.

Unit III: **NAVIGATIONAL AIDS**
Traffic aids and airport marking – lighting airports – runway lighting – taxiway lighting – air traffic control – visual and instrument landing systems – airport drainage – typical layout of existing airport terminal and service blocks – Chennai, Coimbatore, Calcutta, New Delhi and Mumbai

Unit IV: DOCKS AND MANAGEMENT
Dock- different types of wet and dry docks- functional design - various types and their usage- navigational aids- necessity and type of signals- fixed and floating signals- beacons- buoys- different types of dredges and their application

Unit V: HARBOURS
Classification and requirements of harbours – choice of site and general principles governing their design- entrance to harbour – Breakwaters – Classification and construction – wharves –

piers and Bulkheads – Dolphins – Fender and other mooring devices – Typical layout of Existing harbours – Chennai, Cochin, Tuticorin, Mumbai

Text Books:

1. Srinivasan R and Rangwala,S.C, "Harbour Dock and Tunnel engineering", Charotar publishing house, Anand- 2006.
2. Khanna,S.K and Arora,M.G & Jain,S.S, "Airport Planning and Design", New Chand and Bros, Roorkee, 2005.

Reference Books:

1. Vazirani U N & Chandola SP, Transportation Engineering- Vol II, Khanna Publishers, 2 B Nath Market, Nai Sarak, Delhi 110 006 (1988).
2. Rangwala P.S. Airport Engineering, Charotar publishing house, Anand- 2008.
3. Bindra S P Docks and harbour Engineering, Dhanapat Rai and sons, New Delhi 1993.

09CE235 IRRIGATION ENGINEERING

Credits: 3:1:0

OBJECTIVES:

The purpose of this course is to impart knowledge about irrigation methods, hydrology, ground water, distribution system, water logging, drainage and river control

Unit I: Introduction

General – crop seasons – Humid, arid and semiarid regions – necessity of irrigation – water requirements – Duty – Delta – irrigated area – Base period –crop period – water requirement calculation – consumptive use (evapo – transpiration) – Determination of consumptive use – irrigation efficiencies – factors affecting the duty of water - Methods of improving duty - Irrigation scheduling and advantages.

Unit II: Sources, Conveyance and Distribution of Water

Sources of water –Precipitation – Types of Precipitation - Rainfall measurements – Rivers – Streams – Reservoirs and Tanks – Lift irrigation – Devices and Equipments – Tank irrigation – Components – Methods of application of water on field – Surface irrigation – Subsurface irrigation **-** Quality of Irrigation Water.

Unit III: Ground Water, Water logging and Drainage

Ground water hydrology – Aquifers – permeability and transmissibility – steady flow towards a well in confined and water table aquifer – measurement of yield of an open well - Typical cross section of open and tube well – Salinity and water logging – causes and effect of water logging – Waterlogging control – Reclamation of saline land – surface and subsurface drainage – Drainage design for agricultural areas – lay out of drainage system.

Unit IV: Channel Design

Alluvial and non – alluvial soil – Alignment of canals – Distribution systems for canal irrigation – Determination of required channel capacity – channel losses. Design of channels in India – Regime channels – Kennedy's theory - design procedure – use of Garrot's diagram – Lacey's theory - Design procedures – use of Lacey's Diagram - comparison of the two theories. Design procedure for irrigation channel – cross section and components – balancing depth for excavating canals – fixing the longitudinal section of the canal – Classification of canals – canal lining – Maintenance of irrigation canals.

Unit V: Control Structures, River training and control

Dams – types – Canal Regulation works – Canal fall – Head and Cross regulator – Canal escapes – Cross drainage works – Diversion Head works – Weirs and Barrages – Causeways and Culverts – classification of rivers - river training – Groynes and Spurs – Bank Protection.

Text Books:

1. Garg,S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 2003.
2. Punmia, B.C., Pande and Lal, B.B. Irrigation and water power Engineering, Laxmi Publications pvt. Ltd., 2004.

Reference Books:

1. Sahasrabudhe, S.R., Irrigation Engineering and Hydraulic Structures, Katson Publishers, 1998.

09CE236 PROFESSIONAL PRACTICE AND ENTREPRENEURSHIP DEVELOPMENT

Credits: 4:0:0

OBJECTIVES:

- The purpose of this course is to impart knowledge about enterprising, Market surveying and project formulation
- To impart knowledge on small scale industries, financial institutions, taxes, labour laws and organizational structure

Unit I: Entrepreneurship
Definition and concept of enterprising - profile of an entrepreneur - need, scope and characteristics of entrepreneurship - Individual, psychological and sociological - Globalization – WTO, WB, IWF - Exposure to demand based, resource based, import substitute and export promotion industries

Unit II: Marketing
Market survey techniques: need, scope and approaches for project formulation. Criteria for principles of product selection and development: Structure of project report – choice of technology, plant and equipment. Project feasibility analysis: Marketing, technical and financial

feasibility – project report preparation. Elements of marketing and sales management: Nature of project and market strategy, after sales service.

Unit III: Financial Management

Interest and time value of money: simple interest, compound interest, present value, future value, pay back period – accounting rate of return, net present value. Financial management: Capital-working capital-financial institutions, RBI and commercial banks. Banking procedures and foreign exchanges regulations act, letter of Credits:s: and its importance.

Unit IV:Tax and Acts

Starting a small-scale industry – steps involved-role of financial institutions - Tax factors: Income tax, sales tax, excise duty, customs duty. Legal factors: Factories act, pollution act and labour act

Unit V: Organization and Human Resources

A need for Organisation, formulizing the organisational structure - Employee selection, training, personnel relations - Professional practice as applicable to Civil Engineers

Text Book

1. Prasanna Chandra, "Project Preparation, appraisal and implementation", Tata Mc Graw Hill, New Delhi, 1990.
2. Saravanavel.P, "Entrepreneurship Development", ESS Pee Kay Publishing House, Madras, 1987

Reference Book

1. Philip Kotler, "Marketing Management", Prentice Hall, 1990.
2. Prasanna Chandra, "Fundamentals of financial management", Tata McGraw Hill publications, 1995
3. John J.Mampton, "Financial decision making concepts, problems and cases", Prentice Hall of India, 1990.

09CE237 POLLUTION AND CONTROL ENGINEERING

Credits: 4:0:0

OBJECTIVES:

- To introduce the fundamentals of water, noise and air pollution
- To introduce the concepts of solid waste management
- To impart knowledge on ecology, ecosystems and environmental health

Unit I: Water & Noise Pollution and Control

Natural processes - Pollution due to industrial, agricultural and municipal wastes - limitations of disposal by dilution - BOD consideration in streams - Oxygen sag curve - water pollution control legislation.
Noise pollution - Sources and effects - Control measures

Unit II: Air Pollution and Control

Pollution and their sources - Effects of pollution on human health, vegetation and climate - Prevention and control of air pollution - Control of particulates – Industry and air pollution - Air pollution surveys and sampling - Air quality monitoring - Air pollution control legislation.

Unit III: Solid Waste Management

Sources - Characteristics - Quantities - Collection methods and disposal techniques – Source Reduction - Sanitary land fill **-** Incineration and pyrolysis - Composting - Aerobic and anaerobic Economics of composting - Recycling and reuse.
Hazardous Waste Management: Nuclear waste, Bio-medical waste, Chemical wastes – sources and effects – Disposal techniques.

Unit IV: Ecology and Ecosystems

Impact of development - Relationships of environmental quality – Land use and natural resources management - Causes and effects of Environmental pollution
Elements of Environmental Impact Analysis: Environmental impact analysis of urbanisation & industrialization – Environmental impacts of thermal power plants, mining and radioactivity

Unit V: Environmental Health

VECTOR CONTROL: Fundamentals of epidemiology - Vector borne diseases - Types of vectors - Mosquitoes, flies, rodents - Rationale of control and naturalistic methods of control. Uses and limitations of pesticides - Engineering measures of vector control.
FOOD AND MILK SANITATION: Relation of food to disease - Principles of food sanitation - Sanitation of kitchens, restaurants and other catering establishments - Quality changes in milk - milk as carrier of infection - Pasteurisation of milk HTST and LTLT processes – Cattle shed sanitation.

Text Book:

1. Salvato, Environmental Sanitation, John Wiley & Sons, New York 1994.

09CE238 INDUSTRIAL WASTE TREATMENT AND DISPOSAL

Credits: 3:0:0

OBJECTIVES:

- To impart the knowledge about disposal of effluents and the standards for disposal
- To impart the knowledge about biological treatment methods and advanced treatment methods

Unit I: Disposal Effects on Environment

Effects of industrial wastes on streams, land, air - wastewater treatment plants - water quality criteria. Effluent standards - Process modification - Bioassay studies – Environmental legislation

Pollutants Reduction

Waste minimisation - House keeping - Volume and strength reduction - Material and process modifications - recycle, reuse and by-product recovery - Environmental audit.

Unit II: Effluent Treatment

Conventional methods of treatment and disposal of industrial wastes - Equalisation and Neutralisation - Separation of solids - Sedimentation and filtration - Coagulation and flocculation, absorption, chemical precipitation, chemical oxidation, Physiochemical treatment methods - Removal of dissolved impurities - Residue management - Combined treatment of industrial and municipal wastes

Unit III: Biological Treatment Methods

Principles and methods for removal of suspended impurities and organics – aerobic and anaerobic decomposition of organic matter, Stabilization ponds, activated sludge process, Oxidation ditch.

Advanced Waste Water Treatment:

Nitrogen removal – Phosphorous removal – Removal of refractory Organics – Removal of dissolved inorganic substances – Chemical precipitation – ion exchange – Reverse Osmosis – Electro dialysis.

Unit IV: Industrial Process and Waste Treatment – I

Manufacturing process, waste water characteristics, composition, effects and appropriate treatment - flow sheets for chemical industries – Petro-chemical industries, Refineries, Pharmaceutical, Textiles – Apparel industries – Metallurgical industries - Steel plants, mines – Power industries – Fertilizer plants – Cement industry.

Unit V: Industrial Process and Waste Treatment - II

Manufacturing process, waste water characteristics, composition effects and appropriate treatment flow sheets for Pulp and paper industry – Agro-industries, Sugar - Distilleries, Food processing industry – meat packing, pickles, poultry dairy – Leather tanning.

Text Books:

1. Rao.M.N. and Dutta Waste Water Treatment, Oxford and IBH Publishing Ltd., Calcutta, 2008.
2. Eckenfelder, W.W., Industrial Waste Pollution Control, McGraw Hill Book Co., New Delhi, 2003.

Reference Books:

1. Nemerow, N.L., Theory and Principles of Industrial Waste Treatment, AddisonWesley, Reading Mass, 1993.

09CE239 CONSTRUCTION TECHNOLOGY

Credits : 4:0:0

OBJECTIVES:

- The purpose of this course is to impart knowledge about planning of buildings and construction of foundations, roof, floors, brick and stone masonry
- To impart knowledge on doors, windows, staircases, RCC work, water proofing and damp proofing works

Unit I: Site Planning
Precautions in selection of sites – the situations and surroundings of site for various types of building – elements of building planning, requirements, orientation, ventilation and lighting, concept of green buildings
Foundation: Setting out foundation plan on ground – concept of foundation – Bearing capacity of a good foundation – types of foundation and their construction – suitability – Foundation in black cotton soil – Methods of timbering of trenches – Foundation failures and remedial measures.

Unit II: Brick and Stone Masonry
Types of bond in brickwork and their suitability – General principles and precautions in brick masonry – factors affecting thickness of walls - construction of brick masonry – methods of bonding new brick work with old brick work - Comparison of brick and stone masonry - Strength of Brick Masonry – Classifications as per IS code – Classification of Stone masonry – General principles and precautions in stone masonry – specification and construction of stone masonry – composite masonry – lifting appliances – Concrete Hollow block masonry

Unit-III: Roofs and Floors
Roof covering materials – Specifications for laying Mangalore Tiles, Asphalt roofing sheets, Asbestos cement sheets – Aluminium sheets and GI sheets. Accessories for drainage works – shapes of gutters and their sizes - Different types of supporting trusses for the roofing sheets – Timber and concrete roofs – Different types of floors, suitability and construction of floors and floor finishes – Anti-termite Treatment.

Unit IV: Doors, Windows and Staircases
Different types of doors and windows and their suitability, Timber, steel, Aluminium and synthetic. Stair and staircases: Concepts – requirements of a good stair – principles to be observed for planning and layout of stairs – classification of stairs according to their layout and materials of construction

Water Proofing and Damp Proofing

Techniques of plastering – types of rendering – types of pointing and their suitability – Application of paints for new and old work of timber, steel and plaster – preparation and application of white washing and distempering – weathering course.
Damp proofing – causes of dampness – Ill effects – Methods of preventing dampness – Types and classification of damp proofing materials – Requirements of an ideal material for damp proofing – Methods of providing DPC under different situations.

Unit V: R.C.C. Work
Methods of Construction of R.C.C. slabs, Beams & Columns
Miscellaneous Construction Features
Construction sequences: Construction sequence and procedure for RC framed structures with masonry panel walls, load bearing wall structures, industrial shed type building.
Expansion joints: Types and provision of expansion joints for foundations, floors, walls, roofs, beams and slabs. Shoring, Scaffolding and Underpinning: Methods, uses and suitability of different types and precautions for safety – Selection of equipment for earth work, concreting, material handling and erection of Structures

Text Book:
1. Rangwala S.C., Building Construction, Charotar Book Stall, Anand, 2003.

Reference Books:
1. Punmia B.C., A Text Book of Building Construction, A Saurabh & Co (P) Ltd., New Delhi, 1993
2. Relevant IS Codes and National Building Code of India.
3. Sushil Kumar, "Building Construction", Standard Publishers, New Delhi, 1997.

09CE240 INTERIOR DESIGN

Credits: 4:0:0

OBJECTIVES:

- The objective of this course is to give an introduction about the basic principles of interior design and architecture
- To introduce the basic concepts of lighting, ventilation and acoustics

Unit I: Introduction
Definition of the term "Interior Design" – Necessity and application, basic principles of architecture
Principles of Aesthetic Composition: Form, shape & Configuration. Size, Scale and proportion, Equilibrium (Symmetry & Balance) - Axis & Alignment, Repetition & Rhythm, Contrast & Opposition - Vista & View, Texture, Pattern & colour, Light (Natural & Artificial)

Unit II: Circulation and Human Scale

Components of building orientation - building entrance - configuration of path & path-space relationships - Form of circular space with building examples - Human scale and movement with reference to function and furniture

Unit III: Interior Design in Current Practice

Function and planning - working space - living spaces, public spaces and special purpose interiors - space requirement of various purposes such as hotel, restaurant, office, auditorium, banks, schools with reference to IS codes.
Interior layout: Living room, dining room, bed room, kitchen, toilet, office, library and show room.

Unit IV: Colours and Interior

Effect of colour in interiors – Colour circle and its applications – Colour schemes – Emotional effect on colour
Components & Materials for Interiors
Architectural components: Fixed furniture components; Movable furniture components: Furnishings.

Unit V Lighting, Ventilation and Acoustics

Classification of lighting - general and load lighting - Artificial light sources - spectral energy distribution colour temperature - colour reading - Study of lighting accessories and their choice-Design of modern lightings: Lightings of stores, offices, schools, hospitals and houses. Electrical and plumbing layout of a residential building
Acoustics: Materials, reverberation time, Sabine formula

Text Books:

1. Allen Tate & C Ray Smith, Interior Design in the 20th Century, Harper & Row Publishers,1986.

Reference Books:

1. Phillips, Lighting in Architecture, McGraw-Hill co, NewYork, 1981.
2. National Building Code,2005
3.Heepler and Wallach, Architecture Drafting and design, McGraw Hill Book cc, NewYork,1982

09CE241 CONCRETE TECHNOLOGY

Credits: 4:0:0

OBJECTIVES:

- To impart knowledge about concrete making materials, properties of fresh and hardened concrete

- To introduce the concepts of durability of concrete, special concretes and non-destructive testing
- To introduce the concepts of mix design methods

Unit I: Concrete Making Materials - I

Cement: Composition and properties of Portland cement - tests on physical properties - consistency - setting time - soundness - strength - cements of different types - composition - properties and uses with special emphasis for different constructional and weather conditions - IS code specifications.
Water: Requirements of water for concrete making - IS Code specifications.

Unit II: **Concrete Making Materials -II**
Aggregates: Classification - Mechanical Properties - deleterious substances in aggregates - Bulking of sand - Alkali Aggregate reaction - Grading requirements - IS Code specifications
Admixtures: - Accelerators - Retarders - water reducing agents - Plasticisers - Air entraining agents

Unit III:Fresh Concrete And Hardening Of Concrete
Workability - Factors affecting workability - Tests for workability - Segregation - Bleeding - Mixing of concrete - Compaction of concrete - Ready mixed concrete - Pumped Concrete - Preplaced concrete - Shotcrete. Factors affecting strength of concrete - Curing of concrete Maturity of concrete - Micro cracking and autogeneous healing - Evolution of heat and expansion - Shrinkage of concrete - Factors affecting shrinkage of concrete.

Unit IV: Durability of Concrete and Testing of Hardened Concrete
Permeability - Chemical attack - Sulphate attack - Quality of water - Marine atmosphere - Methods to improve durability - Thermal properties of concrete - Fire resistance - Resistance to Abrasion and Cavitation - Acoustic properties - Compression test - Split Tension test - Flexure Test - Test for Bond strength - IS Code provisions - Factors affecting strength test results - Accelerated strength tests - stress strain characteristics - Determination of modulus of elasticity - Electrodynamics determination method - In site strength determination - variation in test results - Distribution of strength - standard deviation - creep of concrete and factors which influence it.

Unit V: Mix Design
Basic considerations - Factors in the choice of mix proportions - Mix design methods - ACI method, IS method – Mix proportions for weigh batching and volume batching - correction for moisture content and bulking - yield of concrete
Special Concretes And Concrete Composites: Light weight concrete: Types - Light weight aggregate concrete-Aerated concrete, No fines concrete - High Strength concrete - Heavy weight concrete for radiation shield - Fiber reinforced concrete - Ferro cement - Polymer concrete - High Performance Concrete - Their properties and applications.

Text Books:
1. Neville, A.M.., "Properties of Concrete", Longman Scientific & Technical, England, 1995

2. Gambhir, M.L., Concrete Technology, Tata Mc Graw Hill Publishing Company limited, New Delhi, 2004
3. Shetty, M.S., "Concrete Technology", S.Chand & Co., New Delhi, 2005

Reference Books:

1. A.R. Santhakumar, "Concrete Technology" Oxford University press, Jai Singh road, Delhi, 2006
2. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, 1990.

09CE242 FLUID MECHANICS AND MACHINERY

Credits: 3:1:0

OBJECTIVES:

- The purpose of this course is to learn the Fluid properties and fundamentals of Fluid statics and fluid flow
- To introduce the concepts of flow measurements and flow through pipes
- To introduce the concepts of momentum principles
- To impart the knowledge on pumps and turbines

Unit I : Fluid Properties
Dimensions and Units – Density – Specific weight - Specific gravity – Viscosity – surface tension – Capillarity – Compressibility – Vapour pressure.
Fluid Statics:

Pressure relation – Pascal's law –Measurement of pressure – Manometers and Gauges, Forces on plane and curved surfaces – Total pressure and centre of pressure.

Unit II : Equations Of Fluid Flow

Types of flow – Stream line – Stream tube – Control volume – Continuity equation – one dimensional and three dimensional flow – velocity potential and stream function – Free and forced vortex flow – Energy equation – Euler's equation in one dimensional form – Bernoulli's equation.

Unit III : Flow Measurements

Orifices - Venturi meter – Orifice meter – Pitot tube – Weirs and Notches.
Flow Through Pipes:
Loss of energy in pipes – Major energy loss - Minor energy losses – pipes in series and parallel – power transmission through pipes – Syphon – Water hammer (Definition)

Unit : IV

Impulse momentum equation- Impact of Jets-plane and curved- stationary and moving plates.

Pumps: Positive displacement pumps - reciprocating pumps - operating principles -slip - indicator diagram - separation- air vessels. centrifugal pumps - operation - velocity triangles - performance curves - Cavitation - Multi staging - Selection of pumps.

Unit V : Turbines
Turbine classification-working principles -Pelton wheel, Francis, Kaplan turbines - Velocity triangles - Similarity laws - Specific speed - Governing of turbines- Surge tanks-Miscellaneous pumps - Jet pump, Gear oil pump,submersible pump – Principle.

Text Books:

1. Modi, P.N. & Seth, S.M., "A Text book of Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi, 2007.
2. Rajput, R.K.," A Text book of Fluid Mechanics and Hydraulic Machines" , S.Chand and Co., New Delhi,1998.

Reference Books :

1. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 2005.
2. Som,S.R, & Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, 1998.
3. Agarwal, S.K., Fluid Mechanics and Machinery, Tata Mc Graw Hill Co., 1997.

09CE243 FLUID MECHANICS LABORATORY

Credits: 0:0:1

OBJECTIVES:

- To give hands on training on Flow measurement, Losses due to friction and pipe fittings

1. Buoyancy Experiment - Metacentric Height
2. Calibration of orifice meter and Venturimeter.
3. Flow through Orifice
4. Determination of loss co-efficient in pipe fittings.
5. Flow through weirs - Cd
6. Flow measurement using Rotameter.
7. Flow visualization-Reynold's apparatus.
8. Determination of friction factor
9. Experiments on Fluid jets-force and efficiency calculation

Text Books

1. Modi,P.N and Seth, S.M., Fluid Mechanics & Fluid Machines, Standard Book House, New Delhi,2007.
2. Rajput, R.K.," A Text book of Fluid Mechanics and Hydraulic Machines" , S.Chand and Co., New Delhi,1998.

09CE244 THEORIES AND PRACTICES OF POLLUTION ENGINEERING

Credits: 4:0:0

OBJECTIVES:

- To know the basics, importance, and methods of water and wastewater treatement
- To study the Engineering methods of sludge disposal
- To know the basics of Air pollution control
- To learn the features of Solid waste management

Unit I Water Treatment Processes
Principles, Functions, and Design of screening, grit chambers, Plain sedimentation tank, Sedimentation aided with coagulation, filtration - Slow and Rapid Sand Filters, and Disinfection Process – Principles of Water Softening, Aeration , Iron and Manganese Removal, and Fluoride Removal.

UnitII Waste water Treatment Processes
Operation and Design of Bar Rack and Grit Chamber – Principles of Primary Treatment and Design of Primary Sedimentation Tank – Disposal of Rackings, Gritty Materials, and Sludge Solids. Trickling Filter – High rate and Standard Rate Filters – Low Cost Waste Water Treatments – Principles and Design of Stabilization Ponds, Oxidation Ponds and Aerated Lagoons – Rural Sanitation

Unit III Engineering Methods of Sludge Disposal
Methods of disposal – self purification of natural stream - Oxygen Sag curve Analysis- Sludge Lagooning - dispoals by land treatment method – sewage farming - sewage sickness

Unit IV Air Pollution Control
Introduction – Classification of pollutants – concepts of lapse rate and dispersion – control devices for particulate contaminants – gaseous contaminants – different types of plumes – dispersion model equations.

Unit V Solid waste management
Solid waste - Definitions –types – sources –properties – Engineering systems for solid-waste management – solid waste generation – on-site handling, storage, and processing – collection of solid wastes – transfer and transport – processing techniques – ultimate disposal

Text Book:

3. Peavy H.S, Rowe D.R. and Tchobanoglous G ,"Environmental Engineering" Tata McGraw Hills, New Delhi, 1985.

4. Punmia B.C., "Environmental Engineering Vol. I & II", Lakshmi Publications (P) Ltd., New Delhi, 2002.

References:

1. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi, 1994.
2. Metcalf & Eddy, M.C., "Wastewater Engineering – Treatment & Reuse", Tata McGraw Hill Publications, New Delhi, 2003

09CE245 MECHANICS OF SOLIDS

Credits: 3:1:0

OBJECTIVES:

- To introduce the concepts of stress and strain
- To introduce the concepts of Shear force and Bending moment
- To introduce the concepts of deflection of beams

Unit I : Simple stress and strain

Stresses and strain due to axial force. Hooke's law, factor of safety, stepped bars - uniformly varying sections - stresses in composite bars due to axial force and temperature - strain energy due to axial force, stresses due to sudden loads and impact. Lateral strain: Poisson's ratio - change in volume – shear stress - shear strain - relationship between elastic constants - Hoop and longitudinal stress in thin cylindrical and spherical shells subjected to internal pressure – changes in dimensions and volume.

Unit II : Shear Force And Bending Moment

Relationship between loading - shear force and bending moment - shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to concentrated loads and uniformly distributed loads only - maximum bending moment and point of contra flexure.

Unit III : Bending Stresses

Theory of simple bending and assumptions – simple bending equation - calculation of normal stresses due to flexure application. Leaf Springs – Strain Energy Due to Bending Moment

Torsion: Theory of torsion and assumptions – Torsion equation - Stresses and Deformation in Solid Circular and Hollow Shafts –Stepped Shafts – Composite Shaft – Stress due to combined bending and Torsion – StrainEnergy due to Torsion. Deformations and Stresses in Helical Springs

Unit IV : Principal Stresses (Two Dimensional)

State of stress at a point, normal and tangential stresses on inclined planes - principal stresses and their planes - plane of maximum shear - Mohr's circle of stresses.

Theories Of Elastic Failure : Maximum principal stress theory – Maximum shear stress theory– Maximum principal strain theory – Strain energy theory - Mohr's theory – simple problems.

Unit V : Deflection Of Beams

Differential equation of elastic line - deflection in statically determinate beams - Macaulay's method for prismatic members - area moment method for stepped beams with concentrated loads. Long columns: Buckling of long columns due to axial load - Euler's and Rankine's formulae for columns of different end conditions.

Text Book:
1.Ramamurtham .S "Strength of Materials", Dhanpat Rai Publishing co, New Delhi, 2008.

Reference Books:
1. Popov, E.P., Mechanics of Materials, Prentice Hall Inc., 1999
2. Andrew, P. and Singer, F.L., Strength of Materials, Harper and Row Publishers, New York, 1987.

09CE246 STRENGTH OF MATERIALS LABORATORY

Credits: 0:0:1

OBJECTIVES:

- To give hands on training on testing of materials

1. Tension test on mild steel
2. Double shear test on mild steel
3. Torsion test on rod
4. Torsion test on thin wire
5. Brinell, Rockwell and Vicker's Hardness tests
6. Charpy and Izod Impact test
7. Cold bend test
8. Tension, Compression (Parallel as well as perpendicular to the grains) and impact tests on timber specimens.
9. Test on springs (Both closed coil and open coiled springs)
10. Deflection tests on timber and steel beams
11. Studies on Fatigue test
12. Test on Bricks

Reference Book:
1.Ramamurtham .S "Strength of Materials", Dhanpat Rai Publishing co, New Delhi, 2008.

09CE247 ENGINEERING MECHANICS

Credits:3:1:0

Objectives:

- The purpose of this course is to impart the laws of mechanics
- To introduce the applications of equations of static equilibrium
- To introduce the concepts of centre of gravity and moment of inertia
- To introduce the methods of analysis of determinate trusses

- To impart knowledge of rectilinear, curvilinear motion, impact of objects, work and energy principles

UNIT I: Forces
Basics – Units and Dimensions – Laws of Mechanics – Vectors – Introduction to Statics & Dynamics.
Force and force systems – parallelogram law of forces – resultant of a system of coplanar forces acting on a particle – equilibrium of a particle under coplanar forces – resultant of a system of spaces force acting on a particle – equilibrium of a particle under space forces – free body diagram.

UNIT II: Rigid Bodies and Friction
Definition of a rigid body, Moment, Couple, Force-couple system – equilibrium of a rigid body under coplanar forces – types of supports – support reactions on beams and frames of determinate structures – problems involving equilibrium of rigid bodies – stable, unstable and neutral equilibrium
Friction – angle of friction and coefficient of friction – laws of dry friction – friction in wedges, ladders, screws and belts.

UNIT III: Cables and Moment of Inertia
Analysis of cables – Analysis of roof trusses by method of joints and method of sections.
Properties of plane sections – areas, centroid, first moment of area, moment of inertia, polar moment of inertia and radius of gyration – parallel and perpendicular axis theorem and its application bodies – mass moment of inertia of thin rectangular plates and solid rectangular prisms.

UNIT IV: Kinematics
Kinematics of particles – rectilinear motion of a particle – uniformly accelerated rectilinear motion – curvilinear motion of particles – rectangular components – motion of projectiles – curvilinear motion in terms of normal and tangential components – relative motion.
Kinetics – Introduction – Potential energy & Kinetic energy – Conservation of energy

UNIT V : Rectilinear Motion, Impulse, Impact
Kinetics of particles – equation of motion for a particle in rectilinear motion – equations of motion for a particle in curvilinear motion in terms of x and y components and in terms of normal and tangential components principle of work and energy – principle of impulse and momentum – impact direct central impact – oblique central impact.

Text Book:

1. Beer, F.P and Johnston, E.R, “Vector Mechanics for Engineers, Statics and Dynamics”, McGraw hill International Book co.

Reference Books:

1. Meriam, J.L. and Kraige, L.S., “Engineering Mechanics (Statics and Dynamics)”, John Wiley & sons.
2. Meriam.,J.L. and Kraige, L.S., Irving H.shames, “ Engineering Mechanics (Statics and Dynamics)”, Prentice Hall of India Pvt. Ltd.

3. Rajasekaran, S and Sankarasubramanian, G., “Engineering Mechanics”, Vikas Publishing House Pvt. Ltd, 1999

09CE248 BUILDING ACOUSTICS

Credits:3:0:0

OBJECTIVES:

- To learn the basics of Acoustics
- To learn to incorporate acoustic design in planning and design of buildings
- To know about the Environmental and Architectural aspects of Acoustics

Unit I: Introduction
Acoustics Engineering - Requirements for good acoustics - General principles of acoustic design - Fundamentals: Noise, Frequency, Sound, Band, Wavelength, Decibel, Reverberation Time

Unit II: Sound Absorbers and Room Acoustics
Sound Absorbers: Introduction - Main categories of absorber, Porous materials - Sound Transmission, Characterization and properties of single walls and floors - Room Acoustics: Introduction - Modeling of sound fields in rooms, Room acoustics parameters

Unit III: Planning and design
Planning and design against outdoor and indoor noise, Residential, Office, Hospital, Hotels and hostels, laboratories and test house, miscellaneous building.

Unit IV: Environmental Acoustics
Weighted sound levels speech interference – highway noise – noise induced hearing loss noise and architectural design specification and measurement of some isolation design of portions.

Unit V: Architectural Acoustics
Building skin envelope, Inter-space noise control, Interior space acoustics, Mechanical equipment noise - Sound in enclosure – A simple model for the growth of sound in a room – reverberation time - Sabine, sound absorption materials – measurement of the acoustic output of sound sources in live rooms – acoustics factor in architectural design.

Text Books:
1. National Building Code-Part VIII Building Services- Section 4, Acoustics, Sound Insulation and Noise Control- Bureau of Indian Standards, New Delhi, 2005
2. IS: 2526 – 1963 (reaffirmed 1996) Code of Practice for Acoustical Design of Auditoriums and Conference Hall- Ninth reprint December 1998 (incorporating Amendment No: 1) New Delhi

09CE301 COMPUTER AIDED METHODS OF STRUCTURAL ANALYSIS

Credit 3:1:0

OBJECTIVES :

- To familiarize the two and three-dimensional structures with programming aspects
- To introduce matrix force and displacement methods
- To develop expert system for preliminary modeling and process

Unit I: Review of Fundamental Concepts
Introduction - Forces and Displacement Measurements - Principle of Superposition - Force and Displacement Methods of Structural Analysis - Betti's law - Stiffness and Flexibility matrices of the elements - a review.

Transformation of Information
Indeterminate Structures - Transformation of system force to element force – Element flexibility to system flexibility - system displacement to element displacement-Transformation of forces and displacement in general

Unit II: Flexibility Method
Choice of redundant - ill and well conditioned equations - Automatic choice of redundants - Transformation of one set of redundant to another set - Thermal expansion -Lack of fit - Application to pin jointed plane and space trusses - Continuous beams, single storeyed rigid frames and grids.

Unit III: Stiffness Method
Development of Stiffness method - Analogy between flexibility and stiffness - Analysis due to thermal expansion - lack of fit - Application to pin jointed plane and space trusses – continuous beams - frames and grids.

Unit IV: Matrix Displacement Methods - Special Topics
Static Condensation Technique - Substructure Technique - Transfer Matrix Method – Symmetry and Anti Symmetry of Structures - Reanalysis Technique - Analysis of non-prismatic and curved members.
Unit V: Direct Stiffness Method
Discrete System - Direct Stiffness approach - Application to two and three dimensional pinjointed trusses - plane frames - Grids
Computer Application (Internal Evaluation only and not for end semester examination)
Computer Applications - application and use of Computer packages such as SAP, STAAD, STARDYNE

Text Books:
1. Rubinstein M F, “Matrix Computer Analysis,” Prentice Hall, New Delhio,1969
2. Rajasekaran .S., and Sankarasubramanian G., “Computational Structural

Mechanics",rentice Hall of India, 2001

Reference Books:

1. Manickaselvam V.K, "Elements of matrix and stability analysis of structures methods of Structural Analysis", Khanna Publishers, Delhi -06, 5th Edition-2001
2. Vaidhyanathan & Perumal.P , "Comprehensive structural Analysis Vol I & II" Lakshmi Publications, Delhi 110 002
3. Meghre,A.S,.Deshmukh . S.K , "Matrix methods of Structural Analysis" Chortar Publishers, Anand (2003)
4. Pandit G.S.,.Gupta S.P , "Structural Analysis", Tata McGraw-Hill Publishing Company Limited, New Delhi (2002)

09CE302 APPLIED ELASTICITY AND PLASTICITY

Credit 3:1:0

OBJECTIVES :

- To study the classical theory of linear elasticity for two and three dimensional state of stress and obtain solutions for selected problems in rectangular and polar coordinates as well as torsion of prismatic bars .
- To understand the plastic stress strain relations, criteria of yielding and elasto- plastic problems

Unit I: Analysis Of Stress And Strain In Cartesian Coordinates

Analysis of stress (two and three dimension)- Body force, surface forces - Uniform state of stress - Principal stresses - stress transformation laws - Differential equations of equilibrium. Analysis of strain (two and three dimension) Strain displacement relations – Compatibility equations - state of strain at a point - strain transformations - principal strain - principle of superposition. Stress - strain relations - generalized Hook's law - Lame's constants

Unit II : Formulation of Elasticity Problems :

Methods of formulation of elasticity problems - Equilibrium equations in terms of displacements – compatibility equations in terms of stresses - Boundary Value problems. St.Venant principle.

Two Dimensional Problems In Cartesian Coordinates:

Plane stress and Plane strain problems - Airy's stress function - polynomials -Application to:

a. Bending of a cantilever loaded at end.
b. Bending of a Beam by uniform load.
c. Bending of a cantilever with a moment at the end.

Unit III:TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES:

General equations in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - Rotating Disc - Bending of a curved bar by force at the end - Effect of circular hole on stress distribution - concentrated force at a point of a straight boundary - Forces on wedges - A circular disc with diametric loading

Unit IV:TORSION OF PRISMATIC BARS
General solutions of the problem by displacement (St. Venant's warping function) and force (Prandtl's stress function) approaches - Membrane analogy-Torsion of shafts of circular and noncircular (elliptic, triangular and rectangular) cross sectional shapes. Torsion of thin rectangular section and hollow thin walled single and multicelled sections.

Unit V : Introduction To Plasticity
Yield criteria, –Rankine's theory - St.Venant's theory - Tresca's criterion - Beltramis theory - Von-mises criterion; Stress-space representation of Von-Mises and Tresca yield criteria through Westergard stress space, Elasto-plastic problems - beams in bending - thick hollow cylinders subjected to internal pressure - torsion of bar of circular cross section - Nadai's sand heap analogy.

Text Books:

1. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, N.Delhi, 1995.
2. Sadhu Singh, "Theory of Plasticity", Khanna Publishers, N.Delhi, 1995.

Reference Books:

1. Chow,P.C. and Pagano,N.J.,"Elasticity, Tensor, Dyadic and Engg. approaches", D.Vannostrard Co., New York, 1968.
2. Timoshenko, S and Goodier, J.N, "Theory of Elasticity", Mc Graw Hill Book Co., 1951.
3. Chakrabarthy, T., "Theory of Plasticity", Mc Graw Hill Book Co., New Delhi, 1988.
4. Mendelson, A., "Plasticity, Theory and Applications", MacMillan Co., New York, 1968.

09CE303 ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES

Credit:3:1:0

OBJECTIVES :

- To learn to design the advanced reinforced concrete structures.
- To learn to design the miscellanies rcc structures like corbels etc..

UNIT I :
Introduction to design Philosophy- Working stress design, limit state design, ultimate load design
Limit State Design of Beams for Shear, Torsion and Bond
Shear strength of beams - Interaction diagrams for combined bending and torsion - Design of members subjected to combined bending, shear and torsion - Skew bending theory - bond, anchorage and splicing of reinforcement; Calculation for deflection and crack width
Precast Construction
Principle of precast construction, advantages,-brief description of methods of precasting

UNIT II : Bunkers and Silos

Design of square bunker-Design of circular silo- Jenssen's theory- Principles of Airy's theory (No derivation for problems) comparison of various codal provisions - Composite column and Tubular column behavioural study. Principles of design of RCC chimney , cooling tower and nuclear structures.

UNIT III : Limit Analysis and Design of Slabs

Behaviour of R.C. slabs under gradually increasing loads - Assumptions made in yield – line theory of slabs - Analysis of isotropically and orthotropically reinforced slabs of various shapes under different edge conditions and equilibrium method - Application to practical design problems - Effect of corner levers - Hillerborg's simple strip method of analysis.Design of flat slabs according to Equivalent frame method

UNIT IV Limit Analysis and Design of Statically Indeterminate Structures

Fundamental principles - Moment redistribution - limit analysis and design of continuous beams and simple portal frames - Check on rotation capacity.

UNIT V: Design of Miscellaneous Structures

Simply supported and continuous deep beams - Grid floors – Orthotropic plate theory-Waffle slab – corbels

Text Books:

1.Bhavikatti S.S " Advanced RCC Design" New age internatonal Pvt Ltd.2006.
3.Varghese, P.C., "Advanced Reinforced concrete structures ", Prentice – Hall of
India Ltd, New Delhi 2003.

Reference Books

1. Krishnaraju,N., "Advanced Reinforced Concrete Design "CBS publications, New Delhi 2005.
2. Punmia B.C " Advanced RCC Design" Laxmi Publications Pvt Ltd",2006.

09CE304 ADVANCED DESIGN OF STEEL STRUCTURES

Credit 3:1:0

OBJECTIVES :

- To design beams subjected to biaxial bending and beam columns as per current code
- To have an experience in the complete design of an Industrial building
- To learn the concept of design of transmission towers
- To learn the analysis and design of multistoeyed buildings
- To learn the concepts of plastic analysis and design of steel structures

Unit I:Limit state design of Beams and Beam columns

Design of Beams subjected to biaxial bending moment - Design of sections subjected to unsymmetrical bending - Elastic lateral torsional buckling - Short Beam-Columns - Long Beam-

Columns - Beam-Columns at Ultimate Load - Effects of Slenderness Ratio and Axial force on Modes of Failure - Beam-Column under Biaxial bending - Differential Equations and Moment Magnification Factors

Unit II:Industrial Building (Design by Limit State method)
Review of loads on structures-Dead, Live, wind and Seismic loads as per National standard-Analysis and Design of Industrial buildings and bents-Sway and non-sway frames- Design of Purlins, louver rails, gable column and Gable wind girder-Analysis and design of Gable frames.

UNIT III:Towers & Stacks
Types of towers - Structural Configurations - Transmission Towers - Loads on Towers - Wind Load - Analysis of a tower

Earth Quake Design of Steel Structures
Design Philosophy and Methodology – Seismic analysis and design verification – Seismic behaviour of beam columns – capacity design – special devices and systems

UNIT IV: Multistoreyed Buildings
Structure of Multistoreyed buildings - Bracing of Multistoreyed frames - Vertical load analysis – Substitute frame method - Lateral Load analysis of frames - Portal Method - Cantilever Method - Factor method - Design of members – Design of connections

UNIT V:Plastic Theory
Introduction - Shape factor – Moment redistribution – upper bound, lower bound and Uniqueness theorems - Combined mechanism - Analysis of single bay and two bay portal frames - Methods of plastic moment distribution - Design of continuous beams and portal frames

Text Book:
1. Design of Steel Structures - N. Subramanian, Oxford University Press, USA, 2008

Reference Books:
1.Dayaratnam, P., “Design of Steel Structures”, A.H.Wheeler & Co. Ltd., Allahabad, 2008
2.Arya and Ajmani, “Design of Steel Structures”, NemChand Brothers, Roorkee, 2007
3.Punmia B.C., Ashok kumar Jain and Arun kumar Jain, `Design of Steel Structures', Arihant Publications, Bombay, 2008
4.Gray, C. S. Kent L.E Mitchell, W.A., and Godfey, W.B., "Steel Designer's manual", English Language Book Society and Granade Publishing, London, 2003
5.Teaching Resource Materials on Steel – SERC, INSDAG, Anna University and IIT Madras

09CE305 - DESIGN OF FOUNDATIONS

Credit 3:1:0

OBJECTIVES :
- To study various types of shallow and deep 1. foundations, sheet pile structures, cofferdams and marine structures..

- To study the design philosophy of various types of machine foundations and special foundations on expansive soils.

Unit I:Net Load Intensity for Foundation Design – Shallow and Deep Foundations
Bearing capacity as a function of width – Settlement - Gross vs. Net load – Allowable soil pressure satisfying bearing capacity and settlement – Footings and Rafts in clay and sand – Backfilled and Compensated rafts – Introduction to Soil-Structure Interaction.
Displacement and replacement piles – Battered and Tapered piles – Individual capacity – Group capacity – Group efficiency – Negative skin friction – Piers – Load tests -Dynamic formulae – Pile construction

Unit II:Bulkheads, Cofferdams and Cut supports
Cantilever sheet pile walls – Anchored bulkheads driven to 'free' and 'fixed' earth supports – Equivalent beam method – Anchorages – Sheet pile .
Cellular cofferdams – Circular and Diaphragm types – Stability analysis.
Terzaghi's wedge theory for earth pressure on cut supports – Design pressure diagram for cut supports – Single wall braced cofferdams
Attaining familiarity with Design Softwares

Unit III:Machine Foundations and Marine Foundations
Simple harmonic motion – Degree of freedom – Natural frequency – Free and Forced vibrations – Resonance – Damping – Soil Dynamics – Determination of soil parameters – Cyclic plate bearing test – Block vibration test – Types of machine foundations – Criteria for selection and design of machine foundations – Construction vibrations – Vibration isolation – Passive and Active isolation – Earthquake geotechnics – Liquefaction.

Marine substructures – Design loads – Wave action and wave pressure – Molitore-Gaillard equation – wave pressure diagram.

Unit IV:Foundations in Expansive Soils, Fills and Rocks:
Expansive clays – Spread of black cotton soils in India – Differential free swell test – Swelling pressure test – Underreamed piles in clays and sands – Load carrying capacities of underreamed piles – Construction of underreamed piles by manual tools.

Placement and compaction of fills – Compaction control – Foundations on fills:
Roack quality designation – Foundations on unweathered, jointed and weathered rocks.

Unit V:Reinforced Earth and Ground Anchors
Mechanics of Reinforced Earth – Design – Materials for components – Construction. Diaphragm walls – Bored pile walls – Prestressed Ground Anchors – Cut-and-cover metro construction – Stabilization with drilling mud – Direct and Reverse mud circulation – Vibro-compaction by Vibroflot – Stone Columns.

Text books:
1.Kurian, N.P.,", Design of Foundation Systems – Principles and Practices (3rd rev. and enl. edn.)" Narosa Publishing House, New Delhi.2005

2.Kurian, N.P., "Modern Foundations – Introduction to Advanced Techniques," Tata McGraw-Hill, New Delhi., 1983

Reference books:

1.Venkataramaiah, C. ," Geotechnical Engineering, (3rd edn.) New Age International (P) Ltd., New Delhi.2005
2.Saran, S. ," Analysis and Design of Substructures, Oxford and IBH, New Delhi.1986
3.Varghese, P.C. ," Foundation Engineering, Prentice-Hall of India Pvt. Ltd., New Delhi.,2005
4.Peck, R.B., Hanson, W.E. and Thornburn, T.H. ," Foundation Engineering (2nd edn.) Wiley Eastern Ltd., New Delhi. 1974

09CE306 STABILITY OF STRUCTURES

Credit 3:1:0

OBJECTIVES :

- To understand the basic principles of stability and buckling and to apply equilibrium and energy approaches for the buckling of compression members and beam columns made of solid as well as thin walled open sections.
- To understand the buckling behaviour of plates and shells and nonlinear theory of buckling

Unit I : **Concepts Of Stability**
Introduction - Stability Criteria - Equilibrium, Energy and Dynamic approaches- South well Plot - Stability of Link models.

Compression Members
Higher order Differential equations - analysis for Various boundary conditions- behaviour of imperfect column - initially bent column - eccentrically loaded column-Energy method- Rayleigh Ritz , Galerkin methods - Effect of shear on buckling – Large deflection of columns.

Unit II : Inelastic Buckling
Introduction - Double modulus theory (reduced modulus) - tangent modulus theory - Shanley's theory - determination of double modulus for various sections.

Beam Columns
Introduction - Beam-columns with concentrated lateral loads - distributed loads - effect of axial loads on bending stiffness - stability of frames - stability functions.

Unit III : Lateral Stability Of Beams
Differential equations for lateral buckling - lateral buckling of beams in pure bending - lateral buckling of cantilever and simply supported I beams

Buckling of Thin-Walled Open Sections
Introduction - torsional buckling - torsional flexural buckling - Equilibrium and energy approaches.

Unit IV : Stability of Plates

Governing Differential equation-Equilibrium, energy concepts - Buckling of rectangular plates of various end conditions - Finite difference method - post-buckling strength

Unit V : Buckling of Shells

Donnel's Equation – Symmetrical Buckling of Cylinder under uniform axial Compression – Cylinder under uniform external lateral pressure – Cylinder subjected to torsion.

Imperfection sensitivity

Perfect systems – Imperfect systems – Imperfection sensitive and insensitive systems – Symmetric and Asymmetric bifurcation –Bifurcation and limit points - Path tracing – Point matching – Path switching

Text Books:

1. Chajes, A., " Principles of Structural Stability Theory", Prentice Hall, 1974.
2. Iyengar, N.G.R., "Elastic Stability of Structural Elements", Macmillan India Ltd., New delhi,2007.

Reference Books:

1. Brush, D.O., and Almorth,B.O., " Buckling of Bars, Plates and Shells", McGrawHill, 1975..
2. Timoshenko, S.P., and Gere,J.M., "Theory of Elastic Stability", 2nd Ed. McGraw-Hill, 1961.
3. El Naschie M S., "Stress, Stability and Chaos in Structural Engineering: An Energy Approach", McGraw Hill International al Editions, 1992.
4. Ashwini Kukar, "Stability of Structures ", Allied Publishers LTD, New Delhi, 1998.
5. Murali L. Gambir," Stability Analysis and Design of Strucures", Springer-Verlog, Berlin, 2004

09CE307 ADVANCED COMPUTER APPLICATION LABORATORY

Credit 0:0:2

A. Program Using Fortran And C Languages:

1. Solution of Linear System of Equations by Cramer's Rule.
2. Solution of Linear System of Equations by Gaussian Elimination method
3. Solution of Linear System of Equations by Gauss Siedel Iteration.
4. Solution of Linear System of Equations using Band Solver technique.
5. Programs for Semi automatic Technique for Flexibility and Stiffness approach.
6. Program for Direct Stiffness Method

B. Finite Element Method:

1. Analysis of 2D Truss by FEM using 2D Truss Program

C. Finite Element Analysis Of Structures (Feast):

1. Analysis of Cantilever beam using FEAST Software package.
2. Analysis of Plates using FEAST Software package
3. Analysis of Shells using FEAST Software package

D. Analysis And Design Of Structures Using STAAD-III Package
1. Analysis of plane rigid jointed frame by STAAD-III package.
2. Analysis of continuous Beams using STAAD-III package
3. Analysis of Trusses using STAAD III-package.

E. Analysis Of Structures Using NISA
1. Analysis of Curved Beams using NISA package.
2. Analysis of plates using NISA package.

F. Modelling Using Auto Cad
1. Solid Modelling using Auto CAD.
2. Design of R.C. Beams, counterfort Retaining Walls using Excel.

G. Analysis Using Ansys Pacakage
1. Stress Analysis of Deep Beams.
2. Analysis of Folded Plates & Shells
3. Analysis of Grids

H. Drafting Using Auto Cad

I. Buckling And Dynamic Analysis Of Structures

Text Book

1. Balaguruswamy. E "Object – Oriented Programming C", Tata Mc Graw Hill.

Reference Books:

1. STAAD PACKAGE MANUAL
2. FEAST PACKAGE – Hand Book for Prewin
3. FEAST C Users Manual
4. ANSYS Package Manual.

09CE308 STRUCTURAL DYNAMICS

Credit 3:1:0

OBJECTIVES :

- To study the basic principles of free and forced vibration (both undamped and damped) of single degree of freedom and multiple degree of freedom systems as well as distributed parameter systems
- To study the basic principles of structural dynamics and the solution techniques for free and forced vibration analysis of building frames subjected to dynamic loads..

UNIT I : Introduction and Principles of Dynamics

Vibration studies and their importance to structural engineering problems elements of vibratory systems and simple harmonic motion - Vibration with and without damping - constraints - generalized mass D'Alembert's principle - Hamilton's principle - Lagrange equations coupling.

Single Degree of Freedom:
Degree of freedom - Equation of motion for S.D.O.F. - damped and undamped free vibrations - Undamped forced vibration - Critical damping - Logarithmic decrement Response to support motion - Response of one degree freedom system to harmonic excitation, damped or undamped - Evaluation of damping resonance - band width method to evaluate damping - force transmitted to foundation - vibration isolation.

UNIT II : Response to General Dynamic Loading
Fourier series expression for loading-Response to general dynamic loading - (blast or earthquake) - Duhamel's integral - Numerical evaluation

UNIT III : Distributed Parameter System
Expression for generalized system properties – Vibrational analysis with Rayleigh's variational method - Rayleigh - Ritz method.
Differential equation of motion - analysis of undamped free vibration of simply supported and cantilever beams - effect of axial loads - numerical evaluation of modes – frequencies and response spectrum

UNIT IV:Multidegree Freedom System
Mathematical model of MDOF system, free vibration of undamped MDOF systems-Natural frequencies and mode shapes – orthogonality conditions,
Solution of the eigen value problem
vector interaction methods - Stodala and Subspace iteration techniques, Transformation methods - Jacobi and Given's method, Frequency search methods – Hozer and Transfer matrix methods Dunkerlay's equation and Rayleigh - Ritz methods.

UNIT V:Analysis of multi storeyed buildings subjected to Dynamic Loads:
Idealisation of multi-storeyed building frames for dynamic analysis -Shear buildings – stiffness, flexibility and mass matrices - free and forced vibration with and without damping.
Solution of Equilibrium Equations in Dynamics
Introduction - Direct integration methods - The central Difference method - The Houbolt method - Wilson-q-method and the Newmark method

Text Books:

1. Clough, R.,W., and Penzien, "Dynamics of Structures", McGraw Hill Book Co Ltd, 1986.
2. Paz Mario," Structural Dynamics - Theory and Computation", CBS publishers, 1999

Reference Books:

1. Craig,R.R., "Structural Dynamics - An Introduction to computer Methods", John Wiley & Sons, 1989.
2. Hurty W.C and Rubinstein, M.F "Dynamics of Structures", Prentice Hall, 1967.
3. Biggs, 3.M., "Introduction to Structural Dynamics", McGraw-Hill, Co., 1964.
4. Thomson, W.T., "Theory of Vibration", Prentice Hall of India, 1975.
5. Manickaselvam, V.K., "Elementary Structural Dynamics", Dhanpat Rai & Sons, 1987.

09CE309 FINITE ELEMENT METHODS IN ENGINEERING

Credit: 3:1:0

OBJECTIVES :

- To understand the basic concept of finite element and derive the shape functions for one, two, and three dimensional finite elements including plate and shell elements.
- To study the various finite element procedures and solution techniques for linear and nonlinear finite element static and stability analysis of structures

Unit I: Introduction

Concept of an element - various element shapes - one, two and three dimensional elements - Finite Element procedure, variational principles and method of weighted residual – Principle of virtual work - Rayleigh Ritz method - Galerkin's method of weighted residual. Displacement, stress and hybrid models - Convergence and compatibility requirements - Assumed displacement field - Pascal Triangle - Melosh criteria – stiffness of an axial element -Two dimensional Truss problem. - Storage schemes - skyline, band forms; Solution of equilibrium problems- Gauss elimination techniques

Unit II : Two Dimensional Elements

Triangular Elements - constant strain Triangle - Element stiffness matrix - various methods of evaluating element stiffness Higher order triangular elements - comparison of different elements. Rectangular Elements - Serendipity family - Lagrangian family - Hermitian family. Sub-Iso-Super Parametric elements - Shape function - Mapping - Linear isoparametric quadrilateral.

Unit III : Three Dimensional Elements

Numerical Integration using Gaussion Quadrature - Weights and Gauss points - Selective and reduced integration. Axisymmetric stress analysis - Tetrahedran element family - parallelopiped element - Hexahedran Element family - ZIB 8 and ZIB 20 elements.

Unit IV : Plate/Shell Elements And Finite Strip Method

Triangular and Rectangular elements - BFS Element - Faceted element for shells - Semi - loof elements - Degenerated shell elements - Axisymmetric shell elements. Finite strip method - Development of stiffness matrix and consistent load vector - Application to folded plates and bridge decks - Applications to Reinforced Concrete.

Unit V : Non-Linear Analysis And Computer Applications

Types of non-linearities - Stability analysis - Load deformation response - Solution techniques - Newton Raphson method - Modified Newton Raphson method, Alpha constant method, Riks Wempner method - classical Eigen Value analysis - programming organisation of Finite Element Schemes - Input / output plotting - Mesh generation aspects - software packages.

Text Book:

1. Rajasekaran, S., "Finite Element Methods in Engineering Design", S.Chand & Co Ltd., New Delhi, 2003

Reference Books:

1. Chandrakant, S.Desai and John F.Abel, "Introduction to the Finite Element method, A numerical Method for Engg. Analysis", Affiliated East West press Pvt.Ltd., Madras, 1972.
2. Tirupathi R.Chandrupatla and Ashok D., Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall of India Pvt.Ltd., New Delhi 2004.
3. Krishnamoorthy C.S., "Finite Element Method - Theory and Programming", Tata Mc Graw Hill Publishing Company", New Delhi 1994.
4. Bathe, K.J., "Finite Element Procedure", Prentice Hall of India, New Delhi 1997.
5. Zienkiewinz O.C., "The Finite Element method Vol. 1 & 2", Mc Graw Hill Book Company,New York 1991.
6. Mukhopadhyay.M., "Matrix, Finite Element Computer and Structural Analysis", Oxford & IBH publishing Co., Pvt. Ltd., New Delhi, 1993.
7. Rajasekaran, S., "Numerical Methods in science and Engineering - A practical approach", A.H. Wheeler & Co., 2^{nd} Edn., 1999.

09CE310 ADVANCED BRIDGE ENGINEERING

Credit 3:1:0

OBJECTIVES :

- To get exposed to the design aspects of various types of bridges
- To learn IRC specifications and Railway loading for the design of bridges
- To learn the design of slab, T beam concrete and prestressed bridges
- To learn the design of steel bridges
- To learn the concept of design of substructure for the bridges
- To learn the construction and maintenance of bridges

Unit I :Design of Concrete Bridges

Introduction and Analysis & Design of Concrete Bridges - Loading standards: IRC and Railway loadings - Reinforced concrete bridge decks: slab, T-beam and- slab, arch, bow string girder types - Critical studies of failure of major bridges

Unit II:Prestressed Concrete Bridges

Prestressed concrete bridges: simple spans, continuous decks; cantilever construction; anchorage of tendons; grouting of tendons - Critical studies of failure of major bridges

Unit III: Steel Bridges

Steel Bridges - Steel superstructure: Plate girder, box girder truss and arch types - Cable stayed bridges and suspension bridges; principles of design, aerodynamic stability and vibrations; simplified designs - Critical studies of failure of major bridges

Unit IV: Substructure and Foundations

Substructure design: piers and abutments of different types - Foundations: Shallow foundations, deep foundations, piles, wells and pneumatic caissons - River training works.

Unit V:Construction and Maintenance

Bearing: metallic and elastomeric types; fixed and movable bearings - Joints: expansion joints; Contraction joints; joint seals - Innovative construction methods: incremental push launching; cantilever construction; erection of precast elements - Bridge maintenance management: inventory, inspection and rehabilitation.

Text Book:

1. Johnson Victor, D., "Essentials of Bridge Engineering", Oxford & IBH Publishing Co., New Delhi, Fourth Edition, 2007.

Reference Books:

1. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, New Delhi, 2007
2. Krishna Raju, N., "Design of Bridges", Oxford & IBH Publishing Co., New Delhi, Third Edition, 2007.
3. T.R. Jagadeesh, M.A. Jayaram, "Design of Bridge Structures", Prentice Hall of India Private Limited, New Delhi, 2007.

09CE311 PRESTRESSED CONCRETE STRUCTURES

Credit 3:1:0

OBJECTIVES :

- To understand the basic concept of prestress of concrete structures.
- To study the prestress **d**esign methods for various structures.

UNIT I : Introduction

Prestressing system –Analysis of Prestress and Bending stresses – pressure line- concept of load balancing- Losses of prestress

Deflection

Short term deflections of uncracked members - Long term deflections - Deflection due to creep in members - Code requirements for the limit state of deflection .- Factors influencing deflection

UNIT II : Design For Flexure

Definition of Type I, Type II and Type III structures - Basic assumptions - Permissible stresses in steel and concrete as per IS:1343 Code - Four basic requirements - Design and choice of sections of post-tensioned beams - Layout of cables - Check for limit state of collapse - Location of positions of wires in pre-tensioned beams.

Design For Shear And Torsion

Shear and principal stresses - Limit state shearing resistance of cracked and uncracked sections - Design of Shear reinforcement by the limit state approach. Interaction diagrams under combined bending, torsion and transverse shear.

UNIT III : Transfer of Prestress

Pretensioned members: Transmission of prestressing force by bond - Transmission length - Factors affecting transmission length - Check for transmission length

Post tensioned members- Anchorage zone stresses - Calculation of bearing stress and bursting tensile forces and reinforcement in anchorage zone based on I.S. 1343 code and Guyon's method.
Composite Construction of Prestressed & Insitu Concrete
Types of composite construction - Analysis for stresses - Effect of Differential shrinkage -Design for flexure and shear.

UNIT IV : Statically Indeterminate Prestressed Concrete Structures
Methods of achieving continuity - Assumptions in elastic analysis - Pressure line - Linear transformation - Concordant cables - Guyon's theorem - Analysis and design of continuous beam

UNIT V
Circular prestressing in liquid retaining tanks - Analysis for stresses - Design of tank wall incorporating the recommendations of IS:3370 Part III Code - Types of Prestressed concrete pipes - Design of pipes.

Other Structures
Methods of achieving partial prestressing - Advantages and disadvantages. Design of prestressed concrete columns and tension members- Design considerations of sleepers, poles, piles and pavements - Use of nonprestressed reinforcement- Methods of prestressing concrete shell structures.

Text Books:

1. Krishna Raju, N., "Prestressed Concrete" Tata McGraw Hill Publishing Company Ltd., New Delhi, 1995. (Fourth edition), 2007.

Reference Books:

1. Lecture notes compiled by Mrs.M.Jemimah Carmichael, Karunya University, Coimbatore.

09CE312 SEISMIC DESIGN OF STRUCTURES

Credit 3:1:0

OBJECTIVES :

- To understand the basic concept of seismic design of concrete structures.
- To study the **d**esign methods for various structures.

Unit I: Engineering seismology
Introduction- Elastic Rebound theory- Plate tectonics- Seismic waves-Seismic zones- Effects of earthquakes-measurement of earthquakes- Design Philosophy and methodology-Conceptual design Considerations

Unit II: Introduction to earthquake resistant design
Basic elements of earthquake resistant design- Configurations – Design Earthquake loads- Load combinations- permissible stresses – Seismic methods of Analysis – Factors in Seismic analysis - Local site effects – Torsion – Overturning moments – Earthquake resistant design methods.

Unit III: Reinforced Concrete Buildings
Behaviour of R.C.Structures –Damage to RCC buildings – Principles of Earthquake resistant Design - Modelling of RC building- Determination and design for lateral force (Code based) - Step by step procedure for seismic analysis problems - Ductility consideration of earthquake design of RC buildings- Ductility Impact, Requirements, Assessment,-Factors affects Ductility- Ductile detailing and earthquake resistant design as per IS 13920-1993 and IS 456-2000 - Capacity based design – step by step procedure.
Shear wall- Behaviour of shear wall – Tall shear wall – Squat shear wall- earthquake resistant design of shear wall

Unit IV: Masonry Structures:
Categories of masonry buildings (IS 4326:1993)- Behaviour of unreinforced, reinforced and infill walls- Improving the seismic behaviour- seismic design considerstions- Seismic Design of masonry buildings

Steel Structures (IS 800 – 2007)
Seismic Behaviour of Steel Structures- Design of Steel Structures: General – Load and load Combinations- Connections, joints and fasteners- Columns- Storey drift- Concentrically Braced frames- Braced Frames- Moment Frames- column Bases

Unit V:Response control Concepts- Earthquake protective system- Base isolation- Energy Dissipation System

Seismic Test Methods- Seismic Evaluation- Methodology: Capacity Demand method, Push Over Analysis, Inelastic Time history analysis

(For Internal Evaluation only and not for End-Semester Examinations)
Global and Local- Methods of Retrofitting- Computer aided seismic evaluation of building systems for earthquake loads- -Hands on session .

Text Book:

1. Pankaj Agarwal and Manish Shrinkhande., "Earthquake Resistant Design of Structures ", prentice hall of India pvt ltd ., New Delhi, 2007.
2. Duggal S.K., Earthquake Resistant Design of Structures ", Oxward University Press. New Delhi, 2007.

Reference books:

1. Chopra, A.K., "Dynamics of Structures – Theory and applications to earthquake Engineering" , prentice hall of India pvt ltd., New Delhi, 2002.
2. Taranath,B.S., "Structural Analysis and Design of Tall Buildings", McGraw-hill book company New York,1999.
3. Naeim,f., "The Seismic Design Hand Book", Second edition, kluwer academic publishers, london,2001.

4. Steven L.Kramer.,"Geotechnical Earthquake Engineering', prentice hall of India pvt ltd., New Delhi, 2004.

09CE313 ADVANCED CONCRETE TECHNOLOGY LABORATORY

Credit: 0:0:2

1. CONCRETE MIX DESIGN FOR M20 AND M50 GRADE
1.1 Indian Standard Method
1.2 ACI method
2. TESTS ON HARDENED CONCRETE
2.1 Determination of Modulus of Elasticity of Concrete
3. Tests on High Performance Concrete
4. Tests on the Behaviour and ultimate strength of Reinforced Concrete Beams.
5. Impact test on FRC specimens.
6. Demonstration of prestressing operations
7. Studies on Electrical Resistance Strain gauges using a Demonstration kit.
8. Non-Destructive Testing of Concrete

TEXT BOOKS

1. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, 1990.
2. Neville, A.M.., "Properties of Concrete", Longman Scientific & Technical, England, 1981.
3. Gambier, "Concrete Technology", Tata McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Orchard, D.F., "Concrete Technology", Vols. 1 & 2, 1963.
2. Shetty, M.S., "Concrete Technology", S.Chand & Co., New Delhi, 1998.
3. Rixon, M.R., "Chemical Admixtures for Concrete", John Wiley & Sons, 1977.
4. Krishnaraju, N. "Design of concrete mixes", Sehgal Educational Consultants & Publishers Pvt.Ltd., Faridabad, 1988.

09CE314 MAINTENANCE AND REHABILITATION OF STRUCTURES

Credit 3:1:0

Unit I: General

Distress monitoring, Causes for distress, Defects due to climate, chemicals, wear, Quality assurance, Quality audit, Quality Management system and Quality control, Structural Appraisal, Concrete floors and pavements

Non Destructive Testing:

Ultrasonic and sonic test- Rebound hammer Test- Strength evaluation of existing structures.

Unit II : Building Cracks

Causes – Diagnosis – Thermal and Shrinkage cracks –Vegetation and trees – Foundation movements – Techniques for Repair – Epoxy injection.

Moisture Penetration

Sources of Dampness – Moisture movement from ground – Reasons for ineffective damping – Leakage in concrete slabs – Pitched roofs – Dampness in solid walls – Condensation – Remedial treatments – Chemical coatings

Unit III : Steel Structures

Types and causes of deterioration – Preventive measures – Repair Procedure – Brittle Failure – Defects in welded joints – Test for defects; – Mechanism of Corrosion – Design and fabrication errors – Distress during erection.

Masonry Structures

Discolouration and weakening of stones – Preservation – Chemical preservatives – Brick masonry structures – Distress and remedial measures

Unit IV : Special Materials for Repair

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferrocement overlay, Fibre reinforced concrete.

Techniques for repair: Polymer coating for rebars, Mortar and dry pack, Vacuum concrete, Gunite and Shotcrete, Shoring and underpinning, plating.

Unit V : Strengthening of Existing Structures

General principle – relieving loads – Strengthening super structures –Conversion to composite construction – Post stressing – Jacketing – Bonded overlays – reinforcement addition – strengthening the substructures– Increasing the load capacity of footing.

Text books

1. Johnson. S.M. ,“Deterioration, maintenance and repair of structures”, McGraw-Hill book company, New York, 1965.
2. R. T. Allen and S. C. Edwards, “ Repair of concrete structures”, Blakie and Sons, UK, 1987.
3. Denison Campbell, Allen and Harold Roper, “Concrete structures”, Materials, Maintenance and Repair, Longman Scientific and technical UK, 1991.

Reference books

1. M. S. Shetty, “Concrete Technology- Theory and Practice”, S. Chand and Company, New Delhi, 1992.
2. Gambhir, ” Concrete Technology”.

09CE315 ANALYSIS AND DESIGN OF PLATE AND SHELL STRUCTURES

Credit 3:1:0

Unit I : Classical Theory of Plates

Differential equation of laterally loaded and thin rectangular plates - Levy and Naviers solution of plates - small deflection theory of plates - analysis of laterally loaded (concentrically loaded) circular, thin plates with simply supported or clamped edges.

Unit II : Design of Folded Plate Roof
Assumptions in the analysis of folded plates - Analysis of folded plate roof as per the ASCE task committee recommendations - Design steps - Minimum thickness and reinforcements as per IS specifications for RC folded plates.

Unit III : Classical Theory of Shells
Structural behavior of thin shells - Classification of shells - Translational and rotational shells - Ruled surfaces - Methods of generating the surface of different shells like hyperbolic paraboloid, elliptic paraboloids conoids etc Membrane theory of doubly curved shells -Edge disturbance

Design of Shells with Double Curvature
Design of the following type of shells a) Spherical shell, b) Conical shell, c) Paraboloid and ellipsoid.

Unit IV : Design of Cylindrical Shells
Design of R.C. Cylindrical shell with edge beams using theory for long shells - Design of shell with ASCE manual coefficients, Prestressed Cylindrical Shells

Unit V : Design of Hyperbolic Paraboloid Shells
Surface definition - Determination of forces - Forces in the edge members - Buckling consideration -Design examples - Detailing of reinforcement

Design of R.C Northlight Shells
Analysis of stresses in northlight shells - Design examples

Text Books

1. Ramaswamy, G.S., “Design and Construction of Concrete Shell roofs”, Revised Ed. R.E.Kriegger, Malabar, Florida, 1984.
2. Timoshenko, S., “Theory of Plates and Shells”, McGraw Hill Book Co., New York, 1990.

Reference Books

1. Chatterjee, B.K., "Theory and design of concrete Shells", Oxford and IBH publishing co, 1971.
2. “Phase 1 - Report on Folded plate construction – Report of the Task Committee on Folded Plate Design – ASCE Structural Division” – Dec. 1963, pp 365 – 406.
3. Kelkar, V.S. and Sewell , R.T., "Fundamentals of the analysis and design of shell structures". Prentice Hall, Inc. New Jersey, 1987.

4. "Design of Cylindrical concrete shell roofs", Manual of Engineering Practice No.31 ASCE, New York, 1952.
5. Billington, D.F., "Thin Shell Concrete Structures" Mc Graw Hill Book Company, 1965.

09CE316 ADVANCED CONCRETE TECHNOLOGY

Credit : 4:0:0

OBJECTIVES :

- To know the advanced types of concrete used for varies type of structures
- To know the durability and other properties of concrete.

Unit I : Concrete Making Materials

Composition and properties of portland cement - tests on physical properties - consistency - setting time - soundness - strength - cements of different types - composition – properties and uses with special emphasis for different constructional and weather conditions – IS code specifications .AGGREGATES: Classification - Mechanical Properties - deleterious substances in aggregates - Bulking of sand - Alkali Aggregate reaction - Grading requirements - IS Code specifications WATER: Requirements of water for concrete making - IS Code specifications. ADMIXTURES: - Accelerators - Retarders - water reducing agents - Plasticisers – Air entraining agents.

Unit II: Fresh Concrete and Hardening of Concrete

Workability - Factors affecting workability - Tests for workability - Segregation - Bleeding - Mixing of concrete - Compaction of concrete - Preplaced concrete - Shotcrete. Factors affecting strength of concrete - Curing of concrete Maturity of concrete - Micro cracking and autogeneous healing - Evolution of heat and expansion - Shrinkage of concrete - Factors affecting shrinkage of concrete.

Unit III: Durability of Concrete and Testing of Hardened Concrete

Permeability - Chemical attack - Sulphate attack - Quality of water - Marine atmosphere - Methods to improve durability - Thermal properties of concrete - Fire resistance -Resistance to Abrasion and Cavitation - Acoustic properties - Compression test – Split Tension test - Flexure Test - Test for Bond strength - IS Code provisions - Factors affecting strength test results - Accelerated strength tests - stress strain characteristics – Determination of modulus of elasticity - Electrodynamics determination method - In site strength determination - variation in test results - Distribution of strength - standard deviation -creep of concrete and factors which influence it.

Unit IV : Mix Design

Basic considerations - Factors in the choice of mix proportions - ACI method, Mix design with fly-ash - IS method – Rapid Method- Steps of design – Mix proportions for weigh batching and volume batching - correction for moisture content and bulking - yield of concrete - Design of high strength concrete mixes – Inspection and Testing of structures: core test, Load test for flexural members

Unit V: Mix Design
BIS method , UK and Australia code method of design mix- mix design softwares-high strength concrete - high performance concrete - self compacting concrete - ready mix concrete- Pumped Concrete

Text Books
1. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, 2003
2.Santhakumar A.R “Concrete Technology”, Oxford University Press N Delhi,2006

Reference Books
1. Neville, A.M., "Properties of Concrete", Longman Scientific & Technical, 2001
2.Viswanath,H.S, “Concrete Technology”, Sapna Book House (p) Ltd,2007.

09CE317 ADVANCED CONSTRUCTION TECHNIQUES AND PROJECT MANAGEMENT

Credit: 4:0:0

OBJECTIVES :

- To know the construction technique of varies structures
- To plan and complete the project within the stipulated time

UNIT I: SUB-STRUCTURE CONSTRUCTION
Box jacking – Pipe jacking – Under water construction of diaphragm walls and basement – Tunneling techniques – driving well and caisson – sinking cofferdam – cable anchoring and grouting – driving diaphragm walls, sheet piles – laying operations for built up offshore system – shoring for deep cutting large reservoir construction with membrance and earth system – wellpoints – dewatering and stand by plant equipment for underground open excavation.

UNIT II: SUPER STRUCTURE CONSTRUCTION
Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – insitu prestressing in high rise structures, aerial transporting, handling and erecting lightweight components on tall structures – erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrappers, bow string bridges, cable stayed bridges – launching and pushing of box decks – Advanced construction techniques in offshore construction practice – construction sequence and methods in RCC domes and prestress domes – support structure for heavy equipment and conveyor and machinery in heavy industries – erection of articulated structures, braced domes and space decks.

UNIT III: REPAIR CONSTRUCTION

Mud jacking grout through slab foundation – micropiling for strengthening floor and shallow profile – pipeline laying – protecting sheet piles, screw anchors – sub grade – water proofing – under pinning advanced techniques – Sequence in demolition and dismantling.

UNIT IV: ORGANIZING PROJECT MANAGEMENT
What is project Management? – Trends in Modern Management – Strategic Planning and Project Programming organization of project participants – Traditional Designer – Constructor sequence – Professional Construction Management – owner – Builder Operation – Turnkey operation – Leadership and Motivation for the project team – Interpersonal Behaviour in Project Organizations – Perception of Owners and Contractors. Innovation and Technological Feasibility – Innovation and Economic Feasibility – Geotechnical Engineering: Investigation –Construction Planning – Computer aided planning

UNIT V:LABOUR, MATERIAL, EQUIPMENT AND FINANCIAL MANAGEMENT
Factors affecting job-site productivity of labour – Labour relations in construction – Problems in collective bargaining – Materials procurement and Delivery – Inventory control – Tradeoffs of costs in Materials Management – Construction equipment – Choice of equipment and standard production rates – Equipments for industrial construction and pre-fabrication. Type of construction cost estimates – Unit cost method of estimation – Application of cost indices to estimating – Estimate based on Engineer's list of quantities allocation of construction costs over time – Estimation of operating costs – Computer Aided Cost Estimation.

Text Books:
1. Jerry Irvine, Advanced Construction Techniques, CA Rocktr, 2001
2. Chitkara.K.K., Construction Project Management, Tata McGraw Hill Co., New Delhi, 2003

Reference Books:
1. Seetharaman .S, 'Construction Engineering and Management', Umesh Publications, Nai Sarak, Delhi – 2002

09CE 318 THEORY OF PLATES

Credit : 4:0:0

UNIT I : Introduction
Thin and thick plates – Plate behavior – Material behavior – Isotropic and orthotropic Materials.

Small Deflection Theory and Classical Methods
Differential equation of plates in Cartesian Coordinates system – boundary conditions – Rigorous solution – Naveir's method – Levy's method.

UNIT II : Symmetrical Bending of Circular Plates

Differential equation for symmetrical bending of laterally loaded circular plates – Simply supported edges – clamped edges – circular plate with a circular hole at the center – circular plate concentrically loaded.

UNIT III :Approximate Methods

Energy method – Galerkins Method – Ritz Method – Simultaneous bending and stretching.

Numerical Methods

Finite difference method – Introduction to Finite Element Method.

UNIT IV : Plate of Other Shapes

Triangular plates – Elliptic plates – Sector plates – Skew plates – Plates on elastic foundation – Continuous plates.

UNIT V : Advanced Topics

Large Deflection theory – Shear Deformation Theories – Mindlin's theory of plates – Flat plates – Engineering approach to design of Rectangular floor slabs.

Text Books:

1. Rudolph Szilard., "Theory and Analysis of Plates", Prentice Hall, 1974.
2. Timoshenko and Krieger., "Theory of Plates and Shells", Mc-Graw Hill Inc, New York, 1959.

Reference Books:

1. Donnel, L.H., "Beams, Plates and Shells", McGraw Hill Inc, 1976.
2. Mansfield., "The Bending and Stretching of Plates"
3. Pucker.A., "Influence Surfaces of Elastic Plates"
4. Bairagi. N.K., "A Text Book of Plate Analysis", Khanna Publishers", New Delhi.

09CE319 MECHANICS OF COMPOSITE MATERIALS

Credit : 4:0:0

Unit I : Introduction

Classification – mechanical behavior – basic terminology – manufacture – advantages.

Unit II : Micro Mechanical Behavior of a Lamina

Determination of constants – elasticity approach to stiffness – comparison of approaches – mechanics of material approach.

Unit III : Macro Mechanical Behavior of a Lamina

Stress – Strain relation for anisotropic material – engineering constants – constitutive relation in plane stress – lamina in arbitrary – bi-axial strength theory.

Unit IV : Macro Mechanical Behavior of a Laminate

Equivalent single layer theory – classical laminate theory – continuum based theory – laminate stiffness – comparison – strength of laminates - stress design of laminates.

Failure Strength Of Laminates

Delamination Theory – Ply drops and Failure Theory – Tsai –Wu Theory.

Unit V : Bending, Buckling and Vibration of Laminate Plates

Governing equations – bending, buckling and vibration – design of simply supported plate under distributed lateral load – buckling under in-plane load – vibration of simply supported laminate plates.

Text Books:

1. Jones, R.M., "Mechanics of Composite Materials II, McGraw – Hill Kogukush International students edition, 1975.

Reference Books:

1. Bose.P., and Reddy. J.N., "Analysis of Composite plates using various plate theories – part I and II – formulation and analytical solution "Structural Engineering and Mechanics, Vol 6, No 6, & 7, Sept, Oct, 1998.
2. Reddy, J.N., "Mechanics of Laminated Composite Plates", CRC Press.

09CE320 DESIGN OF STRUCTURES FOR DYNAMIC LOADS

Credit : 4:0:0

Unit I : Introduction

Factors affecting design against dynamic loads – Behavior of concrete, steel, masonry and soil under impact and cyclic loads – Recap of Structural dynamics with reference to SDOF, MDOF and continuum systems – Ductility and its importance.

Unit II : Design Against Earth-Quakes

Earth-quake characterisation – Response spectrum – seismic coefficient and response spectra methods of estimating loads – Response of framed, braced frames and shear wall buildings – Design as per BIS codes practice – Ductility based design.

Unit III : Design Against Blast and Impact

Characteristics of internal and external blast - Impact and impulse loads – Pressure distribution on buildings above ground due to external blast – underground explosion - Design of buildings for blast and impact as per BIS code of practice.

Unit IV : Design Against Wind

Characteristics of wind – Basic and design wind speeds – Effect of permeability of structure – pressure coefficient – Aeroelastic and Aerodynamic effect - Design as per BIS code of practice including Gust factor approach – tall buildings, stacks and chimneys.

Unit V : Special Considerations

Energy absorption capacity – Ductility of material and the structure – Detailing for ductility – Passive and active control of vibrations – New and favorable materials.

Text Book:

1. Bela Goschy, "Design of Buildings to withstand abnormal loading", Butterworhts, 1990.

Reference Books:

1. Paulay.T and Priestly. M.N.J, "A seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 1991.
2. Dowling. C.H, "Blast Vibration – Monitoring and Control", Prentice Hall Inc, Englewoods Cliffs, 1985.
3. Alan G. Daven Port, "Wind Effects on Buildings and Structures", Proceedings of the Jubileum Conference on Wind effects on Structures", Port Alegne, Brazil, pp 25-29, May 1998, Balkema A.A. Publishers, 1998.
4. Concrete Structures Under Impact and Impulsive loading, Synthesis Report, CEB. Lousanne, Germany, 1988.

09CE321 DISCRETE STRUCTURAL OPTIMIZATION

Credit : 4:0:0

Unit I : Introduction

Basic Concepts of minimum weight – minimum cost design – Objective function, constraints – Brief review of classical methods.

Unit II : Integer Programming

Introduction – Graphical representation – Gomory's cutting plane method – Balas' Algorithm for zero-one programming – Integer polynomial programming – Branch-and-Bound method – Sequential Linear Discrete Programming – Generalized penalty function method.

Unit III : Genetic Algorithm

Genetic Algorithms – Operators – Reproduction – Mutation – Cross Over – Evolution Strategies – Methods for optimal design of structures, continuous beams and single storeyed frames – minimum weight design for truss members.

Unit IV : Ant Colony Algorithm

Natural motivation – Ant algorithm – Network – The ant – Initial population – Ant movement – Ant tours – Pheromone – Evaporation – Introduction to TABU search – sample problem.

Unit V : Application of Artificial Neural Networks to Structural Optimization

Basic concepts – Biological systems – Artificial neural network – application characteristics – overview of learning methods – Review of probability concepts – Fuzzy set theory and logic – Application to Structural Optimization.

Text Books:

1. Rao. S.S. "Engineering Optimization, Theory and Practice", New age International (p) Ltd., New Delhi. Reprint 2002.
2. GoldBerg, D.E., "Genetic Algorithm in Search, Optimization and Machine Learning", Addison – Wesley, 1989.

Reference Books:

1. Spunt, L, "Optimum Structural Design", Prentice Hall, New Jersey, 1971.
2. Gary Parker, R and Ronald L, Discrete Optimization", Academic press 1988.
3. David Corns, Marco Dorigo and Fred Gloves, "New Ideas in Optimization", The McGraw Hill Company, London, 1999.
4. Rajasekaran,S and Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm", Prentice Hall of India Pvt. Ltd, Delhi, 2003.

09CE322 DESIGN OF INDUSTRIAL STRUCTURES

Credit 4:0:0

UNIT I : General

Classification of Industries and industrial structures - Specific requirements for industries like Engineering, Textiles, Chemicals, etc - Site layout and external facilities required.

UNIT II : Functional Requirememnts

(i)Natural and artificial lighting - protection from the sun sky light (ii) Services - electrical wiring fixtures - cable and pipe bridge - electrical installations - substations - Effluent disposal and (iii) Heating and ventilation - air conditioning - fire expanse and chutes - fire alarm, extinguishers and hydrants - Guidelines from factories act.

UNIT III : Industrial R.C. Structures

Design and detailing of R.C. gable frames, corbels, bunkers, silos and chimneys - North light shell roofs and folded plates - cooling towers - Application of prefabrication techniques.

UNIT IV : Industrial Steel Structures

Design of gantry girders, steel bunkers, silos and chimneys - High pressure boilers and piping design.

UNIT V : Miscellaneous

i. Design of Nuclear containment structures.
ii. Design of Power Transmission Structures: cables, Transmission line towers - substation structures - Tower foundations.
iii. Design of machine foundations.

Text Book

1.Proceedings of Advanced Course on Industrial Structures, Structural Engineering Research Centre, Madras, 1982.

Reference Books

1.Manohar, S.N., "Tall chimneys - Design and Construction", Tata Mc Graw Hill, 1985.
2. Santhakumar, A.R. and Murthy, S.S., "Transmission Line Structures", Tata Mc Graw Hill 1992.
3. Srinivasulu, P and Vaidyanathan, C., "Handbook of Machine Foundations", Tata Mc Graw Hill 1976.
4. Jaikrishna and Jain, O.P, Plain and Reinforced Concrete, Vol-II - Nemchand and brothers, 1958.
5. Handbook on Fundamental Requirements of Industrial Buildings (Lighting and Ventilation), BIS.
6. Dayaratnam, P., "Design of Steel Structures", A.H. Wheeler & Co., Ltd., Allahabad,1996.

09CE323 DESIGN OF TALL BUILDINGS

Credit 4:0:0

UNIT – I : Introduction

History - advantages and disadvantages - economics - essential amenities - lifts (elevator) - fire safety - water supply - drainage and garbage disposal - miscellaneous services - systems - structural and foundation systems.

Loads:

Loads on High Rise buildings - code recommendations - wind and earthquake forces - gust factors - Karman vortices - fire-quality assurance.

UNIT II : Structural System In Steel And Concrete

Steel: Beam column frames - vertical shear truss - framed tubes - column diagonal truss tube - bundled tube systems. Concrete: Shear walls - coupled shear walls-framed tubes - tube in tube systems - effects of torsional loads on shear walls.

UNIT III : Static Analysis

Static analysis - High Rise structural systems in steel- analysis of braced and unbraced frames - approximate analysis of framed and bundled tube systems - High Rise structures in concrete - Rosman's analysis of shear wall frame interaction- simplified method of analysis of frame wall systems.

Stability Analysis

Stability consideration of unbraced tall buildings- laterally loaded asymmetric shear buildings - approximate methods of stability analysis – P – Δ method.

UNIT IV : Dynamic Analysis

Dynamic response of braced tall buildings - buildings with shear walls - Rosman's analysis - Analysis to earthquakes - lateral drift limitations in tall buildings - Design of Chimneys, TV towers and tall towers.

UNIT V: Foundation Systems

Deep foundations - Caissons and High Capacity piles - Soil Structure Interaction.

Text Book

1. Taranath,B.S., " Analysis & Design of Tall Building ",McGraw-Hill Book Co, 1988.

Reference Books

1. Ramaswamy, S.D. and Yam,C.T., " Proceedings of the International Conference on Tall buildings", Singapore, 1984.
2. Fintel,M., "Hand Book of Concrete Engineering". Van Nostrand Reinhold co., 1974.
3. Mehta B., "High Rise Buildings" M/S Skyline, 1978

09CE324 PREFABRICATED CONCRETE STRUCTURES

Credit 4:0:0

OBJECTIVES :

- To know the prefabrication technique of varies residential structures
- To know the prefabrication technique of varies industrial structures

UNIT I : Introduction

General principles of prefabrication - Types of prefabrication - specific requirements for planning and layout of prefabrication plant - I.S. Code specifications - Modular coordination - Transportation - Erection - Stages of loading and codal provisions - Material properties - Deflection control - Lateral load resistance.

UNIT II : Floors, Stairs And Roofs

Types of floor slabs - analysis and design of cored and panel types and two-way systems - staircase slab system and design - Types of roof slabs and insulation requirements -Description of joints, their behaviour and reinforcement requirement - short term and long term deflection control.

UNIT III :Walls

Types of wall panels - Blocks and large panels - curtain, partition and load bearing walls -load transfer from floor to wall panels - Vertical loads - Eccentricity and stability of wall panels - Design curves, types of wall joints, their behaviour and design - Leak prevention,joint sealant and sandwich wall panels.

UNIT IV : Design of Industrial Buildings

Components of single storey industrial sheds with crane gantry systems - Design of R.C. roof trusses and roof panels - Design of R.C. crane - gantry girders, corbels, columns and wind bracing design - joints between columns and foundations.

UNIT V : Prefabricated Shell Roof for Industrial Sheds

Hand book based design of cylindrical and bypar prefabricated shells - folded plates -Erection and jointing - Joint design.Hoisting Technology-Equipments for hoisting and erection - Techniques for erection of different types of members such as beams, slabs, wall panels and columns - Design for handling and erection stresses -Methods of minimizing erection stresses.

Text Book:

1. Lasslo Mokk, "Prefabricated concrete for Industrial and Public sectors," Akademiai Kiado, Budapest, 2004.

Reference Books:

1.Kim Elliott "Prifabricated concrete structures". Butterworth-heinemann,2002

2. Precast Concrete: Materials, Manufacture, Properties And Usage, Taylor & Francis Group, 2007.

09CE325 DESIGN OF OFFSHORE STRUCTURES

Credits: 4:0:0

UNIT I : Theories of Periodic Wave Motion

Small amplitude wave theory - Basic equations of hydrodynamics - Integration of equations of motion - Mathematical formulation of wave problem - characteristics of small amplitude waves - Deep and shallow water waves - wave energy - Group velocity of wave trains - Transformation of small amplitude waves - Reflection - reflection and deflection of waves breaking of wave and its importance.

UNIT II : Forces Due to Ocean Waves on Structures

Finite amplitude wave theories - Wave forces on a circular cylinder - coefficient of drag and inertia - Wave forces on breakwaters and sea walls due to non- breaking and broken waves - wave forces on piles.

UNIT III : Shore Protection Works

Sea walls and bulkheads - Groins - Offshore breakwaters - Artificial nourishment - Functional aspects of break waters - Design of breakwaters.

UNIT IV : Piers, Wharves and Quaywalls

General - Functional aspects - Design of wharves, piers and quay walls

UNIT V : Other Structures

Functional aspects and design of Graving dry docks - Floating dry docks - Dolphines - Fenders - Offshore mooring buoys - Offshore marine platform.

Text Book

1. Keddy, D.V. and Arockiasamy, M., "Offshore Structures, Vol.I" Krieger Publishing Company, Malabar, Florida, 1991.

Reference Books

1. Chakrabarti, S.K., "Hydrodynamics of Offshore Structures", Computational Mechanics Publications, 1987.

2. Thomas H.Dawson, "Offshore Structural Engineering", Prentice Hall Inc. Englewood Cliffs, N.J.1983.
3. API Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RPZA, Dalls, Tex.
4. Wiegel, R.L., "Oceanographical Engineering", Prentice Hall Inc, Englewood Cliffs, N.J.1964.
5. Brebia, C.A., Walker, S., "Dynamic Analysis of Offshore structures, New-nes Butterworths, U.K.1979.

09CE326 SPACE STRUCTURES

Credits: 4:0:0

UNIT I : Introduction
Space Structures - Single and Multi-layer grids - barrel vaults- domes – towers- tension structures -pneumatic structures - patterns - notable structures in India and abroad - Material - steel - aluminum - plastics - protection coats for the members.
Practical Construction Methods
Cladding - cambering - drainage- Transportation problem- lifting technique corrosion protection - maintenance and fire protection

UNIT II : Behaviour
Different forms of space structures - tensegrity frame work - tensile structures- pneumatic structures
Prefabricated Space Structural Systems
Mero, Space Deck, Nodus, Unistrut, Triodetic, Unibat, and NS truss

UNIT III : Node Connectors
Mero - Octatube - Nodus System – Triodetic- Modular System-Tomo Unit Truss.

UNIT IV : Analysis

Finite Element Method – Linear – Nonlinear-Collapse-Dynamic and Stability Analysis.

Design of Members

Joints - support systems- foundations
Computer Aided Design
Expert system

UNIT – V : Configuration Processing

Formian Algebra - Case Studies - Failures

Reference Books

1. Nooshin,H., "Formex Configuration Processing in Structural Engineering", Elsevier Applied Science Publishers, London, 1984.
2. All Bulletins of the International Association of Shell and Spatial Structures

3. Proceedings of the First, Second , Third and Fourth International Conferences on Space Structures, University of Surrey, Guidford, England, 1975, 1985, 1993
4. Davies,R.M. (eds), "Space Structures", Blackwell Scientific Publications, Oxford, 1967.
5. Makowski,Z.5. " Steel Space Structures", Michael loseph Ltd., London, 1965.
6. Subramanian,N., "Principles of Space Structures", A.H.Wheeler co., 1983.

09CE327 ENVIRONMENTAL CHEMISTRY

Credits : 4:0:0

OBJECTIVES:
To educate the students in the area of water, air and soil chemistry and train them in the laboratory in the determination of pollutants present in air, water, wastewater and soil.

UNIT I. INTRODUCTION TO CHEMISTRY
Basic concepts from general chemistry: chemical equations, types of chemical reactions, calculations from chemical equations, solutions, activity and activity coefficients, chemical equilibria, chemical thermodynamics, factors affecting chemical equilibrium. Gas laws. Acid - Base Equilibria: fundamentals, equilibrium diagrams, alkalinity and acidity, the carbonic acid system, buffering in water systems. Solubility equlilibria for slightly soluble salts, effect of other solutes on salt solubility Oxidation-reduction Equlilibria: UV visible spectroscopy – basic principles – application – Atomic absorption spectroscopy – Principles – applications Gas and liquid chromatograph – Principles and applications.

UNIT 2. DEGRADATION:
Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis - Degradation of food stuffs, detergents, pesticides and hydrocarbons.

UNIT 3. AQUATIC CHEMISTRY
Metals, complex formation, oxidation and reduction and sorption – E^h – p^H diagrams - chemical speciation – QSAR – Risk evaluation of chemicals.

UNIT 4. ATMOSPHERIC CHEMISTRY
Regions of atmosphere - Chemical and photochemical reactions – photochemical smog, ozone layer depletion – green house gases and global warming – Acid rain.

UNIT 5. SOIL CHEMISTRY
Soil properties, clay minerals - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation.

TEXT BOOK

1. C.N. Sawyer, P.L. MacCarty and G.F. Parkin, Chemistry for Environmental Engineering and Science, Tata McGraw-Hill, Fifth edition, New Delhi, 2003.

REFERENCES:

1. G.W. Vanloon and S.J. Duffy 'Environmental chemistry – a global perspective, Oxford University press, New York., 2000.
2. D.W.Connell, Basic concepts of Environmental Chemistry, Lewis publishers, New York, 1997.
3. Colin Baird, "Environmental Chemistry", Freeman and Company, New York, 1997.
4. S.E. Manahan, Environmental Chemistry, Sixth Edition, Lewis Publishers, New York, 1994.

09CE328 ENVIRONMENTAL MICROBIOLOGY

Credits ; 4:0:0

OBJECTIVES:

To educate the students in microbiology and its applications in environmental engineering, and to train them in experiments related to microbiological examination of water

UNIT 1. INTRODUCTION

Classification of microorganisms—prokaryotic, eukaryotic, structure, characteristics, nucleic acids-DNA, RNA, replication. Culturing of microorganisms, Recombinant DNA technology.

UNIT 2. MICROBIOLOGY OF ENVIRONMENT

Distribution of microorganisms—Water, Air and Soil, Indicator organisms, coliforms—fecal coliforms, E. coli, Streptococcus, Clostridium, Significance in water. Algae in water supplies—problems and control. Concentration and detection of virus, Transmissible diseases.

UNIT 3. METABOLISM OF MICROORGANISMS

Nutrition and metabolism in microorganisms, growth phases, carbohydrate, protein, lipid metabolism-aerobic and anaerobic-respiration, fermentation, glycolysis, Kreb's cycle, hexose monophosphate pathway, electron transport system, oxidative phosphorylation, environmental factors, enzymes, Bioenergetics.

UNIT 4. ROLE OF MICROORGANISMS IN WASTEWATER TREATMENT

Microbiology of biological treatment processes—aerobic and anaerobic, Biodegradation of toxic pollutants—mechanism-- α-oxidation, β-oxidation, nitrification and denitrification, eutrophication.

UNIT 5. TOXICOLOGY

Ecotoxicology—toxicants and toxicity, factors influencing toxicity, effects—acute, chronic, concentration response relationships, test organisms, toxicity testing, bioconcentration, bioaccumulation, biomagnification, bioassay, biomonitoring.

TEXT BOOK

1. Maier, R.M., I.L. Pepper and C.P. Gerba, "Environmental Microbiology", Academic Press, New York, 1999.

REFERENCES

1. Tortora. G.J, B.R. Furke, and C.L. Case, "Microbiology-An Introduction" (4th Ed.), Benjamin/Cummings Publ. Co., Inc., California, 1992.
2. Frank C. Lu and Sam Kacew, LU's Basic Toxicology, Taylor & Francis, London (4th Ed), 2002
3. Baker. K.H. and D.S.Herson, Bioremediation, McGraw-Hill Inc., New York, 1994.

09CE329 PHYSIO-CHEMICAL TREATMENT OF WATER AND WASTEWATER

Credits 3:1:0
OBJECTIVES:
To educate the students on the working principles and design of various physical and chemical treatment systems for water and wastewater.

UNIT 1. PHYSIO-CHEMICAL CHARACTERISTICS
Pollutants in water and wastewater - characteristics, Standards for performance – Significance and need for physico-chemical treatment.

UNIT 2. PHYSICAL TREATMENT PRINCIPLES
Principles of Screening – Mixing, Equalisation – Sedimendation - Filtration – back washing - Incineration – gas transfer - mass transfer coefficients. Adsorption – Isotherms – Principles, equilibria and kinetics, reactors, regeneration, membrane separation, Reverse Osmosis, nano filtration ultra filtration and hyper filtration – electrodialysis, distillation – stripping and crystallization – Recent Advances.

UNIT 3. CHEMICAL TREATMENT PRINCIPLES
Principles of Chemical treatment – Coagulation flocculation - Precipitation – flotation, solidification and stabilization – Disinfection. Ion exchange, Electrolytic methods, Solvent extraction – advance oxidation /reduction – Recent Advances.

UNIT 4. DESIGN OF CONVENTIONAL TREATMENT PLANTS
Selection of unit operations and processes - Design of conventional water treatment plant units – Aerators – chemical feeding – Flocculation – clarifier – filters – Rapid sand filter, slow sand filter, pressure filter – chlorinators. Displacement and gaseous type. Layouts – flow charts – Hydraulic Profile - O & M aspects – case studies

UNIT 5. DESIGN OF INDUSTRIAL WATER TREATMENT AND RECLAMATION

Selection of process - Design of softeners – Demineralisers – Wastewater reclamation - Reverse osmosis plants – Residue management – O and M aspects – Recent Advances - case studies.

TEXT BOOK

1. Metcalf and Eddy, Wastewater engineering, Treatment and Reuse, Tata McGraw-Hill, New Delhi, 2003.

REFERENCES

1. Manual on water supply and Treatment CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1999.
2. Lee, CC and Shun dar Lin, Handbook of Environmental Engineering Calculations, McGraw-Hill, New York, 1999.
3. Qasim, S.R., Motley, E.M., Zhu, G. Water works Engineering – Planning, Design and operation, Prentice Hall, New Delhi 2002.
4. Casey, T.J. Unit treatment processes in water and wastewater Engineering, John Wiley and Sons, London 1993

09CE330 BIOLOGICAL TREATMENT OF WASTEWATER

Credits 3:1:0

OBJECTIVES:

To educate the students on principles and design of various biological treatment units used for wastewater treatment

UNIT 1. INTRODUCTION
Objectives of biological treatment – significance – aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth -attached and suspended growth – Determination of Kinetics coefficients for organics removal – Biodegradability assessment - selection of process.

UNIT 2. AEROBIC TREATMENT OF WASTEWATER
Design of sewage treatment plant units – screen chamber, Grit chamber with proportional flow weir, sedimentation tank - Trickling filters, Rotating Biological contactor, activated sludge process & variations, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems – Disinfected disposal options – reclamation and reuse - Flow charts, layout, hydraulic profile - Recent advances.

UNIT 3. ANAEROBIC TREATMENT OF WASTEWATER
Attached and suspended growth, Design of units – UASB, up flow filters, Fluidised beds – septic tank and disposal – Nutrient removal systems – Layout and Hydraulic profile – Recent advances.

UNIT 4. SLUDGE TREATMENT AND DISPOSAL
Design of Sludge management facilities, sludge thickening, sludge digestion, Biogas generation, sludge dewatering (mechanical and gravity) – upgrading existing plants – ultimate residue disposal – Recent Advances.

UNIT 5. OPERATIONS, MAINTENANCE, MANAGEMENT AND CASE STUDIES

Operational problems – Trouble shooting, Planning, Organising and Controlling of plant operations – capacity building, Case studies on sewage treatment plants – sludge management facilities

TEXT BOOK

1. Metcalf & Eddy, Inc. 'Wastewater Engineering, Treatment and Reuse. Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003

REFERENCES:

1. Arceivala, S.J., Wastewater treatment for pollution control, TMH, New Delhi, 1998.
2. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
3. Qasim, S.R, Wastewater Treatment Plant, Planning, Design & Operation Technomic Publications, New York, 1994.

09CE331 AIR POLLUTION AND CONTROL

Credits 4:0:0
OBJECTIVES:
To educate the students on various methods of control of particulate and gaseous air pollutants

UNIT 1. INTRODUCTION:
Air resource management system - Air quality management - Scales of air pollution problem - Sources and classification of pollutants and their effect on human health vegetation and property - Global implications of air pollution - Meteorology Fundamentals - Atmospheric stability – Micrometeorology - Atmospheric turbulence - mechanical and thermal turbulence - Wind profiles - Atmospheric Diffusion - Atmospheric diffusion theories - Steady-state atmospheric diffusion equation – Plume rise - Diffusion models – Software applications - Ambient air quality and emission standards – Air pollution indices – Indoor Air Pollutants – Models – Air Quality Sampling and Monitoring.

UNIT 2. CONTROL OF PARTICULATE CONTAMINANTS:
Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT 3. CONTROL OF GASEOUS CONTAMINANTS:
Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations – Condensation - design and performance equation – Incineration - Equipment description - design and performance equations - Biological Air Pollution Control Technologies – Bio-Scrubbers, Biofilters – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT 4. EMERGING TRENDS:
Process Modification – Automobile Air Pollution and its control – Fuel Modification - Mechanical Particulate Collectors – Entrainment Separation – Internal Combustion Engines – Membrane Process – Ultraviolet Photolysis – High Efficiency Particulate Air Filters – Technical

& Economic Feasibility of selected emerging technologies for Air pollution control – Control of Indoor Air Quality – Radio active pollution and its control.

UNIT 5. NOISE CONTROL:
Noise Standards - Measurement – Modeling - Control and preventive measures.

TEXT BOOK

1. C S Rao, Environmental Pollution Control Engineering, New Age International (p) Limited, 2006

REFERENCES:

1. Lawrence K.Wang, Norman C Perelra, Yung-Tse Hung, "Air Pollution Control Engineering", Tokyo, 2004.
2. Noel de Nevers, Air Pollution Control Engg., McGraw-Hill, New York, 1995.
3. David H.F Liu, Bela G.Liptak "Air Pollution", Lewis Publishers, 2000.
4. **Anjaneyulu.Y, "Air Pollution & Control Technologies", Allied Publishers (P) Ltd, India, 2002.**

09CE332 WATER AND WASTE WATER ANALYSIS LABORATORY

Credits ; 0:0:2

1. PHYSICAL AND CHEMICAL ANALYSIS OF WATER
   pH, Conductivity, Turbidity, Solids, Chlorides, Sulphates, Alkalinity, Fluorides, Nitrate and heavy metals.

2. PHYSICAL AND CHEMICAL ANALYSIS OF WASTEWATER
   Phosphate, COD, BOD, Organic and ammonical nitrogen, Oil & grease.

09CE333 INDUSTRIAL WATER POLLUTION CONTROL

Credits : 4:0:0

OBJECTIVES:

To educate the students on complete management principles related to individual wastewater – starting from wastewater source identification up to reuse concepts.

UNIT 1. INTRODUCTION
Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater generation rates, characterization and variables – Population equivalent – Toxicity of industrial effluents and Bioassay tests

UNIT 2. INDUSTRIAL POLLUTION PREVENTION
Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Source reduction techniques – Waste Audit – Evaluation of Pollution prevention options – Environmental statement as a tool for pollution prevention – Waste minimization Circles

UNIT 3. INDUSTRIAL WASTEWATER TREATMENT
Equalisation - Neutralisation – Oil separation – Flotation – Precipitation – Heavy metal Removal – Refractory organics separation by adsorption – Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal.

UNIT 4. WASTEWATER REUSE AND RESIDUAL MANAGEMENT
Individual and Common Effluent Treatment Plants – Joint treatment of industrial wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse – Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge – Management of RO rejects.

UNIT 5. CASE STUDIES
Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Petroleum Refining – Pharmaceuticals – Sugar and Distilleries – Food Processing – fertilizers – Thermal Power Plants and Industrial Estates.

TEXT BOOK:
1. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 1999

REFERENCES:
1. Arceivala, S.J., "Wastewater Treatment for Pollution Control", Tata McGraw-Hill, 1998.
2. Frank Woodard Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi, 2001.
3. World Bank Group "Pollution Prevention and Abatement Handbook – Towards Cleaner Production', World Bank and UNEP, Washington D.C.1998.
4. Paul L. Bishop "Pollution Prevention: - Fundamentals and Practice", McGraw-Hill International, 2000.

09CE334 ENVIRONMENTAL IMPACT ASSESSMENT

Credits : 4:0:0

OBJECTIVES:

To educate the students on the scope, steps involved and various methods related to assessment of environmental impact due to development projects.

UNIT 1. INTRODUCTION

Environmental Impact Assessment (EIA) – Environmental Impact Statement – EIA in Project Cycle – Legal and Regulatory aspects in India according to Ministry of Environment and Forests – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Participation of Public and Non-Governmental Organizations in environmental decision making.

UNIT 2. COMPONENTS AND METHODS

Components of EIA - Processes – screening – scoping - setting – analysis – mitigation. Matrices – Networks – Checklists – Connections and combinations of processes - Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA.

UNIT 3. PREDICTION, ASSESSMENT OF IMPACTS AND REPORTING

Prediction tools for EIA – Mathematical modeling for impact prediction – Assessment of impacts – air – water – soil – noise – biological – socio-cultural environments – Cumulative Impact Assessment – Documentation of EIA findings – planning – organization of information and visual display materials – Report preparation.

UNIT 4. ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment.

UNIT 5. CASE STUDIES

Case studies related to the following sectors - Infrastructure - Mining – Industrial - Thermal Power - River valley and Hydroelectric - Nuclear Power.

TEXT BOOK:

1. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey. 2003

REFERENCES:

1. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science London. 1999.
2. Canter, L.W., Environmental Impact Assessment, McGraw-Hill, New York. 1996
3. Biswas, A.K. and Agarwala, S.B.C. Environmental Impact Assessment for Developing Countries, Butterworth Heinemann, London. 1994
4. The World Bank Group, Environmental Assessment Source Book Vol. I, II and III. The World Bank, Washington. 199.1

09CE335 SOLID WASTE ENGINEERING

Credits : 4:0:0

OBJECTIVES:
To educate the students on the principles involved in the management of municipal solid waste and hazardous wastes – from source identification up to disposal.

UNIT 1. INTRODUCTION
Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, plastics and fly ash.

UNIT 2. WASTE CHARACTERISATION AND SOURCE REDUCTION
Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes – Recycling and reuse – Waste exchange.

UNIT 3. STORAGE, COLLECTION AND TRANSPORT OF WASTES
Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport

UNIT 4. WASTE PROCESSING TECHNOLOGIES
Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes

UNIT 5. WASTE DISPOSAL
Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – closure of landfills – landfill remediation

TEXT BOOK
1 George Tchobanoglous, Hilary Theisen and Samuel A, Vigil “Integrated Solid Waste Management, McGraw- Hill International edition, New York, 1993

REFERENCES
1. CPHEEO “Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
2. Micheael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, McGraw-Hill International edition, New York, 2001
3. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2002

09CE336 ENVIRONMENTAL MICROBIOLOGY LABORATORY

Credits 0:0:2

1. Preparation of media, serial dilution and plating, Growth curve
2. Sampling of Microorganisms from air, water and soil, staining – simple and gram staining.
3. Effect of pH, temperatures and nutrients on growth of bacteria
4. Bacteriological analysis of water - Coliforms and streptococcus fecalis by MPN and membrane filter techniques
5. Study of aquatic organisms – Algae, protozoa and fungi

09CE337 WATER AND WASTE WATER CONVEYANCE

Credits 4:0:0

OBJECTIVES:
To educate the students in detailed design concepts related to water transmission mains, water distribution system, sewer networks and storm water drain, with emphasis on computer application.

UNIT 1. PRINCIPLES OF HYDRAULICS
Fluid properties; fluid flow – continuity principle, energy principle and momentum principle; frictional head loss in free and pressure flow, major and minor heads loss, formula for estimation of head loss – pumping of fluids – selection of pumps – Flow measurement.

UNIT 2. WATER TRANSMISSION AND DISTRIBUTION
Planning factors – Water transmission main design – pipe material – economics – water hammer analysis; water distribution pipe networks – methods for analysis and optimisation – Laying and maintenance, insitu lining – appurtenances – corrosion prevention – minimization of water losses – leak detection.

UNIT 3. WASTEWATER COLLECTION AND CONVEYANCE
Planning factors – Design of sanitary sewer; partial flow in sewers, economics of sewer design; sewer appurtenances; material, construction, inspection and maintenance of sewers; Design of sewer outfalls-mixing conditions; conveyance of corrosive wastewaters.

UNIT 4. STORM WATER DRAINAGE

Planning – run-off estimation, rainfall data analysis, storm water drain design – rain water harvesting

UNIT 5. CASE STUDIES AND COMPUTER APPLICATIONS

Computer applications for water transmission, water distribution and sewer design.

REFERENCES

1. G.S.Bajwa, Practical Handbook on Public Health Engineering, Deep Publishers, Shimla, 2003
2. "Manual on water supply and Treatment", CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
3. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1993.
4. B.A. Hauser, Practical Hydraulics Handbook, Lewis Publishers, New York, 1991.

09CE338 REMOTE SENSING AND GIS APPLICATION IN ENVIRONMENTAL ENGINEERING

Credits : 3:1:0

OBJECTIVES:
To educate the students on the principles and application of remote sensing and GIS in environmental engineering.

UNIT 1. PRINCIPLES OF ELECTRO MAGNETIC RADIATION
Concepts of Remote Sensing – Energy sources and radiation principles, Energy interactions in the atmosphere - Spectral reflectance of earth surface features

UNIT 2. REMOTE SENSING PLATFORMS
Aerial Photographs, Photographic Systems – Visible, Infra Red and Microwave sensing - Active and passive sensors - Satellites and their sensors, Indian Space Programme - Satellite data products

UNIT 3. DATA PROCESSING
Photogrammetry – Satellite data analysis – Visual Interpretation, Interpretation equipments - Digital Image Processing – Image rectification, enhancement, classification, data merging and biophysical modeling – Image Processing software

UNIT 4. GEOGRAPHIC INFORMATION SYSTEM
Introduction to GIS concepts - Data base structure – Data analysis - GIS software

UNIT 5. REMOTE SENSING AND GIS APPLICATIONS

Management and monitoring of environment, conservation of resources, coastal zone management – Limitations

TEXT BOOK

1. Lintz, J. and Simonet, Remote Sensing of Environment, Addison Wesley Publishing Company, New Jersey, 1998.

REFERENCES

1. Lillesand, T.M. and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2004.
2. Burrough, P.A. and McDonnell, R.A., Principles of Geographic Information Systems, Oxford University Press, New York, 2001.

09CE 339 AIR AND WATER QUALITY MODELLING

Credits : 4:0:0

OBJECTIVES:

To educate the students on the basic principles, development and application of air and water quality models with computer applications.

UNIT 1. INTRODUCTION

Basics of mathematical Modeling- Modeling as a tool. Procedures of model development. Importance of model building. Characteristics of deterministic models. Classical approach to constrained and unconstrained optimization. State of the art in environmental engineering systems models – climate and system modeling – Erosion and sediment transport

UNIT 2. COMPUTER BASED SOLUTIONS

Formulation of linear optimization models. Linear programming. Sensitivity testing and duality. Solution techniques and computer programming; Formulation of linear optimization models. Application of models - simulation, parameter estimation and experimental design.

UNIT 3. WATER QUALITY MODELLING

Rivers and streams water quality modeling-river hydrology and flow-low flow analysis-dispersion and mixing-flow, depth;water quality modeling process-model sensitivity-assessing model performance; Models for dissolved oxygen, pathogens; Groundwater modeling.

UNIT 4. AIR QUALITY MODELLING

Air Pollution modeling and prediction, modeling technique, modeling for non reactive pollutants, single source short term impact; multiple sources and area sources, model performance, accuracy and utilization.

UNIT 5. CASE STUDIES

Software package applications: Air quality modeling and water quality modeling

TEXT BOOK

1. John Wainwright and Mark Mulligan, Environmental Modelling Finding Simplicity in Complexity, John Wiley and sons Ltd, USA, 2004

REFERENCES

1. Dynamic Modeling of Environmental Systems by Deaton and Wine brake, Wiley &sons, 2002
2. Steven C. Chapra, Surface water quality modeling, McGraw-Hill Inc., New York, 1997
3. Boubel R.W., Fox, D.L., Turner D. B. & Stern, A C. "Fundamentals of Air Pollution, Academic Press, New York, 1994.

09CE340 ENVIRONMENTAL BIOTECHNOLOGY

Credits 4:0:0

OBJECTIVES:

To educate the students on the principles and application of biotechnology in environmental engineering with special reference to waste treatment.

UNIT 1. INTRODUCTION

Principles and concepts of environmental biotechnology—usefullness to mankind, current status.

UNIT 2. DETOXIFICATION OF ENVIRONMENTAL POLLUTANTS

Degradation of high concentrated toxic pollutants—halogenated, non-halogenated, petroleum hydrocarbons, metals. Mechanisms of detoxification—oxidation, dehalogenation, biotransformation of metals, biodegradation of solid wastes.

UNIT 3. MICROBIAL TECHNOLOGY FOR WASTE TREATMENT

Biotechnological remedies for environmental pollution—decontamination of groundwater systems, subsurface environment—reclamation concepts—bioremediation. Production of proteins – biofertilizers. Physical, chemical and microbiological factors of composting – health risk – pathogens – odour management – Microbial cell/enzyme technology – adapted microorganisms – biological removal of nutrients – algal biotechnology and applications in agriculture – role of extracellular polymers. Biogas technology – case studies.

UNIT 4. RECOMBINANT DNA TECHNOLOGY AND GENETIC APPLICATION

Concept of rDNA technology – expression vectors – cloning of DNA – mutation – construction of microbial strains, radioactive probes, protoplast fusion technology – applications.

UNIT 5. ETHICAL AND REGULATORY ISSUES

Environmental effects and ethics of microbial technology – safety of genetically engineered organisms – microbial containment – Risk assessment, IPR – patents.

TEXT BOOK

1. Chaudhury, G.R. 'Biological degradation and Bioremediation of toxic chemicals', Dioscorides Press, Oregon, 1994.

REFERENCES

1. Martin.A.M, 'Biological degradation of wastes', Elsevier Applied Science, London, 1991.
2. Blaine Metting.F (Jr.,) Soil Microbiology Ecology, Marcel Dekker Inc., 1993.
3. Wainwright, M, An Introduction to Environmental Biotechnology, 1999.
4. Old, R.W., and Primrose, S.B., Principles of Gene Manipulation 3rd Ed. Blackwell Sci. Publ., Cambridge, 1985.

09CE341 INDOOR AIR POLLUTION

Credits 4:0:0

OBJECTIVES:

To educate the students on air pollution and control in the indoor environment

UNIT 1. INTRODUCTION

Indoor activities of inhabitants -residence time. Levels of many pollutants in indoor and outdoor air. Design and operation of buildings for improvements of public health. IAQ policy issues: sustainability; indoor air quality as a basic human right.

UNIT 2. INDOOR AIR POLLUTANTS

Air pollutants in indoor environments, private residences, offices, schools, sand public buildings, factors that govern pollutant indoors concentrations, including ventilation. Charateristics, Consequences.

UNIT 3. CONTROL OF POLLUTANTS

Control of several pollutant classes, such as radon, toxic organic gases, combustion byproducts, and microorganisms such as molds and infectious bacteria. Case study by an exploration of public policy related to indoor air.

UNIT 4. CONCEPTS AND TOOLS

Concepts and tools: exposure, material-balance models, statistical models Ventilation

UNIT 5. INDOOR AIR POLLUTION FROM OUTDOOR SOURCES

Indoor air pollution from outdoor sources: particulate matter and ozone; Combustion byproducts; Radon and its decay products. Volatile organic compounds: odors and sick-building syndrome, Humidity Bio-aerosols: infectious disease transmission. Special indoor environments: A/C units in indoor; museums-labs; Measurement methods, Control technologies, Control strategies.

TEXT BOOK

1. Thaddes Godish, Indoor air and Environmental Quality, CRC press, 2000

REFERENCES

1. Nazaroff W.W and L Alvarez-Cohen, Environmental Engineering Science Wiley sons, New York, 2001.
2. Moroni Marco, Seifet Bernd and Lindrall Thomas, Indoor Air Quality: A Comprehensive Reference Book, Elsvier Science, Vol. 3, 1995

09CE342 INSTRUMENTAL METHODS IN ENVIRONMENTAL MANAGEMENT

Credits 4:0:0

OBJECTIVES:

To educate the students on the various instruments used for analysis of air water and soil.

UNIT 1. INTRODUCTION:
Instrumental Methods, Selection of method, Precision and Accuracy, Errors in measuring signals, Noise/signal ratio, base line drift, Indicator tubes.

UNIT 2. SPECTROSCOPIC METHODS:
Electromagnetic radiation, matter radiation interactions; Colorimetry and spectrophotometry, fluorimetry, nephelometry and turbidimetry, flame photometry Atomic Absorption Spectrometry (AAS), Atomic Emission Spectrometry (AES) – Inductively coupled plasma (ICP) and Direct Current Plasma (DCP) spectrometry. ICP – MS (Mass spectrometry).

UNIT 3. CHROMATOGRAPHIC METHODS:
Classical methods, Column, Paper and thin layer chromatography (TLC), Gas Chromatrography (GC), GC-MS, High performance liquid chromatography (HPLC) and Ion chromatrography (IC).

UNIT 4. ELECTRO AND RADIO ANALYTICAL METHODS:
Conductometry, potentiometry, coulometry, amperometry polarography, Neutron Activation Analysis (NAA), X-ray Fluorescence (XRF) and X-ray Diffraction (XRD) methods.

UNIT 5. CONTINUOUS MONITORING INSTRUMENTS:
Non – dispersive infra-red (NDIR) analyzer for CO, chemiluminescent analyzer for NOx, Fluorescent analyzer for SO_2, Auto analyzer for water quality using flow injection analysis; permeation devices.

TEXT BOOK

1. Willard. H., Merritt, L., Dean, D.A. and Settle. F.A. 'Instrumental methods of analysis, 7th Edn. Words Worth, New York, 2004

REFERENCES.

1. Ewing 'Instrumental Methods of Chemical Analysis, 5th Edn., McGraw-Hill, New York, 1995.

2. " Standard Methods for the examination of water and wastewater ", 20th Edition, APHA, Washington, 1998.

09CE343 CONTAMINANT TRANSPORT MODELING FOR GROUND WATER

Credits 4:0:0

OBJECTIVES:
To educate the students on the hydraulics related ground water contamination and modelling ground water quality.

UNIT 1. INTRODUCTION
Ground water and the hydrologic cycles – Ground water as a resource - Ground water contamination – Water quality standards – Sources of contamination – Land disposal of solid wastes – Sewage disposal on Land. Ground water and geologic processes. Physical properties and principles – Darcy's Law – Hydraulic Head and Fluid Potential – Piezometers and Nests. Hydraulic conductivity and permeability – Homogeneity and Anisotropy – Porosity and voids Ratio– Unsaturated flow and the water table – Steady state flow and Transient flow – Compressibility and effective stress – Transmissivity and storativity – Equations of Ground water Flow – Limitations of Darcian Approach – Hydro dynamic dispersion.

UNIT 2. HYDROLOGIC CYCLE AND FLOW NETS
Flow nets – Graphical construction – Flow nets by numerical simulation. Steady state Regional Ground Water flow – steady state hydrologic budgets – Fluctuations in ground water levels.

UNIT 3. RESOURCE EVALUATION
Development of Ground Water resources – Exploration for Aquifers – the response of Ideal aquifers to pumping – Measurement of parameters – Laboratory tests – Piezometer test – Pumping tests – Estimation of saturated hydraulic conductivity – Numerical simulation for aquifer yield prediction – Artificial recharge and induced infiltration – Land subsidence – Sea water intrusion.

UNIT 4. CHEMICAL PROPERTIES AND PRINCIPLES
Constituents – Chemical equilibrium – Association and Dissociation of dissolved species – effects of concentration gradients – Mineral dissolution and solubility – Oxidation and reduction Process – Ion exchange and Adsorption – Environmental isotopes – Field Measurement of Index parameters. Chemical Evolution: Hydro Chemical sequences and facies – graphical methods – Hydro chemical Facies – Ground water in carbonate terrain – Ground Water in crystalline rocks – Ground Water in complex sedimentary systems – Geochemical interpretation of ^{14}C Dates – Process rates and molecular diffusion.

UNIT 5. SOLUTE TRANSPORT
Transport process – non-reactive constituents in homogeneous media and Heterogeneous media – Transport in Fracture media – Hydro chemical behavior of contaminants – Trace metals– Trace

nonmetals – Nitrogen, organic substances – Measurement of parameters – Velocity – Dispersivity – chemical partitioning.
USGS – MOC MODEL - Modelling Principles – MOC Modelling.

TEXT BOOK

1. Randall J. Charbeneau, "Ground water Hydraulics and Pollutant transport "Prentice Hall, Upper Saddle River, 1999.

REFERENCES

1. Todd David Keith, Ground water Hydrology, Second edition, John Wiley and Sons, New York, 1980
2. Allen Freeze, R. and John A. Cherry, "Ground Water", Prentice Hall, Inc., 1979.

09CE344 STRUCTURAL DESIGN OF ENVIRONMENTAL STRUCTURES

Credits 3:1:0

UNIT 1. DESIGN OF PIPES
Structural design of a) Concrete b) Prestressed Concrete c) Steel and d) Castiron piping mains, sewerage tanks design - anchorage for pipes - massive outfalls - structural design and laying - hydrodynamic considerations. Advances in the manufacture of pipes.

UNIT 2. ANALYSIS AND DESIGN OF WATER TANKS
Design of concrete roofing systems a) Cylindrical b) Spherical and c) Conical shapes using membrane theory and design of various types of folded plates for roofing with concrete. IS Codes for the design of water retaining structures.

Design of circular, rectangular, spherical and Intze type of tanks using concrete. Design of prestressed concrete cylindrical tanks - Economic analysis - introduction to computer aided design and packages.

UNIT 3. DESIGN OF SPECIAL PURPOSE STRUCTURES
Underground reservoirs and swimming pools, Intake towers, Structural design including foundation of water retaining structures such as settling tanks, clarifloculators, aeration tanks etc. - effect of earth pressure and uplift considerations - selection of materials of construction.

UNIT 4. REPAIR AND REHABILITATION OF STRUCTURES
Diagonising the cause and damage, identification of different types of structural and non-structural cracks – repair and rehabilitation methods for Masonry, Concrete and Steel Structures.

UNIT 5. EXPOSURE ON STEEL, LATTICE STRUCTURES USED IN WATER AND SEWERAGE WORKS
Field visits are to be made and reports are to be prepared for the study regarding the steel and lattice structures containing water and sewage.

TEXT BOOKS

1. Prestressed Concrete by Krishna Raju, Tata McGraw-ill Publishing Co. 2nd Edition 1988.
2. Reinforced Concrete by N.C.Sinha & S.K.Roy - S.Chand and Co. 1985.

REFERENCES

1. Hulse R., and Mosley, W.H., "Reinforced Concrete Design by Computer", Macmillan Education Ltd., 1986.
2. Ramaswamy, G.S., "Design and Construction of Concrete shell roofs", CBS Publishers, India, 1986.
3. Green, J.K. and Perkins, P.H., "Concrete liquid retaining structures", Applied Science Publishers, 1981.

09CE345 ECOLOGICAL ENGINEERING

Credits 4:0:0

OBJECTIVES:

To educate the students on the principles of ecology as applied to environmental engineering

UNIT 1. INTRODUCTION TO ECOLOGY AND ECOLOGICAL ENGINEERING

Aim, scope and applications of ecology – Development and evolution of ecosystems – Principles and concepts pertaining to communities in ecosystem – Energy flow and material cycling in ecosystems – productivity in ecosystems – Rationale of ecological engineering and ecotechnology – Classification of ecotechnology – Principles of ecological engineering.

UNIT 2. SYSTEMS APPROACH IN ECOLOGICAL ENGINEERING

Principles, components and characteristics of Systems – Classification of systems – Structural and functional interactions of environmental systems – Environmental systems as energy systems – Mechanisms of steady-state maintenance in open and closed systems – Modelling and ecotechnology – Elements of modelling – Modelling procedure – Classification of ecological models – Applications of models in ecotechnology – Ecological economics.

UNIT 3. ECOLOGICAL ENGINEERING PROCESSES

Self-organizing design and processes – Multi seeded microcosms – Interface coupling in ecological systems – Concept of energy – Determination of sustainable loading of ecosystems.

UNIT 4. ECOTECHNOLOGY FOR WASTE TREATMENT

Ecosanitation – Principles and operation of soil infiltration systems – Wetlands and ponds – Source separation systems – Aquacultural systems – Agro ecosystems – Detritus based treatment for solid wastes – Applications of ecological engineering for marine systems.

UNIT 5. CASE STUDIES

Case studies of Integrated Ecological Engineering Systems and their commercial prospects.

TEXT BOOK

1. Kangas, P.C. and Kangas, P., Ecological Engineering: Principles and Practice. Lewis Publishers, New York. 2003.

REFERENCES:

1. Etnier, C. and Guterstam, B., Ecological Engineering for Wastewater Treatment, Lewis Publishers, New York. 1997.
2. White, I.D., Mottershed, D.N. and Harrison, S.J., Environmental Systems – An Introductory Text, Chapman Hall, London. 1994.
3. Mitsch, J.W. and Jorgensen, S.E., Ecological Engineering – An Introduction to Ecotechnology, John Wiley & Sons, New York. 1989.

09CE346 GROUND WATER HYDROLOGY

Credits 3:1:0

UNIT 1. INTRODUCTION

Occurrence of ground water: origin - rock properties affecting ground water vertical distribution - geologic formations as aquifers -types of aquifers - aquifer parameters-ground water basins - springs - ground water in permeable regions

UNIT 2. WATER BALANCE

Ground water balance – ground water flow - Darcy's law - laplace equation - potential flow lines - flow net - steady radial flow into a well - well in uniform flow - steady flow in leaky aquifer - aquifer with percolation - seepage under a dam -unsteady flow - general equation - confined and unconfined aquifers

UNIT 3. WELL HYDRAULICS

Ground water and well hydraulics: steady unidirectional flow - steady radial flow in to a well - well in uniform flow - steady flow with uniform discharge - unsteady radial flow in to a well - confined, unconfined and leaky aquifers - well near aquifer boundaries - multiple well system - partially penetrating wells - characteristics well losses - pumping tests – non equilibrium equation for pumping tests - Thies' method - Jacob method - Chow's method

UNIT 4. TUBE WELLS

Tube wells: design - screened wells - gravel packed wells - well loss-selection of screen size - yield of a well - test holes - well logs - methods of construction - dug wells -shallow tube wells - deep wells - gravity wells - drilling in rocks - screen installation - well completion - well development - testing wells for yield - collector - or radial wells - infiltration galleries - well point system - failure of tube wells

UNIT 4. QUALITY CONTROL OF GROUND WATER

Quality of ground water: ground water samples - measurement of water quality- chemical, physical and bacterial analysis - quality for domestic use - quality for agricultural use - pumps - shallow well pumps - ground water investigation - geographical investigation - electrical resistivity method - seismic refraction method - gravity and magnetic method – test drilling - resistivity logging - potential logging - artificial recharge - recharge by water spreading - sewage recharge - recharge through pits, shafts and wells

TEXT BOOK
1. Todd D.K., Ground Water Hydrology, John Wiley,2 008

REFERENCES
1. Garg S.P., Ground Water & Tube wells, Oxford & IBH, 1993
2. Raghunath H.M., Ground Water Hydrology, Wiely, 2000
3. Raghunath H.M., Hydrology, Wiely Eastern, 2006

09CE347 ENVIRONMENTAL RULES AND LEGISLATION

Credits 4:0:0

UNIT 1. INTRODUCTION
Basics of jurisprudence – Environmental law relation with other disciplines - Criminal law – Common Law – Relevant sections of the Code of Civil Procedure, Criminal Procedure Code – Indian Penal Code.

UNIT 2. INDIAN CONSTITUTION AND ENVIRONMENT
Introduction – Fundamental Rights – Directive Principles of State Policy – Article 48 (A) and 51-A(g) Judicial enforceability – Constitution and Resources management and pollution control – Indian Forest Policy (1990) – Indian Environmental Policy (1992).

UNIT 3. ADMINISTRATIVE REGIME & LEGAL REGIME
Administrative regulations – constitution of Pollution Control Boards Powers, functions, Accounts, Audit etc. – Formal Justice Delivery mechanism Higher and Lower of judiciary – Constitutional remedies writ jurisdiction Article 32, 226 136 special reference to Mandamus and Certiorari for pollution abatement – Equitable remedies for pollution control.

UNIT 4. POLLUTION CONTROL LAWS
Administrative regulation under recent legislations in wear pollution control. Water (prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 Water (prevention & control or Pollution) Cess Act. 1977 as amended by Amendment Act 1987 and relevant notifications.

UNIT 5. ENVIRONMENTAL (PROTECTION) ACT 1986
Relevant notifications in connection with Hazardous Wastes (management and handling) Biomedical wastes (management and handling), Noise pollution, Eco-labelling, and E.I.A.

TEXT BOOK
1. Constitution of India Eastern Book Company Lucknow 12th Edn. 1997.

REFERENCES
1. Constitutional Law of India – J.N. Pandey 1997 (31st Edn.) Central Law Agency Allahabad.
2. Administrative Law U.P.D. Kesari 1998. Universal Book Trade Delhi.

3. Environmental Law H.N. Tiwari, Allahabad Law. Agency 1997.
4. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materials and Statutes) 1991 Tripathi Bombay.
5. Environmental Policy. Forest Policy. Bare Acts – Government Gazette Notifiaciton.

09CE348 MASS TRANSFER IN AIR-WATER-SOIL INTERACTION

Credits 4:0:0

OBJECTIVES:
To educate the students on the mechanism of material transfer between environmental components – air, water and soil.

UNIT 1. EQUILIBRIUM AT ENVIRONMENTAL INTERFACE
Ideal solutions – air – water equilibrium occurrences – pure gases in contact with water-pure liquid in contact with air – partition coefficient for the air – water system. Earthern solid – waste equilibrium occurrences – pure solid and liquid chemicals in contact with water and earthern solids. Earthern solid – air equilibrium occurrences – water – liquid chemical equilibrium occurrences – thermal equilibrium at environmental interfaces.

UNIT 2. TRANSPORT MECHANISMS
Diffusion and mass transfer – molecular diffusion – eddy diffusion – mass transfer theories – mass transfer coefficients – binary mass transfer coefficients in two phases and two resistance theory of interphase mass transfer turbulence in the environment – fundamentals of heat transfer – analogy theories of momentum, heat and mass transfer.

UNIT 3. EXCHANGE RATES BETWEEN AIR AND WATER
Desorption of gases and liquids from aerated basins and rivers – completely mixed basin – plug flow basin – gas exchange rates between the atmosphere and the surface of rivers – exchange of chemical across the air – water interface of lakes and oceans.

UNIT 4. EXCHANGE RATES BETWEEN WATER AND THE EARTHERN MATERIAL

Dissolution of chemicals on the bottom of flowing streams – geometric forms – stream bottom mass transfer coefficients – natural convection dissolution – the upsurge of chemicals from the sediment – water interface of lakes – a Fikian analysis – annual upsurge rate at sediment – water interface – mass transfer coefficients at the sediment – water interface. Flux of chemicals between sediment and the overlying seawater – movement of chemicals through the benthic boundary layer.

UNIT 5. EXCHANGE RATES BETWEEN AIR AND SOIL
Turbulence above the air – soil interface – the Richardson number – chemical flux rates through the lower layer of the atmosphere – Thronthwaite – Holzman equation – evaporation of liquid chemicals spilled on land – chemical flux rates through the upper layer of earthern material.

TEXT BOOK

1. Thibodeaux, L.J, “Environmental Chemo dynamics: Movement Of Chemicals In Air, Water and Soil”, edition 2., Wiley - Interscience, New York, 1996.

REFERENCES

1. Cusssler, E.L, “Diffusion: Mass Transfer In Fluid Systems, “Cambridge University press, 1994.

09CE349 COASTAL POLLUTION MONITORING AND MANAGEMENT

Credits 4:0:0

OBJECTIVES:
To educate the students on aspects of marine pollution and methods of water quality assessment and marine pollution control

UNIT 1. OCEANOGRAPHY
General features of ocean – Conservation laws – Wave characteristics and theories - Sediment transport — Tides - Ocean Currents – Thermocline circulation – General circulation of ocean waters, Tsunamis, Storm surge – Principles of Marine geology

UNIT 2. COASTAL ENVIRONMENT
Living resources – coral reefs, mangroves, seagrass, seaweeds, fishery potential – nonliving resources – manganese nodules, heavy minerals – Beaches, Estuaries, Lagoons – Shoreline changes

UNIT 3. MARINE SURVEYING
Sea surveying planning and preparation – Oceanographic instrumentation - Hydrographic Surveying – Underwater surveying - Measurement of physical properties of ocean water - sea bed sampling

UNIT 4. MARINE POLLUTION AND MONITORING
Physiochemical properties of sea water - Sources of marine pollution and impacts on coastal ecosystems, Oil pollution – oil spill detection, dispersion, impacts on adjacent area – Oil spill modeling, mitigation measures – Oil exploration and their effects – Marine outfalls - Impacts of Ports and Harbour on marine water quality – dredging – Human intervention in estuarine ecosystem –- sea water classification - Physical modeling in Coastal Engineering – Ocean monitoring satellites -Applications of Remote sensing and GIS in marine studies,

UNIT 5. MARINE POLLUTION CONTROL
National and International treaties, protocols in marine pollution - Exclusive Economic Zone - Sustainable development

TEXT BOOK

1. Kennish, M.J., Pollution impacts on Marine Biotic Communities, CRC press New York, 1998

REFERENCES

1. Newman, M.C., Roberts Jr. M.H., Male R.C. (Editors), Coastal and Estuarine Risk Assessment, Lewis Publishers, Washington, D.C., 2002
2. U.S. Army Corps of Engineers, Shore Protection Manual, Washington D.C., 2002

09CE350 UNIT OPERATIONS AND UNIT PROCESSES LABORATORY

Credits 0:0:2

(Prerequisite: Physical and Chemical treatment of water and wastewater, and biological treatment of wastewater)

OBJECTIVES:
To conduct laboratory studies on water and wastewater treatment units.

LIST OF EXPERIMENTS

1) Coagulation and Flocculation.
2) Batch studies for sedimentation.
3) Characteristics of Filter media.
4) Studies on Filtration.
5) Water softening.
6) Adsorption studies / Kinetics.
7) Silt Density Index.
8) Reverse Osmosis.
9) Kinetics of suspended growth process (activated sludge process).
10) Kinetics of attached growth process (Rotating Biological Contactors).
11) Sludge volume Index.
12) Anaerobic Reactor systems / Kinetics.
13) Advanced Oxidation Processes.
14) Chlorine Demand Estimation.

TEXT BOOK

1. Lee, CC & Shun dar Lin, Hand book of Environmental Engineering Calculations, Mc Graw Hill, New York, 1999.

REFERENCES

1. Metcalf & Eddy, Inc. 'Wastewater Engineering, Treatment, Disposal and Reuse, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2003.
2. Casey T.J. Unit treatment processes in water and wastewater engineering, John Wileys Sons, London, 1993.

09CE 351 CONSTRUCTION EQUIPMENT

Credit 3:0:0

Objectives

- To know about the construction equipment and management
- To study about the equipment used for earthwork excavation
- To learn about the various construction equipment and their applications

Unit I: Construction Equipment Management

Identification – Planning - Equipment Management in Projects - Maintenance Management – Replacement – Unit Operating Cost - Cost Control of Equipment - Depreciation Analysis – Safety Management

Unit II: Equipment for Earthwork
Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers

Unit III: Other Construction Equipment

Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment

Unit IV: Materials Handling Equipment

Forklifts and related equipment - Portable Material Bins – Conveyors - Hauling Equipment

Unit V: Equipment for Production of Aggregate and Concreting

Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment – Transporters

References:
1.Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, 5th Edition, McGraw-Hill, Singapore, 2001

2.Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2007.

3.Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2007.

4.Dr. Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi. 1983.

09CE 352 ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION

Credit 3:0:0

Objectives

- To learn the fundamentals of energy production systems and consumptions
- To study the energy conservations pertaining to environment
- To understand the concepts of energy efficient design and smart buildings
- To have an exposure in the management of services
- To learn about the conservation in mechanical devices

Unit I Introduction

Fundamentals of Energy – Energy production systems – Heating, Ventilating and Air conditioning – Solar Energy and conservation – Energy economics Analysis – Energy conservation and audits – Domestic energy consumption – savings – challenges – Primary energy use in buildings – Residential – commercial – Institutional and public buildings

Unit II Environmental

Energy and resource conservation – Design of green buildings – Evaluation tools for building energy – Embodied and operating energy – Peak demand – comfort and indoor air quality – Visual and acoustical quality – Land, water and materials – airborne emissions and Waste Management

Unit III Design

Natural building design consideration – Energy efficient design strategies – Contextual factors – Longevity and process assessment – Renewable energy sources and design – Advanced building technologies – Smart buildings – Economics and cost analysis.

Unit IV Services

Energy in building design – Energy efficient and environmental friendly building – thermal phenomena – Thermal comfort – Indoor air quality – Climate, Sun and solar radiation – Psychometrics – Passive heating and cooling systems – Active HVAC systems – Preliminary investigations – Goals and policies – Energy audit – Types of Energy Audit – Analysis of results – Energy flow diagram – Energy consumption/Unit production – Identification of wastage – Priority of conservative measures – Maintenance of energy management programme

Unit V Energy Management

Energy management of electrical equipment – Improvement of power factor – Management of maximum demand – Energy savings in pumps – Fans – Compressed air systems – energy savings in lighting systems – Air conditioning systems – Applications – Facility operation and maintenance – Facility modifications – Energy recovery dehumidifier – Waster heat recovery – Steam plants and distribution systems – Improvement of boiler efficiency – Frequency of blow down – steam leakage – Steam flash and condense return

References:

1. Moore F., "Environmental control systems ", McGraw Hill, Inc., 1994.
2. Brown, G.Z, Sun, " Wind and Light: Architectural design Strategies ", John Wiley & Sons., 1985.

3. Cook, J, " Award - Winning Passive Solar Design ", McGraw Hill, 1984

09CE 353 BUILDING BYE LAWS

Credits:3:0:0

Objectives

- To understand the provisions of the act of building byelaws
- To know the procedure of getting building permit
- To learn the building performance byelaws
- To know how to plan byelaws and to know about different types of forms

Unit I: Definitions
Preamble – Provision of the act – Jurisdiction – Repeal and Saving - Definitions – Act – Commissioner – corporation – Dwelling Unit – Existing Buildings – Floor Area Ratio – Form – Ground coverage – Height of a building – Land use – Master plan – Period of construction – Plinth – Sanctioned Design and Specification – Sanctioned use – Schedule – Setbacks or Margins

Unit II Procedure Byelaws
Building permit and Building use permit – Responsibilities of owner and persons on record – Procedure for obtaining, revising and revalidating a building permit – Procedure during construction – Procedure for obtaining a building use permit – Procedure for obtaining a variance

Unit III Building performance byelaws
Buildings and Infrastructure – Environmental Management – Pollution control – Structural Safety – Fire prevention and safety – Maintenance and upgradation

Unit IV Planning Byelaws
Heritage conservation byelaws – General planning byelaws

Unit V :
Schedules and forms

References:

1.Building bye laws of Delhi, 2005

09CE 354 CONSTRUCTION PERSONNEL MANAGEMENT

Credit 3:0:0

Objectives

- To learn the fundamentals of human behaviour under various situations

- To relate the behaviour pattern to manpower planning in organizational setups
- To understand the means of management of construction personnel
- To know the methods to adopt training as a tool for improvement

Unit I: Manpower Planning
Manpower planning, organizing, staffing, directing, and controlling – personal principles

Unit II: Organization
Organization – span of control – Organization charts – Staffing plan – Development and Operation of human resources – managerial Staffing – Recruitment – Selection – Placement

Unit III: Human Behaviour
Introduction to the field of people management – basic individual psychology – motivation – job design and performance management – Managing groups at work – self managing work teams – Intergroup behavior and conflict in organizations – Leadership – Behavioral aspects of decision making; and communication for people management

Unit IV: Management and Development Methods
Compensation – Wages and Salary, employee benefits, employee appraisal and assessment – Employee services – Safety and Health – Discipline and discharge – Special Human resource problems, Performance appraisal – Employee handbook and personal manual – Job descriptions and organization structure and human relation – Productivity of Human resources

Unit V: Training and Development
Identification of training needs – training calendar – outsourcing for training – in-house training – training to overcome deficiencies – evaluation of training

Reference Books:

1. Carleton counter II and Jill Justice coutier, 'The complete Standard Handbook of Construction Personnel Management' Prentice Hall, Inc., New Jersey, 1989
2. Memoria, C,B "Personal management", Himalaya Publishing Co., 1992
3. Josy J. Familaro, "Handbook of Human Resources Administration", McGraw-Hill International Edition, 1987
4. Pringle Charles, "Management Longenecker" Emerricle Publishing company, 1981
5. Dwived R.S. "Human Relations and Organizational Behaviour BH -1987

09CE 355 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL

Credit 3:0:0

Objectives

- To know about construction plans and activities
- To get knowledge about scheduling procedures

- To get awareness about cost control and monitoring
- To know about the quality control
- To get exposed to data based management system

Unit I: Construction Planning

Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities - Coding Systems

Unit II: Scheduling Procedures and Techniques

Relevance of Construction Schedules - The Critical Path Method - Calculations for Critical Path Scheduling - Activity Float and Schedules - Presenting Project Schedules - Critical Path Scheduling for Activity-on-Node and with Leads, Lags, and Windows - Calculations for Scheduling with Leads, Lags and Windows - Resource Oriented Scheduling - Scheduling with Resource Constraints and Precedences - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Scheduling in Poorly Structured Problems - Improving the Scheduling Process.

Unit III: Cost Control, Monitoring and Accounting
The Cost Control Problem - The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

Unit IV: Quality Control and Safety during Construction
Quality and Safety Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality Control - Quality Control by Statistical Methods - Statistical Quality Control with Sampling by Attributes - Statistical Quality Control with Sampling by Variables - Safety

Unit V: Organization and Use of Project Information
Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in Databases - Relational Model of Databases - Other Conceptual Models of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow.

References:

1. Chitkara, K.K. “Construction Project Management: Planning, Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoenngam, “Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications”, Wiley, New York, 1995.

3. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000

09CE 356 ESTIMATING AND QUANTITY SURVEYING

Credit: 0:0:2

Objectives

- The purpose of this course is to impart the techniques of estimation of buildings, roads, and irrigation structures.
- To introduce the concepts of rate analysis and tendering
- To inculcate the concepts of valuation and their application to building

Unit I: Procedure of Estimating Quantities

Introduction – Main items of work – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C., Doors, Windows, Flooring, White Washing, colour washing, Distempering and their Units.

Unit II: Rate Analysis

Factors affecting rates – importance – Materials for different items of work – Rates of materials and labour – analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works

Unit III: Cost Estimate of Buildings

Approximate methods – Plinth area estimate – Cubical Contents estimate. Detailed estimate – Estimation of the cost of single storeyed buildings by individual wall method and centre line method - Estimation: R.C.C. slab roof, Beam, Column, Foundation

Unit IV: Cost Estimate of Other Structures

Estimation of roads – Earth work, Pitching of Slopes - Estimation of water supply and sanitary works like septic tank, Soak pit, Manhole, sewer line, etc.

Unit V: Specifications and Valuation

Specifications – Objectives – types of specifications – principles of specification writing – typical specifications. Valuation – Market value – Book value – Scrap value – Salvage value – annuity – Capitalized values – sinking fund – depreciation – Valuation of a building – Rent fixation – Mortgage – Lease.

Text Books

1. Dutta B.N "Estimating and Costing", UBS Publications, 2005
2. Rangawala S.C., "Estimating and Costing", Charotar Anand, 2002

Reference Books

1. Kohli, D.D and Kohli R.C., "A Text book on Estimating, Costing and Accounts", S. Chand and Co., New Delhi, 2003

09CE 357 BUILDING DRAWING

Credit: 0:0:2

Objectives:

- Preparation of plan, elevation and sections of various types of building
- To develop imagination and creative skills in planning and detailing of buildings

Symbols and sign conventions related to Architecture - Traffic - Electrical Circuits -Plumbing & welding - Metric Brick - Bonds in Brick masonry, cross walls and corner walls. Joinery in wood work - timber doors, windows and ventilators - paneled and glazed types. Planning and detailing of Stairs and Staircases. Plan, Elevation, Section and Perspective Views of single-storeyed residential buildings

Text Book:

Balgopal, T.S., Prabhu, T.S., Building drawing and detailing, Spades Publishing KDFA building Calicut, 1987.

09CE 358 PROJECT FORMULATION AND APPRAISAL

Credit 3:0:0

Objectives

- To understand elements of project formulation and appraisal
- To learn the costing, appraisal and financial aspects of projects
- To study the implications of private sector participation in construction projects

Unit I: Project Formulation

Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required

Unit II: Project Costing

Project Cash Flows – Time Value of Money – Cost of Capital

Unit III: Project Appraisal

NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice

Unit IV: Project Financing

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators

Unit V: Private Sector Participation

Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer

References

1. Prasanna Chandra, Projects – Planning Analysis Selection Implementation & Review Sixth Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2006
2. Joy P.K., Total Project Management - The Indian Context (Chapters 3 - 7), New Delhi, Macmillan India Ltd., 2006
3. United Nations Industrial Development Organisation (UNIDO) Manual for the preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987
4. Barcus, S.W. and Wilkinson J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986

09CE 359 CONTRACT LAWS AND REGULATIONS

Credit 3:0:0

Objectives:

- To know about the different construction contracts
- To get knowledge about tenders and contracts
- To know about importance of arbitration laws
- To know about the legal aspects
- To study about labour regulations

Unit I: Construction Contracts
Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts

Unit II: Tenders
Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamil Nadu Transparency in Tenders Act.

Unit III: Arbitration
Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Arbitration Act - Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs

Unit IV: Legal Requirements
Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations

Unit V: Labour Regulations
Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamil Nadu Factory Act – Child Labour Act - Other Labour Laws

References

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M. Tripathi Private Ltd., Bombay, 2000

2. Tamil Nadu PWD Code, 1986

3. Jimmie Hinze, Construction Contracts, 2nd Edition, McGraw-Hill, 2001

4. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, 6th Edition, McGraw-Hill, 2000

09CE 360 BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY

Credit 3:0:0

Objectives

- To know about the different types of building materials
- To get knowledge about brick and stone masonry
- To learn about floors and roofs
- To know about the plastering and painting
- To understand about stairs, scaffolding and formwork

Unit I: Building Materials
Types and properties of cement – cement mixes – rolled steel sections – types of reinforcement rods – terracotta and glazed products

Unit II: Brick and Stone Masonry
Types of Bricks – Bonds (English & Flemish), Tools for Brick Laying Brick laying – Comparison of brick and stone masonry – defects in Brick masonry – Definition of terms used in stone masonry – materials - classification of stone masonry – supervision of stone masonry – safe loads on stone masonry.

Unit III: Types of Floors and Roof
Selection of Floor materials – Mud – Brick – cement Concretes – Terrazzo – Mosaic – tiled Asphalt flooring – R.C.C. Floors – Types of pitched roofs

Unit IV: Plastering and Painting
Types of mortars for plastering – Tools for plastering – method of plastering – types of plaster finishes – defects in plastering – paints and painting – constituents of a paint – types of paint – painting on different surfaces – defects in painting.

Unit V: Stairs, Form-work and Scaffolding
Technical terms – requirement of stair – dimensions of stair – classification of stair - Requirements of formwork – loads on form work – shuttering for columns – beams and floors – scaffolding

Text Book:

1. Punmia. S.C, Building Construction Lakshmi Publication (P) Ltd., 2006

References:

1. Rangwala, S.C., “Engineering Materials", Charotar Publishing House, Anand, 2007.
2. Surendra Singh, “Building Materials", Vikas Publishing Company, New Delhi, 2002.
3. Arora S.P. and Bindra S.P., "Building Construction Planning Techniques and method of Construction", Dhanpat Rai and Sons, New Delhi, 1997.

09CE 361 FUNDAMENTALS OF CIVIL ENGINEERING

Credit: 3:0:0

Objectives

- To know about the history, scope, functions and components of buildings
- To get knowledge about surveying
- To know about importance of water supply and sanitation
- To know about the transportation systems
- To get exposed to airport, harbour and dock

Unit I: Introduction, Components and Functions of Buildings
Introduction: Engineering – Civil Engineering – History and development of Civil Engineering – Scope of Civil Engineering – Functions of Civil Engineers – General concepts relating to buildings – Selection of site - Basic functions of buildings – Major components of buildings – Foundations – Purpose of a foundation – Bearing capacity of soils – types of foundations

Unit II: Surveying
Surveying: Definition and purpose – classification – Basic principles – Measurement of length by chains and tapes – Calculation of area of a plot – Measurement of bearings and angles using a prismatic compass – Leveling – longitudinal and Cross-sectioning – calculation of areas and volumes – contours and their applications – use of transit theodolite

Unit III: Water Supply and Sanitary Engineering
Water supply Engineering: Sources of water supply – quantity of water requirements – Purification of water involving sedimentation, filtration and disinfection.
Sanitary Engineering: Definition of terms – collection and disposal of solid wastes – sewage systems – Septic tanks – oxidation ponds

Unit IV: Highways and Railways
Transportation Engineering: Importance of roads – Classification of Highways – Cross sections of water bound macadam, bituminous and cement concrete roads – Traffic signs and signals
Railways: Importance of railways – Gauges – components of a permanent way
Bridges: components of culverts – Causeways, slab Bridge, T-beam and Slab Bridge, suspension bridge.

Unit V: Airport, Harbours, Dams and Irrigation
Functions and general layout of an airport – Functions and general layout of a harbor – Dams: Purpose of Dams – types of dams – Earth, masonry and concrete, arch and buttress dams – Selection of site for the dam – Irrigation Engineering: Definition of irrigation – types of irrigation – canal irrigation system

Text Book:

1. Johnson Victor D. and Esther Malini, "Basic Civil Engineering", Allied Publishers Limited, Madras, 2002

Reference Books

1. Arunachalam N., "Basic Civil Engineering", Pratheeba Publishers, Coimbatore, 2000
2. Ramesh Babu V., "Basic Civil Engineering", Anuradha Agencies, Kumbakonam, 2001

09CE 362 QUALITY CONTROL LAB

Credit: 0:0:2

Objectives:

- To give hands on training on testing of cement and aggregates
- To give hands on training on testing of concrete
- To impart knowledge on mix design of procedures
- To impart knowledge on testing of highways materials

Tests on Cement: Specific gravity, Fineness, specific surface, soundness, consistency, initial and final setting time, compressive strength of cement mortar.
Tests on Fine Aggregate: Tests to find alkalinity, organic content, etc. - particle size distribution and fineness modulus - specific gravity and voids ratio - Bulking of sand.

Tests on Coarse Aggregate : Particle size distribution and fineness modulus - specific gravity - voids - absorption test - crushing and impact strength - abrasion test.
Concrete Mix Design: ACI and IS Methods
Test on Fresh Concrete: Slump test, Vee-Bee test, compaction factor test.
Tests on Hardened Concrete: Compression test on cubes - Modulus of rupture test - splitting tension test - Determination of modulus of elasticity.

Text Books

1.Shetty, M. S., `Concrete Technology', S. Chand & Co., New Delhi, 1998.
2.Khanna, S.K., and Justo C.E.G., Highway Engineering, Nem Chand and Bros. 2005.

Reference Book

1.Davis, H.F., Troxell, G.E and Hauck, G.R.H., The testing of Engineering Materials, Mc.Graw Hill International Book Co.,1995

09CE 363 COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING LAB

Credit 0:0:2

Objectives

- To introduce the concepts of planning and scheduling
- To introduce the concepts of project management using Primavera

Exercises

1. Planning

2. Scheduling
3. Controlling Resources
4. Resources leveling
5. Updating progress
6. Estimation of cost
7. Earned Value analysis
8. Tabular and graphical reports
9. Handling multiple projects
10. Project utilities
11. Autocost rules

Text Book:
Project planning and Management – Primavera Reference Guide published by CADD CENTRE

09CE 364 CONSTRUCTION PROJECT MANAGEMENT

Credit 3:0:0

Unit I : The Owners' Perspective
Introduction - Project Life Cycle - Types of Construction - Selection of Professional Services - Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - Changing Environment of the Construction Industry - Role of Project Managers

Unit II : Organizing for Project Management
Project Management - Trends in Modern Management - Strategic Planning and Project Programming - Effects of Project Risks on Organization - Organization of Project Participants - Traditional Designer-Constructor Sequence - Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team - Interpersonal Behavior in Project Organizations - Perceptions of Owners and Contractors

Unit III: Design and Construction Process
Design and Construction as an Integrated System - Innovation and Technological Feasibility - Innovation and Economic Feasibility - Design Methodology - Functional Design - Physical Structures-Geo-technical Engineering Investigation - Construction Site Environment - Value Engineering - Construction Planning - Industrialized Construction and Pre-fabrication - Computer-Aided Engineering

Unit IV: Labor, Material and Equipment Utilization
Historical Perspective - Labor Productivity - Factors Affecting Job-Site Productivity - Labor Relations in Construction - Problems in Collective Bargaining - Materials Management - Material Procurement and Delivery - Inventory Control - Tradeoffs of Costs in Materials Management. - Construction Equipment - Choice of Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks

Unit V: Cost Estimation

Costs Associated with Constructed Facilities - Approaches to Cost Estimation - Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Cost Indices - Applications of Cost Indices to Estimating - Estimate Based on Engineer's List of Quantities - Allocation of Construction Costs Over Time - Computer Aided Cost Estimation - Estimation of Operating Costs.

References

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
3. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
4. Choudhury, S, Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
5. Ernest E. Ludwig, Applied Project Engineering and Management, Gulf Publishing Company, Houstan, Texas, 1988.
6. Harold Kerzner, Project Management – A Systems Approach to Planning, Scheduling and Controlling, CBS Publishers & Distributors, Delhi, 1988.
7. Joy, P.K., Total Project Management – The Indian Context, Macmillan India Ltd., New Delhi, 1992.

09CE 365 PROJECT SAFETY MANAGEMENT

Objectives

- To know about the accidents in construction and legal implications
- To become aware of safety programmes
- To be exposed to the contractual obligations
- To learn about the design of safety

Credit 3:0:0

Unit I: Construction Accidents

Accidents and their Causes – Human Factors in Construction Safety - Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications

Unit II: Safety Programmes

Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives

Unit III: Contractual Obligations
Safety in Construction Contracts – Substance Abuse – Safety Record Keeping

Unit IV: Designing for Safety

Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Subcontractual Obligation – Project Coordination and Safety Procedures – Workers Compensation

Unit V: Owners' and Designers' Outlook

References:

1. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001
3. Tamil Nadu Factory Act

09CE 366 Advanced Building Drawing (Using Auto CADD & Archi CAD)

Credit: 0:0:2

Objectives

- To introduce the basic commands of drafting software
- To impart knowledge on drafting software such as AutoCAD & Archi CAD
- To impart knowledge on generation of different views using software

Plan, Elevation, Section and Perspective Views of single-storeyed residential and public buildings such as hospitals, restaurants and auditoriums - Using AUTOCAD and Archi CAD

Text Book

2. Balgopal,T.S., Prabhu,T.S., Building drawing and detailing, Spades Publishing KDFA building Calicut, 1987.

Reference Book

1. AUTO CAD Manual- Autodesk work book on AUTO CAD Level
2. Archi CAD Manuel

09CE 367 BUILDING SERVICES

Credit 3:0:0

Objectives

- To learn about water supply and sanitation arrangements in a building
- To understand the essentials of electrical installations in a building
- To get an exposure to air conditioning and fire safety arrangement
- To pioneer the concepts of intelligent building

Unit I:– Building Sanitation

Water quality, Purification and treatment - water supply systems-distribution systems in small towns - types of pipes used - laying jointing, testing-testing for water tightness plumbing system for building-internal supply in buildings - municipal bye laws and regulations - Rain Water Harvesting - Sanitation in buildings-arrangement of sewerage systems in housing - pipe systems - storm water drainage from buildings - septic and sewage treatment plant - collection, conveyance and disposal of town refuse systems.

Unit II: Electrical Installations in Buildings

Types of wires, wiring systems and their choice - planning electrical wiring for building - main and distribution boards - transformers and switch gears - modern theory of light and colour - synthesis of light - luminous flux - candela - lens of illumination-lighting design-design for modern lighting.

Unit III: Air Conditioning System and Applications

Ventilation and its importance-natural and artificial systems-Window type and packaged air-conditioners-chilled water plant - fan coil systems-water piping - cooling load - air conditioning systems for different types of buildings - protection against fire to be caused by A.C. Systems.

Unit IV: Fire Safety -General Provisions

Causes of fire in buildings-safety regulations-NBC-planning considerations in buildings like Non-combustible materials, construction, staircases and A.C. systems, special features required for physically handicapped and elderly in building types-heat and smoke detectors-dry and wet risers-Automatic sprinklers - Capacity determination of OHT and UGT for fire-fighting needs.

Unit V: Advanced Topics

Intelligent buildings-Building automation-Smart buildings - Building services in high rise buildings.

Reference Books:

1. G.M. Fair, J.C. Geyer and D. Okun, Water and Waste Engineering", Vol. II, John Wiley &sons,Inc.,New York. 1968
2. R.G.Hopkinson and J.D.Kay, "The Lighting of Buildings, Faber and Faber", London, 1969
3. "Hand book for Building Engineers in Metric Systems", NBC, New Delhi, 1968
4. "Philips Lighting in Architecture Designs", McGraw Hill, New York, 1964
5. "Time Saver Standards for Architecture Design Data", Callendar JH, McGraw Hill, 1974
6. William H. Severns and Julian R. Fellows, "Air conditioning and Refrigeration", John Wily and sons, London,1988

09CE 368 MODERN CONSTRUCTION MATERIALS

Credit 3:0:0

Objectives

- To learn about types of concrete and their advantages
- To study about metals used in construction
- To get an exposure in composite construction and intelligent buildings

Unit I :Concretes
High strength and High performance concrete-Fiber Reinforced concrete – Admixtures

Unit II: Metals
New Alloy steels-Aluminium and its products-Other alloys

Unit III: Composites
Plastics-Reinforced polymers-FRP-Celular cores

Unit IV: Other Materials
Water proofing compounds-Non -weathering Materials - Flooring and Facade Materials

Unit V: Smart and Intelligent Materials
Brief outlines and uses

References:

1. Shan Somayaji, "Civil Engineering Materials", 2nd Edition, Prentice Hall Inc., 2001.
2. Mamlouk, M.S. and Zaniewski, J.P., "Materials for Civil and Construction Engineers", Prentice Hall Inc., 2006.
3. Derucher, K.Korfiatis. G. and Ezeldin, S., "Materials for Civil and Highway Engineers", 4th Edition, Prentice Hall Inc., 1999.
4. Aitkens, "High Performance Concrete", McGraw Hill, 1999.

09CE369 BEHAVIOUR, ANALYSIS AND DESIGN OF RCC ELEMENTS

Credits : 3:1:0

OBJECTIVES

- To understand the concepts of flexural behavior and design of slabs, beams and columns
- To learn about the behavior of beams under shear, torsion and combined bending and torsion
- To learn about the analysis and design of multistoreyed building frames

Unit I: Behaviour of Beams under Flexure

Limit state design concepts - Statistical and probabilistic concepts of safety- Behaviour of reinforced concrete beam under gradually increasing flexural loads up to collapse – Requirement of Flexural Reinforcement – Selection of member sizes - Limit state design of singly and doubly reinforced rectangular and flanged beams for flexure - Check for deflection and crack width as per I.S.456 code, Deep Beams

Unit II: Behaviour of beams under Shear, Bond and torsion

Shear strength of beams – Interface shear and shear friction – shear connectors in flexural members – shear design examples – Equilibrium torsion and compatibility torsion – Torsional stiffness – Design strength in torsion - combined bending and torsion – Interaction diagrams - Skew bending theory – space truss analogy - Design of members subjected to combined bending, shear and torsion - bond, anchorage and splicing of reinforcement.

Unit III: Limit State Design of Columns:
Behaviour, strength and design of axially loaded and eccentrically loaded short and long columns – code requirements on slenderness limits, minimum eccentricities and reinforcement – use of interaction diagrams - Design of columns carrying axial load and biaxial moments.

Unit IV : Limit Analysis and Design of Slabs
Behaviour of R.C. slabs under gradually increasing loads - Assumptions made in yield - line theory of slabs - Analysis of isotropically and orthotropically reinforced slabs of various shapes under different edge conditions by virtual work method and equilibrium method - Application to practical design problems - Effect of corner levers - Hillerborg's simple strip method of analysis.

Unit V: Behaviour Analysis & Multistorey Frames
Analysis for vertical loads adopting substitute frames - Analysis for wind forces using portal method - Design of plane frames - Detailing of joints - Joints of space frames - Shear Walls - Use of shear walls in high rise buildings - Types of shear walls - behaviour of cantilever walls - interaction of shear walls and rigid jointed frames - Design for Earthquake forces.

Text Books:
1 Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice – Hall of India Ltd, New Delhi , 2008.
2. S. Unnikrishna pillai and Devadas Menon, “Reinforced concrete design” – Tata McGraw Hill Publishing company limited, New Delhi, 2003

References
1. Regan, P. D and Yu, C.W., "Limit state design of structural concrete", Chatto & Windus, London, 1973.
2. Purushotaman,P. "Reinforced concrete structural Elements", Tata McGraw Hill, Publishing Co., Pvt. Ltd., New Delhi, 1984.

09CE370 GLOBAL POSITIONING SYSTEM

Credit 3:0:0

OBJECTIVES:

- To understand the basics of Geodesy and Global Positioning System
- To have knowledge about GPS data processing and GPS applications

Unit I: Introduction
Definition – basics of geodesy – classification and basic concepts of satellite geodesy – historical development and applications of satellite geodesy.

Historical techniques
Photographic determination of directions – electronic distance measurements (SECOR) – other early observation techniques

Unit II: Doppler techniques and Basics of Global Positioning System
Doppler Effect and basic positioning concept – development and status of the navy navigation satellite systems (TRANSIT). Fundamentals – introduction space, control segments – observation principles – signal structure, broad cast ephimerides, orbit representation, structure of GPS data, GPS receivers – concepts & Receiver components. Navigation receivers

Unit III: GPS Data processing and errors
GPS observables and data processing – parameter estimation – solution ambiguities – data handling – cycle slips – RINEX data – software concepts - Static, kinematic surveys - Error budget correction – satellite geometry and accuracy measures – multipath effect

Unit IV: GPS Applications
Software modules and data processing – possible applications – geodetic control survey – cadastral surveying and GIS, engineering and monitoring, geodynamics, marine geodesy and hydrography – Photogrammetry and remote sensing – GLONASS – comparison with NAVSTARGPS

Unit V: Laser Ranging & Field work
Overview of laser ranging – basic concepts of satellite altimetry – planned missions and spatial methods - Study on GPS instruments, static and kinematic surveying using DGPS

Text books:
1. Seeber, G., Satellite Geodesy, Walter De Gruyter, Berlin, 1993.
2. Alfred leick, GPS Satellite Surveying, John Wiley and Sons, 1995.
3. Hofmann Wellenhof, B. Lichtenegger, H. and Collins, j., Global Positioning System, Springer – Verlag, New York, 1994

09CE371 PRINCIPLES OF REMOTE SENSING

Credit 3:0:0

OBJECTIVES:

- To understand the basics of Remote sensing
- To know the data acquisition process and data analysis

Unit I: Physics of Remote Sensing

Introduction of remote sensing, Electromagnetic spectrum, physics of remote sensing, effects of atmosphere, atmospheric windows, spectral reflectance of earth's surface features in different wave length regions of EM spectrum, Atmospheric influences on spectral response patterns, multi concept of remote sensing.

Unit II: Data Acquisition

Platforms, various types of platforms, importance of remote sensing data for natural resources management, different types of aircraft, manned and unmanned space craft used for data acquisition, characteristics of different types of platforms, LANDSAT, SPOT, IRS, ERS,INSAT, JERS IKONOS and other platforms.

Unit III: Data acquisition sensors (Visible and Infrared)

Photographic products, B&W, Colour and Colour Infrared films and their characteristics, resolving power of lenses and films, optomechanical, Electro optical sensor, spatial, spectral and radiometric resolution, thermal sensors, geometric characteristics of thermal imagery, calibration of thermal scanner, signal to noise ratio.

Unit IV: Data Acquisition sensors (Microwave)

Concepts of microwave remote sensing, SLAR, SAR, Scaterometers, Altimeter, Satellite and Airborne Sensors, characteristics of microwave imageries

Unit V: Data Analysis

Different types of data products and their characteristics, basic principles of digital analysis.

References

1. Paul Curran P.J., "Principles of remote Sensing", 1983.
2. Sabins F.F. Jr., "Remote sensing principles and Image Interpretation", W.H. Freeman and Company, 1978.
3. Lillesand, T.M. and Kiefer R.W. "Remote sensing and Image Interpretation", II edition of john Wiley and sons 1993

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ADDITIONAL SUBJECT

Sub. Code	Name of the Subject	Credits
10CE201	Civil Engineering Materials and Geology	4:0:0
10CE202	Intelligent Buildings	3:0:0
10CE203	Introduction to Architecture and Town Planning	3:0:0
10CE204	Watershed Management	3:0:0
10CE205	Introduction to Interior Design	3:0:0
10CE206	Environmental Impact Assessment	3:0:0
10CE207	Surveying Practical	0:0:2

10CE201 CIVIL ENGINEERING MATERIALS AND GEOLOGY

Credit: 4:0:0
Objectives:

- To understand the formation of rocks and properties of minerals
- To understand the properties of engineering materials
- To understand the tests to be done on materials

Outcomes:

- Students will be able to carry out engineering investigations
- Students will be able to identify important minerals
- Students will be able to select different building materials according to requirement

Unit I: General Geology and Mineralogy

Geology in Civil Engineering – branches of geology – Earth structure and composition – elementary knowledge on continental drift and plate tectonics. Earth processes – weathering - work of rivers, wind and sea and their Engineering importance – Elementary knowledge on symmetry elements of important crystallographic systems – physical properties of minerals – study of the following rock forming minerals – Quartz family, felspar family, hornblende, calcite, garnet - Properties, behaviour and engineering significance of clay minerals.

Unit II : Petrology and Structural Geology
Classification of rocks –Igneous, sedimentary and metamorphic rocks - Description, Occurrence, Engineering properties and Distribution of following rocks - Igneous rocks – granite, pegmatite and basalt - Sedimentary rocks – sandstone, limestone, shale and conglomerate - Metamorphic rocks - quartzite, marble, slate, gneiss and schist - Attitude of beds – outcrops – geological maps – study of structures – folds, faults and joints – their bearing on Engineering investigations. – Geological conditions necessary for construction of dams and tunnels.

Unit III: Stones, Bricks and Timber
(i) Stones, Requirement of good building stone, characteristics of stones and their testing. Common building stones. Preservation of stones.
(ii) Bricks : Manufacture of clay bricks, and their classification. Properties of clay bricks and their testing. Problems of efflorescence & lime bursting in bricks & tiles.
iii) Timber : Classification and identification of timber, Fundamental Engineering properties. Defects in timber, seasoning and preservation of timber.

Unit IV : Civil Engineering Materials
Cement and Concrete – raw material – manufacture – type and properties of cement – steel – heat treatment process – alloy steels – plain and deformed bars – relative merits – strength specifications - Desirable characteristics of reinforcing steel - Principles of cold working - Detailed Discussion on reinforcing steel mechanical and physical properties chemical composition - Uses of ceramics – refractories – terracotta and glazed products –Paints – varnishes – distemper - Plastic emulsions - Rubber, Aluminium, Glass, Plastics.

Unit V: Gypsum, Lime and Puzzolona
(i) Gypsum : Forms of gypsum and gypsum plaster, properties of gypsum plaster, building products of gypsum and their uses.
(ii) Lime : Manufacture of lime, classifications of limes, properties of lime.
(iii) Puzzolona : Natural and Artificial fly ash, Surkhi (burnt clay puzzolona), rice husk and ash puzzolona, properties and specifications for use in construction.

Text Books:

1. Parbin Singh, Engineering and general Geology, Katson publication House, 2007.
2. Krynine and Judd, Engineering Geology and Geotechniques, McGraw Hill Book Company 1970.
3. Rangwala, S.C., " Engineering Materials ", Charotar Publishing House, Anand, 1997.
4. Surendra Singh, " Building Materials ", Vikas Publishing Company, New Delhi, 1996.

Reference Books:

1. Legget, R.F., and Hatheway, A.W., Geology and Engineering, McGraw Hill Book Company. 1988.
2. Blyth, Geology for Engineers, BLBS, 1985.

10CE202 INTELLIGENT BUILDINGS

Credits: 3:0:0

Objectives:

- To provide knowledge on the underlying concepts of intelligent buildings
- To provide the working principles of building automation systems, office automation systems, and communication systems
- To provide basic knowledge of the construction and installation of the structured cabling system enabling integrated system connections

Unit 1: Introduction

Introduction to Intelligent buildings - Basic concepts of intelligent buildings - Intelligent building automation - Building automation system- Cost analysis of intelligent buildings – Introduction to smart materials

Unit 2: Heating Ventilation and Air Conditioning
Introduction - Human Comfort - Comfort Air-conditioning – Classification - Air conditioning Systems - Electrical installations and illumination - Introduction, Terminologies in electrical power engineering - Electrical power transmission to buildings-Electrical power quality in buildings - Lighting systems in buildings

Unit 3: Fire Protection Systems
Introduction - Type of fire service installations - Automatic fire alarm detection – Sprinklers - Hose reels hydrants- Foam systems - Microprocessor based alarm

Unit 4: Security And Safety Systems
Introduction- Designing a security system- Intrusion sensors and space sensors - Closed circuit television system - Central alarm systems – Health monitoring systems
Unit 5: Building Electronics
Introduction - Microprocessor based control - Programmable logic controller - Communication principles - Telephone systems - Communal aerial broadcasting - Satellite communication - Fibre optic system

Text Books:

1. Shengwei Wang, "Intelligent Buildings and Building Automation", Spon Press, London, 2009.
2. Derek Clements Croome, "Intelligent Building Design, Management and Operations", Thomas Telford Publishing, London, 2004.

References:
1. Albert Ting –pat So wai Lok Chan, "Intelligent Building Systems", Kluwer Academic Publisher, U.S.A, 1999.
2. Ehrlich, C., "Intelligent Building Dictionary: Terminology for Smart, Integrated, Green Building Design, Construction, and Management" San Francisco, Calif: Hands-on-Guide, 2007.
3. Michael Wigginton, Jude Harris, "Intelligent Skins", Architectural Press, Burfington, 2003.
4. www.ieindia.org
   www.koetterfire.com
   www.informit.com

10CE203 INTRODUCTION TO ARCHITECTURE AND TOWN PLANNING

Credits: 3:0:0

Objectives:
- To impart a basic knowledge on architecture and town planning
- To enable the students to appreciate and practice the basic principles in architecture and town planning in their areas of engineering

Unit I: Introduction to Architecture
Definition of the term 'Architecture' – Brief history of architecture - Key factors influencing architecture of any region: Culture, climate, topography, building materials, economy and technology - Human scale in architecture -
Space requirements for human activity
Architectural Space, Mass and Time
Space and Mass - Visual and emotional effects of geometric forms and their derivatives - The sphere, cube, pyramid, cylinder and cone – Concept of time in architecture

Unit II: Interior Design
Principles of interior landscaping - Texture, height grouping and layout - Plant species – Specifications - Open office system - Industrial interiors and specialized interior space design - Styles of Interiors - Italian, English, French, Japanese styles - Exposure to eminent interior designer's works

Unit III: Landscaping:
Concept of landscaping – Necessity – Study of trees, plants and shrubs for landscaping – Concepts of Green Building

Unit IV: Basics of Town Planning
Town planning – Definition - Objectives, necessity and principles adopted - Types of urban growth: their advantages and disadvantages - Town planning surveys: necessity, objectives and classification - Urban road patterns: types, specific advantages and disadvantages
Unit V: Land use Planning
Scope and content of Master plan -
Regional plan - Structure plan -
Urban renewal -
Planning standards for neighbourhood -
Basic principles in planning various land uses: residential, commercial, industrial, and recreational – Introduction to town planning legislation

Text Books:

1. Rangwala,S.C., Town Planning, Charotar Publishing House, Anand, Gujarat, 2007.
2. Gurcharan Singh & Jagdish Singh, Building planning, Designing and Scheduling,Standard Publishers Distributors, Nai Sarak , Delhi 1999.

References:

1. Hiraskar,G.K., Fundamentals of Town Planning,Dhanpat Rai and Sons, Delhi, 2005.
2. Abir Bandyopadhyay, Textbook of Town planning, Books and Allied publishers, Calcutta, 2000.
3. Francis D.K.Ching, Architecture – Form, Space and Order, Van Nostrand Reinhold Company, NewYork,1979.
4. James Fergusson , History of Indian and Eastern Architecture (Volume 1)
5. General Books Publisher, London,2009
6. 5.National Building Code 2005, Bureau of Indian Standards, New Delhi
7. www.spiritus-temporis.com
8. 7.www. archone.tamu.edu
9. 8.www.wisegeek.com

10CE204 WATERSHED MANAGEMENT

Credit 3:0:0

Objectives:

- To make the student understand the processes leading to degradation of soil and aquatic ecosystems and implementation of conservation measures
- To achieve integrated and sustainable development of watersheds

Unit 1: Introduction to Watershed

Watershed delineation-Watershed development: definition and concepts, objectives and need-Integrated and multidisciplinary approach for watershed management

Unit 2: Characteristics of Watershed

Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology- Socio-economic features

Unit 3: Watershed Management

Definition of watershed management – Factors affecting watershed management- Preparation of land drainage schemes-Types and design of surface drainage – Ground water recharge and development - Artificial recharge - Farm ponds - Percolation tanks

Unit 4: Soil Conservation

Controlling soil erosion and soil salinity- Estimation of soil loss due to erosion: Universal Soil Loss Equation – Structural measures of soil conservation – Agronomic measures of soil conservation.

Unit 5: Water Conservation and Harvesting

Types of water conservation and water harvesting structures for different types of catchments - Rainwater harvesting - Catchment and roof top harvesting-Harvesting structures- Soil moisture conservation - Check dams -

Text Books

1. J V S Murthy, Watershed Management - New Age International Publishers, New Delhi, 1998
2. Ghanshyam Das, Hydrology and Soil Conservation Engineering. Prentice-Hall of India Pvt. Ltd., New Delhi. 2000.
3. Tideman E. M., Watershed Management. Omega Scientific Publishers, New Delhi. 1996.

References

1. N C Thanh, A K Biswas, Environmentally sound water management UNEP, International Training Centre for Water Resources Management (ITCWRM), International Water Resources Association (IWRA) , Oxford University Press, Delhi 1990
2. Suresh R., Soil and Water Conservation Engineering. Standard Publishing Distributors, New Delhi. 2000.
3. M Newson, Land, Water and Development: River Basin Systems and Their Sustainable Management, Routledge, London, 1992
4. G J Young, J C I Dooge and J C Rodda, Global Water Resources Issues, Cambridge University Press, Cambridge, UK, 1994.
5. http://www.kerala.gov.in/keralcalljuly04/p17-19.pdf

6. http://megphed.gov.in/knowledge/RainwaterHarvest/Chap8.pdf
7. http://wgbis.ces.iisc.ernet.in/energy/paper/gis/gis.pdf
8. Indian Standard for Drinking Water as per BIS specifications -IS 10500-1991, Bureau of Indian Standards, New Delhi.

10CE205 INTRODUCTION TO INTERIOR DESIGN

Credits: 3:0:0

Objectives:

- To introduce the students to the concepts of interior design
- To enable students to choose the right interior design
- To enable them to supervise the interior design works

Unit –I: Introduction

Elements of interior design. Transformation of design elements - Optical illusion - Study of geometric patterns - Enveloping space, contained space and residual spaces - Spaces within space – Concepts of Green Building

Unit-II: Wall Composition and Colour Planning

Principles of lines- Wall composition guidelines - Colour for interiors : hue, chroma and tonal values - Effect of light on colour - Various colour schemes like analogues, complementary, triadic etc - Colour symbolism - Industrial colour codes - International standards - Colour planning process

Unit-III Interior Lighting

Interior lighting- Direct and indirect lighting - Location and light grid systems - Luminaire types, quality of lighting - Ambient, task and accent lighting - Various systems of air conditioning

Unit-IV: Interior Landscaping

Principles of interior landscaping - Texture, height grouping and layout - Plant species – Specifications - Open office system - Industrial interiors and specialized interior space design - Styles of interiors - Italian, English, French, Japanese styles - Exposure to eminent interior designers works

Unit-V: Interior Design Schemes

Furniture design - Modular approach in system furnishings - Selection and design of accessories - Presentation of interior design schemes with detailed specification for the materials and technology used - Performance evaluation criteria for the design provisions

Text Books:

1. Allen Tate and C Ray Smith, "Interior Design in the 20th Century", Harper and Row Publishers, New York, 2005.
2. Christine M. Piotrowski," Professional Practice for Interior Designers", 3rd Edition John Wiley & Sons, United States,2001.

References:

1. Geoffrey,H., Baaker, "Design Strategies in Architecture – An Approach to Analysis to Form", Van Nostrand Publications, London, 1989.
2. John F. Pile, "Color in Interior Design", McGraw-Hill Professional Publishing, New York, 1997.
3. Joseph De Chiara, Julius Panero, "Time-Saver Standards for Interior Design and Space Planning", McGraw-Hill, New York, 2001.
4. IS 3646 – (1965). " Code of Practice for Illumination", Bureau of Indian Standards, New Delhi.
5. Handbook on National Building Code 2005, Bureau of Indian Standards, New Delhi.
6. www.architecture-student.com
7. www.gardenvisit.com
8. www.sereneinteriors.com
9. www.freshome.com

10CE206 ENVIRONMENTAL IMPACT ASSESSMENT

Credits: 3:0:0

Objectives:

- To build capacity among students on EIA and to enable them to carry out environmental appraisal of project works
- To enable them to suggest alternate measures to avoid large scale adverse impacts on environment

Unit 1: Introduction
Definition and concept of environmental impact assessment - Environmental protection - Environmental policy and legislations - Acts on air and water pollution – Legislation for preservation of historical sites and archaelogical monuments - Factors for consideration in assessing environmental impact - Short term vs long term effects – Environmental impact due to natural hazards and climate change

Unit 2: Social and Economic Factors
Social and economic impact analysis - Physical, cultural, archaeological and aesthetic considerations – Resettlement and Rehabilitation - Examples of types of social impact analysis

Unit 3: Assessment Methods
Assessment methods – Rapid Impact Assessment - Checklist method – Matrix method – Environmental Impact Statement

Unit 4: Air Quality Assessment and Noise Quality Assessment
Air quality impact analysis - Air pollutants – Sources - Atmospheric interactions-Environmental impact - Assessment methodology - Case studies - Noise impact analysis - Effects of noise on people - Estimating transportation noise impact - Examples

Unit 5: Water Quality Assessment

Water quality impact analysis - Water quality criteria and standards - Water quality impact caused by projects related to highways, power plants, agriculture and irrigation - Forest management - Vegetation and wild life

Text Books:

1. 1.Anjaneyuku.Y and Valli Manickam, Environmental Impact Assessment Methodologies, BS Publications, Hyderabad, 2007.
2. Sacrates. J and Karthigarani.R., Environmental Impact Assessment, ABH Publishing Co., NewDelhi, 2008.

References:

1. John G Rau, David C Wooten, Environmental impact Analysis Handbook, Mc Graw Hill Book Company, New Delhi, 1980.
2. John Glasson,Riki Therivel, Andrew Chadwi,Introduction to Environmental Impact Assessment, 3rd Edition, Routledge, U.S.A., 2005.
3. Richard K.Morgan, Environmental Impact Assessment Methodological Prospective, Klumur Academic Publishers, 3rd Edition, 2002.
4. M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds) "Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2007
5. B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds) "Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2007
6. www.eicinformation.org
7. www.gdrc.org/uem/eia.html
8. www.unep.ch/etu/publications/textONUBr.pdf

10CE207 SURVEYING PRACTICAL

Credits: 0:0:2

Objectives:

- To give hands - on practical training on the usage of conventional and modern tools for surveying
- To know the usage of theodolite and tacheometer
- To introduce the concept of curves and contouring
- Introduction to the usage of total station

Experiments

1. Study of instruments in surveying lab

2. Setting out works – Foundation marking
3. Fly levelling
4. Longitudinal Section and Cross Section
5. Differential levelling
6. Measurement of horizontal angles by repetition method and reiteration method
7. Solutions to problems on heights and distances by observations using theodolite
8. Stadia and tangential tacheometry
9. Tacheometric contouring (radial)
10. Setting out simple curve by ordinates from long chord
11. Setting out combined curves
12. Total station surveying to ascertain the distance and included angle between two points
13. Measurement of areas using Planimeter and Global Positioning System
14. Setting out position of Columns using Theodolite.
    (12 Experiments will be given to students from the list given above)

Text Books:

1. Kanetkar, T.P and Kulkarni, S.V., Surveying and Levelling, Vol.II, Pune Vidyarthi Griha Prakashan, Pune, 2004.
2. Punmia, B.C., Advanced Surveying , Standard Publishers, New Delhi, 2005.
3. Punmia, B.C., Vols. I & II , Standard Publishers, New Delhi, 2008

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REVISED & NEW SUBJECTS

Sub.Code	Name of the Subject	Credit
10CE 301	Construction Planning, Scheduling and Control	3:0:0
10CE 302	Project Formulation and Appraisal	3:0:0
10CE 303	Construction Personnel and Management	3:0:0
10CE 304	High Performance Concrete	4:0:0
10CE 305	Advanced Soil Mechanics	3:1:0
10CE 306	Participatory Water Management	3:0:0
10CE 307	Irrigation Water Management	3:0:0

10CE 301 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL

Credit 3:0:0

Objectives

- To know about construction plans and activities
- To get knowledge about scheduling procedures
- To get awareness about cost control and monitoring
- To know about the quality control
- To get exposed to data based management system

Unit I: Construction Planning

Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Project life cycle - Defining Work Tasks - Defining Precedence Relationships Among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities - Coding Systems

Unit II: Scheduling Procedures and Techniques

Resource Oriented Scheduling - Scheduling with Resource Constraints and Precedence - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation -- Scheduling in Poorly Structured Problems - Improving the Scheduling Process.

Unit III: Cost Control, Monitoring and Accounting

The Cost Control Problem - The Project Budget - Forecasting for Activity Cost Control – Budget control - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

Unit IV: Quality Control and Safety during Construction

Quality and Safety Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality Control - Quality Control by Statistical Methods - Statistical Quality Control with Sampling by Attributes - Statistical Quality Control with Sampling by Variables - Safety

Unit V: Organization and Use of Project Information

Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in Databases - Relational Model of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow.

Text Books:

1. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000

References:

1. Calin M. Popescu, Chotchai Charoenngam, "Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications", Wiley, New York, 1995.

10CE 302 PROJECT FORMULATION AND APPRAISAL

Credit 3:0:0

Objectives

- To understand elements of project formulation and appraisal
- To learn the costing, appraisal and financial aspects of projects
- To study the implications of private sector participation in construction projects

Unit I: Project Formulation

Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Detailed Project Report – Different Project Clearances required

Unit II: Project Costing

Sources of cash flows - Time Value of Money- Present value of money – Future value of money – Cost of Capital

Unit III: Project Appraisal

NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Concepts of Risk Analysis – Selection of a Project and Risk Analysis in Practice

Unit IV: Project Financing

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators

Unit V: Private Sector Participation

Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer

Text Books:

1. Prasanna Chandra, Projects – Planning Analysis Selection Implementation & Review Sixth Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2006
2. Joy P.K., Total Project Management - The Indian Context (Chapters 3 - 7), New Delhi, Macmillan India Ltd., 2006

References:

1. United Nations Industrial Development Organisation (UNIDO) Manual for the preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987
2. Barcus, S.W. and Wilkinson J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986

10CE303 CONSTRUCTION PERSONNEL MANAGEMENT

Credit 3:0:0

Objectives

- To learn the fundamentals of human behaviour under various situations
- To relate the behaviour pattern to manpower planning in organizational setups
- To understand the means of management of construction personnel
- To know the methods to adopt training as a tool for improvement

Unit I: Manpower Planning
Manpower planning – Needs – Steps- Importance – personal principles

Unit II: Organization
Organization – span of control – Organization charts – Staffing plan – Development and Operation of human resources – managerial Staffing – Recruitment – Selection – Placement

Unit III: Human Behavior
Introduction to the field of people management – basic individual psychology – job design and performance management – Managing groups at work – self managing work teams – Intergroup behavior and conflict in organizations – Behavioral aspects of decision making

Unit IV: Management and Development Methods
Compensation – Wages and Salary, employee benefits – Employee services – Safety and Health – Discipline and discharge – Special Human resource problems, Performance appraisal – Employee handbook and personal manual – Job descriptions and organization structure and human relation – Productivity of Human resources

Unit V: Training and Development
Identification of training needs – training calendar – outsourcing for training – in-house training – training to overcome deficiencies – evaluation of training

Text Books:

1. Carleton counter II and Jill Justice coutier, 'The complete Standard Handbook of Construction Personnel Management' Prentice Hall, Inc., New Jersey, 1989

2. Memoria, C,B “Personal management”, Himalaya Publishing Co., 1992
3. Josy J. Familaro, “Handbook of Human Resources Administration”, McGraw-Hill International Edition, 1987

Reference Books:

1. Pringle Charles, “Management Longenecker” Emerricle Publishing company, 1981
2. Dwived R.S. “Human Relations and Organizational Behaviour BH -1987

10CE 304 HIGH PERFORMANCE CONCRETE

Credit 4:0:0

Objectives:

- To understand the characteristics of high performance concrete
- To design high performance concrete mixes
- To understand the fire resistance of self compacting concrete

Unit I : Introduction to Self Compacting Concrete:
Self compacting concrete – history - definition – applications of SCC – advantages of SCC – workability tests on fresh SCC. European guidelines on constituent materials, Properties of SCC and mix design approach.

Unit II : Cracks in Concrete:
Codal Provision on fire, Resistance of Concrete to fire – IS Code provisions. Cracks in concrete - types - Intrinsic cracking, structural cracking - causes and remedies - plastic cracks - causes and remedies - thermal contraction cracks

Unit III : Tests on High Performance Concrete:
Permeability - chemical attack - sulphate attack - durability - Thermal properties of concrete - fire resistance - compression test - split tension test -flexure Test - stress strain characteristics of concrete - Determination of modulus of elasticity- Ultrasonic pulse velocity method, rebound hammer test.

Unit IV : Mix Design:
Basic considerations - Factors in the choice of mix proportions - Mix design methods – ACI method, IS method -mix proportions for weigh batching and volume batching - correction for moisture content and bulking - Design of high strength concrete mixes.

Unit V : Case Studies on Fire Resistance:
Case studies on fire resistance of self compacting concrete, Fire damaged concrete, Effect of fire on flexural and shear behavior of beams.

Text Books

1. M. S. Shetty, “Concrete Technology- Theory and Practice”, S. Chand and Company, New Delhi, 2009.

Reference Books

1. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, 1990.

2. Gambhir, “Concrete Technology”, Tata McGraw Hill, New Delhi, 2003.
3. A.R.Santha Kumar, “Concrete Technology”, Oxford University Press N Delhi, 2006.
4. IS: 10262, "Recommended Guidelines for Concrete Mix Design", 1982.
5. European Guidelines on Self Compacting Concrete.

10CE305 ADVANCED SOIL MECHANICS

Credit 3:1:0

Objectives:

- To understand the various laws related to permeability, shear strength and stress distribution
- To understand failure mechanisms of slope
- To develop knowledge in soil exploration and soil sampling

Unit I : Introduction

Nature of soil - Soil description and classification for engineering purposes - IS Classification system – Objectives of Soil Exploration - Disturbed and undisturbed sampling - Depth of soil exploration - Number and disposition of bore holes - Geophysical methods – Penetration tests.

Unit II : Permeability and Seepage

One dimensional flow through soil – permeability – Darcy’s Law – Field and laboratory permeability tests – Flow through stratified soil – Seepage pressure and quick sand phenomenon – Two dimensional flow – Laplace equation – Electrical analogy – flow net – applications for sheet pile cut off and earth dam – phreatic line – Piping.

Unit III : Stress Distribution and Settlement

Concept of effective and neutral stresses – Soil Water statics – Capillary phenomenon – Vertical Stress distribution in soil – Boussinesq equation – line load – Uniformly distributed loads –Influence chart – approximate methods – Westergaard’s equation – Pressure bulb – causes of settlement - components of settlement – Immediate and consolidation Settlement – Methods of minimising settlement – Codal Provisions.

Unit I V: Shear Strength

Shear strength of cohesive and cohesionless soils - Mohr - Coulomb failure theory - saturated soil mass -Measurement of shear strength, direct shear - Triaxial compression, UCC and Vane shear tests - Pore pressure parameters.

Unit V : Slope Stability

Slope failure mechanisms - Types - Infinte slopes - Finite slopes - Total stress analysis for saturated clay - Method of slices - friction circle method - Use of stablity number - Slope protection measures.

Text Books:

1. Punmia B.C., " Soil Mechanics and Foundations ", Laxmi Publications Pvt. Ltd., New Delhi, 2005.

2. Arora K.R., “Soil Mechanics and Foundation Engineering ", Standard Publishers and Distributors, New Delhi, 2009.

References:

1. Holtz R.D. and Kovacs W.D., “Introduction to Geotechnical Engineering ",Prentice-Hall, 1995.
2. Gopal Ranjan and Rao A.S.R., " Basic and applied soil mechanics ", Wiley Eastern Ltd., New Delhi (India), 1997.
3. Khan I.H., " A text book of Geotechnical Engineering ", Prentice Hall of India, New Delhi, 2004.
4. McCarthy D.F., “Essentials of Soil Mechanics and Foundations ", Prentice-Hall, 2006.
5. Sutten B.H.C., “Solving Problems in Soil Mechanics", Longman Group Scientific and Technical, U.K. England, 1994.

10CE306 PARTICIPATORY WATER MANAGEMENT

Credit 3:0:0

Objectives:

- To introduce the student to the concept of farmer involvement in water management.
- To highlight the value of participatory approach for better performance of the irrigation systems, and for providing other facilities to the water users through organized associations.

Unit I : Fundamentals of Sociology

Sociology as a science: basic concept – Perspectives of sociology – Social system – Early sociological thought.

Unit II : Concept of Participation

Introduction – Irrigation as a socio-technical process – System management by agencies and users – Farmers organization and participation: need, and contribution to irrigation management.

Unit III : Water User Association

Kinds of participation – Activities in irrigation management – Water users Association – Types and levels of operation and organization in irrigation systems – User roles in irrigation management – Role of community organizers –Organizational structure for watershed management-Role of SHGs and NGOs-Participatory planning and implementation of watershed projects.

Unit IV : Supporting Farmers Organization and Participation

Policy consideration – Support – Experimentation, phasing and flexibility – Bottom-up approach – Existing organizations – Ownership – Non-political associations – Bureaucratic reorientation – Compatibility of objectives – Choices in organizational design – Scope of activity – Size and structure – Membership and decision making – Leadership and responsibilities – Legal basis – Channels for implementation.

Unit V : Improving Agency Relation with Farmers
Agency incentives – Technical cooperation – Special roles and style of agency – Irrigation management transfer.

Text Books:

1. Uphoff N. Improving International Irrigation Management with Farmer Participation – Getting the Process Right – Studies in Water Policy and Management. New Westview Press, 1986.
2. Geijar J.C. M.A., Irrigation Management Transfer in Asia. FAO/RAP, Thailand. 1995.

References:

1. Abraham Mark, Social Research Methods. Prentice. Hall Inc. Eaglewood Cliffs, N.J. 1993.
2. Chambers R., Managing Canal Irrigation. Oxford IBM Publishing Co., New Delhi. 1988.
3. Desai A.R., Rural Sociology in India. Popular Prakashan, Bombay. 1969..
4. Johnson S.H., Vermillon D.L. and Sagardoy J.A., Irrigation Management Transfer – Selected Papers from the International Conference Management Transfer. Wuhan, China, IIMI, FAO, Rome. 1994.
5. Korten F.F, and Robert Y.Siy, Jr., Transforming a Bureaucracy – the Experience of the Phillipine National Irrigation Administration. Ateneo De Manila University Press, Quezon City, P.O. Box 154, Manila. 1989.
6. Michal C.M. Putting People First. Sociological Variables in Rural Development, Oxford University Press, London. 1985

10CE307 IRRIGATION WATER MANAGEMENT

Credit 3:0:0

Objectives:

1. To introduce soil-water-plant relationships in the context of irrigation.
2. To introduce the concepts of scheduling, water distribution, design and methods of irrigation.

Unit I : Development of Irrigation
Importance of irrigation – Impact of irrigation on development of humanity – Need for irrigation– Development of irrigation in India – National Water Policy

Unit II : Crop Water Requirement
Infiltration and movement of water in soil – Soil-water-plant relationships-Role of climate – Water requirement of crops – Evapotranspiration (ET) and consumptive use - Effective rainfall-Soil and water quality-Leaching requirements – Irrigation requirements-FAO procedure - Duty of water.

Unit III : Water Distribution

Canal network and canal regulation – Methods of distribution: supply based and demand based – Delivery of water to farms – Measurement of water – Scheduling of irrigation – Frequency and interval of irrigation-Turn system.

Unit IV : Surface Irrigation Methods
Classification of irrigation methods – Border irrigation: design parameters, evaluation and ideal wetting pattern – Furrow irrigation: design parameters, types of furrows, evaluation, ideal wetting pattern and planting techniques – Basin irrigation: types of basins, suitable crops, soils and slopes, ideal wetting pattern, shapes and size.

Unit V : Drip and Sprinkler Irrigation Methods
Drip irrigation: components, suitable crops and land types – Sprinkler irrigation: types, components, and suitable crops.

Text Books:

1. Majumdar D. P., Irrigation Water management Principles and Practices, Prentice Hall of India, New Delhi, 2005.
2. Dewasish Choudhary, Irrigation Theory and Practice, Anmol Pub., 2008

References:

1. Michal A.M., Irrigation Theory and Practice, Vikas Publishing House, New Delhi, 1999.
2. Van den Bosch B.E., Hoevenaars J. and Broumer C., Irrigation Water Management Training Manual No.1 to 7, FAO, Rome, 1999.
3. Asawa G.L., Irrigation Engineering, New Age International Private Limited, New Delhi, 1996

SCHOOL OF CIVIL ENGINEERING

ADDITIONAL SUBJECT

Subject Code	Subject Name	Credit
10CE308	Structural Design of Foundations	3:1:0

10CE308 STRUCTURAL DESIGN OF FOUNDATIONS

Credits: 3:1:0

Objectives:

- The aim of this course is to expose the student to the principles of structural design of foundations, which has several features specific to foundations unlike the superstructural elements
- Together with the existing subject on Geotechnical Design of Foundations (09CE305) this subject gives a complete understanding of the entire gamut of foundation design

Unit I: Limit State Design of Reinforced Concrete – A Review

Grades of concrete – Mix design – Characteristic loads and material strengths – Limit states of collapse and serviceability – Reinforcement detailing – General aspects

Unit II: Shallow Foundations

Soil pressure for structural design – Continuous footings – Independent footings: square, rectangular, circular – Critical sections – Design under vertical loads and moments - Combined footings: rectangular, trapezoidal and cantilever types – Rafts: flat slab and beam and slab types – Introduction to 'soil-structure interaction' and its implications in design

Unit III: Deep Foundations

Piles: vertical and horizontal loads – Pile group analysis – Piers: analysis and design – Caissons: stability analysis and structural analysis

Unit IV: Retaining Structures

Reinforced concrete cantilever retaining wall – Cantilever sheet pile wall – Anchored bulkheads (free and fixed earth support): structural analysis and design.

Unit V: Substructures

Earth pressure in relation to cuts – Different supporting systems for cuts – Arching in soil: principle and applications – Prestressing in foundations – Introduction to shell foundations.

Text Books:

1. Kurian, N.P., “Design of Foundation Systems: Principles and Practices,” (3rd rev. and enl. edn.) Narosa Publishing house, New Delhi, 2005.
2. Peck, R.B., Hanson, W.E. and Thornburn, T.H., “Foundation Engineering,” (2nd edn.) Wiley Eastern Ltd., New Delhi, 1980.

Reference Books:

1. Bowles, J.E., “Foundation Analysis and Design,” (5th edn.), McGraw-Hill, New York, 1995.
2. Teng, W.C., “Foundation Design,” Prentice-Hall of India (Pvt.) Ltd., New Delhi, 1965.
3. Varghese, P.C., “Design of Reinforced Concrete Foundations,” PHI Learning Pvt. Ltd., New Delhi, 2009.
4. Kurian, N.P., “Shell Foundations: Geometry, Analysis, Design and Construction,” Narosa Publishing House, New Delhi, 2006.

SCHOOL OF CIVIL ENGINEERING

LIST OF SUBJECTS

Sub. Code	Name of the Subject	Credits
12CE101	Basic Civil Engineering	2:0:0
12CE201	Survey	4:0:0
12CE202	Mechanics of Solids	3:1:0
12CE203	Engineering Mechanics	3:0:0
12CE204	Engineering Geology	3:0:0
12CE205	Mechanics of Fluids	3:1:0
12CE206	Survey Lab	0:0:2
12CE207	Building Drawing	0:0:2
12CE208	Hydraulics Lab - I	0:0:2
12CE209	Applied Hydraulics and Hydraulic Machinery	3:1:0
12CE210	Advanced Strength of Materials	3:1:0
12CE211	Soil Mechanics	3:0:0
12CE212	Strength of Materials Lab	0:0:2
12CE213	Hydraulics Lab - II	0:0:2
12CE214	Structural Analysis	3:0:0
12CE215	Highway Engineering	3:0:0
12CE216	Computational Methods	3:1:0
12CE217	Reinforced Concrete Structures	3:1:0
12CE218	Water Supply Engineering	3:0:0
12CE219	Foundation Engineering	3:0:0
12CE220	Concrete Laboratory	0:0:2
12CE221	Geotechnical Engineering Laboratory	0:0:2
12CE222	Environmental Engineering Laboratory	0:0:2
12CE223	Design of Steel Structures	3:0:0
12CE224	Advanced Structural Analysis	3:0:0
12CE225	Prestressed Concrete and Masonry Structures	3:0:0
12CE226	Sanitary Engineering	3:0:0
12CE227	Water Resources Engineering	3:0:0
12CE228	Railways, Airports and Harbours	3:0:0
12CE229	Design and Drawing (R.C.C and Steel)	0:0:2
12CE230	Estimation and Costing lab	0:0:2
12CE231	Computer Application Lab	0:0:2

12CE232	Safety Engineering and Quality Control	3:0:0
12CE233	Design of Bridge Structures	3:0:0
12CE234	Design of Marine Structures	3:0:0
12CE235	Fundamentals of Remote Sensing and GIS	3:0:0
12CE236	Design of Tall Structures	3:0:0
12CE237	Hydrologic Processes	3:0:0
12CE238	Construction Practices	3:0:0
12CE239	Industrial Waste Treatment and Disposal	3:0:0
12CE240	Rehabilitation of Structures	3:0:0
12CE241	Finite Element Techniques	3:0:0
12CE242	Construction Management	3:0:0
12CE243	Global Climate Change and its Impacts	3:0:0
12CE244	Design and Drawing of Water Management Structures	0:0:2
12CE245	Highway Laboratory	0:0:2
12CE246	Survey Camp	0:0:2
12CE247	Groundwater Development and Management	3:0:0
12CE248	Architecture and Town Planning	3:0:0
12CE249	Smart Materials and Smart Structures	3:0:0
12CE250	Solid Waste management	3:0:0
12CE251	Environmental Impact Assessment	3:0:0
12CE252	Building Services	3:0:0
12CE253	Natural Disaster Management	3:0:0
12CE254	Transportation Planning	3:0:0
12CE255	GIS applications	3:0:0
12CE256	Ground Improvement Techniques	3:0:0
12CE257	Intelligent Buildings	3:0:0
12CE258	Geographical Information System	3:0:0
12CE259	Industrial Waste Treatment and Disposal	3:0:0
12CE260	Introduction to Architecture and Town planning	3:0:0
12CE261	Watershed Management	3:0:0
12CE262	Environmental Impact Assessment	3:0:0
12CE263	Fluid Mechanics and Machinery	3:1:0
12CE264	Mechanics of Solids	3:1:0
12CE265	Strength of Materials laboratory	0:0:1
12CE266	Fluid Mechanics and Machinery Laboratory	0:0:1
12CE301	Computer Aided Methods of Structural Analysis	3:1:0
12CE302	Applied Elasticity and Plasticity	3:1:0

12CE303	Advanced Design of Reinforced Concrete Structures	3:1:0
12CE304	Advanced Design of Steel Structures	3:1:0
12CE305	Structural Dynamics	3:1:0
12CE306	Advanced Concrete Technology	4:0:0
12CE307	Stability of Structures	3:1:0
12CE308	Finite Element Methods in Engineering	3:1:0
12CE309	Prestressed Concrete Structures	3:1:0
12CE310	Design of Foundations	3:1:0
12CE311	Seismic Design of Structures	3:1:0
12CE312	Structural Engineering Laboratory	0:0:2
12CE313	Advanced Design of Bridges	3:1:0
12CE314	Maintenance and Rehabilitation of Structures	4:0:0
12CE315	Analysis and Design of Plate and Shell	3:1:0
12CE316	Computer Aided Structural Engineering Laboratory	0:0:2
12CE317	Experimental Techniques and Instrumentation	3:1:0
12CE318	Theory of Plates	3:1:0
12CE319	Mechanics of Composite Materials	4:0:0
12CE320	Design of Structures for Dynamic Loads	3:1:0
12CE321	Design of Tall Buildings	3:1:0
12CE322	Design of Composite Structures	3:1:0
12CE323	Design of Industrial Structures	3:1:0
12CE324	Optimization of Structures	3:1:0
12CE325	Prefabricated Concrete Structures	4:0:0
12CE326	Design of Coastal and Offshore Structures	4:0:0
12CE327	Space Structures	4:0:0
12CE328	Construction Management and Project Management	4:0:0
12CE329	High Performance Concrete	4:0:0
12CE330	Advanced Construction Techniques	4:0:0
12CE331	Nonlinear Analysis of Structures	3:1:0
12CE332	Research Methodology	4:0:0

12CE101 BASIC CIVIL ENGINEERING

Credits: 2:0:0

Course Objective

- To know the history, scope and functions of civil engineering discipline
- To study basic engineering mechanics and materials and their properties
- To expose to different areas of civil engineering field

Course Outcome

- Student understood the importance of civil engineering and role of civil engineers in infrastructure development

Unit I

INTRODUCTION TO CIVIL ENGINEERING: Scope of civil engineering - Significant contribution of civil engineers – Examples of great civil engineers and notable civil engineering projects – Role of civil engineering in infrastructure and natural resources development and conservation – Dependence of other sectors on civil engineering – Socio-economic considerations in civil engineering works – Introduction to environmental impact assessment.

Unit II

SURVEYING AND BASIC MECHANICS:
Surveying: Introduction - Purpose and Objectives of surveying - Classification - Basic principles - Calculation of the area of a plot.
Basic Mechanics: Types of forces - Determination of forces and moments - Simple stress and strain – Moment of inertia - First moment of area.

Unit III

CONSTRUCTION MATERIALS: Characteristics and engineering properties of stones, bricks, timber, steel, glass, aluminum, tiles, plastics, bitumen, cement and concrete – Paints and emulsions - Introduction to plumbing.

Unit IV

INFRASTRUCTURE DEVELOPMENT: Public Buildings - Highways and railways: purpose, types and typical cross-sections - Airports and harbors: purpose, types and typical layouts.

Unit V

NATURAL RESOURCES DEVELOPMENT AND CONSERVATION: Introduction to irrigation structures and methods - Water supply – Hydropower projects - Introduction to Sanitary engineering - Waste treatment: types, purposes and components.

Text Books

1. Ramesh Babu, V., “Basic Civil Engineering”, Anuradha Agencies, Kumbakonam, 2001.
2. Palanichamy, M. S.,“Basic Civil Engineering”, Tata McGraw Hill Publishing Co. Limited, New Delhi, 2008.
3. Kottiswaran, “Engineering Mechanics”, Balaji Publications, 2003.

Reference Books

1. Johnson Victor, D and Esther Malini, “Basic Civil Engineering”, Allied Publishers Limited, Chennai, 2002.
2. Arunachalam, N, “Basic Civil Engineering”, Pratheeba Publishers, Coimbatore, 2000.

12CE201 SURVEY

Credits: 4:0:0

Course Objective

- To understand the principles of land and hydrographic surveying
- To know the application of surveying in civil engineering projects

Course Outcome

- Students enabled to conduct survey for civil engineering projects

Unit I
LEVELLING: Definition – Instruments – Temporary and permanent adjustments – Booking – Reduction – Curvature and Refraction correction – Reciprocal levelling - Contour: characteristics and uses – Areas and volumes: Trapezoidal and Simpson’s rule.

Unit II
THEODOLITE SURVEYING: Study of theodolite – Temporary and permanent adjustments – Measurement of horizontal angles: repetition and reiteration methods – Traversing - Closing error and distribution: Bowditch’s and Transit rule – Omitted measurements – Heights and distances.
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Unit III
TACHOMETRIC SURVEYING: Principle of stadia method – Distance and elevation formulae for staff held vertical – Instrumental constants – Anallactic lens – Tangential method – Substense bar.

Unit IV
CURVE AND HYDROGRAPHIC SURVEYING:
Curve Surveying: Types of curves - Elements of simple curves – Setting out simple curves by linear and angular methods – Introduction to transition curve: requirements and functions.
Hydrographic Surveying: Shore line survey – Soundings: instruments used, methods of location using GPS.

Unit V
TRIANGULATION: Classification of triangulation systems - Intervisibility and height of stations - Signals and towers – Base line corrections: temperature, pull, sag and slope - Satellite stations: reduction to centre – Introduction to modern instruments: Total station.

Text Books

1. Kanetkar, T.P. and Kulkarni, S.V., “Surveying and Levelling”, Parts 1 and 2, Pune Vidyarthi, Griha Prakashan, 1995.

2. Basak, N., “Surveying and Levelling”, McGrawHill & Co., 2011.

Reference Books

1. Bannister, A. and Raymond S., “Surveying”, ELBS, Sixth Edition, 1992.
2. Duggal, S.K., “Surveying”, Volume I and 2, McGraw Hill & Co., Third Edition, 2009

12CE202 MECHANICS OF SOLIDS

Credits: 3:1:0

Course Objective

- To explore the state of stress (two dimensional) and evaluate the principal stresses and principal planes by analytical and graphical methods
- To study the behaviour of determinate beams
- To learn the theory of torsion and stresses developed in solid, hollow shafts and helical springs

Course Outcome

- Student enabled to analyse the behaviour of determinate beams under various types of loads
- Student learnt to analyse springs and shafts of different types
- Student gained a clear understanding of stress, strain and torsion

Unit I

STRESS, STRAIN AND DEFORMATION IN SOLIDS: Tension, compression and shear stresses – Hooke’s law – Stress–strain diagram for mild steel – Ultimate stress and working stress – Elastic constants and relationship between them – Material types - Material properties : homogeneous, isotropic, brittle, elastic, strong and tough – Composite bars – Thermal stresses – Strain energy due to axial load – Stress due to suddenly applied and impact load.

Unit II

COMBINED STRESSES: Two dimensional state of stress at a point – Normal and shear stresses on any plane - Analytical Method: principal planes and principal stresses - Graphical method - Mohr’s circle - Two dimensional state of strains at a point - Principal strains and their directions - Stresses and deformations in thin cylinders and spherical shells due to internal pressure.

Unit III

BENDING MOMENT AND SHEAR FORCE: Types of supports - Types of beams - Definition of shear force and bending moment at any cross section of a beam - Sketching of shear force and bending moment diagrams for cantilever, simply supported and over hanging beams for any type of loading – Relationships among loading, shear force and bending moment.

Unit IV

STRESSES IN BEAMS: Theory of simple bending – Analysis of bending stresses – Load carrying capacity of beams – Proportioning sections – Flitched beams - Leaf springs – Strain energy due to bending moment – Shear stress distribution – Strain energy due to transverse shear force.

Unit V

TORSIONAL STRESSES: Elastic theory of torsion – Stresses and deformation in circular solid and hollow shafts – Stepped shafts – Composite shafts – Power transmitted by shafts - Strength of shafts - Torsion of thin walled open, closed sections and non-circular sections (only application of formulae) - Stress due to combined bending and torsion – Strain energy due to torsion - Deformations and stresses in helical springs.

Text Books

1. Egor, P.Popov,“ Engineering Mechanics of Solids” ,Prentice Hall of India, New Delhi, 2001.
2. Rajput, R.K., “Strength of Materials”, S. Chand & Co. Ltd., New Delhi, 2006.
3. Bansal, R.K .,“Strength of Materials”, Laxmi Publications, New Delhi, 2010.

Reference Books

1. Beer, Johnson and Dewolf ,“Mechanics of Materials”, Tata McGraw-Hill Education, 2004.
2. Prakash, D.S. Rao, “Strength of Materials: A Practical Approach”, Volume 1, Universities Press, 2004.
3. Subramaniam, R., “Strength of Materials”,Oxford University Press, 2005.
4. Timeshenko, S.P. and Young, D.H., “Elements of Strength of Materials”, V Edition, Affiliated East-West Press Pvt. Ltd., New Delhi, 1998.

12CE203 ENGINEERING MECHANICS

Credits: 3:0:0

Course Objective

- To make the student understand the principles of equilibrium of forces
- To enable the student to learn the basic principles of statics and dynamics

Course Outcome

- Student enabled to resolve the forces and apply the concept in static and dynamic structures

Unit I

INTRODUCTION AND FORCE RESULTANT: Forces and force systems - Parallelogram law of force – Resultant of a system of coplanar forces acting on a particle - Equilibrium of a particle under coplanar forces - Resultant of a system of space force acting on a particle - Equilibrium of a particle under space force – Free body diagram.

Unit II

STATICS OF RIGID BODY AND FRICTION:

Rigid Body: Rigid body – Moment of force couple - Properties – Resolution of force into force and couple – Equilibrium of a rigid body under coplanar forces – Types of support – Reaction at supports of beams and frames – Problems involving equilibrium of rigid bodies – Stable, unstable and neutral equilibrium.

Friction: Angle of friction – Co-efficient of friction - Laws of dry friction – Friction in wedges and ladder.

Unit III

CABLES AND TRUSSES: Analysis: cables, roof trusses – method of joints – method of sections

Centroid and Moment of Inertia: Properties of plane sections: centroid, first moment of area, moment of inertia, polar moment of inertia, radius of gyration - Parallel axis theorem - Mass centre and mass moment of inertia: thin circular and rectangular plates, rectangular prism, cylinders and cones.

Unit IV

KINEMATICS OF PARTICLES: Rectilinear motion – Projectiles - Curvilinear motion - Rectangular components - Motion of projectiles - Equation of curvilinear motion in X and Y components - Normal and tangential components - Kinetic energy and potential energy – Principle of work and energy – Conservation of energy.

Unit V

KINETICS OF PARTICLES: Rectilinear and curvilinear motion - Impulse momentum principle - Principle of work and energy – Impact: direct, central and oblique central.

Text Books

1. Beer, F.P. and Johnson, E.R., "Vector Mechanics for Engineers, Statics and Dynamics", McGraw Hill International Book Co., 1995.
2. Timoshenko and Yung, "Engineering Mechanics", McGraw Hill Book Co., 1995.

Reference Books

1. Merriam. J. L., "Engineering Mechanics", Vol.1 and 2, Wiley International, 1988.
2. Irving, H. Shames, "Engineering Mechanics - Statics and Dynamics ", Third Edition, Prentice-Hall of India Pvt. Ltd., 1993.
3. Rajasekaran, S., and Sankarasubramanian, G.,"Engineering Mechanics", Vikas Publishing House Pvt. Ltd., 1999.
4. Kottiswaran, "Engineering Mechanics", Balaji Publications, 2003.

12CE204 ENGINEERING GEOLOGY

Credits: 3:0:0

Course Objective

- To understand the formation of rocks and properties of minerals
- To impart knowledge on geology to civil engineers

Course Outcome

- Students enabled to incorporate geological concepts in civil engineering structures
- Students built capacity to apply their knowledge in foundation engineering, tunneling and mining

Unit I

GENERAL GEOLOGY: Geology for civil engineers – Branches of geology – Earth structure and composition – Introduction to continental drift and plate tectonics - Earth processes – Geological formations – Action of water and wind on rocks.

Unit II
MINERALOGY: Introduction to symmetry of important crystallographic systems – Physical properties of minerals – Study of rock forming minerals: quartz, feldspar, hornblende, calcite, garnet - Properties, behaviour and engineering significance of clay minerals.

Unit III
PETROLOGY: Classification of rocks – Igneous, sedimentary and metamorphic rocks: description, occurrence, engineering properties and distribution - Igneous rocks: granite, pegmatite and basalt - Sedimentary rocks: sandstone, limestone, shale and conglomerate - Metamorphic rocks: quartzite, marble, slate, gneiss and schist.

Unit IV
STRUCTURAL GEOLOGY: Attitude of beds – Outcrops – Geological maps – Study of structures – Folds, faults and joints: influence on engineering investigations.

Unit V
GEOPHYSICAL METHODS AND INVESTIGATIONS: Seismic and electrical methods for subsurface investigations – Prospecting for groundwater - Remote sensing for civil engineering applications - Geological conditions necessary for design and construction: dams and reservoirs, tunnels, buildings and road cuttings - Investigation of landslides and subsidence: causes and mitigation.

Text Books
1. Chenna Kesavulu, N., "Text Book of Engineering Geology", Macmillan India Ltd., 2007.
2. Venkat Reddy, "Engineering Geology for Civil Engineers", Oxford & IBH, 1993.
3. Parbin Singh, A., "Text Book of Engineering and General Geology", Katson Publishing House, Ludhiana, 1993.

Reference Books
1. Blyth, F.G.H. and De Freitas, M.H., "Geology for Engineers", Edward Arnold, London, 1984.
2. Bell, F.G., "Fundamentals of Engineering Geology", B.S Publications, Hyderabad, 2005.

12CE205 MECHANICS OF FLUIDS

Credits: 3:1:0

Course Objective
- To introduce the fundamental concepts of fluid statics, kinematics and dynamics
- To introduce the concepts of flow measurements, flow through pipes
- To introduce the concepts of dimensional analysis and model analysis

Course Outcome
- Student enabled to understand the various types of flow and flow profiles
- Student learnt to carryout flow measurements

- Student exposed to design pipe networks
- Student built capacity to carry out dimensional analysis and model studies

Unit I

FLUID PROPERTIES AND FLUID STATICS: Scope of fluid mechanics - Definition of a fluid - Dimensions and units - Viscosity, density, perfect gas, vapour pressure and surface tension - Basic equation of fluid statics – Pressure – Pascal's law - Pressure measurements: manometers - Forces on plane and curved surfaces - Buoyancy and floatation - Relative equilibrium.

Unit II

BASIC CONCEPTS OF FLUID FLOW:

Kinematics : Methods of describing fluid motion - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials - Flow nets.

Dynamics: Concepts of system and control volume - Application of control volume to continuity, energy and momentum - Euler's equation of motion along a stream line - Bernoulli's equation - Free and forced vortex flow.

Unit III

FLOW THROUGH PIPES:

Laminar flow: Definition – Reynold's experiment – Reynold's number – Hagen Poiseuille equation for a circular pipe.

Turbulent flow: Definition – Darcy-Weisbach's equation – Moody's diagram – friction factor for laminar and turbulent flow: smooth and rough pipes.

Energy loss in pipes – Hydraulic gradient, energy gradient – Major energy loss – Minor energy loss – Pipes in series and parallel – Equivalent pipe – Power transmission through pipes – Syphon – Water hammer (definition).

Unit IV

FLOW MEASUREMENTS: Venturimeter - Orifice meter - Pitot tube - Mouthpiece and orifice – Introduction to open channel flow - Weirs and notches: rectangular, triangular, broad crested, narrow crested - Flumes.

Unit V

DIMENSIONAL ANALYSIS AND SIMILITUDE: Fundamental and secondary dimensions – Dimensional homogeneity – Rayleigh and Buckingham-pi theorem methods – Similitude – Significance of dimensionless numbers – Classification of hydraulic models – Scale effect.

Text Books

1. Modi, P.N. and Seth, S.M., "A Text book of Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi, 2007.
2. Rajput, R.K.," A Text book of Fluid Mechanics and Hydraulic Machines", S.Chand and Co., New Delhi, 1998.
3. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2005.

Reference Books

1. Garde, R.J., "Fluid Mechanics through problems", New Age International, 2006.

2. Som,S.R, & Biswas, “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw Hill, 1998.
3. Agarwal, S.K., “Fluid Mechanics and Machinery”, Tata Mc Graw Hill Co., 1997.

12CE206 SURVEY LAB

Credits: 0:0:2

Course Objective

- To train the students to acquire skill in operation of various survey instruments
- To give hands on training on the use of conventional and modern tools of surveying

Course Outcome

- Student trained to carry out various type of surveys.

LIST OF EXPERIMENTS:

1. Use of Dumpy level - fly levelling
2. Use of Dumpy level – reciprocal levelling
3. Measurement of horizontal angles by the method of repetition
4. Measurement of horizontal angle by the method of reiteration
5. Setting out works – foundation marking
6. Single plane method
7. Double plane method
8. Stadia tacheometry and determination of constants of a theodolite
9. Tangential tacheometry
10. Setting out a simple circular curve by ordinates from long chord
11. Setting out a circular curve by Rankine’s method of tangential angles
12. Measurement of area using Total station
13. Measuring the water level in an open well
14. Estimating the c/s of a river

Text Books

1. Kanetkar, T.P. and Kulkarni, S.V., “Surveying and Levelling”, Part 1 and 2, Pune Vidyarthi Griha Prakashan, 1995.
1. Basak, N., “Surveying and Levelling”, McGrawHill & Co., 2011.

12CE207 BUILDING DRAWING

Credits: 0:0:2

Course Objective

- To impart basic knowledge on symbols, traffic signs, electrical circuits, joinery, plumbing items and staircases
- To impart knowledge on drawing of plan, section and elevation of buildings
- To impart knowledge on drafting AutoCAD software

Course Outcome

- Students trained in basic civil engineering drawing

- Students enabled to plan and draw buildings

LIST OF EXPERIMENTS:

1. Symbols and sign conventions related to architecture, traffic, electrical circuits, plumbing, welding and joinery in wood work
2. Metric brick – bonds in brick masonry corner walls
3. Timber doors – panelled, panelled and glazed type
4. Timber windows – panelled and glazed type
5. Planning and detailing of stairs and staircases
6. Plan, elevation and section of single-storeyed residential building
7. Plan, elevation and section of two-storeyed residential building
8. Plan, elevation and section of schools building
9. Plan, elevation and section of auditorium building
10. Plan, elevation and section of hostel building
11. Plan, elevation and section of hospital building
12. Plan, elevation and section of commercial building
13. Plan, elevation and section of industrial buildings

Text Books

1. Balagopal Prabhu, T. S., "Building Drawing and Detailing", Spades Publishing, KDFA Building, Calicut, 1987.
2. Sikka.V.B., "A Course in Civil Engineering Drawing", 4th Edition, S.K.Kataria and Sons, New Delhi, 1998.

Reference Books

1. AUTO CAD Tutorials and Manual- Autodesk Work Book on AUTO CAD Level I and II CAD/CAM centre, Coimbatore
2. Gurucharan Singh & Jagdish Singh, "Building Planning, Designing and scheduling", Standard Publishers, New Delhi, 2001
3. IS: 962 – 1967, Code of Practice for Architectural and Building Drawing, Bureau of Indian Standards, New Delhi
4. IS: 4021 – 1983, Specification for Timber Door, Window and Ventilator Frames, Bureau of Indian Standards, New Delhi
5. IS: 1003 – 1977, Part I, II Specification for Timber Panelled and Glazed Shutters, Bureau of Indian Standards, New Delhi

12CE208 HYDRAULICS LAB - I

Credits: 0:0:2

Course Objective

- To give hands on training on Flow measurement, Losses due to friction and pipe fittings
- To give hands on training on working of different types of Pumps.

Course Outcome

- Student enabled to carry out flow measurements
- Student enabled to study the performance of pumps

FLUID MECHANICS:
1. Determination of Darcy's friction factor.
2. Calibration of flow meters.
3. Flow over notches.
4. Flow through orifice.
5. Determination of minor losses in pipes

FLUID MACHINERY:
1. Performance of Centrifugal pump.
2. Performance of Submersible pump.
3. Performance of Reciprocating pump.
4. Performance of Gear Oil pump
5. Performance of Jet pump

Text Books

1. Modi, P.N. and Seth, S.M., "Fluid Mechanics & Fluid Machines", Standard Book House, New Delhi, 2007.
2. Rajput, R.K., "A Text Book of Fluid Mechanics and Hydraulic Machines", S.Chand and Co., New Delhi, 1998.

Reference Books

1. Som, S.R., & Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Co., 1998.
2. Agarwal, S.K., "Fluid Mechanics and Machinery", Tata Mc Graw Hill Co., 1997.
3. Garde, R.J., "Fluid Mechanics through problems", New Age International, 2006.

12CE209 APPLIED HYDRAULICS AND HYDRAULIC MACHINERY

Credits: 3:1:0

Course Objective
- To learn the fundamentals of uniform and non-uniform flow in open channels
- To introduce the concepts of boundary layer theory and flow around submerged objects
- To introduce the concepts of momentum principles
- To impart the knowledge on pumps and turbines

Course Outcome
- Student enabled to design channels with uniform flow conditions
- Student trained to calculate the forces on submerged bodies and the force due to impact on moving and stationary objects
- Student built capacity to operate and select turbines and pumps

Unit I
OPEN CHANNEL FLOW: Types of flow - Uniform flow - Chezy's and Manning's equations - Hydraulically best sections - Uniform flow computations - Specific energy - Critical flow.
Varied Flow: Hydraulic jump – Energy equations and solutions – Gradually varied flow – Surges - Study of flow profiles - Back water and drawdown curves.

Unit II

BOUNDARY LAYER AND FLOW AROUND SUBMERGED BODIES: Definition – Displacement, momentum and energy thickness - Boundary layer equations – Boundary layer separation – Laminar and turbulent boundary layers – Forces on submerged bodies – Expression for drag and lift – Types of drag – Stream lined and bluff bodies.

Unit III

MOMENTUM PRINCIPLE: Impulse momentum equation – Application of linear momentum principle - Impact of jet - Force exerted by a jet on normal, inclined and curved surfaces for stationary and moving cases only.

Unit IV

TURBINES: Typical layout and components of a hydro-electric project - Classification of water turbines – Working principles and design of Pelton wheel, Francis and Kaplan turbines – Inlet and outlet velocity triangles - Head and efficiencies of turbines – Draft tube and its types – Similarity laws – Specific speed – Operating characteristics – Governing of turbines – Selection of turbines.

Unit V

PUMPS:

Centrifugal Pump: Classification – Components and working – Inlet and outlet velocity triangles – Head losses and efficiencies - Minimum starting speed – Specific speed – Performance curves – Selection of pumps - Cavitation.

Positive Displacement Pump: Reciprocating pump – Types – Components and working of reciprocating pump – Slip – Indicator diagram – Air vessel.

Miscellaneous pumps: multistage pumps, submersible pumps, jet pumps, rotary pumps (working principles only).

Text Books

1. Modi, P.N. & Seth, S.M., “A Text book of Fluid Mechanics and Hydraulic Machines”, Standard Book House, New Delhi, 2007.
2. Rajput, R.K., “A Text book of Fluid Mechanics and Hydraulic Machines” , S. Chand and Co., New Delhi,1998.
3. Bansal, R.K., “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, New Delhi, 2005.

Reference Books

1. Som, S.R, & Biswas, “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw Hill, 1998.
2. Agarwal, S.K., “Fluid Mechanics and Machinery”, Tata Mc Graw Hill Co., 1997.
3. Hubert Chanson, “Hydraulics of Open Channel flow’, Butterworth-Heineman Ltd., 2nd Edition, 2004.

12CE210 ADVANCED STRENGTH OF MATERIALS

Credits: 3:1:0

Course Objective

- To understand the concepts of deflection, stability criteria, theories of failure, unsymmetrical bending, behaviour of curved bars and shear centre

Course Outcome

- Student enabled to understand the concept of deflection, stability criteria, failure theories, symmetrical and unsymmetrical bending and shear centre
- Student learnt to analyse curved beams

Unit I

DEFLECTION OF DETERMINATE BEAMS: Governing differential equation - Double integration method - Macaulay's method - Moment area method - Conjugate beam method.

Unit II

COLUMNS AND STRUTS: Columns: behaviour of axially loaded short, medium and long members - Critical loads with different end conditions – Eccentrically loaded long columns - Euler's method - Eccentrically loaded short columns - Empirical formulae: Rankine–Gordon , straight line formula.

Unit III

THICK CYLINDERS AND FAILURE THEORIES: Thick cylinders - Lame's equation - Hoop stress and radial stress distribution – Compound cylinders - Shrink fit.
Theories of Elastic Failure: Maximum principal stress theory - Maximum shear stress theory - Maximum principal strain theory - Strain energy theory - Mohr's theory - Simple problems.

Unit IV

SHEAR CENTRE AND CURVED BEAMS: Shear center - Introduction to non-circular sections - Shear center for thin walled beam of mono-symmetric open sections - Shear flow in thin walled beams of open sections - Curved Beams: stresses due to bending by Winkler Bach formula; rectangular, trapezoidal and circular solid section; Crane hook problem.

Unit V

UNSYMMETRICAL BENDING OF STRAIGHT BEAMS: Symmetrical and unsymmetrical bending - Bending stresses in beams subjected to unsymmetrical bending - Change in direction of neutral axis - Increase in stress compared to symmetrical bending.

Text Books

1. Egor, P.Popov ,“ Engineering Mechanics of Solids”, Prentice Hall of India, New Delhi, 2000.
2. Rajput, R.K., “Strength of Materials”, S. Chand & Co. Ltd., New Delhi, 2006.
3. Bansal, R.K., “Strength of Materials”, Laxmi Publications Ltd., New Delhi, 2010.
4. Bedi, D.S., “Strength of Materials”, Khanna Book Publishing Co. (P) Ltd., Delhi, 2000.
5. Ramamurtham, S., “Strength of Materials”, Dhanpat Rai Publishing Co., New Delhi, 2008.

Reference Books

1. Jindal, U.C, “Strength of Materials”, Asian Books Pvt. Ltd., 2004.
2. Timeshenko, S.P. & Young, D.H., “Elements of Strength of Materials”, 5th Edition, Affiliated East-West Press Pvt. Ltd., New Delhi, 1998.
3. Bedi, D.S., “Strength of Materials”, Khanna Book Publishing Co. (P) Ltd., Delhi, 2000.

4. Andrew Pytel Ferdinand L.Singer, “Strength of Materials”, International Student Edition (ISE Reprint), Harper Collins College Division, 1999.

12CE211 SOIL MECHANICS

Credits: 3:0:0

Course Objective

- To develop analytical skills in dealing with soil as a medium in civil engineering discipline.
- To provide the description and classification of soil and analysis of stresses in soils under different loading conditions
- To develop an understanding of the principles of effective stress in saturated soils, and its application to one dimensional compression and consolidation
- To familiarize the students with an understanding of permeability and seepage of soils

Course Outcome

- Student enabled to find out the index and engineering properties of the soil and apply it to the foundation design of buildings

Unit I

INTRODUCTION: Geotechnical engineering: scope – Historical landmarks – Soil formation – Clay mineralogy – Surface activity – Volume-weight relationships – Tests for specific gravity and water content - Tests for field density: core-cutter and sand replacement methods.

Unit II

INDEX PROPERTIES AND SOIL CLASSIFICATION: Grain size distribution – Sieve analysis and hydrometer analysis – Consistency limits and their determination – Soil classification systems: triangular and plasticity charts.

Unit III

PERMEABILITY, EFFECTIVE STRESS AND SEEPAGE: Darcy’s law – Hydraulic gradient - Coefficient of permeability – Constant and variable head permeability tests – Inter-granular and pore-water pressures – Critical hydraulic gradient – Quick sand - Seepage – Flownets – Equi-potential and flow lines – Uplift pressures – Seepage forces – Piping – Protective filters – Pumping tests.

Unit IV

CONSOLIDATION AND COMPACTION: Definition of consolidation - Spring analogy for consolidation – Terzaghi’s theory of one-dimensional consolidation – Degree of consolidation and time factor – Consolidation test – Coefficient of consolidation – Compression index – Consolidation settlement - Compaction – Difference between consolidation and compaction - Standard and modified proctor tests - Concept of optimum moisture content and maximum dry density - Zero air voids line - Factors influencing compaction - Field compaction methods - Proctor needle for field control.

Unit V

SHEAR STRENGTH: Cohesion and internal friction – Mohr's circle – Mohr-Coulomb theory – Shear strength and effective stress – Shear strength and drainage – Shear strength tests – Direct shear test – Tri-axial compression test – Unconfined compression test – Vane shear test – Shear strength of sand – Critical void ratio – Shear strength of clays.

Text Books

1. Arora, K. R., "Soil Mechanics & Foundation Engineering", Standard Publishers, 2005.
2. Venkataramaiah, C.,"Geotechnical Engineering" (3rd Edn.), New Age International (P) Ltd., New Delhi, 2005.
3. Gulhati, S.K. and Datta, M., "Geotechnical Engineering", Tata McGraw-Hill, New Delhi, 2005.

Reference Books

1. Terzaghi, K. and Peck, R.B., "Soil Mechanics in Engineering Practice", John Wiley & Sons, USA, 1967.
2. Gopal Ranjan and Rao, A. S. R., "Basic & Applied Soil Mechanics", New Age International Publishers, 2000.
3. IS 1498-1970, "IS code of Practice for classification and identification of soils for general engineering purposes", Bureau of Indian Standards, New Delhi.
4. IS 2720, "IS code of Practice for methods of test for soils. (Latest Edition)". Bureau of Indian Standards, New Delhi.

12CE212 STRENGTH OF MATERIALS LAB

Credits: 0:0:2

Course Objective

- To apply the theory of mechanics of solids on real specimens
- To give hands on training on testing of real specimens

Course Outcome

- Students enabled to demonstrate the application of theories
- Built capacity to determine experimental parameters

LIST OF EXPERIMENTS:

1. Tension Test on Mild Steel
2. Double Shear Test on Mild Steel
3. Brinell Hardness Test
4. Rockwell Hardness Test
5. Charpy and Izod Impact Test
6. Test on Open Coil Helical Springs
7. Test on Closed Coil Helical Springs
8. Test on Carriage Springs
9. Tension, Compression (Parallel and perpendicular to grains)
10. Deflection Test on Timber and Steel Beams
11. Compressive Test on Bricks
12. Torsion Test on Steel Wire
13. Cold Bend Test (Demonstration only)

14. Studies on Fatigue Test (Demonstration only)

Text Books

1. Bansal, R. K, “Strength of Materials”, Laxmi Publications (P). Ltd., 2007.
2. Rajput, R. K, “Strength of Materials”, S Chand & Co., 2007.

Reference Books

1. Jindal, U.C, “ Strength of Materials”, Asian Books Pvt. Ltd., 2004.
2. Timeshenko, S.P. & Young, D.H., “Elements of Strength of Materials, 5th Edition, Affiliated East-West Press Pvt. Ltd. New Delhi, 1998.
3. Bedi, D.S., “Strength of Materials”, Khanna Book Publishing Co. (P) Ltd., Delhi, 2000.

12CE213 Hydraulics Lab - II

Credits: 0:0:2

Course Objective

- To give hands on training on the principle and working of different types of turbines
- To impart knowledge on open channel flow profiles

Course Outcome

- Student enabled to understand working and selection of turbines
- Student learnt to visualize various forms of open channel flows

FLUID MECHANICS:

1. Impact of jet on vanes.
2. Reynolds’ experiment.
3. Venturi flume
4. Hydraulic jump
5. Tilting flume

FLUID MACHINERY:

1. Performance of Vertical turbine pump.
2. Load test on Pelton wheel.
3. Load test on Francis turbine
4. Load test on Kaplan turbine
5. Performance test on Turgo turbine

METEORLOGICAL EXPERIMENTS:

1. Rainfall Recording gauges
2. Anemometers
3. Double ring infiltrometer test

Text Books

1. Modi, P.N and Seth, S.M., “Fluid Mechanics & Fluid Machines”, Standard Book House, New Delhi, 2007.
2. Rajput, R.K., “A Text book of Fluid Mechanics and Hydraulic Machines”, S.Chand and Co., New Delhi, 1998.

Reference Books

1. Som, S.R, & Biswas, “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw Hill Co., 1998.
2. Agarwal, S.K., “Fluid Mechanics and Machinery”, Tata Mc Graw Hill Co., 1997.
3. Garde, R.J., “Fluid Mechanics through problems”, New Age International, 2006.

12CE214 STRUCTURAL ANALYSIS

Credits: 3:0:0

Course Objective

- To introduce the fundamentals of energy and force methods for the analysis of structures
- To introduce the concepts of rolling loads and influence lines
- To introduce the fundamentals of analysis of arches, suspension bridges and space frames

Course Outcome

- Student gained knowledge on fundamentals of energy and force methods for the analysis of structures such as arches, suspension bridges and space frames

Unit I

INTRODUCTION TO STRUCTURAL ANALYSIS: Basic methods of structural analysis - Definition and determination of static and kinematic indeterminacy - Degrees of freedom - Conditions of equilibrium - Principles of superposition.

Work–energy Principles: Principle of virtual work – Displacements - Castigliano’s first theorem - Castigliano’s second theorem - Betti Maxwell’s law - Theorem of least work - Deflections of pin-jointed plane frames and rigid plane frames - Williott diagram.

Unit II

ROLLING LOADS AND INFLUENCE LINES: Influence lines for reaction, shear force and bending moment in beam sections – Criteria for maximum and absolute maximum moments and shears – Application of Muller Breslau’s principle to indeterminate beams - Application to beams with one degree of indeterminacy.

Unit III

ARCHES: Three hinged - Two hinged parabolic and semi circular arches - Determination of reaction, normal thrust, and bending moment – Influence line for stress resultants in two hinged and three hinged arches.

Unit IV

SUSPENSION BRIDGES AND SPACE TRUSSES: Cables and suspension bridges with three hinged stiffening girders - Analysis of rigid jointed space frames using method of tension coefficients.

Unit V

FORCE METHOD: Method of consistent deformation - Application to truss subjected to loads – Application of Clapeyron's theorem of Three moments to fixed and continuous beams – Temperature, lack of fit, settlement of support – Effects in structures.

Text Books

1. Bhavikatti, S., "Structural Analysis", Vol.1 & 2, Vikas Publishing House Pvt. Ltd., New Delhi, 2003.
2. Devadas Menon, "Advanced Structural Analysis", Alpha Science International, 2009.

Reference Books

1. Norris and Wilber, "Elementary Structural Analysis", Tata McGraw Hill Publishing Co., 2005.
2. Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill Publishing Co., 2005.
3. Vaidyanathan, R. and Perumal,P., "Structural Analysis" Vol.1 & 2, Laxmi Publications, New Delhi, 2004.
4. Pandit, G.S. and Gupta, S.P., "Structural Analysis – A Matrix Approach", Tata McGraw Hill Publishing Co. Ltd., 2006.

12CE215 HIGHWAY ENGINEERING

Credits: 3:0:0

Course Objective

- To educate the student on the importance of transportation system in national development
- To impart a thorough understanding in planning, design, construction and maintenance of highways

Course Outcome

- Student enabled to fully appreciate the role of transportation system in national development and acquires an in-depth knowledge of highway engineering

Unit I

INTRODUCTION TO TRANSPORTATION ENGINEERING: Role of transportation in society - Transportation systems and characteristics - Transportation planning: land use - Transportation interaction - Introduction to urban transportation planning - Transportation systems management (TSM) techniques - Initial recommendations for highway planning in India - Saturation system - Third 20 year road development plan - Institutions for transportation development at national level.

Unit II

TRAFFIC AND HIGHWAY ENGINEERING:

Traffic Engineering: Vehicular and road user characteristics - Traffic studies - Junctions and signals - Traffic control devices.

Highway Engineering: Classification of roads, highway planning and geometric design - Highway cross sectional elements - Sight distance and application (derivations and problems in SSD and OSD) - Super elevation - Horizontal and vertical alignments - Geometric design of ghat Roads (IRC standards only).

Unit III

DESIGN OF RIGID AND FLEXIBLE PAVEMENTS: Rigid and flexible pavements - Components and their functions - Design principles of flexible and rigid pavements - Factors affecting the design of pavements: climate, sub-grade soil and traffic - Design practice for flexible pavements CBR method and IRC recommendations - Design practice for rigid pavements (IRC recommendations).

Unit IV
HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE: Desirable properties and testing of highway materials – Soil: California bearing ratio, field density tests – Aggregate: crushing, abrasion and impact tests – Bitumen: penetration, ductility, viscosity, binder content and softening point tests.
Construction practice: Water bound macadam road, bituminous road and cement concrete road (as per IRC and MORTH specifications) - Highway drainage (IRC recommendations).

Unit V
HIGHWAY MAINTENANCE: Types of defects in flexible pavements – Surface defects, cracks, deformation, disintegration – Symptoms, causes and treatments - Types of pavement failures in rigid pavements – Scaling, shrinkage, warping, structural cracks, spalling of joints and mud pumping – Special repairs - Pavement evaluation – Pavement surface conditions and structural evaluation - Overlay design by Benkleman Beam Method (procedure only).

Text Books

1. Khanna, S.K. and Justo, C.E.G., “Highway Engineering”, 8th Edn., Nem Chand and Bros., Roorkee, 2001.
2. Kadiyali, L. R, “Principles and Practice of Highway Engineering”, Khanna Technical Publications, Delhi, 2000.
3. Banks, J. H., “Introduction to Transportation Engineering”, McGraw-Hill Book Co., 2002.

Reference Books

1. IRC 37-1984, Guidelines for the Design of Flexible Pavements.
2. IRC 58-1984, Guidelines for the design of Rigid Pavements for Highways.
3. Ministry of Road Transport and *Highways (*MORTH) Guidelines for Highways.
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12CE216 COMPUTATIONAL METHODS

Credits: 3:1:0

Course Objective

- To make the students understand the concepts of linear and nonlinear solutions in civil engineering
- To expose the students on application of numerical methods in real time problems

Course Outcome

- Students enabled to solve linear and nonlinear problems in civil engineering

Unit I

SIMULTANEOUS LINEAR ALGEBRIC EQUATIONS: Gaussian elimination - Gauss Jordan method - Jacobi and Gauss Seidel iterative methods - Solution of ill-conditioned equations - Errors and approximations - Computer applications to truss analysis problems
Eigen Values and Eigen Vectors: Power method - Sweeping techniques - Jacobi iterations - Computer applications to stability and dynamic problems.

Unit II
SOLUTIONS OF TRANSCENDENTAL AND POLYNOMIAL EQUATIONS: Graffe's root square method – Bairstow's method - Newton Raphson's methods - Iterative methods - Computer application to backwater curves in open channel flow
Numerical differentiation and integration: Numerical differentiation - Numerical integration - Open and close quadrature - Gaussian quadrature - Trapezoidal and Simpson's rule – Computer application to deflection of non-prismatic beams - Computation of earth volume.

Unit III
INTERPOLATION: Newton's forward and backward interpolation - Lagrange interpolation - Curve fitting - Methods of least squares - Computer application to fit stress and strain curve of concrete
Newmark's method: Deflected shape of statically determinate beams: prismatic and non-prismatic beams - Concentrated loads – Uniformly distributed varying loads using Newmark's method.

Unit IV
ORDINARY FIRST ORDER DIFFERENTIAL EQUATIONS: Taylor's series - Euler's method - Modified Euler's method – Runge Kutta's method – Milne's predictor corrector method - Adam's predictor corrector method - Computer application to dynamic loading - Water tank to blast loading.

Unit V
DIFFERENCE APPROACH: Finite difference operator - Application to: deflection of beams and buckling of columns - Partial difference equation - Elliptic equation - Explicit method - Computer application to temperature distribution and seepage problems - Crank Nicholson's method for parabolic equations - Application to consolidation problems - Explicit methods to hyperbolic equation - Application to vibration of springs and water hammer problems.

Text Books

1. Rajasekaran, S.,"Numerical Methods in Science and Engineering - A Practical Approach", 2nd Edn., Wheeler Publishing Co.,1999.
2. Kandasamy, P., Thilagavathy, K, and Gunavathy, K., "Numerical Methods", S.Chand and Co. Ltd, 1999.

Reference Books

1. Venkataram, M.K.,"Numerical Methods in Science and Engineering", The National Publishing Co., Madras, 1995
2. Bathe, K.J., "Finite Element Procedures in Engineering Analysis", Prentice Hall, New Jersey, 1982.
3. Richard. W. Hamming., "Numerical Methods for Scientists and Engineers", Courier Dover Publications, 1987.

12CE217 REINFORCED CONCRETE STRUCTURES

Credits: 3:1:0

Course Objective

- To impart comprehensive knowledge on the design of reinforced concrete structural elements such as beams, columns, slabs and footings
- To understand the behaviour of reinforced concrete structure and the design philosophies

Course Outcome

- Student enabled to understand the behaviour of concrete structures, design the building concrete elements and structures

Unit I

INTRODUCTION TO REINFORCED CONCRETE STRUCTURES: Basic material properties: constituents of concrete mix – IS 456 code provisions on concrete - Basic design concepts: working stress, ultimate load and limit states design - Design of rectangular beam section by elastic method.

Unit II

LIMIT STATE DESIGN OF SLABS AND STAIRCASES: Slab types – Limit state design (LSD) - One way slab - Two way slab – Circular slab - Types of stair cases - Design of dog-legged stair case.

Unit III

LIMIT STATE DESIGN OF BEAMS: Rectangular beam – Doubly reinforced - flanged beams - Lintel and sunshade - Flexure, shear, torsion & anchorage.

Unit IV

LIMIT STATE DESIGN OF COLUMNS AND FOOTINGS: Short, long axially and eccentrically loaded columns (Interaction curve) – Design of Isolated and combined rectangular footings for two columns.

Unit V

DESIGN OF WATER TANK AND RETAINING WALLS: Design of circular and rectangular tanks resting on ground – Underground water tank - Soil earth pressure - Retaining wall types - Design of cantilever retaining wall.

Text Books

1. Unnikrishna Pillai and Devdas Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Co. Ltd., 2002.
2. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India Pvt. Ltd., 2002.
3. Ashok, K. Jain, “Reinforced Concrete Limit State Design”, Nemchand & Bros., 2007.

Reference Books

1. Purushothaman, P, “Reinforced Concrete Structural Elements”, Tata McGraw Hill Publishing Co. Ltd., 1992.

2. Krishna Raju, N, “Design of Reinforced Concrete Structures”, CBS Publishers and Distributors, Delhi 1995.
3. IS 456-2000, “Indian Standard Code of practice for Plain and Reinforced concrete Structures”, Bureau of Indian Standards, New Delhi.
4. SP 16-1980, “Design Aids for Reinforced Concrete”, Bureau of Indian Standards, New Delhi.

12CE218 WATER SUPPLY ENGINEERING

Credits: 3:0:0

Course Objective

- To know the basics, importance and fundamental methods in water supply engineering
- To make the students conversant with principles of treatment and distribution

Course Outcome

- Student gained knowledge in selection of water sources, treatment and distribution methods.
- Student acquired skills to undertake major water supply projects

Unit I
PLANNING FOR WATER SUPPLY SYSTEM: Sources of water - Source selection - Water quality standards – BIS – WHO – EURO - Course objective of public water supply systems - Design period - Population forecasting - Water demand - Standards on per-capita demand and variation in demand pattern.

Unit II
WATER QUALITY ANALYSIS : Water analysis – Physical : turbidity , color , odour and taste - Chemical : BOD, COD, total solids, hardness, acidity, alkalinity, pH, chlorides and sulphates, residual chlorine, heavy metals – Biological: bacteria in water, coliform index and most probable number.

Unit III
WATER TREATMENT PROCESSES: General layout of common water treatment plant - Water treatment processes – Principles and functions: flash mixers, flocculators, sedimentation tanks and sand filters – Aeration - Disinfection – Iron and manganese removal - Defluoridation and demineralization – Dearsenification – Water softening – Design: screen, flocculators, sedimentation tank, slow sand filter and rapid sand filter.

Unit IV
CONVEYANCE SYSTEM: Intake structures – Gravity and pressure systems - Pipe materials Laying, jointing and testing of pipes – Appurtenant components – Pumps – Types and their selections – Pumping station.

Unit V
WATER DISTRIBUTION SYSTEM: Requirements of water distribution – Layout of distribution system – Types - Service reservoirs – Analysis of distribution network: Hardy cross

method - Operation and maintenance – Leak detection – House service connection.

Text Books

1. Garg, S.K., "Environmental Engineering", Vol. I, Khanna Publishers, New Delhi, 2010.
2. Peavy, H. S., Rowe, D. R. and George Tchobanoglous, "Environmental Engineering", McGraw-Hill Book Co., New Delhi, 1995.

Reference Books

1. Shah, C. S., "Water Supply and Sanitation", Galgotia Publishing Co., New Delhi, 1994.
2. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
3. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1993
4. Duggal, K. N., "Elements of Environmental Engineering", S.Chand & Co. Ltd, New Delhi, 2007.

12CE219 FOUNDATION ENGINEERING

Credits: 3:0:0

Course Objective

- To develop an understanding of the behaviour of foundations of engineering structures and to gain knowledge of the design methods that can be applied to practical problems
- To provide the students with a basic understanding of the essential steps involved in a geotechnical site investigation
- To introduce to the students, the principle, types of foundations and the factors governing the choice of the most suitable type of foundation for a given solution
- To familiarize the students with the procedures used for: a) bearing capacity estimation, b) end bearing capacity, c) skin friction, and d) stability of slopes and stabilization

Course Outcome

- Students familiarized with the site investigation and stress distribution in the soil
- Students enabled to calculate bearing capacity and earth pressure

Unit I

STRESS DISTRIBUTION IN SOILS AND BEARING CAPACITY: Soil elasticity – Homogeneity and isotropy – Semi-infinite mass – Stress distribution by dispersion – Boussinesq's theory – Newmark's influence chart – Westergaard's theory – Bulb of pressure – Elastic settlement - Plate bearing test – Code values for presumptive safe bearing pressures – Prandtl's theory – Terzaghi's theory – Terzaghi's bearing capacity factors – Brinch Hansen's shape, depth and inclination factors – Meyerhof's theory – Effect of water table on bearing capacity – Settlement and differential settlement.

Unit II

SUBSOIL EXPLORATION, SAMPLING AND FIELD TESTS: Trenches – Auger boring – Helical and posthole augers – Wash boring – Percussion drilling – Rotary drilling – Sampling methods – Sample disturbances – Geophysical methods – Static and dynamic cone penetration tests – Standard penetration test.

Unit III :
FOUNDATION CLASSIFICATION, SHALLOW FOUNDATIONS AND DEEP FOUNDATIONS: Types of foundations and their classifications – Choice of foundation – Net load – Geotechnical design – Footings: combined footings and rafts – Compensated rafts – Classification of piles based on different criteria – Mechanics of load transfer through piles – Negative skin friction – Under-reamed piles – Pile load tests – Construction of piles – Piers – Caissons – Types and construction.

Unit IV
EARTH PRESSURES AND RETAINING STRUCTURES: Active, passive and at-rest pressures – Rankine's theory of earth pressure – Coulomb's theory of earth pressure – Graphical methods by Rebhan/Poncelet and Culmann – Influence of surcharges – Earth pressure under submergence – Layered backfills - Gravity retaining structures – Masonry and reinforced concrete cantilever retaining walls – Stability analysis – Drainage provisions – Sheet pile walls.

Unit V
STABILITY OF SLOPES AND SOIL STABILIZATION: Infinite and finite slopes – Stability analysis – Total and effective stress analysis – Method of slices – Bishop's method – Friction circle method – Taylor's method - Definition of stabilization - Types of stabilization: mechanical, lime, cement and geotextiles – Functions of geotextiles.

Text Books

1. Arora, K. R., "Soil Mechanics & Foundation Engineering", Standard Publications, 2005.
2. Punmia, B. C., "Soil Mechanics & Foundations", Laxmi Publications, 2007.
3. Joseph, E. and Bowles., "Foundation Analysis & Design", McGraw Hill, 2005.

Reference books

1. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers, 2000.
2. Venkataramiah, "Geotechnical Engineering", New Age International Publishers, 2005.
3. Shashi, K. Gulhati and Manoj Dutta, "Geotechnical Engineering", Tata McGraw-Hill Publishing Co. Limited, New Delhi, 2008.
4. Leonards, G.A., "Foundation Engineering", Tata McGraw-Hill Publishing Co. Limited, 2004.
5. Teng, W.C., "Foundation Design ", PHI, 2002.
6. Tomlinson, M.J., "Foundation Design & Construction", Pitman, 2006.
7. Murthy, V.N.S., "Soil Mechanics & Foundations", CBS Publishers, 2003.

12CE220 CONCRETE LABORATORY

Credits: 0:0:2

Course Objective

- To give hands on training in testing of cement and aggregates
- To give hands on training in testing of concrete
- To impart knowledge on mix design procedures

Course Outcome

- Student enabled to understand the field problems through experimentation
- Student learnt to check the quality of concrete material in the construction
- Student acquired knowledge on concrete mix design

TESTS ON CEMENT:

1. Specific gravity
2. Fineness
3. Consistency
4. Initial and final setting time
5. Soundness Test
6. Compressive strength of cement mortar

TESTS ON FINE AND COARSE AGGREGATE:

1. Tests on particle size distribution and fineness modulus
2. Specific gravity
3. Bulking of sand

CONCRETE MIX DESIGN:

1. IS method for different mixes

TEST ON FRESH CONCRETE:

1. Slump test
2. Compaction factor test

TESTS ON HARDENED CONCRETE:

1. Compression test on cubes and cylinder
2. Modulus of rupture test
3. Split tensile strength test
4. Determination of modulus of elasticity

Text Books

1. Shetty, M. S., "Concrete Technology", S. Chand and Co., New Delhi, 1998.

Reference Books

1. Gambhir, M.L., "Concrete Technology – Theory and Practice", Tata McGraw Hill Publishing Ltd, New Delhi , 2011.
2. IS 2386 – 1963 Part I, III, "Methods of test for aggregate for concrete", Bureau of Indian Standards, New Delhi.
3. IS 516 – 1959," Method of test for strength of concrete", Bureau of Indian Standards, New Delhi.
4. IS 10262-2009, "IS standard for recommended guidelines for concrete mix design", Bureau of Indian Standards, New Delhi.

12CE221 GEOTECHNICAL ENGINEERING LABORATORY

Credits: 0:0:2

Course Objective

- To give hands on training in determination of soil properties
- To give hands on training in field tests

Course Outcome

- Students enabled to find out the index and engineering properties of the soil

LIST OF EXPERIMENTS:

1. Moisture content determination (oven drying)
2. Specific gravity of coarse and fine grained soil (pycnometer)
3. Relative density test for sand
4. Grain size analysis of soil (sieve analysis and hydrometer analysis)
5. Consistency limits and indices (liquid limit, plastic limit, shrinkage limit apparatus)
6. Standard Proctor's compaction test (IS light compaction test)
7. Field density test (sand replacement test apparatus and core cutter)
8. Permeability tests – Constant head and variable head (permeameter)
9. Unconfined compression test
10. Laboratory vane shear test
11. Direct shear test
12. Triaxial compression test
13. Consolidation test

Text Books

1. Lambe, T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.
2. IS 2720-1983, "I.S. Code of Practice: Methods of tests for Soil", , Bureau of Indian Standards, New Delhi.

12CE222 ENVIRONMENTAL ENGINEERING LABORATORY

Credits: 0:0:2

Course Objective

- To make the students conversant with the experimental procedures for quantitative estimation of water quality parameters.
- To give hands on training on the testing of waste water quality.

Course Outcome

- Student enabled to test the water quality and will have thorough knowledge on the quality standards.

ANALYSIS OF WATER QUALITY PARAMETERS:

1. Determination of pH, conductivity and total dissolved solids
2. Determination of acidity and alkalinity
3. Determination of chlorides
4. Determination of dissolved oxygen
5. Determination of fluorides, iron and manganese
6. Estimation of phosphates and sulphates
7. Determination of sodium and potassium

8. Determination of turbidity and optimum coagulant dose by Jar test apparatus
9. Determination of available chlorine in bleaching powder, break point chlorination and chlorine demand
10. Determination of MPN index for coliforms

ANALYSIS OF WASTE WATER CHARACTERISTICS:

1. Determination of total solids, settlable solids, suspended solids, volatile solids
2. Determination of BOD and COD
3. Determination of ammonia – nitrogen and nitrates

Text Books

1. Sawyer, N.C., and McCarty, P.L., "Chemistry for Environmental Engineering", 5th Edn.,McGraw-Hill Book Co., New York., 1985.

Reference Books

1. "Standard Methods for the Examination of Water and Waste Water", APHA-AWWA-WPCF, 25th Edn.,Washington (D.C), 1995.

12CE223 DESIGN OF STEEL STRUCTURES

Credits: 3:0:0

Course Objective

- To learn the design of steel components and structures subjected to external loading as per IS 800-2007(Limit State Method).

Course Outcome

- The student is enabled to perform the design of various steel components and structures subjected to external loading as per IS 800-2007 code provisions.

Unit I

STEEL SECTIONS AND CONNECTIONS: Introduction to steel and steel structures - Working stress design and limit state design - Design loads and load combinations - Design of structural fasteners: bolts and welds - Design of eccentric connections: bolted and welded.

Unit II

TENSION AND COMPRESSION MEMBERS: Design of tension members – Net sectional area of plates and angles – Permissible stresses – Tension splices – Lug angle - Design of compression members – Design of laced and battened compression members.

Unit III

BEAMS AND BEAM COLUMNS: Design of flexure members: beams rolled sections, built-up sections: laterally restrained and unrestrained beams – Design of beam columns.

Unit IV

GIRDERS AND COLUMN BASES: Design: Welded plate girders, gantry girder – Design of column bases.

Unit V

ROOF TRUSSES: Types of roof trusses – Dead load, live load, wind load – Design of purlins – Analysis and design of trusses.

Text Books

1. Subramanian, N., "Design of Steel Structures", Oxford University Press, USA, 2008.

Reference Books

1. Bhavikatti, S .S., "Design of Steel Structures by Limit State Method as per IS:800-2007", I K International Publishing House Pvt. Ltd., New Delhi, 2009.
2. Duggal, S.K., "Limit State Design of Steel Structures", Tata McGrawHill & Co., New Delhi, 2010.
3. Arya and Ajmani, "Design of Steel Structures", NemChand Brothers, Roorkee, 2007.
4. Teaching Resource Materials on Steel – SERC, INSDAG, Anna University and IIT Madras, 2000.
5. IS 800-2007, "General Construction in Steel - Code of Practice", Bureau of Indian Standards, New Delhi.

12CE224 ADVANCED STRUCTURAL ANALYSIS

Credits: 3:0:0

Course Objective

- To introduce the concepts of slope deflection method, moment distribution methods, flexibility and stiffness methods of analysis
- To introduce the fundamentals of analysis of multistorey frames and plastic analysis

Course Outcome

- Student enabled to analyze structures by slope deflection method, moment distribution method, and matrix methods of analysis

Unit I

SLOPE DEFLECTION METHOD: Slope deflection equations - Analysis of continuous beams and rigid frames (with and without sway) - Symmetry and asymmetry - Simplification for hinged end - Support settlements.

Unit II

MOMENT DISTRIBUTION METHOD: Analysis of continuous beams – Plane rigid frames with and without sway – Bending moments, shear force and thrust diagrams - Symmetric structure subjected to symmetric and anti-symmetric loading.

Unit III

MATRIX FLEXIBILITY METHOD: Characteristics of flexibility and stiffness method - Structure and element coordinates - Transformation of force and displacement - Structural flexibility in terms of element flexibility - Flexibility method - Forces not acting at co-ordinates - Formulation of structure flexibility matrix - Application to determinate and indeterminate trusses, beams and frames - Determination of displacements and bending moments.

Unit IV
MATRIX STIFFNESS METHOD: Forces not acting at co-ordinates - Formulation of structure stiffness matrix - Determination of displacements - Application to determinate and indeterminate trusses, beams and frames – Simple problems - Static condensation technique.

Unit V
INTRODUCTION TO MULTI-STOREYED FRAMES AND PLASTIC ANALYSIS :
Methods of analysis of building frames: problems in portal frame and cantilever methods - Step-by-step procedure for analysis by substitute frame method.
Introduction to Plastic Analysis: Indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism.

Text Books
1. Bhavikatti, S. S., "Structural Analysis", Vol.1 and 2, Vikas Publishing House Pvt Ltd., New Delhi, 2003.
2. Negi, L.S. and Jangid, R.S., "Structural Analysis", Tata McGraw Hill Publishing Co., 2003
3. Devadas Menon, "Advanced Structural Analysis", Alpha Science International, 2009.

Reference Books
1. Norris and Wilber, "Elementary Structural Analysis", Tata McGraw Hill Publishing Co., 2005.
2. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi Publications, New Delhi, 1999.
3. Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill Publishing Co., 2005.
4. Vaidyanathan, R. and Perumal, P., "Structural Analysis", Vol.1 & 2, Laxmi Publications, New Delhi,2004.
5. Pandit, G.S. and Gupta, S.P., "Structural Analysis – A Matrix Approach", Tata McGraw Hill Publishing Co. Ltd., 2006.
6. Wang, C.K., "Intermediate Structural Analysis", Tata McGraw-Hill Publishing Co., 2010.

12CE225 PRESTRESSED CONCRETE AND MASONRY STRUCTURES

Credits: 3:0:0

Course Objective
- To impart knowledge on design of bridges for IRC loadings
- To understand the performance of prestressed concrete structures
- To study the behaviour of masonry and timber structures

Course Outcome
- Student enabled to design bridges, prestressed concrete members and masonry structures

Unit I

DESIGN OF RCC BRIDGES: Design: Slab bridge and T-beam - Slab bridge for IRC loadings Class AA & Class A - Load distribution in interconnected girders by Courbon's method.

Unit II

PRINCIPLES OF PRESTRESSING: Basic concepts – Advantages – Materials required – Principles of prestressing - Systems and methods of prestressing – Analysis of sections: stress concept, strength concept and load balancing concept – Layout of cables.

Unit III

BEHAVIOUR OF PSC MEMBERS: Losses of prestress – Factors affecting the losses of prestress - Deflections of prestressed concrete members - Factors influencing deflections – Short term deflection - Effect of tendon profile on deflections.

Unit IV

DESIGN OF PSC FLEXURAL MEMBERS: Behaviour of flexural members - Determination of ultimate flexural strength – Code provisions - Design of flexural members - Design for shear - Design of anchorage zone reinforcement.

Unit V

DESIGN OF MASONRY AND TIMBER STRUCTURES: Brick works – Classification of masonry walls – Design of pillar - Axial and eccentricity loads – Load bearing walls - Design of solid walls: axially loaded, eccentrically loaded - Walls with openings - Solid and built up timber columns.

Text Books

1. Krishnaraju, N., "Prestressed Concrete", Tata McGraw Hill Co., New Delhi, 1998.
2. Dayaratnam, P., "Brick and Reinforced Brick Structures", Oxford & IBH Publishing House, 1997.
3. Krishnaraju, N., "Design of R.C.Structures", CBS Publishers and Distributors, Delhi 2003.

Reference Books

1. Rajagopal, N., "Prestressed Concrete", 2nd Edn., Narosa Publications, New Delhi, 2007.
2. Lin,T. Y., "Design of Prestressed Concrete Structures", Asia Publishing House, Bombay, 1995.
3. Anand, S.Arya., "Masonry and Timber Structures including Earthquake Resistant Design", Nemchand & Bros, Roorkee (U.P), 2006.
4. IS 1343-1983, "Code of Practice for Prestressed Concrete", Bureau of Indian Standards, New Delhi.
5. IS 1905 – 1997, " Code of Practice for Structural use of unreinforced masonry".Bureau of Indian Standards, New Delhi.
6. IS 883-1984, "Design of Structural Timber in Building - Code of Practice", Bureau of Indian Standards, New Delhi.

12CE226 SANITARY ENGINEERING

Credits: 3:0:0

Course Objective

- To introduce the theory and concepts of sewerage systems
- To introduce the theory and concepts of sewage treatment

Course Outcome

- Students acquired knowledge in selection of treatment and disposal methods
- Students developed skills to undertake major projects on treatment and disposal

Unit I

INTRODUCTION: Objective of public sewerage systems – Important terms and definitions - Sources of wastewater – Quantity of sanitary sewage – Estimation of storm runoff – Characteristics and composition of sewage and their significance — Sewage standards.

Unit II

COLLECTION AND CONVEYANCE OF SEWAGE: Sewage conveyance system – Conservancy and water carriage system – Sewers: types, materials, joints – Laying and construction of sewer lines – Testing of sewer lines – Cleaning and maintenance of sewers – Sewer appurtenant components.

Unit III

SEWAGE TREATMENT: General layout of municipal sewage treatment plant – Primary process: grit chamber, skimming tank, sedimentation tank - Secondary treatment: activated sludge process, trickling filter, oxidation pond – Design of grid chamber, trickling filter, oxidation pond.

Unit IV

SEWAGE DISPOSAL AND SLUDGE MANAGEMENT: Sewage disposal – Method: dilution and land treatment – Sewage farming – Sewage sickness and its preventive measures – Comparison of disposal methods – Sludge digestion process : stages, factors affecting sludge digestion and control – Design of sludge digestion tank - Sludge thickening - Sludge conditioning and dewatering – Final disposal of digested sludge – Natural systems – Bio-remediation: constructed wetlands, stabilization pond – Self purification and oxygen sag curve analysis.

Unit V

HOUSE DRAINAGE: General principles of water drainage in buildings – Sanitary fixtures and fittings – Systems of sanitary plumbing: one pipe, two pipe, single stack – Function and types of traps - House drainage – House sewer connection: septic tank, soak pit and dispersion trenches.

Text Books

1. Garg, S.K., “Environmental Engineering”, Vol II, Khanna Publishers, New Delhi, 2010.
2. Metcalf and Eddy, “Wastewater Engineering, Treatment and Reuse”, Tata McGraw-Hill, New Delhi, 2003.

Reference Books

1. Punmia, B.C., Arun Kumar Jain and Ashok Kumar Jain, “Wastewater Engineering”, Vol. II, Laxmi Publications (P) Ltd, New Delhi, 2009.
2. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1993.

3. Duggal, K. N., “Elements of Environmental Engineering”, S.Chand & Co. Ltd, New Delhi, 2007.

12CE227 WATER RESOURCES ENGINEERING

Credits: 3:0:0

Course Objective

- To introduce the concepts of surface and ground water hydrology
- To enable the student to develop skills to plan and implement water resources systems

Course Outcome

- Student enabled to apply the concept to manage water resources and also apply it for hydrological modeling
- Student learnt to plan and design basic water resources projects

Unit I

SURFACE WATER HYDROLOGY: Introduction – Hydrologic cycle and hydrological data – Precipitation: different forms of precipitation, rainfall measurements - Hydrologic abstractions: interception and depression storage, evaporation, transpiration, infiltration, infiltration indices – Runoff: factors affecting runoff, estimation of runoff, basic concepts of rainfall-runoff model, empirical formulae – Unit hydrograph method – Flood estimation by empirical formulae.

Unit II

GROUND WATER HYDROLOGY: Types of aquifers – Permeability and transmissibility – Steady flow towards a well in confined and unconfined aquifer – Pumping tests – Drawdown – Types of wells - Measurement of yield of an open well - Interference of open wells – Artificial recharge – Conjunctive use of surface and groundwater.

Unit III

WATER FOR FOOD: Necessity of irrigation - Crop seasons - Humid, arid and semiarid regions – Command area – Crop period – Consumptive use and ET (Evapotranspiration) – Determination of consumptive use - Irrigation water requirement - Duty and delta — Irrigation efficiencies – Irrigation methods - Sprinkler and drip irrigation – Canal design – Regulatory works: aqueducts, tank surplus weir, tank sluice - Subsurface drainage – Participatory irrigation management.

Unit IV

WATER FOR DRINKING: Different types of sources – Abstraction methods – Treatment plants – Basics of distribution system – Percapita demand – Estimation of water requirement for a region – Water pricing.

Unit V

WATER FOR ENERGY AND OTHER USES: Basic components of hydro-electric projects: reservoir, dams, spillways, water conveyance system, tunnels, surge tanks, penstocks, anchor blocks – Turbines – Water for recreation – Aqua-tourism – Water for environment – Water related environment problems: floods, droughts, erosion and sedimentation, pollution and their mitigation measures.

Text Books

1. Linsley, R.K. and Franzini, J.B., “Water Resources Engineering”, McGraw Hill Inc, 2000.
2. Garg,S.K., “Irrigation Engineering and Hydraulic Structures”, Khanna Publishers, 2009.

Reference Books

1. Sahasrabudhe, S.R., “Irrigation Engineering and Hydraulic Structures”, Katson Publishers, 1994.
2. Michael, A.M., “Irrigation – Theory and Practices”, Vikas Publishing House, New Delhi, 1990.
3. Subramanya, K., “Engineering Hydrology”, Tata McGraw Hill, 1998.

12CE228 RAILWAYS, AIRPORTS AND HARBOURS

Credits: 3:0:0

Course Objective

- To impart a sound knowledge in planning, design, construction and operation of railways
- To understand basics in planning, design and operation of airport and harbors
- To introduce the application of artificial intelligence in the field of transportation engineering

Course Outcome

- Student gained basic understanding on railway engineering
- Student enabled to appreciate the complexity involved in the design and operation of airports and harbors.

Unit I

RAILWAY PLANNING AND DESIGN: Role of Indian Railways in national development - Location surveys and alignment - Rail gauges - Coning – Adzing - Permenant way components – Functions - Requirements – Creep - Tractive resistance - Geometric design of railway tracks: gradient, super-elevation, widening of gauges in curves, transition curves, vertical curves and grade compensation (derivations of formulae and problems).

Unit II

RAILWAY TRACK CONSTRUCTION, MAINTENANCE AND OPERATION:

Track construction: points and crossings, signaling, interlocking and track circuiting, construction and maintenance – Conventional and modern methods (Remote Sensing, GIS & GPS) for railway alignment - Track construction, maintenance and materials - Track drainage - Layouts of railway stations and yards

Tunnels: Introduction to tunneling, tunneling through soils, soft and hard rocks, tunnel ventilation – Metro rail.

Unit III

AIRPORT PLANNING AND DESIGN: Airport planning - Components of airports - Airport site selection - Taxiways, runways and aprons - Wind Rose diagram - Runway orientation - Runway pavement design - Terminal area - Airport layout - Airport buildings - Passenger facilities - Parking area and airport zoning.

Unit IV

HARBOUR ENGINEERING: Definition of terms: harbours, ports, docks, tides and waves – Harbours: types, requirements, classification – Site investigation for location - Planning and layout concept of satellite ports - Terminal facilities – Port buildings: warehouse, transit sheds, inter-modal transfer facilities - Mooring accessories - Navigational aids - Coastal structures: piers, breakwaters, wharves, jetties, quays, spring fenders - Coastal shipping, inland water transport and container transportation.

Unit V

EXPERT SYSTEMS: Fundamentals of artificial neural networks - Genetic algorithms - Fuzzy logic and expert systems - Simple applications in the field of transportation engineering.

Text Books

1. Saxena Subhash, C., and Satyapal Arora, A., "Course in Railway Engineering", Dhanpat Rai and Sons, Delhi, 1998.
2. Khanna, S. K., Arora, M. G., and Jain, S. S., "Airport Planning and Design", Nemchand and Brothers, Roorkee, 1994.
3. Haykin, S., "Neural Networks- A Comprehensive Foundation", Macmillan Press, NY, 1994.
4. George, J. Klir, and Folger, T. A., "Fuzzy Sets, Uncertainty, and Information", Prentice Hall, 1988.
5. Timothy, J. Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, Inc., 1995.

Reference Books

1. Horonjeff, R. and McKelvy, F. X., "Planning and Design of Airports", McGraw-Hill International Editions, 1993.
2. Agerschou, H., Lungren, H., and Sorensen, T., "Planning and Design of Ports and Marine Terminals", John Wiley & Sons, 1984.
3. Rangwala, S. C.," Railway Engineering", Charotar Publishing House, 1995.
4. Harmon, P., and King, D., "Artificial Intelligence in Business-Expert Systems", A Willey Press Book, J. Willey & Sons, 1985.

12CE229 DESIGN AND DRAWING (R.C.C AND STEEL)

Credits: 0:0:2

Course Objective

- To impart the knowledge about the design of RCC and steel structures
- To give hands on experience in detailing of structures

Course Outcome

- Student enabled to design and draw the reinforcement of RCC and steel structures

PART-A:

Detailed design and drawing of the following reinforced concrete structures:

1. Building floors consisting of slabs and beams
2. Column and footing
3. Cantilever retaining walls
4. Counterfort retaining walls
5. Circular and rectangular water tanks resting on the ground
6. Rectangular overhead water tanks
7. Slab bridge
8. Dog-legged staircase

PART-B:

Detailed design and drawing of the following steel structures:

1. Steel column, base plate and foundations
2. Welded plate girder
3. Gantry girder
4. Simple roof truss and details of joints

Text Book

1. Krishna Raju, N., "Structural Design & Drawing (RCC &Steel)", Universities Press, 2nd Edn., 2004.

Reference Books

1. Krishnamurthy, D., "Structural Design and Drawing" Vol.II, CBS Publishers & Distributors, Delhi, 1992.
2. SP-34-1987, Handbook on Reinforcement and Detailing.
3. SP 6: Part 1: 1964, Handbook for Structural Engineers - Structural steel sections.
4. IS 456-2000, "Indian Standard Code of practice for Plain and Reinforced concrete Structures", Bureau of Indian Standards, New Delhi.
5. IS 800-2007, "General Construction in Steel - Code of Practice", Bureau of Indian Standards, New Delhi.

12CE230 ESTIMATION AND COSTING LAB

Credits: 0:0:2

Course Objective

- To impart techniques of estimation of buildings, roads, and irrigation structures
- To introduce the concepts of rate analysis

Course Outcome

- Student enabled to do rate analysis of various works in construction, estimation of structures

LIST OF EXPERIMENTS:

1. Calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C., doors, windows, flooring, white washing, colour washing, distempering with their units
2. Calculation of rates for cement concrete, brick masonry, stone masonry, hollow block masonry, plastering, painting, flooring,
3. Calculation of rates for road works, sanitary works, water supply works and electrical works.
4. Estimation of cost of single-storeyed buildings by individual wall method and centre line method
5. Estimation of roofs: R.C.C. slab roof, GI sheet roof, tiled roof, roof truss
6. Estimation of R.C.C.works : beam, T-beam and slab, column, foundation, stair case, retaining wall etc.
7. Estimation of roads: earth work, pitching of slopes, hill roads
8. Estimation of R.C.C. slab culvert, pier, pipe culvert, R.C.C. T-beam bridge
9. Estimation of irrigation works like canals, aqueducts, syphon
10. Estimation of water supply and sanitary works like septic tank, soak pit, manhole, sewer line
11. Valuation, depreciation and rent fixation of buildings
12. Inviting tenders for given question
13. Techno-economic indices

Text Books

1. Dutta, B.N., "Estimating & Costing in Civil Engineering Theory and Practice", UBS Publishers & Distributors Limited, New Delhi, 1996.
2. Rangawala, S.C., “Estimating and Costing”, Charotar Publishing house, 2002.

Reference Book

1. Chakraborti, M., "Estimating, Costing, Specification and Valuation on Civil Engineering", Calcutta, 2002.

12CE231 COMPUTER APPLICATION LABORATORY

Credits: 0:0:2

Course Objective

- To give hands on training on Programming language
- To introduce the concepts of excel programming
- To make the students to analyse and design structural elements using STAAD Pro
- To introduce the concepts of project management using Primavera

Course Outcome

- The student learnt to solve civil engineering problems by C- programmes, Excel spread sheet, STAAD Pro and Primavera

DEVELOPMENT AND IMPLEMENTATION OF PROGRAMS FOR THE FOLLOWING IN C LANGUAGE:

1. Deflection of cantilever and simply supported beams
2. Limit state design of RCC Rectangular beam
3. Design of tension and compression steel members

DEVELOPMENT AND IMPLEMENTATION OF PROGRAMMES FOR THE FOLLOWING USING EXCEL SPREAD SHEET:

1. Design of Staircase and Retaining Wall
2. Design of One-way and Two-way slab
3. Design of septic tank

STRUCTURAL ANALYSIS AND DESIGN USING STAAD PRO:

1. Analysis of 2D and 3D Rigid jointed frames
2. Analysis of 2D and 3D Pin jointed frames
3. Analysis and design of 2D Truss
4. Structural Design of the following, using STAAD Pro and detailing of the same using AUTOCAD: RCC Slab, RCC Beam, RCC Column and Footing, Retaining wall and Water tank
5. Concrete mix design calculations using MATHCAD

COMPUTER APPLICATION IN CONSTRUCTION MANAGEMENT USING PRIMAVERA (DEMONSTRATION ONLY):

1. Planning – Scheduling and Resource Analysis

COMPUTER AIDED ESTIMATION AND COSTING USING SCADDS/EXCEL SPREAD SHEET:

1. Quantity surveying and Cost Estimation

Text Books

1. Balaguruswamy, E., “Object – Oriented Programming in C”, Tata McGraw Hill, 2008.
2. Shah, V.L., “Computer aided design in reinforced concrete”, Structures publication, Pune, 2009.

Reference Books

1. “Project planning and Management” – Primavera Reference Guide.
2. STAAD Pro 2007 V8i Analysis Reference Manual.

12CE232 SAFETY ENGINEERING AND QUALITY CONTROL

Credits: 3:0:0

Course Objective

- To understand the TQM tools and techniques
- To be familiar with ISO certification, rules and regulation
- To know the safety measures to be considered in construction

Course Outcome

- Student enabled to apply TQM tools and techniques in field
- Student learnt the safety measures to be taken during construction

UNIT I

INTRODUCTION: Introduction - Need for quality - Definition of quality and Total Quality Management (TQM) - Basic concepts of TQM – TQM Principles – TQM tools and techniques - Quality management system

QUALITY SYSTEMS: Need for ISO - Quality System – Elements, documentation, quality auditing - ISO 9000, ISO 14000 and ISO 18000: concepts, requirements and benefits.

UNIT II

TQM TOOLS & TECHNIQUES I : The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, bench marking process – FMEA – Stages, Types

UNIT III

CONSTRUCTION SAFETY MANAGEMENT: Safety – Causes of accidents – Techniques of construction Safety – Safety Policy – Assessing risks - Construction hazards and solution - Maintenance and utility safety: electrical circuits, Ladders/ elevated platforms, Light fixtures, Trenching, shoring and excavation – Safety in receiving and storing operations – safety in tunnels

UNIT IV

BUILDING FIRE SAFETY: Fire load, fire resistant material and fire testing – Structural fire protection – Structural integrity – Exists and egress – Fire certificates – Fire safety requirements for high rise buildings – Snookers – Code provisions on fire testing and safety.

UNIT V

ENVIRONMENTAL AND HEALTH SAFETY: Chemical and hazardous material safety – Waste disposal – Compressed gas cylinders – Use of mercury and Uranium – Radiation safety – Dusts – Electricity - Safety of large hydraulic structures: submergence, earthquake, flood.

Text Books

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2006).
2. Derek, James, “Fire Prevention Hand Book”, Butter Worths and Company,London, 1986.

Reference Books

1. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
2. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006.

3. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.

12CE233 DESIGN OF BRIDGE STRUCTURES

Credits: 3:0:0

Course Objective

- To enrich the students with knowledge on various aspects of structural design of common types of concrete, steel, prestressed bridges and culverts

Course Outcome

- Student enabled to design concrete, steel, prestressed bridges and culverts.

Unit I

HISTORICAL DEVELOPMENT OF BRIDGES: Investigation for Bridges – Need for investigation – Selection of site – Subsoil exploration – Hydraulic requirements.

Unit II

STEEL BRIDGES: Introduction to steel bridges – Types – Advantages - Standards for railway bridges - Design of plate girder railway bridges for railway loading.

Unit III

PRESTRESSED CONCRETE BRIDGES: Introduction to prestressing concepts – Advantages - Design of prestressed concrete bridge (simply supported case only).

Unit IV

AQUEDUCTS AND BOX CULVERTS: Introduction to aqueducts and box culverts – Design of box culverts.

Unit V

CONSTRUCTION AND MAINTENANCE OF BRIDGES: Construction methods, inspection and maintenance of bridges – Case studies of recent major bridges – Case studies on failure of major bridges.

Text Books

1. Johnson Victor, D., “Essentials of Bridge Engineering”, Oxford and IBH Publishing Co., New Delhi, 2007.
2. Ponnuswamy, S., “Bridge Engineering”, Tata McGraw Hill Co., New Delhi, 2008.

Reference Books

1. Krishna Raju, N.,“ Design of Bridges” , 4th Edition, Oxford and IBH Publishing Co., New Delhi, 2009.
2. Jagadeesh, T.R. and Jayaram, M.A., “Design of Bridge Structures”, PHI Learning Private Ltd New Delhi, 2009.

3. IRC 5, “Standard Specifications and Code of Practice for Road Bridges- Section I”, Indian Road Congress, New Delhi.
4. IRC 6, “Standard Specifications and Code of Practice for Road Bridges- Section II”, Indian Road Congress, New Delhi.
5. IRC 21, ““Standard Specifications and Code of Practice for Road Bridges- Section III”, Indian Road Congress, New Delhi.

12CE234 DESIGN OF MARINE STRUCTURES

Credits: 3:0:0

Course Objective

- To impart the fundamental knowledge of Wave hydrodynamics, Forces acting on Marine structures to the students
- To introduce the students to the design principles involved in the design of marine structures

Course Outcome

- The student gained fundamental knowledge in Wave Hydrodynamics
- Able to understand the differences in the design principles involved in the design of Marine structure compared to that of a regular structure.

Unit I
OCEAN WAVE HYDRODYNAMICS:
Waves : Review of Basic Fluid Mechanics - Classification of water waves - Two-dimensional wave equation and wave characteristics - Wave theories - Small amplitude waves - Finite amplitude waves - Water particle kinematics - Wave energy, power - Wave deformation - Reflection, Refraction, Diffraction, Breaking of waves - Wave Forecasting Methods - Spectral description of Ocean Waves - Design wave and Significant Wave height.

Unit II
OCEAN CURRENTS AND FORCES ON MARINE STRUCTURES:
Currents: Classification - Behaviour - Design Criteria, Scour and other effects of currents.
Forces: Wave forces - Morison equation - Wave loads on vertical, inclined and horizontal cylinders. Diffraction theory - Wave slamming and slapping - Wave impact pressures and forces on Coastal Structures - Breakwaters, Seawalls.

Unit III
BREAKWATERS: Design principles of breakwaters - Functional design - Safety factors, General code provisions - Factors determining their selection - Rubble mound breakwaters - Design factors - Hydraulics of cover layer design - Design of structure cross section - Stability of foundations - Vertical wall breakwaters - Types - Design factors - Pile breakwaters, Tandem breakwater and Floating breakwaters and structures.

Unit IV

WHARVES, PIERS, BULKHEADS, DOLPHINS AND MOORINGS: Types and factors controlling selection of type - Design considerations - Design of Wharves, Piers, Bulkheads, Groynes and dolphins - Mooring forces - Coastal protection measures against tsunami.

Unit V

DRY DOCKS, LOCKS, SLIPWAY AND OTHER STRUCTURES: Dry docks - Types of dock walls and floors - Design factors - Locks, slipways, light houses.

Text Books

1. Wood, A.M.M., and Fleming, C.A.,"Coastal Hydraulics", Macmillan Press Limited, 1981.
2. Dean, R.G. and Dalrymple, R.A.,"Water Wave Mechanics for Scientists and Engineers", Prentice-Hall., Inc., Englewood Cliffs, New Jersey, 1994.
3. Quinn, A. D.,"Design and Construction of Port and Marine Structures", McGraw-Hill Book Co., 1972.
4. Graff, W. J.,"Introduction to Offshore Structures – Design, Fabrication, Installation", Houston: Gulf Publishing Co., 1981.

Reference Books

1. Chakrabarti, S.K., "Handbook of Offshore Engineering", Elseviers, 2005.
2. Horikawa, K., "Coastal Engineering", University of Tokyo Press, 1978.
3. Thoresen, C.A., "Port Design – Guidelines and recommendations", Tapir Publications, 1988.
4. US Army Corps of Engineers, "Shore Protection Manual", C.E.M., 2001.

12CE235 FUNDAMENTALS OF REMOTE SENSING AND GIS

Credits: 3:0:0

Course Objective

- To introduce the students to the basic concepts and principles of various components of remote sensing.
- To provide an exposure to GIS and its practical applications in civil engineering.

Course Outcome

- Student learnt the principles of remote sensing and analysing digital images
- Student built capacity to select sensors and data products for civil engineering applications

UNIT I

EMR AND ITS INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL: Definition of remote sensing and its components – Electromagnetic spectrum – Wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – Spectral signature concepts – Typical spectral reflective characteristics of water, vegetation and soil.

UNIT II

PLATFORMS AND SENSORS: Types of platforms – Orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – Resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors.

UNIT III
IMAGE INTERPRETATION AND ANALYSIS: Types of Data Products – Types of image interpretation – Basic elements of image interpretation - Visual interpretation keys – Digital image processing – Pre-processing – Image enhancement techniques – Multispectral image classification – Supervised and unsupervised.

UNIT IV
GEOGRAPHIC INFORMATION SYSTEM: Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS software – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

UNIT V
DATA ENTRY, STORAGE AND ANALYSIS: Data models – Vector and raster data – Data compression – Data input by digitization and scanning – Attribute data analysis – Integrated data analysis – Modeling in GIS – Highway alignment studies – Land Information System.

Text Books

1. Lillesand, T.M., Kiefer, R.W. and Chipman, J.W., “Remote Sensing and Image Interpretation”, 5th Edn., John Willey and Sons (Asia) Pvt. Ltd., New Delhi, 2004.
2. Anji Reddy, M., “Textbook of Remote Sensing and Geographical Information System”, 2nd Edn., B.S Publications, 2002.

Reference Books

1. Lo, C.P.and Yeung, A.K.W., “Concepts and Techniques of Geographic Information Systems”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2002.
2. Peter, A. Burrough, Rachael A. McDonnell, “Principles of GIS”, Oxford University Press, 2000.
3. Ian Heywood, “An Introduction to GIS”, Pearson Education Asia, 2000.

12CE236 DESIGN OF TALL STRUCTURES

Credits: 3:0:0

Course Objective

- To enlighten the students on the behavior, analysis and design of tall buildings.

Course Outcome

- The student gained knowledge to perform analysis and design of tall buildings.

Unit I
INTRODUCTION: Design Philosophy - Modern concepts: High performance concrete, Fiber reinforced concrete, Light weight concrete, Self compacting concrete.

Unit II
LOADING: Loading types: Gravity, Impact, Construction and Wind – Static and Dynamic approach, Analytical method, Wind Tunnel Experimental methods - Earthquake Loading – Equivalent lateral Load analysis - Combinations of loading.

Unit III
BEHAVIOUR OF STRUCTURAL SYSTEMS: Factors affecting growth - Height and structural form, Behaviour: Braced frames, Rigid Frames, Infilled frames, Shear walls, Coupled Shear walls, Wall – Frames, Tubulars, Cores, Outrigger braced, Hybrid systems.

Unit IV
ANALYSIS OF TALL BUILDINGS: Introduction to analysis of tall buildings - Modeling for approximate analysis, accurate analysis and reduction techniques - Analysis of structures as an integral unit - Analysis for member forces, drift and twist.

Unit V
DESIGN OF TALL BUILDINGS: Basic design of tall buildings – Design: differential movement, creep and shrinkage effects, temperature effects and fire resistance.

Text Books

1. Bryan Stafford Smith and Alex Coull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 1991.

Reference Books

1. Taranath, B.S, “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 2011.
2. Coull, A. and Smith Staford, B. "Tall Buildings ", Pergamon Press, London, 1997.
3. Lynn, S.Beedle, “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1996.

12CE237 HYDROLOGIC PROCESSES

Credits: 3:0:0

Course Objective

- To provide a basic knowledge of different hydrologic components
- To impart knowledge on hydrological data acquisition, analysis and interpretation

Course Outcome

- Students enabled to understand the various hydrologic processes
- Students understood the procedure of estimation of water at various levels and further use it for planning

Unit I

HYDRAULICS AND HYDROLOGY: Definition and introduction to hydraulics and hydrological science - Structure and properties of water - Conservation of mass - Conservation of energy - Hydrologic cycle and components: Precipitation, evaporation, evapotranspiration, infiltration and other abstractions**.**

Unit II

PRECIPITATION: Precipitation - Types of precipitation - Precipitation measurement: precipitation gauges, satellite estimates of precipitation, radar measurement of precipitation - Interpretation of precipitation data: estimating missing precipitation data - Average precipitation over area: isohyets and Thiessen polygon.

Unit III

RUNOFF AND STREAM FLOW: Phenomena of runoff: surface retention, infiltration - Runoff cycle - Estimating the volume of storm runoff: storm analysis - Basin characteristics - Streamflow measurements and rating curves - Storm hydrograph analysis - Unit hydrograph - Flood estimation.

Unit IV

EVAPORATION AND TRANSPIRATION: Factors affecting evaporation process - Estimation of evaporation from pan evaporation, Thornthwaite and Penman-Monteith methods - Water-budget, Lysimeter determination of evapotranspiration – Soil moisture - Infiltration loss estimation.

Unit V

SUBSURFACE HYDROLOGY: Groundwater concepts – Properties and types of aquifer – Saturated flow – Steady state one dimensional flow – Steady state well hydraulics – Unsteady groundwater flow – Theis method and Jacobs method – Ground Water Estimation by GEC norms - Geophysical exploration - Sea water intrusion.

Text books

1. Subramanya ,K., "Engineering Hydrology", Tata McGraw Hill, 2nd Edition, 2003.
2. Ward and Robinson, "Principles of Hydrology", Tata McGraw Hill, 1998.

Reference Books

1. Ojha, Berndtsson, Bhunya, " Engineering Hydrology", Oxford Press, 2008.
2. Linsley, R., Kohler, M. and Paulhus, J., "Hydrology for Engineers", McGraw Hill, 1975.

12CE238 CONSTRUCTION PRACTICES

Credits: 3:0:0

Course Objective

- To understand the construction materials
- To know the construction sequences

Course Outcome

- Students enabled to select the required construction materials

- Students acquired knowledge to plan and execute the project effectively

Unit I
CONSTRUCTION MATERIALS: Civil engineering materials - Properties of materials - Natural materials: soil, stone, wood, sand, aggregates, and water - Masonry materials: bricks, blocks and mortar - Concrete and concrete products - Steel and other metals – Bitumen - Composite materials: particulate, fibre-reinforced, structural composites – Glass – Aluminium – Geosynthetics – Water proofing materials.

Unit II
BUILDING PLANNING: Precautions in selection of sites – Situations and surroundings of site for various types of building – Elements of building planning: requirements, orientation, ventilation and lighting - Concepts of green buildings
Foundation: Setting out foundation plan on ground – Concepts of foundation – Bearing capacity of a good foundation – Types of foundation and their construction – Suitability – Foundation in black cotton soil – Methods of timbering of trenches – Foundation failures and remedial measures.

Unit III
CONCRETE CONSTRUCTION: Types of cement - Composition - Properties and uses with special emphasis for different constructional and weather conditions - IS code specifications - Process of manufacture of concrete – Batching – Mixing – Transporting – Placing – Compaction of concrete – Curing – Finishing - Testing of fresh and hardened concrete.

Unit IV
CONSTRUCTION METHODS: Construction sequence and procedure for Reinforced Concrete framed structures with masonry panel walls - Methods of Construction of R.C.C. slabs, Beams and Columns – Construction methods: Pre-cast and cast-in-situ concrete, steel, masonry, temporary structures (formwork, shoring, underpinning and scaffolding).

Unit V
CONSTRUCTION EQUIPMENT: Selection of equipment for earthwork, concreting, material hardening and erection of structures (cranes) – Dewatering and pumping equipment.

Text Books

1. Varghese, P. C., “Building Constructions”, Prentice Hall, 2007.
2. Neville, A. M., “Properties of Concrete”, fourth edition, Pearson Education Ltd. 2004.

Reference Books

1. Arora, S. P. and Bindra S. P., “Building Construction”, Dhanpat Rai and Sons, New Delhi, 1997.
2. Punmia, B. C., “Building Construction”, Laxmi Publications (P) Ltd., New Delhi , 1993.
3. Peurifoy, R. L., “Form work for Concrete Structures”, McGraw Hill Book Co., 1999.
4. Gambhir, M. L., “Concrete Technology”, Tata McGraw Hill Publishing Co., New Delhi, 1995.
5. Shetty, M. S., “Concrete Technology” S.Chand & Co. Ltd., 2003.

12CE239 INDUSTRIAL WASTE TREATMENT AND DISPOSAL

Credits: 3:0:0

Course Objective

- To know the effects, importance and fundamental methods in Industrial waste treatment
- To impart knowledge about disposal of effluents and the standards for disposal

Course Outcome

- Students gained knowledge on waste management
- Students acquired develop skills to undertake major project related to industrial treatment

Unit I

DISPOSAL EFFECTS ON ENVIRONMENT AND REDUCTION: Effects of industrial wastes on streams, land and air - Water quality criteria - Effluent standards - Process modification - Bioassay studies, Waste minimisation - Housekeeping - Volume and strength reduction.

Unit II

EFFLUENT TREATMENT: Physico-chemical processes - Equalisation and neutralisation - Separation of solids - Sedimentation and filtration - Coagulation and flocculation, absorption, Biological Treatment processes - Aerobic and anaerobic decomposition of organic matter - Activated sludge process, trickling filters, Advanced waste water treatment: chemical precipitation, ion exchange, reverse osmosis, electro dialysis and electrocoagulation.

Unit III

EFFLUENT REUSE AND RESIDUAL MANAGEMENT: Common Effluent Treatment Plants, Zero Discharge Concept, Radioactive and Biomedical waste, Treatment of Hazardous wastes - Solidification, incineration, landfills, leachate treatment.

Unit IV

INDUSTRIAL PROCESS AND WASTE TREATMENT: Manufacturing process, waste water characteristics, effects and appropriate treatment - Flow sheets for Petro-chemical industries, Textiles, Tanneries, Mining industries, Dairy, Sugar, Paper and Pulp, Thermal Power Plants.

Unit V

EFFLUENT STANDARDS AND LEGISLATIONS: Environmental Impact Assessment (EIA) - Environmental Auditing, ISO-14000 - Polluter Pays Principle - Environmental Protection Act - Air Act - Water Act - Wetland Regulatory Notification and Coastal Zone Regulation.

Text Books

1. Rao, M.N. and Dutta, “Waste Water Treatment”, Oxford and IBH Publishing Ltd., Calcutta, 1979.

2. Eckenfelder, W.W., “Industrial Waste Pollution Control”, McGraw Hill Book Co., New Delhi, 1989.

Reference Books

1. Nemerow, N.L., “Theory and Principles of Industrial Waste Treatment”, Addison Wesley, Reading Mass, 1963.
2. Gurnham, C.F., “Principles of Industrial Waste Treatment”, Wiley & Sons, New York, 1965.

12CE240 REHABILITATION OF STRUCTURES

Credits: 3:0:0

Course Objective

- To get exposed to the repair and rehabilitation structures and structural elements
- To know the materials used for repair.
- To have a knowledge about the repair techniques

Course Outcome

- Students enabled to study the distress in structures, diagnosis the causes and rehabilitate them with suitable repair techniques.

Unit I

MAINTENANCE AND REPAIR STRATEGIES: Definitions: Maintenance, repair and rehabilitation - Facets of Maintenance - Importance of Maintenance – Quality Assurance and Quality control, Structural Appraisal : concrete , steel and masonry structures – Inspection, Strength evaluation of existing structures - Assessment procedure for evaluating a damaged structure - Nondestructive testing methods.

Unit II

DISTRESS AND ITS CAUSES: Distress monitoring - Causes for deterioration: Structural causes and Non Structural causes - Symptom, prevention and remedy - Classification of cracks – Visual examination of cracks – Evaluation of cracks - Distress in sub structure – Distress in super structure.

Unit III

INFLUENCE ON SERVICEABILITY AND DURABILITY: Effect on strength, permeability, thermal properties - Effects due to climate, temperature, chemicals and dampness - Effects of cover thickness – Error in design, construction and fabrication - Defects in joints in steel structures – Mechanism of Corrosion – Distress due to corrosion: Prevention and remedial measures.

Unit IV

TECHNIQUES FOR REPAIR:

Epoxy Injection – Stitching – Routing and sealing – External stressing –Blanketing – Overlays – Judicial Neglect – Autogeneous healing – Jacketing – Polymer coating for rebars - Mortar and dry pack - Gunite and Shotcrete - Shoring and underpinning – plating - Cathodic protection - Miscellaneous methods.

Unit V

REHABILITATION OF CONCRETE AND MASONRY DAMS: Foundation - Loss of strength under repeated action – Erosion and solution - Ageing grout curtains and drains – sedimentation, leakage detection and their prevention and remedial measures - Super structure - Chemical reaction resulting in swelling – Shrinkage and creep effect - Degradation and loss of strength due to repeated action – failures and repairing of joints - Dam during flood and earthquakes - Instrumentation and monitoring of dams and reservoirs.

Text books

1. Johnson, S.M.,"Deterioration, Maintenance and Repair of Structures", McGraw-Hill book Co., New York, 1965.
2. Allen, R.T. and Edwards, S.C., "Repair of concrete structures", Blakie and Sons, UK, 1987.
3. Denison Campbell, Allen and Harold Roper, "Concrete structures, Materials, Maintenance and Repair", Longman Scientific and technical UK, 1991.
4. Deofferey P .Sims, "The Rehabilitation of Dams and Reservoirs", Brown & Root Services .UK, 1999.

Reference Books

1. Alien, R.T., and Sc Edwards, "Repair of concrete structures", Blake and sons, U.K. 1987.
2. Neville, A.M., "Properties of Concrete", The English Language book society and pitman publishing, 2002.
3. Shetty, M.S., "Concrete Technology – Theory and Practice", S. Chand & co., New Delhi, 1982

12CE241 FINITE ELEMENT TECHNIQUES

Credits: 3:0:0

Course Objective

- To understand the fundamentals of finite element method
- To use finite element method as a tool for solving problems

Course Outcome

- Students enabled to apply finite element technique to solve engineering problems

Unit I

INTRODUCTION: Concept of Finite Element Method – Discretization - Energy principles - Classical techniques in FEM - Rayleigh-Ritz weighted method of approximation.

Unit II

ONE DIMENSIONAL PROBLEM: Modeling – Shape functions - Potential energy approach – Galarkin approach – Formulation of stiffness matrix and load vector – Finite element equations – Boundary condition – Quadratic shape functions – Applications to plane trusses, beams.

Unit III

TWO DIMENSIONAL CONTINUUM: Introduction – Elements for plane strain and plane stress problems - Displacement model – Natural coordinates – Area and volume coordinates - Triangular elements and 4 noded - Quadrilateral elements – Element stiffness matrix – Force vector - Galarkin approach - Stress calculation – Temperature effects.

Unit IV
AXISYMMETRIC CONTINUUM: Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs.

Unit V
ISOPARAMETRIC FORMULATION (TWO DIMENSIONAL CONTINUUM): Sub-iso-superparametric elements - 4 noded quadrilateral elements – Shape functions - Element stiffness matrix and force vector - Gaussian quadrature - Stress calculations – Numerical Integration.

Text Books

1. Chandrupatla, T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", Pearson Education, 3rd Edition, 2002.
2. David, V. Hutton, "Fundamentals of Finite Element Analysis", McGraw-Hill Int. Edn., 2004.

Reference Books

1. Rao, S.S., "The Finite Element Method in Engineering", Pergammon Press, 1989
2. Logan, D.L., "A First course in the Finite Element Method", Third Edition, Thomson Learning, 2002.
3. Robert, D.Cook., David.S, Malkucs Michael E. Plesha , "Concepts and Applications of Finite Element Analysis", 4th Edn., Wiley and Sons, 2003.
4. Ed. Wiley, Reddy, J.N., "An Introduction to Finite Element Method", McGraw-Hill International Student Edition, 1985.
5. Zienkiewicz, O.C and Taylor, R.L., "The Finite Element Method, Basic formulation and linear problems", Vol.1, McGraw-Hill, 5th Edn., 1989.

12CE242 CONSTRUCTION MANAGEMENT

Credits: 3:0:0

Course Objective

- To introduce the concepts of management, resources and construction planning
- To introduce the labour laws, principle of accounting
- To introduce fundamentals concepts of computer applications in construction Management

Course Outcome

- Students understood the duties of individual in construction filed and about the labour safety and welfare
- Students gained knowledge about tenders, contracts and some basic knowledge about computer applications in construction

Unit I

PRINCIPLES OF MANAGEMENT: Definition - Management Course Objective and functions - Organizational chart of a construction company - Manager's duties and responsibilities - Public relations - Leadership and team – Work, ethics, morale, delegation and accountability.

Unit II

CIVIL ENGINEERING MANAGEMENT:

Construction Planning: Collection of field data - Preliminary estimates - Approval and sanction of estimates – Budget provision - Construction stages - Scheduling methods - Progress reports and charts.

Resource Planning: Planning for materials, machines, factors affecting purchase, rent, and lease of equipment, and cost-benefit estimation - Resource allocation

Labour and Labour Welfare: Relationship between management and labour - Manpower planning, training, recruitment, motivation, welfare measures and safety laws - Industrial psychology.

Unit III

MANAGEMENT METHODS: Concepts of network - Network planning method - CPM/PERT/GERT - Management by network analysis and control - Principles of cost control - Control by graphical representation, bill of quantities and network analysis.

Unit IV

DEPARTMENTAL PROCEDURES:

Contract: Contract system - Types of contracts - Specifications, documents, procedures, conditions, taxes, construction laws, legal implications and penalities.

Tender and Tender Documents: Definition - Calling of tenders - Tender documents - Submission of tenders - Processing of tenders - Negotiations and settlement of contracts – E-tendering – Global tendering.

Unit V

ACCOUNTS AND STORES: Measurements of work - Recording - Checking - Types of bills - Mode of payment – Budget estimate - Revised estimates - Completion reports and certificates - Claims and transfer classifications of transactions - Ledger accounts - Imprest Account - Cash book-Suspense classification - Stores - maintenance and inspection - Inventories – Accounting of surplus and shortage of stores - Procedures adopted in P.W.D. and C.P.W.D.

Introduction to Computer Application in Construction Management: Planning – Scheduling and Resource Analysis - Recording and Operations – Project Accounting, Costing and Finance.

Text Books

1. Seetharaman, S., "Construction Engineering and Management", Umesh Publications, 2007.
2. Sengupta, B., and Guha, H., "Construction Management and Planning", Tata McGraw-Hill Book Co., 2000.

Reference Books

1. Rana,V.K., "Construction Management Practice", Tata McGraw-Hill publishing Co.,2000.

2. Chitkara, K.K., “Construction Project Management”, Tata McGraw-Hill publishing Co.,2000.
3. Sharma, J.L., “Construction Management and Accounts”, Sathya Prakashan, New Delhi, 1994.

12CE243 GLOBAL CLIMATE CHANGE AND ITS IMPACTS

Credits: 3:0:0

Course Objective

- To expose the students to the complexities, impacts on socio economic and environmental spheres and initiatives to mitigate Global Climate Change

Course Outcome

- Students gained knowledge about the processes related to climate change and learnt the methods and to combat climate change

Unit I

INTRODUCTION: Ancient Earth - Climate and Chemical Histories, Paleo-indicators of climate, Global energy balance, Concern about Climate Change, Climate Change and Sustainable development.

Unit II

CLIMATE AND WEATHER: Factors affecting global, regional and local climates - Tropical, Monsoon, Polar, Desert, Mid-latitude climates and their role in global climate change - Antarctica, Greenland and the North Pole case studies.

Unit III

ELEMENTS AND PROCESSES RELATED TO CLIMATE CHANGE: Structure and driving forces of the earth. Earth’s carbon reservoirs- marine and terrestrial carbon cycles - The Atmosphere - Radiation budget, Circulation, Stability, Chemistry of Atmosphere - Global wind systems, weather maps - Importance of water, Global Ocean Circulation - Industrialization and urbanization - Greenhouse gases, lifestyle changes.

Unit IV

IMPACTS OF GLOBAL CLIMATE CHANGE: The Greenhouse effect – Ecosystems and species interactions, global warming, sea level rise, ozone problem, El Nino and southern oscillation, storms, thunderstorms, tornadoes, changes in agricultural production, droughts, spread of epidemics, wildfires and other extreme weather events - Nuclear winter.

Unit V

CLIMATE CHANGE MITIGATION / ADAPTATION: Climate change and the political realm - Mission of the Intergovernmental Panel on Climate Change - International agreements and protocols - Future use of energy and fossil fuels - Role of Governments, industries, and individuals - Concept of CDM and carbon finance.

Text Books

1. Lee, R. Kump, Kasting, F. James and Robert, C. Crane, "The Earth System", 2nd Edition, Prentice Hall, 2004.
2. Houghton, J.T., "Climate Change 2001: The Scientific Basis", Cambridge University Press, Cambridge, U.K., 2001.

Reference Books

1. Ruddiman, W.F., "Earth's Climate: Past and Future", W.H. Freeman and Company, 2001.

12CE244 DESIGN AND DRAWING OF WATER MANAGEMENT STRUCTURES

Credits: 0:0:2

Course Objective

- The purpose of this course is to impart the knowledge about the design of irrigation and environmental engineering structures
- To get hand-on experience in drawing of irrigation and environmental engineering Structures

Course Objective

- Students gained expertise to design and draw irrigation and environmental engineering structures

PART A:

Design of the following irrigation works are to be worked out and detailed drawings are to be drawn:

1. Tank sluice with tower head
2. Tank surplus weir.
3. Canal Regulator (Head regulator)
4. Canal drop.
5. Syphon aqueduct
6. Direct Sluice

PART B:

Design of the following Environmental Engineering works are to be worked out and detailed drawings are to be drawn.

1. Flash mixer, flocculation and sedimentation tanks.
2. Rapid sand filter
3. Septic tank with dispersion trenches
4. Imhoff tank.
5. Activated Sludge Process Unit
6. Trickling filter

Additional drawings to be made without design (only for internal evaluation)

1. General layout of water supply scheme.
2. General layout for drainage scheme.
3. Details of Manholes and pumping station.
4. Layout of waste water treatment plant.

Text Books

1. Satyanarayanamurthy, C., “Design of Minor Irrigation and Canal Structures”, Wiley eastern Limited, 1994.
2. Ellis, W.M., “College of Engineering Manual: Irrigation”, The Textile Institute Publishers, 1955.
3. Gharpure, V.N., A Text Book of water supply Engineering, Allied Publishers limited, 1993.

12CE245 HIGHWAY LABORATORY

Credits: 0:0:2

Course Objective

- To give hands on training in testing of aggregates
- To impart knowledge on testing of highway materials

Course Outcome

- Student enabled to understand the field problems through experimentation
- Student learnt to check the quality of material used in the highway

TESTS ON AGGREGATE AND BITUMINOUS MATERIALS:

1. Flakiness index
2. Elongation index
3. Specific gravity and water absorption capacity
4. Crushing test
5. Impact strength test
6. California bearing ratio (CBR) test
7. Abrasion resistance test using Deval’s abrasion and Los Angeles Abrasion test.
8. Attrition test
9. Marshall stability test on asphalt
10. Ductility test for bitumen/tar
11. Penetration of bitumen
12. Determination of softening point
13. Flash and fire point of bitumen

Text Books

1. Martin Rogers, “Highway Engineering”, Wiley-Blackwell, 2003.
2. Khanna, S. K., and Justo, C.E.G., “Highway Engineering”, Nem Chand and Bros., 2005.

Reference Books

1. IS 2386 – 1963 Part I, III, Methods of test for aggregate for concrete, Bureau of Indian Standards, New Delhi.

12CE246 SURVEY CAMP

Credits: 0:0:2

A Survey Camp for ten days will be conducted to train the students to establish control on surveying according to the practical studied.

12CE247 GROUNDWATER DEVELOPMENT AND MANAGEMENT

Credits: 3:0:0

Course Objective

- To provide the student an introduction to the occurrence, distribution and movement of ground water.
- To equip the student with the skills and techniques to interpret and analyse the groundwater data for effective management of groundwater resources.

Course Outcome

- Students enabled to resolve groundwater related problems including response of aquifers to pumping wells.

Unit I

INTRODUCTION: Ground Water Occurrence: Ground water hydrologic cycle - Origin of ground water - Rock properties effecting ground water – Vertical distribution of ground water - Zone of aeration and zone of saturation - Types of aquifers.

Unit II

PHYSICAL PROPERTIES: Ground Water Movement: Permeability, Darcy's law, storage coefficient, transmissivity, porosity, Specific yield and Specific retention-Differential equation governing ground water flow.

Unit III

WELL HYDRUALICS: Analysis of Pumping Test Data: Steady flow groundwater flow towards a well in confined and unconfined aquifers – Dupit's and Theim's equations: assumptions, formation constants - Yield of an open well interface and well tests.

Unit IV

GROUNDWATER DEVELOPMENT: Artificial Recharge of Ground Water: Concept of artificial recharge – Recharge methods - Applications of GIS and remote sensing in artificial recharge of ground water along with case studies.

Unit V

GROUNDWATER MANAGEMENT: Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods - Subsurface methods: geophysical logging and resistivity logging - Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation - Saline Water Intrusion in aquifer: occurrence of saline water intrusions - Ghyben- Herzberg relation - Shape of interface - Control of seawater intrusion - Groundwater Basin Management: concepts of conjunction use, Case studies.

Text Books

1. Fetter, C. W., "Applied Hydrogeology", Merril Publishing Co., 4th Edn., 2001.
2. Karanth, K.R, "Groundwater Assessment Development and Management", Tata McGraw-Hill Publishing Co. Ltd, 1987

References

1. Bear, J., "Hydraulics of Groundwater", McGraw Hill, New York, 1979.

2. Thangarajan, M., “Groundwater: Resource Evaluation, Augmentation, Contamination, Restoration, Modeling and Management”, Capital Publications, 2006.
3. Freeze, A.R. and Cherry, J.A., “Groundwater”, John Willey Publishers, 1979.
4. Hiscock, Kevin, “Hydrogeology, Principles and Practice”, Blackwell Publishing, Oxford, UK, 2005.
5. Todd, D.K., “Groundwater Hydrology”, John Wiley & Sons, 2007.

12CE248 ARCHITECTURE AND TOWN PLANNING

Credits: 3:0:0

Course Objective

- To impart the knowledge on the basics of town planning, use of land, planning legislations, Architecture and landscaping

Course Outcome

- Students learnt the concepts of architecture and landscaping and town planning
- Students enable to prepare architectural design

Unit I

INTRODUCTION TO ARCHITECTURE: Definition - Architecture – Vitruvian principles - Brief history of Greek, Roman, Egyptian and Indian architecture - Key factors influencing the architecture of any region: Culture, Climate, Topography, Building materials, Economic & Technology - Prominent World Architecture styles during various periods in history - Anthropometrics – Human Scale in Architecture - Space requirements for Human activity.

Unit II

ARCHITECTURAL DESIGN AND LANDSCAPING: Architectural Design – An analysis– integration of function and aesthetics – Introduction to basic elements and principles of design
Landscape Architecture: Concept, Necessity, Study of trees, plants & Shrubs for landscaping.

Unit III

CLIMATE AND ENVIRONMENTAL RESPONSIVE DESIGN: Man and environment interaction - Factors that determine climate – Characteristics of climate types – Design for various climate types – Passive and active energy controls – Green building concepts.

Unit IV

TOWN PLANNING AND LANDUSE PLANNING: Planning – Definition, concepts and processes - Urban planning standards and zoning regulations - Urban renewal – Conservation – Principles of Landscape design - Scope and Content of Master plan, Regional plan, Detailed development plan - Basic principles in planning of various land uses: Residential, Commercial, Industrial, Agricultural and Recreational.

Unit V

PLANNING LEGISLATIONS: Evolution of Indian planning legislation - Organisation and administration of planning agencies at National, State, Regional level and Metropolitan Level - Tamil Nadu Town and Country Planning Act - Building bye laws - Function of local Authority - Provision of Building Regulations.

Text Books

1. Rangwala, S.C., “Town Planning”,Charotar Publishing House, Gujarat, 2007.
2. Gurcharan Singh and Jagdish Singh,“Building planning, Designing and Scheduling”, Standard Publishers Distributors, Delhi, 1999.
3. Givoni, B., “Man Climate and Architecture”, Applied Science, Barking ESSEX, 1982.
4. Gallian B. Arthur and Simon Eisner, “The Urban Pattern – City Planning and Design”, Affiliated Press Pvt. Ltd., New Delhi, 1995.

Reference Books

1. Hiraskar, G.K., “Fundamentals of Town Planning”, Dhanpat Rai and Sons, Delhi, 2005.
2. Abir Bandyopadhyay, “Textbook of Town planning”, Books and Allied publishers,2000.
3. Francis D.K.Ching, “Architecture - Form, Space and Order”, Van Nostrand Reinhold Co., NewYork, 1979.

12CE249 SMART MATERIALS AND SMART STRUCTURES

Credits: 3:0:0

Course Objective

- To give an in-depth knowledge on properties of smart materials and their use in structures.

Course Outcome

- Student understood the concept of smart materials and their structural applications.

Unit I

PROPERTIES OF MATERIALS AND ER AND MR FLUIDS: Piezoelectric Materials and properties - Actuation of structural components - Shape Memory Alloys - Constitutive modeling of the shape memory effect, vibration control - Embedded actuators - Electrorheological and magnetorheological fluids - Mechanisms and Properties - Fiber Optics - Fiber characteristics - Fiber optic strain sensors.

Unit II

VIBRATION ABSORBERS: Parallel damped vibration absorber - Gyroscopic vibration absorber - Active vibration, absorber - Applications - Vibration Characteristics of mistuned systems - Analytical approach.

Unit III

MEASURING TECHNIQUES: Strain Measuring Techniques using Electrical strain gauges - Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

Unit IV

CONTROL OF STRUCTURES: Control modeling of structures - Control strategies and limitations - Classification of control systems: Classical control, Modern control, Optimal control and Digital control - Active structures in practice.

Unit V

APPLICATIONS IN CIVIL ENGINEERING: Application of Shape Memory - Alloys in Bridges – Concept of Smart Bridges – Application of ER Fluids - Application of MR Dampers in Different Structures – Application of MR Dampers in Bridges and High Rise Structures – Structural Health Monitoring - Application of Optical Fibres - Concept of Smart Concrete.

Text Books

1. Srinivasan, A.V., and Michael McFarland. D., "Smart Structures – Analysis and Design", Cambridge University Press, 2001.

Reference Books

1. Brian Culshaw, "Smart Structures and Materials", Artech House, Boston, 1996.
2. Gandhi, M.V and Thompson, B.S., "Smart Materials and Structures", Chapman and Hall, 1992.

12CE250 SOLID WASTE MANAGEMENT

Credits: 3:0:0

Course Objective

- To educate the students on the principles involved in the management of municipal solid waste and hazardous wastes – from source identification up to disposal.

Course Outcome

- Student gained knowledge on selection of municipal solid waste collection and treatment methods.
- Student developed skills to undertake major projects related to municipal solid waste management

Unit I

INTRODUCTION: Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, plastics and fly ash.

Unit II

WASTE CHARACTERISATION AND SOURCE REDUCTION: Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous characteristics – TCLP tests – Waste sampling and characterization plan - Source reduction of wastes – Recycling and reuse – Waste exchange.

Unit III

STORAGE, COLLECTION AND TRANSPORT OF WASTES: Handling and segregation of wastes at source – Storage and collection of municipal solid wastes - Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation–

Compatibility, storage, labeling and handling of hazardous wastes – Hazardous waste manifests and transport.

Unit IV

WASTE PROCESSING TECHNOLOGIES: Objective of waste processing – Material separation and processing technologies – Biological and chemical conversion technologies – Methods and controls of Composting – Thermal conversion technologies and energy recovery – Incineration – Solidification and stabilization of hazardous wastes - Treatment of biomedical wastes.

Unit V

WASTE DISPOSAL: Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – Site selection - Design and operation of sanitary landfills, secure landfills and landfill bioreactors - Leachate and landfill gas management – Landfill closure and environmental monitoring – Closure of landfills – Landfill remediation.

Text books

1. George Tchobanoglous, Hilary Theisen and Samuel, A. Vigil, "Integrated Solid Waste Management", McGraw- Hill International edition, New York, 1993.

Reference Books

1. "CPHEEO Manual on Municipal Solid waste management", Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
2. Micheael, D. LaGrega, Philip, L. Buckingham, Jeffrey, C. E., "Environmental Resources Management, Hazardous waste Management", McGraw-Hill International edition, New York, 2001.
3. Vesilind, P.A., Worrell, W and Reinhart, "Solid waste Engineering", Thomson Learning Inc., Singapore, 2002.

12CE251 ENVIRONMENTAL IMPACT ASSESSMENT

Credits: 3: 0: 0

Course Objective

- To educate the students on the scope, steps involved and various methods related to assessment of environmental impact due to development projects.

Course Outcome

- Student developed skills to undertake EIA projects

Unit I

INTRODUCTION: Environmental Impact Assessment (EIA) – Environmental Impact Statement – EIA in Project Cycle – Legal and Regulatory aspects in India according to Ministry of Environment and Forests – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Participation of Public and Non-Governmental Organizations in environmental decision making.

Unit II

COMPONENTS AND METHODS: Components of EIA - Processes – Screening – Scoping - Setting – Analysis – Mitigation - Matrices – Networks – Checklists – Connections and combinations of processes - Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA.

Unit III

PREDICTION, ASSESSMENT OF IMPACTS AND REPORTING : Prediction tools for EIA – Mathematical modeling for impact prediction – Assessment of impacts – Air – Water – Soil – Noise – Biological-socio-cultural environments – Cumulative Impact Assessment – Documentation of EIA findings – Planning – Organization of information and visual display materials – Report preparation.

Unit IV

ENVIRONMENTAL MANAGEMENT PLAN: Environmental Management Plan – Preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment.

Unit V

CASE STUDIES: Case studies related to the following sectors - Infrastructure - Mining – Industrial – Thermal Power - River valley and Hydroelectric - Nuclear Power.

Text Books

1. Canter, L.W., "Environmental Impact Assessment", McGraw-Hill, New York. 1996.
2. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley-Interscience, New Jersey, 2003.

Reference Books

1. Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II, Blackwell Science London. 1999.
2. Biswas, A.K. and Agarwala, S.B.C., "Environmental Impact Assessment for Developing Countries", Butterworth Heinemann, London. 1994.
3. The World Bank Group, "Environmental Assessment Source Book", Vol. I, II and III, The World Bank, Washington. 1991.

12CE252 BUILDING SERVICES

Credits: 3:0:0

Course Objective

- To learn about water supply and sanitation arrangements in a building
- To understand the essentials of electrical installations in a building
- To get an exposure to air conditioning and fire safety arrangement
- To pioneer the concepts of intelligent building

Course Outcome

- Students gained knowledge about the essential services to be carried out in a building

Unit I

BUILDING SANITATION: Water quality, purification and treatment - Water supply systems - Distribution systems in small towns - Types of pipes – Laying, jointing - testing for water tightness plumbing system for building - Internal supply in buildings - Municipal bye laws and regulations - Rain water harvesting - Sanitation in buildings - Arrangement of sewerage systems in housing - pipe systems - Storm water drainage from buildings - Septic and sewage treatment plant - Collection, conveyance and disposal of town refuse systems.

Unit II

ELECTRICAL INSTALLATIONS IN BUILDINGS: Types of wires, wiring systems and their choice - Planning electrical wiring for building - Main and distribution boards - Transformers and switch gears - Modern theory of light and colour - synthesis of light - Luminous flux - Candela - Lens of illumination - Lighting design - Design for modern lighting.

Unit III

AIR CONDITIONING SYSTEM AND APPLICATIONS: Ventilation and its importance - Natural and artificial systems - Window type and packaged air- conditioners - Chilled water plant - Fan coil systems - Water piping - Cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C. Systems.

Unit IV

FIRE SAFETY-GENERAL PROVISIONS: Causes of fire in buildings - Safety regulations - NBC-planning considerations in buildings like Non-combustible materials, construction, staircases and A.C. systems, special features required for physically handicapped and elderly in building types - Heat and smoke detectors -dry and wet risers - Automatic sprinklers - Capacity determination of OHT and UGT for fire -fighting needs.

Unit V

ADVANCED TOPICS: Intelligent buildings - Building automation - Smart buildings – Green Buildings - Building services in high rise buildings.

Text Books

1. "Hand book for Building Engineers in Metric Systems", NBC, New Delhi, 1968.
2. "Philips Lighting in Architecture Designs", McGraw Hill, New York, 1964.
3. "Time Saver Standards for Architecture Design Data", Calendar JH, McGraw Hill, 1974.

Reference Books

1. Fair, G.M., Geyer, J.C. and Okun, D., "Water and Waste Engineering", Vol. II, John Wiley and sons, New York. 1968.
2. Hopkinson, H.G. and Kay, J.D., "The Lighting of Buildings, Faber and Faber", London, 1969.
3. William H. Severns and Julian R. Fellows, "Air conditioning and Refrigeration", John Wiley and sons, London, 1988.

12CE253 NATURAL DISASTER MANAGEMENT

Credits: 3:0:0

Course Objective

- To expose the students to the natural and manmade disasters
- To train the students to study the effect of disasters and methods to mitigate disasters.

Course Outcome

- Students understood the effect of disaster and strategies to be adopted for disaster management

Unit I

NATURAL DISASTERS: Meaning and nature of natural disasters: types and effects - Floods, drought, cyclone, earthquakes, landslides, avalanches, Volcanic eruptions, Heat and cold waves - Climatic change: global warming, Sea level rise, ozone depletion.

Unit II

MAN MADE DISASTERS: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Unit III

DISASTER MANAGEMENT: Effect to migrate natural disaster at national and global levels - International strategy for disaster reduction - Concepts of disaster management: national disaster management framework; financial arrangements; role of NGOs, community–based organizations and media - Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Unit IV

DISASTER PREPAREDNESS: Ways and means; skills and strategies; rescue, relief, reconstruction and rehabilitation - Case studies - Seismic vulnerability of urban areas - Seismic response of R.C. frame buildings with soft first storey - Using risks-time charts to plan for the future. Lateral strength of masonry walls - Cyclone resistant house for coastal areas.

Unit V

LANDSLIDES: Landslide hazards zonation mapping and geo-environmental problems associated with the occurrence of landslides - Landslide casual factors in urban areas - Roads and landslide hazards in Himalaya - Use of electrical resistivity method in the study of landslide - Studies in Rock-mass classification and landslide management in Garhwal-Himalaya, India.

Text Books

1. Iyengar, C.B.R.I.,“Natural Hazards in the Urban Habitat” , Tata McGraw Hill Co., 2001.
2. Jon Ingletone,“Natural Disaster management”, Tulor Rose, 1999.
3. Singh, R.B.,“Disaster Management”, Rawat Publications,2000.

Reference Books

1. Sachindra Narayan, “Anthropology of Disaster management”, Gyan Publishing House, 2000.

12CE254 TRANSPORTATION PLANNING

Credits: 3:0:0

Course Objective

- To introduce the concepts of urban transportation planning and intelligent transportation systems
- To impart knowledge on the complexity involved in the planning and management of various public transportation systems

Course Outcome

- Student enabled with a sound understanding of the basics of urban transportation planning and the advancements in planning and management of various public transportation Systems.

Unit I

TRANSPORTATION ECONOMICS: Economic significance of transport - Demand for transport - Influencing factors, temporal and spatial variations, elasticity of demand - Supply of transport services - Development of systems supply function; Transport costs - Long-run and short-run costs, fixed and variable costs, and marginal costs - Transportation innovations and environmental impact assessment.

Unit II

INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS: Introduction to Intelligent Transportation systems (ITS) - Definition of ITS and Identification of Course Objective of ITS - Historical Background, Benefits of ITS - Programs in the World - Overview of ITS implementations in developed countries, ITS in developing countries - ITS data collection techniques and ITS functional areas.

Unit III

URBAN TRANSPORTATION PLANNING: Urban transportation planning concepts - Systems approach to the planning process, Trip generation basics; variables influence trip generation - Trip distribution modeling - Factors governing trip distribution, growth-factor methods and gravity models, calibration of gravity models – Nodal - Split modeling - Factors influencing mode choice, discrete choice models.

Unit IV

PUBLIC TRANSPORTATION (ROAD, RAIL AND MASS TRANSIT SYSTEMS): Development of public transportation; Modes of urban passenger transportation - Types and characteristics; advanced public transportation systems - Technologies and applications. Characteristics of bus transportation in urban areas – Fare policy – route planning – Planning of terminals – Break-even point and its relevance - Characteristics of suburban, IRT, RRT and Metro rail systems – Planning of rail terminals – Unified traffic and transport authority - Future of public transportation.

Unit V

PUBLIC TRANSPORTATION (AIRPORTS AND HARBORS):
Air Transportation: Classification and size of airports - Aircraft characteristics - Air traffic control - Airport location and necessary surveys - Layout of runways, taxiways and aprons - Terminal service facilities - Passenger, baggage and cargo handling systems.
Waterway Transportation: Port development - Classification of ports - Traffic and hinterland studies - Passenger, fishery, containers, bulk cargo handling facilities.

Text Books

1. Bruton, Michael, J., "Introduction to Transport Planning", Hutchinson, London, 1970.
2. Kadiyali, L.R., "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 1997.
3. Roger, R., Stough., "Intelligent Transport Systems – Cases and Policies", Edward Elgar Publications, 2001
4. Horonjeff, R, and Mckelvey., "The Planning and Design of Airports", McGraw Hill Co., 1989.
5. Ernst, G., Frankel., " Port Planning and Development", John Wiley & Sons, USA, 1987.

Reference Books

1. Hutchinson, B.G., "Principles of Urban Transport Systems Planning", McGraw Hill, London, 1974.
2. Vukan, R., and Vuchic, A., "Urban Public Transport Systems and Technology", Prentice Hall, 1981.
3. John, W.Dickey, "Metropolitan Transportation Planning", Tata McGraw Hill Publishing Co. Ltd, New Delhi, 1990.

12CE255 GIS APPLICATIONS

Credits: 3:0:0

Course Objective
- To provide exposure to applications of GIS in various application domains

Course Outcome
- Student gained knowledge to apply GIS modeling for various applications in civil engineering domain

Unit I
NATURAL RESOURCE MANAGEMENT APPLICATIONS: Forestry: Resource inventory, forest fire growth modeling – Land: Land use planning, watershed management studies – Water – Identification of ground water recharge – Resource information system – Wetlands management, wildlife habitat analysis – Environmental Impact Assessment.

Unit II
DISASTER MANAGEMENT & FACILITY MANAGEMENT APPLICATIONS: Disaster management: Use of GIS in risk assessment, mitigation, preparedness, response and recovery phases of Disaster management – Utilities – Water utility applications – Electric utility Application – Telecommunication: Tower spotting, route optimization for meter reading for utilities – Other utilities.

Unit III

LOCATION-SPECIFIC SERVICES APPLICATION : Vehicle Tracking: Automatic vehicle location (AVL), Components of AVL: Invehicle Equipment, various communication channels, web server, client – Vehicle tracking alarms used in Vehicle tracking, Fleet management – Vehicle navigation – Emergency call: Address geocoding, Distress call application.

Unit IV

LAND INFORMATION SYSTEM & WEB GIS APPLICATIONS : Land information system (LIS) – Tax mapping – Mobile mapping - Other LIS applications – Web GIS: Architecture of Web GIS, Map server, Web GIS applications.

Unit V

BUSINESS, HEALTH AND OTHER APPLICATIONS: Business applications: Siting a new facility, customer loyalty studies, market penetration studies – Health application: Disaster surveillance, health information system – Crime Mapping: Mapping crime data, hot Spot Analysis – 3D GIS.

Text Books

1. Paul Longley, Michael F. Goodchild, David J.Maguire and David W. Rhind, "Geographic Information Systems and Science", John Wiley and Sons, 2005.
2. Uzair M.Shamsi, "GIS Tools for Water, Wastewater, and Stormwater Systems", ASCE Press, 2002.
3. Van Dijk and M.G. Bos,, "GIS and Remote Sensing Techniques in Land-And-Water-Management", Kluwer Academic Publishers, 2001.

Reference Books

1. Alan, L. and Melnick, M.D.,"Introduction to Geographic Information Systems for Public Health", Aspen Publishers, first edition, 2002.
2. Amin Hammad and Hassan Karimi, "Telegeoinformatics: Location- based Computing and Services", CRC Press, 2004.
3. Allan Brimicombe, "GIS Environmental Modeling and Engineering", Taylor & Francis, 2003.

12CE256 GROUND IMPROVEMENT TECHNIQUES

Credits: 3:0:0

Course Objective

- To identify basic deficiencies of various soil deposits and in a position to decide various ways and means of improving the soil and implementing improvement techniques.

Course Outcome

- Student enabled to get knowledge in different ground improvement techniques with and without addition of materials in soil.

Unit I

INTRODUCTION: Definition - Necessity of soil improvement - Selection of improvement method – Methods of ground improvement – Factors to be considered in the selection of best soil improvement technique - Geotechnical problems in alluvial, lateritic and black cotton soil.

Unit II
COMPACTION: Introduction to soil improvements without the addition of any material - Surface compaction - Compaction piles in sand - Dynamic compaction of sands - Vibratory compaction in sand - Vibroflotation in sand – Explosions in sand - Terra probe method - Replacement process - Vibroflotation in clays - Preloading techniques

Unit III
DEWATERING AND GROUT TECHNIQUES: Dewatering Techniques - Well points – Vacuum and electro-osmotic methods – Seepage analysis for two–dimensional flow for fully and partially penetrated soils in homogeneous deposits (simple cases only) – Grouting: types, desirable characteristics of grouts, grouting methods , grouting applications - Seepage control in soil under dams and for cutoff walls - Seepage control in rock under dams - Stabilization grouting for under-pinning.

Unit IV
EARTH REINFORCEMENT: Soil improvement using reinforcing elements - Introduction to reinforced earth: mechanism, concepts, applications - Reinforced earth retaining walls - Reinforced embankments - Improvement using natural materials (introduction only).

Unit V
GEOSYNTHETICS AND MISCELLANEOUS METHODS: Types , applications (only general applications) - Types of geosynthetics - Geotextiles as separators, filters, and drainage media - Crib walls, gabbions and matressess, anchors, rock bolts and soil nailing, stone column, micropiles.

Text Books

1. Purushothama Raj, P., “Ground Improvement Techniques”, Laxmi Publications (P) Ltd., New Delhi, 1999.
2. Koerner, R.M., “Construction and Geotechnical Methods in Foundation Engineering”, McGraw Hill, 1994.

Reference Books

1. Moseley, “Text Book on Ground Improvement”, Blackie Academic Professional, Chapman & Hall, 2002.
2. Das, B.M., “Principles of Foundation Engineering” (Fifth edition), Thomson Asia Pvt.Ltd., Singapore, 2003.
3. Manfred Hausmann, “Engineering principles of Ground Improvement” ,Mc Graw Hill Pub. Co., New York, 2002.

12CE266 FLUID MECHANICS AND MACHINERY LABORATORY

Credit: 0:0:1

Course Objective

- To give hands on training on Flow measurement, Losses due to friction and pipe fittings
- To give hands on training on working of different types of Pumps and turbine

Course Outcome

- Student enabled to carry out flow measurements
- Student enabled to study the performance of pumps

FLUID MECHANICS:

1. Determination of Darcy's friction factor
2. Calibration of flow meters
3. Flow over notches
4. Determination of minor losses in pipes

FLUID MACHINERY:

1. Performance of Centrifugal pump
2. Performance of Submersible pump
3. Performance of Jet pump
4. Load test on Francis turbine

Text Books

1. Modi, P.N. and Seth, S.M., "Fluid Mechanics & Fluid Machines", Standard Book House, New Delhi, 2007.
2. Rajput, R.K., "A Text Book of Fluid Mechanics and Hydraulic Machines", S.Chand and Co., New Delhi, 1998.

Reference Books

1. Som, S.R, & Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Co., 1998.
2. Agarwal, S.K., "Fluid Mechanics and Machinery", Tata Mc Graw Hill Co., 1997.

12CE257 INTELLIGENT BUILDINGS

Credits: 3:0:0

Course Objective

- To provide knowledge on the underlying concepts of intelligent buildings
- To provide the working principles of building automation systems, office automation systems, and communication systems
- To provide basic knowledge of the construction and installation of the structured cabling system enabling integrated system connections

Course Outcome

- Students enabled to understand and construct automated buildings

Unit I

INTRODUCTION: Introduction to Intelligent buildings - Basic concepts – Intelligent building automation - Building automation system - Cost analysis of intelligent buildings – Introduction to smart materials.

Unit II

HEATING VENTILATION AND AIR CONDITIONING: Introduction - Human comfort - Comfort air-conditioning - Classification - Air conditioning systems - Electrical installations and illumination - Introduction, terminologies in electrical power engineering - Electrical power transmission to buildings - Electrical power quality in buildings - Lighting systems in buildings.

Unit III

FIRE PROTECTION SYSTEMS: Introduction - Type of fire service installations - Automatic fire alarm detection – Sprinklers - Hose reels hydrants - Foam systems -Microprocessor based alarm.

Unit IV

SECURITY AND SAFETY SYSTEMS: Introduction - Designing a security system - Intrusion sensors and space sensors - Closed circuit television system - Central alarm systems – Health monitoring systems.

Unit V

BUILDING ELECTRONICS: Introduction - Microprocessor based control - Programmable logic controller – Communication principles - Telephone systems - Communal aerial broadcasting - Satellite communication - Fibre optic system.

Text Books

1. Shengwei Wang, "Intelligent Buildings and Building Automation", Spon Press, London, 2009.
2. Derek Clements Croome, "Intelligent Building Design, Management and Operations", Thomas Telford Publishing, London, 2004.

Reference Books

1. Albert Ting –pat So wai Lok Chan, "Intelligent Building Systems", Kluwer Academic Publisher, U.S.A, 1999.
2. Ehrlich, C., "Intelligent Building Dictionary: Terminology for Smart, Integrated, Green Building Design, Construction, and Management" San Francisco, Calif: Hands-on-Guide, 2007.
3. Michael Wigginton, Jude Harris, "Intelligent Skins", Architectural Press, Burfington, 2003.

References

1. www.ieindia.org
2. www.koetterfire.com
3. www.informit.com

12CE258 GEOGRAPHICAL INFORMATION SYSTEM

Credits: 3:0:0

Course Objectives

- To introduce the concepts of GIS, Spatial Analysis DEM and DTM
- To introduce the concepts of Remote Sensing
- To impart knowledge on application of GIS for land information system, water resources management, environmental analysis, Network analysis and urban sprawl analysis

Course Outcome

- Students enabled to apply GIS concepts in various aspects of Civil Engineering

Unit I

INTRODUCTION: Definition – Map and map analysis, - Automated Cartography - History and development of GIS - Hardware requirement - System concepts - Coordinate concepts - Standard packages.

Unit II

DATA ENTRY, STORAGE AND MAINTENANCE: Type of data - Spatial and non spatial data - Data structure - Points, lines, polygon - Vector and raster - Files, file organization – Database - Digitiser, scanner - Dbase files and data formats – Data compression.

Unit III

DATA ANALYSIS AND MODELLING: Spatial Analysis - Data retrieval - Query, simple analysis - Recode, overlay - Vector data analysis, raster data analysis - Modelling in GIS - Digital Elevation Model – DTM - Artificial intelligence - Expert system.

Unit IV

DATA OUTPUT AND ANALYSIS: Types of output data - Display on screen, printer and other output devices - Sources of errors - Types of errors - Elimination, accuracies

Unit V

GIS APPLICATION: Application areas - Case studies will be down load from internet, Water resources management - Environmental analysis - Network analysis - Remote sensing applications - Monitoring of urban sprawl - Cadastral record and LIS

Text Books

1. Peter, A. Burrough, "Principle of Geographical Information System" ,Oxford University Press,2000
2. Thomas M. Lillisand, "Remote Sensing and Image Interpretation", Wiley India (p) Ltd., 2007.

Reference Books

1. Ian Heywood, “An introduction to Geographical Information systems”, Pearson Education Limited, 2003.
2. M.Anji Reddy, “Textbook of Remote Sensing and Geographical Information Systems”, BS Publications, 2001.

12CE259 INDUSTRIAL WASTE TREATMENT AND DISPOSAL

Credits: 3:0:0

Course Objective

- To impart the knowledge about disposal of effluents and the standards for disposal
- To impart the knowledge about biological treatment methods and advanced treatment methods

Course Outcome

- Students understood the methods and standards of disposal of effluents
- Students gained knowledge about the implementation of biological treatment methods and advanced treatment methods

Unit I
DISPOSAL EFFECTS ON ENVIRONMENT: Effects of industrial wastes on streams, land, air - Wastewater treatment plants - Water quality criteria. Effluent standards - Process modification - Bioassay studies – Environmental legislation
Pollutants Reduction: Waste minimisation - House keeping - Volume and strength reduction - Material and process modifications - recycle, reuse and by-product recovery - Environmental audit.

Unit II
EFFLUENT TREATMENT: Conventional methods of treatment and disposal of industrial wastes - Equalisation and Neutralisation - Separation of solids - Sedimentation and filtration - Coagulation and flocculation, absorption, chemical precipitation, chemical oxidation, Physiochemical treatment methods - Removal of dissolved impurities - Residue management - Combined treatment of industrial and municipal wastes.

Unit III
BIOLOGICAL TREATMENT METHODS: Principles and methods for removal of suspended impurities and organics – Aerobic and anaerobic decomposition of organic matter, Stabilization ponds, activated sludge process, Oxidation ditch.
Advanced Waste Water Treatment: Nitrogen removal – Phosphorous removal – Removal of refractory Organics – Removal of dissolved inorganic substances – Chemical precipitation – ion exchange – Reverse Osmosis – Electro dialysis.

Unit IV
INDUSTRIAL PROCESS AND WASTE TREATMENT-I: Manufacturing process, waste water characteristics, composition, effects and appropriate treatment - Flow sheets for chemical industries – Petro-chemical industries, Refineries, Pharmaceutical, Textiles – Apparel industries

– Metallurgical industries - Steel plants, mines – Power industries – Fertilizer plants – Cement industry.

Unit V

INDUSTRIAL PROCESS AND WASTE TREATMENT-II: Manufacturing process, waste water characteristics, composition effects and appropriate treatment flow sheets for Pulp and paper industry – Agro-industries, Sugar - Distilleries, Food processing industry – Meat packing, pickles, poultry dairy – Leather tanning.

Text Books

1. Rao, M.N. and Dutta, "Waste Water Treatment", Oxford and IBH Publishing Ltd., Calcutta, 2008.
2. Eckenfelder, W.W., "Industrial Waste Pollution Control", McGraw Hill Book Co., New Delhi, 2003.

Reference Books

1. Nemerow, N.L., "Theory and Principles of Industrial Waste Treatment, AdisonWesley, Reading Mass, 1993.

12CE260 INTRODUCTION TO ARCHITECTURE AND TOWN PLANNING

Credits: 3:0:0

Course Objective

- To impart a basic knowledge on architecture and town planning
- To enable the students to appreciate and practice the basic principles in architecture and town planning in their areas of engineering

Course Outcome

- Student understood the principles of architecture and town planning

Unit I

INTRODUCTION TO ARCHITECTURE: Definition of the term 'Architecture' – Brief history of architecture - Key factors influencing architecture of any region: Culture, climate, topography, building materials, economy and technology - Human scale in architecture - Space requirements for human activity.

Architectural Space, Mass and Time: Space and Mass - Visual and emotional effects of geometric forms and their derivatives – The sphere, cube, pyramid, cylinder and cone – Concept of time in architecture

Unit II

INTERIOR DESIGN: Principles of interior landscaping - Texture, height grouping and layout - Plant species – Specifications - Open office system - Industrial interiors and specialized interior space design - Styles of Interiors - Italian, English, French, Japanese styles - Exposure to eminent interior designer's works.

Unit III

LANDSCAPING: Concept of landscaping – Necessity – Study of trees, plants and shrubs for landscaping – Concepts of Green Building.

Unit IV

BASICS OF TOWN PLANNING: Town planning – Definition - Objective, necessity and principles adopted - Types of urban growth: their advantages and disadvantages - Town planning surveys: necessity, Objective and classification - Urban road patterns: types, specific advantages and disadvantages.

Unit V

LAND USE PLANNING: Scope and content of Master plan - Regional plan - Structure plan - Urban renewal - Planning standards for neighbourhood - Basic principles in planning various land uses: residential, commercial, industrial, and recreational – Introduction to town planning legislation.

Text Books

1. Rangwala,S.C., "Town Planning", Charotar Publishing House, Anand, Gujarat, 2007.
2. Gurcharan Singh & Jagdish Singh, "Building planning, Designing and Scheduling",Standard Publishers Distributors, Nai Sarak , Delhi 1999.

Reference Books

1. Hiraskar,G.K., "Fundamentals of Town Planning",Dhanpat Rai and Sons, Delhi, 2005.
2. Abir Bandyopadhyay, "Textbook of Town planning", Books and Allied publishers, Calcutta, 2000.
3. Francis D.K.Ching, "Architecture – Form, Space and Order", Van Nostrand Reinhold Company, NewYork,1979.
4. James Fergusson , "History of Indian and Eastern Architecture", Volume 1, General Books Publisher, London,2009
5. National Building Code 2005, Bureau of Indian Standards, New Delhi

References

1. www.spiritus-temporis.com
2. www.archone.tamu.edu
3. www.wisegeek.com

12CE261 WATERSHED MANAGEMENT

Credits: 3:0:0

Course Objective

- To make the student understand the processes leading to degradation of soil and aquatic ecosystems and implementation of conservation measures
- To achieve integrated and sustainable development of watersheds

Course Outcome

- Student gained knowledge about integrated and sustainable development of watersheds through soil erosion and conservation studies

Unit I

INTRODUCTION TO WATERSHED: Watershed delineation -Watershed development: definition and concepts, Objective and need - Integrated and multidisciplinary approach for watershed management.

Unit II

CHARACTERISTICS OF WATERSHED: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology - Socio-economic features.

Unit III

WATERSHED MANAGEMENT: Definition of watershed management – Factors affecting watershed management - Preparation of land drainage schemes - Types and design of surface drainage – Ground water recharge and development - Artificial recharge - Farm ponds - Percolation tanks.

Unit IV

SOIL CONSERVATION: Controlling soil erosion and soil salinity - Estimation of soil loss due to erosion: Universal Soil Loss Equation – Structural measures of soil conservation – Agronomic measures of soil conservation.

Unit V

WATER CONSERVATION AND HARVESTING: Types of water conservation and water harvesting structures for different types of catchments - Rainwater harvesting - Catchment and roof top harvesting - Harvesting structures - Soil moisture conservation - Check dams.

Text Books

1. Murthy, J.V.S., "Watershed Management", New Age International Publishers, New Delhi, 1998
2. Ghanshyam Das, "Hydrology and Soil Conservation Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi, 2000.
3. Tideman, E. M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996.

Reference Books

1. Thanh, N.C., Biswas, A.K., "Environmentally sound water management" UNEP, International Training Centre for Water Resources Management (ITCWRM), International Water Resources Association (IWRA) , Oxford University Press, Delhi, 1990
2. Suresh, R., "Soil and Water Conservation Engineering", Standard Publishing Distributors, New Delhi, 2000.
3. Newson, M., "Land, Water and Development: River Basin Systems and Their Sustainable Management", Routledge, London, 1992.
4. Young, G.J., Dooge, J.C.I and Rodda, J.C., "Global Water Resources Issues", Cambridge University Press, Cambridge, UK, 1994.

References

1. http://www.kerala.gov.in/keralcalljuly04/p17-19.pdf
2. http://megphed.gov.in/knowledge/RainwaterHarvest/Chap8.pdf
3. http://wgbis.ces.iisc.ernet.in/energy/paper/gis/gis.pdf
4. Indian Standard for Drinking Water as per BIS specifications -IS 10500-1991, Bureau
5. of Indian Standards, New Delhi.

12CE262 ENVIRONMENTAL IMPACT ASSESSMENT

Credits: 3:0:0

Course Objective

- To build capacity among students on EIA and to enable them to carry out environmental appraisal of project works
- To enable them to suggest alternate measures to avoid large scale adverse impacts on environment

Course Outcome

- Students built capacity to carry out environmental appraisal of project works
- Students enabled to manage large scale adverse impacts on environment

Unit I

INTRODUCTION: Definition and concept of environmental impact assessment - Environmental protection - Environmental policy and legislations - Acts on air and water pollution – Legislation for preservation of historical sites and archaelogical monuments - Factors for consideration in assessing environmental impact - Short term vs long term effects – Environmental impact due to natural hazards and climate change.

Unit II

SOCIAL AND ECONOMIC FACTORS: Social and economic impact analysis - Physical, cultural, archaeological and aesthetic considerations – Resettlement and Rehabilitation - Examples of types of social impact analysis.

Unit III

ASSESSMENT METHODS: Assessment methods – Rapid Impact Assessment - Checklist method – Matrix method – Environmental Impact Statement.

Unit IV

AIR QUALITY ASSESSMENT AND NOISE QUALITY ASSESSMENT: Air quality impact analysis - Air pollutants – Sources - Atmospheric interactions-Environmental impact - Assessment methodology - Case studies - Noise impact analysis - Effects of noise on people - Estimating transportation noise impact – Examples.

Unit V

WATER QUALITY ASSESSMENT: Water quality impact analysis - Water quality criteria and standards - Water quality impact caused by projects related to highways, power plants, agriculture and irrigation – Forest management - Vegetation and wild life.

Text Books

1. Anjaneyuku,Y. and Valli Manickam, “Environmental Impact Assessment Methodologies”, BS Publications, Hyderabad, 2007.
2. Sacrates, J. and Karthigarani, R., “Environmental Impact Assessment”, ABH Publishing Co., NewDelhi, 2008.

References Books

1. John G. Rau, David C. Wooten, “Environmental Impact Analysis Handbook”, Mc Graw Hill Book Company, New Delhi, 1980.
2. John Glasson, Riki Therivel and Andrew Chadwi, “Introduction to Environmental Impact Assessment”, 3rd Edition, Routledge, U.S.A., 2005.
3. Richard K. Morgan, “Environmental Impact Assessment Methodological Prospective”, Klumur Academic Publishers, 3rd Edition, 2002.
4. Parry, M.L., Canziani, O.F., Palutikof, J.P., Van der Linden, P.J. and Hanson, C.E., “Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change”, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2007.
5. Metz, B., Davidson, O.R., Bosch, P.R., Dave, R. and Meyer, L.A.“Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change”, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2007

References

1. www.eicinformation.org
2. www.gdrc.org/uem/eia.html

12CE263 FLUID MECHANICS AND MACHINERY

Credits: 3:1:0

Course Objective

- The purpose of this course is to learn the fluid properties and fundamentals of fluid statics and fluid flow
- To introduce the concepts of flow measurements and flow through pipes
- To impart the knowledge on pumps and turbines

Course Outcome

- Students built capacityto carry out flow measurements and flow through pipes
- Students learnt to operate and maintain the pumps and turbines

Unit I

FLUID PROPERTIES: Dimensions and Units – Density – Specific weight - Specific gravity – Viscosity – surface tension – Capillarity – Compressibility – Vapour pressure.

Fluid Statics: Pressure relation – Pascal’s law –Measurement of pressure – Manometers and gauges, Forces on plane and curved surfaces – Total pressure and centre of pressure.

Unit II :

EQUATIONS OF FLUID FLOW: Types of flow – Stream line – Stream tube – Control volume – Continuity equation – One dimensional and three dimensional flow – Velocity potential and stream function – Free and forced vortex flow – Energy equation – Euler's equation in one dimensional form – Bernoulli's equation.

Unit III

FLOW MEASUREMENTS: Orifices - Venturi meter – Orifice meter – Pitot tube – Weirs and Notches.

Flow Through Pipes: Loss of energy in pipes – Major energy loss - Minor energy losses – pipes in series and parallel – power transmission through pipes – Syphon – Water hammer (Definition)

Unit IV

PUMPS: Impulse momentum equation- Impact of Jets-plane and curved- stationary and moving plates - Positive displacement pumps - reciprocating pumps - operating principles -slip -indicator diagram - separation- air vessels - Centrifugal pumps - operation - velocity triangles - performance curves - Cavitation - Multi staging - Selection of pumps.

Unit V

TURBINES: Turbine classification - Working principles - Pelton wheel, Francis, Kaplan turbines – Velocity triangles - Similarity laws - Specific speed - Governing of turbines - Surge tanks - Miscellaneous pumps - Jet pump, Gear oil pump, submersible pump – Principle.

Text Books

1. Modi, P.N. & Seth, S.M., "A Text book of Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi, 2007.
2. Rajput, R.K., "A Text book of Fluid Mechanics and Hydraulic Machines" , S.Chand and Co., New Delhi,1998.

Reference Books

1. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2005.
2. Som,S.R, & Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, 1998.
3. Agarwal, S.K., "Fluid Mechanics and Machinery", Tata Mc Graw Hill Co., 1997.

12CE264 MECHANICS OF SOLIDS

Credits: 3:1:0

Course Objective

- To introduce the concepts of stress and strain
- To introduce the concepts of Shear force and Bending moment
- To introduce the concepts of deflection of beams

Course Outcome

- Students understood the concepts of Shear force and Bending moment
- Students built capacityto understand the deflection of beams

Unit I

SIMPLE STRESS AND STRAIN: Stresses and strain due to axial force - Hooke's law, factor of safety, stepped bars – Uniformly varying sections - Stresses in composite bars due to axial force and temperature - Strain energy due to axial force, stresses due to sudden loads and impact - Lateral strain: Poisson's ratio - Change in volume – Shear stress - Shear strain - Relationship between elastic constants - Hoop and longitudinal stress in thin cylindrical and spherical shells subjected to internal pressure – Changes in dimensions and volume.

Unit II

SHEAR FORCE AND BENDING MOMENT: Relationship between loading - Shear force and bending moment - Shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to concentrated loads and uniformly distributed loads only - Maximum bending moment and point of contra flexure.

Unit III

BENDING STRESSES: Theory of simple bending and assumptions – Simple bending equation - Calculation of normal stresses due to flexure application. Leaf Springs – Strain Energy Due to Bending - Moment Torsion: Theory of torsion and assumptions – Torsion equation - Stresses and Deformation in Solid Circular and Hollow Shafts –Stepped Shafts – Composite Shaft – Stress due to combined bending and Torsion – Strain energy due to Torsion - Deformations and Stresses in Helical Springs.

Unit IV

PRINCIPAL STRESSES (TWO DIMENSIONAL): State of stress at a point, normal and tangential stresses on inclined planes - Principal stresses and their planes - Plane of maximum shear - Mohr's circle of stresses.

Theories Of Elastic Failure: Maximum principal stress theory – Maximum shear stress theory– Maximum principal strain theory – Strain energy theory - Mohr's theory – Simple problems.

Unit V

DEFLECTION OF BEAMS: Differential equation of elastic line - Deflection in statically determinate beams - Macaulay's method for prismatic members – Area moment method for stepped beams with concentrated loads. *Long columns:* Buckling of long columns due to axial load - Euler's and Rankine's formulae for columns of different end conditions.

Text Book

1. Ramamurtham, S., "Strength of Materials", Dhanpat Rai Publishing Co., New Delhi, 2008.

Reference Books

1. Popov, E.P., "Mechanics of Materials", Prentice Hall Inc., 1999
2. Andrew, P. and Singer, F.L., "Strength of Materials", Harper and Row Publishers, New York, 1987.

12CE265 STRENGTH OF MATERIALS LABORATORY

Credits: 0:0:1

Course Objective

- To apply the theory of mechanics of solids on real specimens
- To give hands on training on testing of real specimens

Course Outcome

- Students enabled to demonstrate the application of theories
- Built capacity to determine experimental parameters

1. Tension test on mild steel
2. Double shear test on mild steel
3. Torsion test on rod
4. Torsion test on thin wire
5. Brinell, Rockwell and Vicker's Hardness tests
6. Charpy and Izod Impact test
7. Cold bend test
8. Tension, Compression (Parallel as well as perpendicular to the grains) and impact tests on timber specimens.
9. Test on springs (Both closed coil and open coiled springs)
10. Deflection tests on timber and steel beams
11. Studies on Fatigue test
12. Test on Bricks

Text Books

1. Bansal, R. K, "Strength of Materials", Laxmi Publications (P). Ltd., 2007.
2. Rajput, R. K, "Strength of Materials", S Chand & Co., 2007.

Reference Books

1. Jindal, U.C, " Strength of Materials", Asian Books Pvt. Ltd., 2004.
2. Timeshenko, S.P. & Young, D.H., "Elements of Strength of Materials, 5th Edition, Affiliated East-West Press Pvt. Ltd. New Delhi, 1998.
3. Bedi, D.S., "Strength of Materials", Khanna Book Publishing Co. (P) Ltd., Delhi, 2000.

12CE301 COMPUTER AIDED METHODS OF STRUCTURAL ANALYSIS

Credits: 3:1:0

Course Objective

- To familiarize the student with two and three-dimensional structures including the programming aspects
- To introduce the matrix force and matrix displacement methods
- To develop the expert system for preliminary modeling and process

Course Outcome

- Student enabled to analyze the structures using flexibility and stiffness method

Unit I

CONCEPTS OF FORCE AND DISPLACEMENT METHOD: Introduction - Generalized and constraint coordinates - Transformation of forces and displacements -–Analogy between flexibility and stiffness.

Force Method (Flexibility): Choice of redundant - Formulation of flexibility matrix - Thermal expansion – Lack of fit - Application to pin jointed plane and space trusses - Continuous beams, single storied rigid frames and grids.

Unit II

DISPLACEMENT METHOD (STIFFNESS): Kinematic indeterminacy - Formulation of stiffness matrix - Thermal expansion - Lack of fit - Application to pin jointed plane and space trusses – Continuous beams - frames and grids.

Unit III

DISPLACEMENT METHOD (LARGE STRUCTURES): Static condensation technique - Substructure technique - Transfer matrix method – Symmetry and anti-symmetry of structures - Reanalysis technique - Analysis of non-prismatic members.

Unit IV

INTRODUCTION TO FINITE ELEMENT: Discrete system - Direct stiffness approach - Application to plane and space trusses - Plane frames – Grids.

Unit V

CLASSICAL THEORY OF PLATES: Differential equation of laterally loaded and thin rectangular plates - Levy and Navier's solution of plates - small deflection theory of plates - Analysis of laterally loaded (concentrically loaded) circular, thin plates with simply supported or clamped edges.

Text Books

1. Rajasekaran, S., and Sankara Subramanian, G., "Computational Structural Mechanics", Prentice Hall of India, 2001.
2. Ramaswamy, G.S., "Design and Construction of Concrete Shell Roofs", Revised edn.
3. R.E.Kriegger, Malabar, Florida, 1984.

Reference Books

1. Manickaselvam,V.K., "Elements of Matrix Analysis of Structures and Stability", 5thedn., Khanna Publishers, Delhi, 2001.
2. Vaidhyanathan and Perumal, P., "Comprehensive Structural Analysis Vol I & II", Lakshmi Publications, Delhi, 2004.
3. Meghre, A.S and Deshmukh, S.K., "Matrix Methods of Structural Analysis", Chortar Publishers, 2003.
4. Pandit, G.S. and Gupta, S.P., "Structural Analysis", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.
5. Rubinstein, M. F., "Matrix Computer Analysis," Prentice Hall, New Delhi, 1966.

12CE302 APPLIED ELASTICITY AND PLASTICITY

Credits: 3:1:0

Course Objective

- To study the classical theory of linear elasticity for two and three dimensional state of stress and obtain solutions for selected problems in rectangular and polar coordinates as well as torsion of prismatic bars
- To understand the plastic stress-strain relations, criteria of yielding and elasto-plastic problems

Course Outcome

- Students enabled to apply the concept of advanced structural mechanics
- Students capacitated to study the real time behaviour of structures in elastic and plastic limit

Unit I

ANALYSIS OF STRESS AND STRAIN IN CARTESIAN COORDINATES: Analysis of stress (two and three dimension) - Body force, surface forces - Uniform state of stress - Principal stresses - Stress transformation laws - Differential equations of equilibrium - Analysis of strain (two and three dimension) - Strain displacement relations – Compatibility equations - State of strain at a point - Strain transformations - Principal strain - Principle of superposition - Stress-strain relations - Generalized Hooke's law - Lame's constants.

Unit II

FORMULATION OF ELASTICITY PROBLEMS: Methods of formulation of elasticity problems - Equilibrium equations in terms of displacements - Compatibility equations in terms of stresses - Boundary value problems - St.Venant principle.

Two Dimensional Problems in Cartesian Coordinates: Plane stress and plane strain problems - Airy's stress function - Polynomials -Application to: bending of a cantilever loaded at end, bending of a beam by uniform load, bending of a cantilever with a moment at the end.

Unit III

TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES: General equations in polar coordinates - Stress distribution symmetrical about an axis - Pure bending of curved bars - Strain components in polar coordinates - Rotating disc - Bending of a curved bar by force at the end - Effect of circular hole on stress distribution - Concentrated force at a point of a straight boundary - Forces on wedges - Circular disc with diametric loading.

Unit IV

TORSION OF PRISMATIC BARS: General solutions of the problem by displacement (St. Venant's warping function) and force (Prandtl's stress function) approaches - Membrane analogy - Torsion of shafts of circular and noncircular (elliptic, triangular and rectangular) cross sectional shapes - Torsion of thin rectangular section and hollow thin walled single and multicelled sections.

Unit V

INTRODUCTION TO PLASTICITY: Yield criteria – Rankine's theory - St.Venant's theory - Tresca's criterion - Beltrami theory - Von-Mises criterion; Stress-space representation of Von-

Mises and Tresca yield criteria through Westergard stress space - Elasto-Plastic problems - Beams in bending - Thick hollow cylinders subjected to internal pressure - Torsion of bar of circular cross section - Nadai's sand heap analogy.

Text Books

1. Sadhu Singh., "Theory of Elasticity", Khanna Publishers, N.Delhi, 1995.
2. Sadhu Singh., "Theory of Plasticity", Khanna Publishers, N.Delhi, 1995.
3. Timoshenko, S and Goodier, J.N, "Theory of Elasticity", Mc Graw Hill Book Co., 1970.

Reference Books

1. Chow, P.C and Pagano, N.J., "Elasticity, Tensor, Dyadic and Engineering approaches", D.Vannostrard Co., New York, 1968.
2. Timoshenko, S. and Goodier, J.N., "Theory of Elasticity", Mc Graw Hill Book Co., New Delhi, 1970.
3. Chakrabarthy, T., "Theory of Plasticity", Mc Graw Hill Book Co., New Delhi, 1988.
4. Mendelson, A., "Plasticity - Theory and Applications", MacMillan Co., New York, 1968.

12CE303 ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES

Credits:3:1:0

Course Objective

- To study the behaviour, analysis and design of R.C. structures
- To learn to design the miscellaneous RCC structures like corbels, deep beams, folded plates, shells

Course Outcome

- Students learnt working stress, limit state and ultimate method
- Students capacitated to design of some important and special RC elements
- Students understood detailing requirements of RC elements clearly

Unit I

LIMIT STATE DESIGN OF BEAMS: Introduction to design methodologies - Working stress - Limit state - Ultimate load theory - Limit state of collapse – Flexure – Shear - Torsion - Bond, anchorage and splicing of reinforcement - Limit state of serviceability for bending members – Deflection - Crack width.

Unit II

DESIGN OF FLAT SLABS: Introduction – Advantages - Action of flat slab - Code provision - Design of flat slab using equivalent frame method - Shear in flat slab: one way & two way - Shear due to unbalanced moment - Shear reinforcement design - Design of spandrel beams.

Unit III

DESIGN OF FOLDED PLATE AND SHELL STRUCTURES: Folded plates – Advantages - Structural behaviour - Code provision - Design of folded plates using beam methods and iteration method - Shell terminology – Classification - General specification - Design of concrete shell with circular directrix using membrane theory - Design of circular and cylindrical shell using beam theory.

Unit IV

DESIGN OF MISCELLANEOUS / SPECIAL STRUCTURES: Design of square bunkers and cylindrical silo - Design of deep beams & corbels - Code provision - Approximate analysis and design of grid floors – Introduction to Chimneys.

Unit V

INELASTIC BEHAVIOUR OF REINFORCED CONCRETE BEAMS: Introduction – Inelastic behaviour – Stress-strain characteristics of concrete – Moment curvature relation - Concept of plastic hinges – Moment redistribution – Conditions – Moment redistribution of continuous beam.

Text Books

1. Varghese, P.C., "Advanced Reinforced Concrete Structures", Prentice Hall of India Ltd., New Delhi, 2003.
2. Krishnaraju, N., "Advanced Reinforced Concrete Design", CBS Publications, New Delhi, 2005.
3. Varghese, P.C., "Limit state design of RCC structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.
4. Timoshenko, S. "Theory of Plates and Shells", McGraw Hill Book Co., New York, 1990.

Reference Books

1. Mark Fintel, "Hand book of Concrete Engineering, Reinhold, New York, 1995.
2. Bhavikatti, S.S., "Advanced RCC Design", New Age International Pvt Ltd., New Delhi, 2006.
3. Purushothaman, P., "Reinforced Concrete Structural Elements: Behaviour, Analysis and Design", Tata McGraw Hill, New Delhi, 1986.

12CE304 ADVANCED DESIGN OF STEEL STRUCTURES

Credits: 3:1:0

Course Objective

- To design beams and beam columns subjected to biaxial bending
- To have knowledge about complete design of an Industrial building
- To learn about the design of connections in steel buildings
- To learn the concepts of plastic analysis in design of steel structures

Course Outcome

- Student enabled to design steel beams, columns, trusses providing the connection details

Unit I

DESIGN OF CONNECTIONS: Introduction to IS 800-2007 – General design requirements - Limit state design

Welded Connection: Introduction – Classification - Stresses in fillet and butt weld – Code provisions - Design of connections - Welded stiffened seat connection - Welded unstiffened seat connection

Bolted Connection: Design strength of bolts - High strength friction grip bolts - Code provisions bolted seat connection.

Unit II

LIMIT STATE DESIGN OF BEAMS AND BEAM COLUMNS: Design of Beams subjected to biaxial bending moment - Design of sections subjected to unsymmetrical bending - Elastic lateral torsional buckling

Beam Columns: Short beam columns - long beam columns – beam columns at ultimate Load - Effects of slenderness ratio and axial force on modes of failure – Beam column under biaxial bending.

Unit III

INDUSTRIAL BUILDING: Review of loads on structures - Dead, Live, Wind and Seismic loads as per National Standard - Analysis and Design of Industrial buildings and bents - Sway and non-sway frames - Design of Purlin - Analysis and design of Gable frames.

Unit IV

TOWERS & LIGHT GAUGE STEEL SECTIONS: Types of towers - Structural Configurations - Types of bracing patterns - Transmission Towers - Loads on Towers - Wind Load – Analysis of Microwave towers.

Light Gauge Steel Sections: Introduction – Forms of light gauge sections – concepts - Design of stiffened and unstiffened beams - Design of stiffened and unstiffened columns.

Unit V

PLASTIC THEORY : Introduction - Shape factor – Moment redistribution – upper bound, lower bound and Uniqueness theorems - Combined mechanism - Analysis of single bay and two bay portal frames - Methods of plastic moment distribution - Design of continuous beams and portal frames.

Text Books

1. Subramanian, N., “Design of Steel Structures” - Oxford University Press, USA, 2008.
2. Duggal, S.K., “Limit state design of steel structures”, Tata McGraw Hill Education Private Limited, New Delhi, 2009.

Reference Books

1. Punmia, B.C., Ashok kumar Jain and Arun kumar Jain, “Design of Steel Structures”, Arihant Publications, Bombay, 2008.
2. Gray,C.S., Kent, L.E., Mitchell, W.A., and Godfey, W.B., "Steel Designer's manual", English Language Book Society and Granade Publishing, London, 2003.
3. Teaching Resource Materials on Steel – SERC, INSDAG, Anna University and IIT Madras.

12CE305 STRUCTURAL DYNAMICS

Credits: 3:1:0

Course Objectives

- To impart knowledge on the basic principles of free and forced vibration (both undamped and damped) of single degree of freedom and multiple degree of freedom systems as well as distributed parameter systems
- To introduce the basic principles of structural dynamics and the solution techniques for free and forced vibration analysis of building frames subjected to dynamic loads

Course Outcome

- Students enabled to carry out vibration studies and their importance to structural engineering problems
- Students learnt to analyze multi storied buildings subjected to dynamic Loads

Unit I

INTRODUCTION TO PRINCIPLES OF DYNAMICS: Vibration studies and their importance to structural engineering problems - Elements of vibratory systems and simple harmonic motion - Vibration with and without damping - Constraints - Generalized mass - D'Alembert's principle - Hamilton's principle - Lagrange equations - Coupling.

Single Degree of Freedom: Degree of freedom - Equation of motion for S.D.O.F. - Damped and undamped free vibrations - Undamped forced vibration - Critical damping - Logarithmic decrement - Response to support motion - Response of one degree freedom system to harmonic excitation, damped or undamped - Evaluation of damping resonance - Band width method to evaluate damping - Force transmitted to foundation - Vibration isolation.

Unit II

RESPONSE TO GENERAL DYNAMIC LOADING: Fourier series expression for loading - Response to general dynamic loading (blast or earthquake) - Duhamel's integral - Numerical evaluation.

Unit III

DISTRIBUTED PARAMETER SYSTEM: Expression for generalized system - Properties – Vibrational analysis with Rayleigh's variational method - Rayleigh-Ritz method - Differential equation of motion - Analysis of undamped free vibration of simply supported and cantilever beams - Effect of axial loads - Numerical evaluation of modes – Frequencies and response spectrum

Unit IV

MULTI DEGREE FREEDOM SYSTEM: Mathematical model of MDOF system - Free vibration of undamped MDOF systems - Natural frequencies and mode shapes – Orthogonality conditions.

Solution of the Eigen Value Problem: Vector interaction methods - Stodala and subspace iteration techniques - Transformation methods - Jacobi and Given's method - Frequency search methods - Holzer method, Transfer matrix methods and Dunkerlay's equation - Rayleigh-Ritz methods.

Unit V

ANALYSIS OF MULTI STORIED BUILDINGS SUBJECTED TO DYNAMIC LOADS: Idealisation of multi-storeyed building frames for dynamic analysis - Shear buildings – Stiffness - flexibility and mass matrices - Free and forced vibration with and without damping.

Solution for Equilibrium Equations: Introduction - Direct integration methods - Central difference method - Houbolt method - Wilson-θ-method - Newmark method.

Text Books

1. Clough, R.,W., and Penzien, "Dynamics of Structures", McGraw Hill Book Co Ltd, 1986.
2. Paz Mario," Structural Dynamics - Theory and Computation", CBS publishers, US, 1999.

Reference Books

1. Craig, R.R., "Structural Dynamics - An Introduction to Computer Methods", John Wiley
   and Sons, UK, 1989.
2. Hurty, W.C and Rubinstein, M.F., "Dynamics of Structures", Prentice Hall, 1967.
3. Biggs, M., "Introduction to Structural Dynamics", McGraw-Hill, Co., New Delhi, 1964.
4. Thomson, W.T., "Theory of Vibration", Prentice Hall of India, 1975.
5. Manickaselvam, V.K., "Elementary Structural Dynamics", Dhanpat Rai and Sons, New Delhi, 1987.

12CE306 ADVANCED CONCRETE TECHNOLOGY

Credits: 4:0:0

Course Objective

- To impart thorough knowledge on advanced types of concrete used for varies types of structures.
- To make them understand the durability and other properties of concrete.
- To introduce the concept in rehabilitation of concrete structures.

Course Outcome

- Students enabled to design a concrete mix.
- Students understood the behavior and properties of concrete, durability aspects of concrete and Special concretes

Unit I

MATERIALS FOR MAKING CONCRETE:

Cement: Composition and properties of Portland cement - Tests on physical properties - Consistency - setting time - Soundness - Strength - Cements of different types - Composition – Properties and uses with special emphasis for different constructional and weather conditions – IS code specifications.

Aggregates: Classification - Mechanical properties - Deleterious substances in aggregates - Bulking of sand - Alkali aggregate reaction - Grading requirements - IS code specifications.

Water: Requirements of water for concrete making – IS code specifications.

Admixtures: Accelerators - Retarders - Water reducing agents - Plasticizers – Air entraining agents.

Unit II

FRESH AND HARDENED CONCRETE: Workability – Segregation - Bleeding - Process of concrete manufacturing – Mixing - Placing – Compaction – Curing - Finishing - Maturity of concrete - Evolution of heat and expansion - Factors affecting strength of concrete - Compression test - Split tension test - Flexure Test - IS code provisions - Accelerated strength tests - Stress strain characteristics - Determination of modulus of elasticity - Tests on durability - Permeability - Chemical attack - Sulphate attack - Quality of water - Marine atmosphere - Thermal properties of concrete - Fire resistance - Resistance to Abrasion and Cavitation - Acoustic properties – Fatigue - Creep - Methods to improve durability.

Unit III

MIX DESIGN: Basic considerations - Factors in the choice of mix proportions - ACI method, BIS method , UK and Australia code method of design mix - IS method – Rapid Method - Steps of design – Mix proportions for weigh batching and volume batching - correction for moisture content and bulking - yield of concrete - Design of high strength concrete mixes – Mix design with flyash.

Unit IV

SPECIAL CONCRETES: High strength concrete - High performance concrete - Addition of pozzolanic and mineral admixtures - High volume fly ash concrete (HVFA) - Lightweight concrete - Aerated concrete - No-fines concrete - High density concrete - Sulphur infiltrated concrete - Fiber reinforced concrete - Cold weathering concrete - Hot weathering concrete - Self-compacting concrete - Ready mix concrete - Pumped Concrete - Prepacked concrete - Vaccum concrete - Ferro cement - Bacterial concrete.

Unit V

DISTRESS AND ITS REMEDIAL MEASURES: Distress - Structural causes – Remedial measures – Repair techniques.

Text Books

1. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, UK, 2003.
2. Shetty, M.S., “Concrete Technology Theory and Practice”, S.Chand & Company, New Delhi, 2005.
3. Santhakumar, A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2006.

Reference Books

1. Gambhir, M.L., "Properties of Concrete", Longman Scientific & Technical, UK, 2001.
2. Viswanath, H.S., “Concrete Technology”, Sapna Book House (p) Ltd, 2007.

12CE307 STABILITY OF STRUCTURES

Credits: 3:1:0

Course Objective

- To understand the basic principles of stability and buckling

- To impart knowledge on equilibrium and energy approaches for the buckling of compression members and beam columns made of solid as well as thin walled open sections
- To understand the buckling behaviour of plates and shells and nonlinear theory of buckling

Course Outcome

1. Student enabled to apply the principles of stability for civil engineering structures

Unit I

INTRODUCTION AND ELASTIC BUCKLING: Concept - Stability criteria - Static and dynamic approach - Higher order differential equations - Various boundary conditions - Imperfections in approach - Initially bent column - Eccentrically loaded column - Large deflection of columns - Energy method - Rayleigh-Ritz method - Galerkin method - Effect of shear on buckling.

Unit II

INELASTIC BUCKLING: Double modulus theory (reduced modulus) - Tangent modulus theory - Shanley's theory - Determination of double modulus for various sections.
Beam Columns: Introduction - Beam-columns with concentrated lateral loads - Distributed loads - Effect of axial loads on bending stiffness - Stability of frames - Stability functions.

Unit III

LATERAL STABILITY OF BEAMS: Differential equations for lateral buckling - Lateral buckling of beams in pure bending - Lateral buckling of cantilever and simply supported I beams.
Buckling of Thin-Walled Open Sections: Introduction - Torsional buckling - Torsional flexural buckling - Equilibrium and energy approaches.

Unit IV

STABILITY OF PLATES: Governing differential equation - Equilibrium, energy concepts - Critical load of a plate uniformly compressed in one direction - Uniaxially compressed plate fixed along all edges - Critical load of plate in shear - Galerkin's method - Finite difference method - Post-buckling strength.

Unit V

BUCKLING OF SHELLS: Donnel's equation - Symmetrical buckling of cylinder under uniform axial compression - Cylinder under uniform external lateral pressure - Cylinder subjected to torsion.
Imperfection sensitivity: Perfect systems - Imperfect systems - Sensitive and insensitive systems - Symmetric and asymmetric bifurcation - Bifurcation and limit points - Path tracing - Point matching - Path switching.

Text Books

1 Chajes, A., "Principles of Structural Stability Theory", Prentice Hall, New Delhi, 1974.
2 Iyengar, N.G.R., "Elastic Stability of Structural Elements", Macmillan India Ltd., New Delhi, 2007.

Reference Books

1. Brush, D.O., and Almorth,B.O., " Buckling of Bars, Plates and Shells", McGrawHill, 1975.
2. Timoshenko, S.P., and Gere, J.M., "Theory of Elastic Stability", 2nd Ed. McGraw-Hill, 1961.
3. El Naschie, M.S., "Stress, Stability and Chaos in Structural Engineering: An Energy Approach", McGraw Hill International Editions, 1992.
4. Ashwini Kukar, "Stability of Structures ", Allied Publishers Limited, New Delhi, 1998.
5. Murali, L. Gambir, “Stability Analysis and Design of Structures”, Springer-Verlog, Berlin, 2004.

12CE308 FINITE ELEMENT METHODS IN ENGINEERING

Credits: 3:1:0

Course Objective

- To understand the basic concept of finite element and derive the shape functions for one, two, and three dimensional finite elements including plate and shell elements.
- To study the various finite element procedures and solution techniques for linear and nonlinear structures.

Course Outcome

- Student enabled to analyze the problems using finite element method.

Unit I

CONCEPTS OF FINITE ELEMENT: Boundary value problem - Element types - Variational principles - Method of weighted residual - Principle of virtual work - Rayleigh-Ritz method - Galerkin’s method of weighted residual - Energy principles - Displacement, stress and hybrid model - Convergence and compatibility requirements -Pascal’s triangle - Stiffness of an axial element - Two dimensional truss problem - Melosh criteria -Storage schemes.

Unit II

STRESS AND STRAIN ANALYSIS (TWO DIMENSIONAL): Triangular Elements - Constant strain triangle - Element stiffness matrix - Various Methods of evaluating element stiffness higher order triangular elements - comparison of different elements. Rectangular Elements - Serendipity family - Lagrangian family - Hermitian family - Sub-Iso-Super parametric elements - Shape function - Mapping - Linear iso-parametric quadrilateral.

Unit III

STRESS ANALYSIS (THREE DIMENSIONAL ELEMENTS): Numerical Integration using Gaussian Quadrature - Weights and gauss points - Selective and reduced integration - Axisymmetric stress analysis - Tetrahedron element family - Parallelepiped element - Hexahedron Element family - ZIB 8 and ZIB 20 elements.

Unit IV

PLATE/SHELL ELEMENTS AND FINITE STRIP METHOD: Triangular and rectangular elements - BFS Element - Faceted element for shells - Semi-loof elements - Degenerated shell elements - Axisymmetric shell elements - Finite strip method - Development of stiffness matrix and consistent load vector - Application to folded plates and bridge decks - Applications to reinforced concrete.

Unit V

MESHING AND SOLUTION PROBLEMS : Higher order elements - P and H methods of mesh refinement - Ill conditioned elements - Discretization errors – Auto and adaptive mesh generation techniques - Error evaluation.
Applications: Modeling and analysis using recent software's.

Text Book

1. Rajasekaran, S., "Finite Element Methods in Engineering Design", S.Chand & Co Ltd., New Delhi, 2003.

Reference Books

1. Chandrakant, S.Desai and John, F.Abel., "Introduction to the Finite Element method, A numerical Method for Engineering. Analysis", East West press Private Limited, Madras, 1972.
2. Tirupathi, R.Chandrupatla and Ashok, D. Belegundu., "Introduction to Finite Elements in Engineering", Prentice Hall of India Private Limited., New Delhi, 2004.
3. Krishnamoorthy, C.S., "Finite Element Method - Theory and Programming", Tata Mc Graw Hill Publishing Company", New Delhi, 1994.
4. Bathe, K.J., "Finite Element Procedure", Prentice Hall of India, New Delhi, 1997.
5. Zienkiewinz, O.C., "The Finite Element Method Vol. 1 & 2", Mc Graw Hill Book Company, New York, 1991.
6. Mukhopadhyay, M., "Matrix, Finite Element Computer and Structural Analysis", Oxford & IBH publishing Co., Pvt. Ltd. New Delhi, 1993.
7. Rajasekaran, S., "Numerical Methods in Science and Engineering - A practical approach", 2^{nd} Edn., A.H. Wheeler & Co., 1999.

12CE309 PRESTRESSED CONCRETE STRUCTURES

Credits: 3:1:0

Course Objective

- To understand the basic concepts of prestressing concrete structures
- To study the prestress design methods for various structures

Course Outcome

- Student enabled to design a prestress structure

Unit I

INTRODUCTION: Prestressing system - Analysis of prestress and bending stresses - Pressure line - Concept of load balancing - Losses of prestress.
Deflection: Short term deflections of uncracked members - Long term deflections - Deflection due to creep in members - Code requirements for the limit state of deflection - Factors influencing deflection.

Unit II

DESIGN FOR FLEXURE: Definition of Type I, Type II and Type III structures - Basic assumptions - Permissible stresses in steel and concrete as per IS:1343 Code - Four basic requirements - Design and choice of sections of post-tensioned beams - Layout of cables - Check for limit state of collapse - Location of positions of wires in pre-tensioned beams.
Design for Shear and Torsion: Shear and principal stresses - Limit state shearing resistance of cracked and uncracked sections - Design of shear reinforcement by the limit state approach - Interaction diagrams under combined bending, torsion and transverse shear.

Unit III
TRANSFER OF PRESTRESS: **Pretensioned members:** Transmission of prestressing force by bond - Transmission length - Factors affecting transmission length - Check for transmission length.
Post tensioned members: Anchorage zone stresses - Calculation of bearing stress and bursting tensile forces and reinforcement in anchorage zone based on I.S. 1343 code and Guyon's method.
Composite Construction of Prestressed & Insitu Concrete: Types of composite construction - Analysis for stresses - Effect of Differential shrinkage - Design for flexure and shear.

Unit IV
STATICALLY INDETERMINATE PRESTRESSED CONCRETE STRUCTURES: Methods of achieving continuity - Assumptions in elastic analysis - Pressure line – Linear transformation - Concordant cables - Guyon's theorem - Analysis and design of continuous beam.

Unit V
CIRCULAR PRESTRESSING: Liquid retaining tanks - Analysis for stresses - Design of tank wall incorporating the recommendations of IS:3370 Part III Code - Types of Prestressed concrete pipes - Design of pipes.
Other Structures: Methods of achieving partial prestressing - Advantages and disadvantages - Design of prestressed concrete columns and tension members - Design considerations of sleepers, poles, piles and pavements - Use of non-prestressed reinforcement - Methods of prestressing concrete shell structures.

Text Book
1. Krishna Raju, N., "Prestressed Concrete", 4th Tata McGraw Hill Publishing Company Ltd., New Delhi, 2007.

Reference Books

1. Sinha, N.C. and Roy, S.K.,“Fundamentals of Prestressed Concrete”, S.Chand and Co., 1998.
2. Lin.T.Y.,“Design of Prestressed Concrete Structures”, John Wiley and Sons Inc,1981.
3. Evans, R.H. and Bennett, E.W., “Prestressed Concrete”, Chapman and Hall, London, 1958.
4. Rajagopalan.N, “Prestressed Concrete”, Narosa Publications, New Delhi, 2008.

12CE310 DESIGN OF FOUNDATIONS

Credits: 3:1:0

Course Objective

- To study various types of shallow and deep foundations, sheet pile structures, cofferdams and marine structures.
- To study the design philosophy of various types of machine foundations and special foundations on expansive soils.

Course Outcome

- Students enabled to adopt the right choice of foundation
- Students gained knowledge to design foundation for different structures for different soil condition.

Unit I

NET LOAD INTENSITY FOR FOUNDATION DESIGN - SHALLOW AND DEEP FOUNDATIONS: Bearing capacity as a function of width - Settlement - Gross vs. Net load - Allowable soil pressure satisfying bearing capacity and settlement - Footings and rafts in clay and sand - Backfilled and compensated rafts - Introduction to soil-structure interaction - Displacement and replacement piles - Battered and tapered piles - Individual capacity - Group capacity - Group efficiency - Negative skin friction – Piers - Load tests - Dynamic formulae - Pile construction.

Unit II

BULKHEADS, COFFERDAMS AND CUT SUPPORTS: Cantilever sheet pile walls - Anchored bulkheads driven to free and fixed earth supports - Equivalent beam method – Anchorages - Sheet pile.
Cellular Cofferdams: Circular and diaphragm types - Stability analysis - Terzaghi's wedge theory for earth pressure on cut supports - Design pressure diagram for cut supports - Single wall braced cofferdams.
Design Software's pertaining to foundation. (For internal Assessment only)

Unit III

MACHINE FOUNDATIONS AND MARINE FOUNDATIONS : Simple harmonic motion - Degree of freedom - Natural frequency - Free and forced vibrations – Resonance - Damping - Soil Dynamics - Determination of soil parameters - Cyclic plate bearing test - Block vibration test - Types of machine foundations - Criteria for selection and design of machine foundations - Construction vibrations - Vibration isolation - Passive and active isolation - Earthquake geotechnics - Liquefaction.
Marine Substructures: Design loads – Wave action and wave pressure – Molitore-Gaillard equation – Wave pressure diagram.

Unit IV

FOUNDATIONS IN EXPANSIVE SOILS, FILLS AND ROCKS: Expansive clays - Spread of black cotton soils in India - Differential free swell test - Swelling pressure test - Under reamed piles in clays and sands - Load carrying capacities of under reamed piles - Construction of under reamed piles by manual tools - Placement and compaction of fills - Compaction control - Foundations on fills: rock quality designation - Foundations on un-weathered, jointed and weathered rocks.

Unit V

REINFORCED EARTH AND GROUND ANCHORS: Mechanics of reinforced Earth – Design - Materials for components - Construction - diaphragm walls - Bored pile walls - Prestressed ground anchors - Cut-and-cover metro construction - Stabilization with drilling mud - Direct and reverse mud circulation - Vibro-compaction by Vibrofloat - Stone Columns.

Text Books

1. Kurian, N.P.,", Design of Foundation Systems – Principles and Practices (3^{rd} rev. and enl. edn.)" Narosa Publishing House, New Delhi, 2005.
2. Kurian, N.P., "Modern Foundations – Introduction to Advanced Techniques," Tata McGraw-hill, 1982.

Reference Books

1. Venkataramaiah, C., "Geotechnical Engineering", 3^{rd} edn., New Age International (P) Limited, New Delhi, 2005.
2. Saran, S., "Analysis and Design of Substructures", Oxford and IBH, New Delhi, 1986.
3. Varghese, P.C., "Foundation Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi, 2005.
4. Peck, R.B., Hanson, W.E and Thornburn, T.H., "Foundation Engineering" 2^{nd}edn. Wiley Eastern Ltd., New Delhi, 1974.

12CE311 SEISMIC DESIGN OF STRUCTURES

Credits: 3:1:0

Course Objective

- To understand the basic concept of seismic design.
- To study the design methods for various structures.

Course Outcome

- tudent enabled to apply the concept earthquake resistant design.
- Student capacitated to evaluate the damage in earthquake affected areas.
- Students learnt to apply the methods of retrofitting in structures.

Unit I

ENGINEERING SEISMOLOGY: Introduction - Elastic rebound theory - Plate tectonics - Seismic waves - Seismic zones - Effects of earthquakes - Measurement of earthquakes: magnitude and intensity - Earthquake history - Catastrophic failures - Lessons learnt from past earthquakes - Design philosophy and methodology - Conceptual design considerations.

Unit II

INTRODUCTION TO EARTHQUAKE RESISTANT DESIGN: Basic elements of earthquake resistant design – Configurations - Design earthquake loads - Load combinations - permissible stresses - Seismic methods of analysis - Factors in seismic analysis - Local site effects – Torsion - Overturning moments - Earthquake resistant design methods - Behavior of R.C.Structures - Principles of earthquake resistant design - Modeling of RC building - Determination and design for lateral force (IS 1893-2002 part I) - Seismic analysis problems.

Unit III

REINFORCED CONCRETE BUILDINGS: Ductility consideration of earthquake design of RC buildings - Impact of ductility – Requirements - Assessment - Factors affects ductility - Ductile detailing and earthquake resistant design as per IS 13920-1993 and IS 456-2000 - Capacity based design - Step by step procedure - Behavior and design of shear wall in earthquake.

Unit IV

MASONRY STRUCTURES: Categories of masonry buildings (IS 4326:1993) - Behaviour of unreinforced, reinforced and infill walls - Improving the seismic behavior - Seismic design considerations- Seismic design of masonry buildings

Steel Structures (IS 800 – 2007): Seismic behaviour of steel structures - Design of steel structures - General considerations - Load and load combinations - Connections, joints and fasteners - Columns - Storey drift - Concentrically braced frames - Braced frames - Moment frames - Column bases.

Unit V

RESPONSE CONTROL CONCEPTS: Earthquake protective system - Base isolation - Energy dissipation system - Seismic test methods - Seismic evaluation – Methodology - Capacity demand method - Push over Analysis - Inelastic time history analysis.

Methods of Retrofitting: Global and local - Techniques of retrofitting.

Text Books

1. Pankaj Agarwal and Manish Shrinkhande., "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd., New Delhi, 2007.
2. Duggal, S.K., "Earthquake Resistant Design of Structures", Oxford University Press, New Delhi, 2007.

Reference Books

1. Chopra, A.K., "Dynamics of Structures - Theory and Applications to Earthquake Engineering", Prentice Hall of India private limited, New Delhi, 2002.
2. Taranath,B.S., "Structural Analysis and Design of Tall Buildings", McGraw-Hill book Company, New York, 1999.
3. Naeim, F., "The Seismic Design Hand Book", 2nd Edition, Kluwer academic publishers, London, 2001.
4. Steven, L.Kramer., "Geotechnical Earthquake Engineering", Prentice Hall of India Pvt Ltd., New Delhi, 2004.

12CE312 STRUCTURAL ENGINEERING LABORATORY

Credits: 0:0:2

Course Objective

- To impart basic knowledge on properties of building materials
- To impart knowledge on concrete mix design for low strength and high strength concrete
- To study the behaviour of fresh and hardened concrete, high performance concrete
- To impart knowledge on non-destructive testing

Course Outcome

- Student enabled to identify the suitable materials needed for concreting
- Student understood the behavior of concrete for different types of loading

1. Concrete Mix Design for M20 and M50 Grade
1.1 Indian Standard Method
1.2 ACI method
2. Study of properties of building materials
2.1 Tests on aggregates
2.1 Tests on cement
3. Study on testing methods of fresh concrete
3.1 Workability
3.2 Plasticizer dosage content
4. Study on testing methods of Hardened concrete
4.1 Determination of strength Parameter (Compressive, Tensile and Flexural strength)
4.2 Determination of modulus of elasticity of concrete
4.3 Determination of relationship between H/D ratios
5. Determination of impact strength of fiber reinforced concrete
6. Tests on high performance concrete
7. Effect of water used for curing on strength of concrete
8. Non-Destructive Testing of Concrete

Study Experiments

i) Tests on the behaviour and ultimate strength of Reinforced Concrete Beams, columns and beam column joints.
ii) Demonstration of prestressing operations
iii) Studies on Electrical Resistance Strain gauges using a Demonstration kit.

Text Books

1. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, England, 1990.
2. Neville, A.M., "Properties of Concrete", Longman Scientific & Technical, England, 1981.
3. Gambir, M.L., "Concrete Technology", Tata McGraw Hill, New Delhi, 2004.

Reference Books

1. Orchard, D.F., "Concrete Technology", Vols. 1 & 2, 1963.
2. Shetty, M.S., "Concrete Technology", S.Chand & Co., New Delhi, 1998.
3. Rixon, M.R., "Chemical Admixtures for Concrete", John Wiley & Sons, 1977.
4. Krishnaraju, N., "Design of concrete mixes", Sehgal Educational Consultants & Publishers Pvt.Ltd., Faridabad, 1988.

12CE313 ADVANCED DESIGN OF BRIDGES

Credits: 3:1:0

Course Objective

- To get exposed to the design aspects of various types of bridges
- To learn IRC specifications and Railway loading for the design of bridges
- To learn the design of reinforced concrete, prestressed bridges and steel bridges

- To learn the design concepts of substructure for the bridges

Course Outcome

- Student enabled to design concrete, steel and prestress bridges with substructures.

Unit I

DESIGN OF CONCRETE BRIDGES: Introduction - Loading standards: IRC and railway loadings - Analysis and design - Courbon's theory - Reinforced concrete slab bridge - T-beam Slab Bridge - Arch bridge - Critical studies of failure of major bridges.

Unit II

PRESTRESSED CONCRETE BRIDGES: Prestressed concrete bridges: simple spans, continuous decks, anchorage of tendons and grouting of tendons - Critical studies of failure of major bridges.

Unit III

STEEL BRIDGES: Steel Bridges - Simplified designs of super structure: plate girder, box girder, truss and arch - Principles of design - Cable stayed bridges - Suspension bridges - Aerodynamic stability and vibrations - Critical studies of failure of major bridges.

Unit IV

SUBSTRUCTURE AND FOUNDATIONS: Substructure design: piers and abutments of different types - Foundations: Shallow foundations, deep foundations, piles, wells and pneumatic caissons.

Unit V

CONSTRUCTION AND MAINTENANCE: Bearing: metallic and elastomeric types, fixed and movable bearings - Joints: expansion joints, Contraction joints, joint seals - Innovative construction methods: incremental push launching, cantilever construction and erection of precast elements - Bridge maintenance management: inventory, inspection and rehabilitation.

Text Book

1. Johnson Victor, D., "Essentials of Bridge Engineering", Oxford &IBH Publishing Co., New Delhi, Fourth Edition, 2007.

Reference Books

1. Raina, V.K., "Concrete Bridge Practice, Analysis, Design and Economics", Tata McGraw- Hills Publishing Company Limited.
2. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, New Delhi, 2007
3. Krishna Raju, N., "Design of Bridges", 3rd Edn., Oxford & IBH Publishing Co., New Delhi, 2007.
4. Jagadeesh, T.R and Jayaram, M.A., "Design of Bridge Structures", Prentice Hall of India Private Limited, New Delhi, 2007.

12CE314 MAINTENANCE AND REHABILITATION OF STRUCTURES

Credits: 4:0:0

Course Objective

- To get exposed to the repair and rehabilitation structures and structural elements
- To know the materials used for repair.
- To have a knowledge about the repair techniques

Course Outcome

- Student enabled to study the distress in structures, diagnosis the causes and rehabilitate them with suitable repair techniques.

Unit I

MAINTENANCE AND REPAIR STRATEGIES: Definitions: Maintenance, repair and rehabilitation - Facets of Maintenance - Importance of Maintenance - Quality Assurance and control - Structural appraisal : concrete, steel and masonry structures – Inspection - Strength evaluation of existing structures - Assessment procedure for evaluating a damaged structure - Nondestructive testing methods.

Unit II

DISTRESS AND ITS CAUSES: Distress monitoring - Causes for deterioration: Structural causes and Non Structural causes - Symptom, prevention and remedy - Classification of cracks - Visual examination of cracks - Evaluation of cracks - Distress in sub structure - Distress in super structure.

Influence on Serviceability and Durability: Effect on strength, permeability, thermal properties - Effects due to climate, temperature, chemicals and dampness - Effects of cover thickness - Error in design, construction and fabrication - Defects in joints in steel structures - Mechanism of Corrosion - Distress due to corrosion: Prevention and remedial measures.

Unit III

TECHNIQUES FOR REPAIR: Epoxy Injection – Stitching - Routing and sealing - External stressing – Blanketing – Overlays - Judicial neglect - Autogeneous healing – Jacketing - Polymer coating for rebars - Mortar and dry pack - Gunite and Shotcrete - Shoring and underpinning - plating - Cathodic protection - Miscellaneous methods.

Unit IV

REHABILITATION OF CONCRETE AND MASONRY DAMS: Foundation: loss of strength under repeated action, erosion and solution, ageing grout curtains and drains, sedimentation, leakage detection - Prevention and remedial measures – Super structure: chemical reaction resulting in swelling, shrinkage and creep effect, degradation and loss of strength due to repeated action, failures and repairing of joints - Dam during flood and earthquake - Instrumentation and monitoring of dams and reservoirs.

Unit V

RETROFITTING: Methods of retrofitting: global and local - Techniques of retrofitting.
Demolition of structures: Engineered demolition techniques for structures.

Text Books

1. Johnson, S.M., “Deterioration, Maintenance and Repair of Structures”, McGraw-Hill book company, New York, 1965.
2. Allen, R.T., and Edwards, S.C., “Repair of concrete structures”, Blake and Sons, UK, 1987.
3. Denison Campbell, Allen and Harold Roper, “Concrete structures - Materials, Maintenance and Repair”, Longman Scientific and technical, UK, 1991.
4. Deofferey, P .Sims, “The Rehabilitation of Dams and Reservoirs”, Brown &Root Services, UK.

Reference Books

1. Shetty, M.S., “Concrete Technology- Theory and Practice”, S. Chand and Company, New Delhi, 1992.
2. Gambhir, M.L., “Concrete Technology”, Tata McGraw Hill Publishing Company, New Delhi, 2004.

12CE315 ANALYSIS AND DESIGN OF PLATE AND SHELL STRUCTURES

Credits: 3:1:0

Course Objective

- To enable the student to understand the structural behavior of plates and shells
- To enable the student to analyze and design different types of shells and folded plates

Course Outcome

- Student enabled to analyze and design shells and folded plate roofs

Unit I

CLASSICAL THEORY OF PLATES: Differential equation of laterally loaded and thin rectangular plates - Levy and Naviers solution of plates - Small deflection theory of plates - Analysis of laterally loaded (concentrically loaded) plates: circular thin plates with simply supported or clamped edges.

Unit II

DESIGN OF FOLDED PLATE ROOF: Assumptions in the analysis of folded plates - Analysis of folded plate roof as per the ASCE task committee recommendations - Design steps - Minimum thickness and reinforcements as per IS specifications for RC folded plates.

Unit III

CLASSICAL THEORY OF SHELLS: Structural behavior of thin shells - Classification of shells: translational and rotational shells - Ruled surfaces - Methods of generating the surface of different shells: hyperbolic, paraboloid, elliptic paraboloids, conoids, etc. - Membrane theory of doubly curved shells - Edge disturbance.

Design of Shells with Double Curvature: Design of the following type of shells: spherical shell, conical shell, paraboloid and ellipsoid.

Unit IV

DESIGN OF CYLINDRICAL SHELLS: Design of R.C. cylindrical shell with edge beams using theory for long shells - Design of shell with ASCE manual coefficients - Prestressed cylindrical shells.

Unit V

DESIGN OF HYPERBOLIC PARABOLOID SHELLS: Surface definition - Determination of forces - Forces in the edge members - Buckling consideration -Design examples - Detailing of reinforcement.

Design of R.C North-light Shells: Analysis of stresses in north-light shells - Design examples

Text Books

1. Ramaswamy, G.S., “Design and Construction of Concrete Shell Roofs”, R.E.Kriegger, Malabar, Florida, 1984.
2. Timoshenko, S., “Theory of Plates and Shells”, McGraw Hill Book Co., New York, 1990.

Reference Books

1. Chatterjee, B.K., "Theory and design of concrete Shells", Oxford and IBH publishing co, 1971.
2. “Phase 1 - Report on Folded plate construction – Report of the Task Committee on Folded Plate Design – ASCE Structural Division” – Dec. 1963, pp 365 – 406.
3. Kelkar, V.S. and Sewell, R.T., "Fundamentals of Analysis and Design of Shell Structures", Prentice Hall, Inc., New Jersey, 1987.
4. “Design of Cylindrical concrete shell roofs", Manual of Engineering Practice No.31 ASCE, New York, 1952.
5. Billington, D.F., “Thin Shell Concrete Structures”, McGraw Hill Book Company, New York, 1965.

12CE316 COMPUTER AIDED STRUCTURAL ENGINEERING LABORATORY

Credits: 0:0:2

Course Objective

- To introduce the application of FEM in Software Packages
- To make the students to analyze and design various structural elements using STAAD Pro and ANSYS

Course Outcome

- Student capacitated to analyse and design RCC and steel structures by using STAAD Pro and ANSYS

A. Analysis and Design of Structures (STAAD Pro)

1. Analysis and design of 3D rigid jointed frames (static and dynamic loads)
2. Analysis and design of 3D pin jointed frames (static and dynamic loads)
3. Analysis and design of industrial building (static and dynamic loads)
4. Analysis and design of rcc bridges
5. Analysis and design of flat slab building systems
6. Analysis and design of shear wall building system

7. Analysis and design of raft footing

B. Finite Element Analysis of Structures (ANSYS)
1. Analysis of 2D and 3D beams
2. Analysis of 2D truss
3. Analysis of plates
4. Analysis of shells

C. Analysis and Design of Structures using SAP/ETABS – Demonstration only
1. Analysis and design of 3D rigid jointed frames (static and dynamic loads)
2. Push over analysis of rigid jointed frames

Reference Books

1. STAAD Pro 2007 V8i Analysis Reference Manual.
2. ANSYS 11.0 Analysis Reference Manual.
3. SAP Analysis Reference Manual – “Computers and structures”.

12CE 317 EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION

Credits: 3:1:0

Course Objective
- To have a knowledge on the advanced types of equipment used in lab and field
- To understand the testing methods of concrete
- To learn the principles of measurements of static and dynamic response of structures and carryout the analysis of results.

Course Outcome
- Students learnt the working principles of equipment and its application

UNIT I
FORCES AND STRAIN MEASUREMENT: Choice of experimental stress analysis methods - Errors in measurements - Strain gauge, principle: types, performance and uses - Photo elasticity: principle and applications – Principles and operation of universal testing machine (UTM) - Hydraulic jacks and pressure gauges - Electronic load cells - Proving rings - Calibration of testing machines - Long-term monitoring - Vibrating wire sensors - Fibre optic sensors - Demonstration of Moiré and stress freezing techniques.

UNIT II
VIBRATION MEASUREMENTS: Characteristics of structural vibrations – Transducers - Types - Linear Variable Differential Transformer (LVDT): working principles - Transducers for velocity and acceleration measurements - Vibration meter – Seismographs - Vibration analyzer - Display and recording of signals - Cathode Ray Oscilloscope - XY Plotter - Chart Plotters - Digital data acquisition systems.

UNIT III

ACOUSTICS AND WIND FLOW MEASURES: Principles of Pressure and flow measurements – Pressure transducers – Sound level meter – Venturimeter and flow meters – Wind tunnel and its use in structural analysis – Structural modeling – Direct and indirect model analysis – Load tests on actual structures - Load Testing of bridges – Tests to ensure dam safety.

UNIT IV

DISTRESS MEASUREMENTS AND CONTROL: Diagnosis of distress in structures – crack observation and measurements – corrosion of reinforcement in concrete – Half cell, construction and use – Controlled blasting for demolition – Techniques for residual stress measurements.

Tests on Beams and Structures: Modulus of rupture of plain beams – Slope and deflection of beams – Shear studies in RC beams – Creep test – Model analysis for concrete structures – Determination of reactions of a two hinged parabolic arch with variable moment of inertia.

UNIT V

NON DESTRUCTIVE TESTING METHODS : Load testing on structures, buildings, bridges and towers – Rebound Hammer – Penetration techniques - Pullout tests - acoustic emission – ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating, Advanced NDT methods: Ultrasonic pulse echo, Impact echo, impulse radar techniques, Ground penetrating radar (GPR) - Resonant frequency methods – Radio-active methods – Nuclear methods – Electrical methods. – Accelerated curing test.

Text Books

1. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 1996.
2. Dalley, J.W and Riley, W.F, "Experimental Stress Analysis", Mc Graw Hill Book Company, New York, 1991.
3. Srinath, L.S., Raghavan, M.R., Lingaiah,K., Gargesha,G., Pant,B and Ramachandra.K, "Experimental Stress Analysis", Tata McGraw Hill Company, New Delhi, 1984.
4. Sirohi, R.S., Radhakrishna, H.C., "Mechanical Measurements", New Age International (P) Ltd, 1997.
5. Bray, D.E. and Stanley, R.K., "Course Material on Non-destructive Evaluation", McGraw Hill Publishing Company, New York,1989.
6. Ganesan,T.P., "Model Analysis of Structures", University Press, India, 2000.

12CE318 THEORY OF PLATES

Credits: 3:1:0

Course Objective

- To enable the student to understand the fundamental concepts of plates
- To make the student analyze plate for different loading and different boundary conditions

Course Outcome

- Student enabled to analyze different types of plate

Unit I

INTRODUCTION: Thin and thick plates - Plate behavior - Material behavior - Isotropic and orthotropic Materials.

Small Deflection Theory and Classical Methods: Differential equation of plates in cartesian coordinates system - Boundary conditions - Rigorous solution - Naveir's method - Levy's method.

Unit II

SYMMETRICAL BENDING OF CIRCULAR PLATES: Differential equation for symmetrical bending of laterally loaded circular plates – Simply supported edges – clamped edges – circular plate with a circular hole at the center – circular plate concentrically loaded.

Unit III

APPROXIMATE METHODS: Energy method – Galerkins Method – Ritz Method – Simultaneous bending and stretching.

Numerical Methods: Finite difference method – Introduction to Finite Element Method.

Unit IV

PLATE OF OTHER SHAPES: Triangular plates – Elliptic plates – Sector plates – Skew plates – Plates on elastic foundation – Continuous plates.

Unit V

ADVANCED TOPICS: Large deflection theory - Shear deformation theories - Mindlin's theory of plates - Flat plates - Engineering approach to design of rectangular floor slabs.

Text Books

1. Rudolph Szilard., "Theory and Analysis of Plates", Prentice Hall, 1974.
2. Timoshenko and Krieger., "Theory of Plates and Shells", McGraw Hill Inc, New York, 2010.

Reference Books

1. Donnel, L.H., "Beams, Plates and Shells", McGraw Hill Inc, New York, 1976.
2. Mansfield., "The Bending and Stretching of Plates", Cambridge University Press, 2005.
3. Pucker,A., "Influence Surfaces of Elastic Plates". Wien, New York, Springer-Verlag, 1964.
4. Bairagi, N.K., "A Text Book of Plate Analysis", Khanna Publishers", New Delhi. 1986.

12CE319 MECHANICS OF COMPOSITE MATERIALS

Credits: 4:0:0

Course Objective

- To know the types of composite materials and its behaviour
- To understand the bending, torsion and vibration behaviour of composite concrete

Course Outcome

- Students enabled to understand the properties of composite materials, durability and application.
- Students capacitated to predict the actual behavior of composite structures.

Unit I

INTRODUCTION: Classification - Mechanical behaviour - Basic terminology – Manufacture -

Advantages.

Unit II

MICRO MECHANICAL BEHAVIOR OF A LAMINA: Determination of constants - Elasticity approach to stiffness - Comparison of approaches - Mechanics of material approach.

Unit III

MACRO MECHANICAL BEHAVIOR OF A LAMINA: Stress-Strain relation for anisotropic material - Engineering constants - Constitutive relation in plane stress - Lamina in arbitrary - Bi-axial strength theory.

Unit IV

MACRO MECHANICAL BEHAVIOR OF A LAMINATE: Equivalent single layer theory – Classical laminate theory – Continuum based theory – Laminate stiffness – Comparison – Strength of laminates - Stress design of laminates.

Failure Strength of Laminates: Delamination theory - Ply drops and failure theory – Tsai-Wu theory.

Unit V

BENDING, BUCKLING AND VIBRATION OF LAMINATE PLATES: Governing equations: bending, buckling and vibration – Design of simply supported plate under distributed lateral load – Buckling under in-plane load – Vibration of simply supported laminate plates.

Text Book

1. Jones, R.M., "Mechanics of Composite Materials II", McGraw Hill Kogukush International student's edition, 1975.

Reference Books

1. Bose, P., and Reddy, J.N., "Analysis of Composite plates using various plate theories – part I and II – formulation and analytical solution", Structural Engineering and Mechanics, Vol. No. 6 & 7, 1998.
2. Reddy, J.N., "Mechanics of Laminated Composite Plates", CRC Press, 1999.

12CE320 DESIGN OF STRUCTURES FOR DYNAMIC LOADS

Credits: 3:1:0

Course Objective

- To study the basic principles of dynamic loads
- To study the basic types of dynamic loads and its behavior on structures

Course Outcome

- Students enabled to study the analysis of multi storied buildings subjected to Dynamic Loads.

Unit I

INTRODUCTION: Dynamic loads - Factors affecting design – Behavior under impact and cyclic loads: concrete, steel, masonry and soil – Single degree of freedom system (SDOF), Multi degree of freedom system (MDOF) and continuum systems – Ductility and its importance.

Unit II
DESIGN AGAINST EARTHQUAKES: Earthquake characterization - Site amplification - Measurement of earthquakes and measurement parameters predictive relationship - Modification of earthquake due to the nature of soil - Peak ground acceleration - Response spectrum – Seismic coefficient and response spectra methods of estimating loads – Response of framed, braced frames and shear wall buildings.

Unit III
DESIGN AGAINST BLAST AND IMPACT: Characteristics of internal and external blast - Impact and impulse loads – Pressure distribution on buildings above ground due to external blast – Underground explosion - Design of buildings for blast and impact as per BIS code of practice.

Unit IV
DESIGN AGAINST WIND: Characteristics of wind – Basic and design wind speeds – Effect of permeability of structure – Pressure coefficient – Aero elastic and Aerodynamic effect - Design as per BIS code of practice including gust factor approach – Tall buildings, stacks and chimneys.

Unit V
SPECIAL CONSIDERATIONS: Energy absorption capacity – Ductility of material and the structure – Detailing for ductility – Passive and active control of vibrations – New and favorable materials.

Text Book
1. Bela Goschy, "Design of Buildings to withstand abnormal loading", Butterworth, 1990.

Reference Books
1. Paulay,T and Priestly, M.N.J., "A seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 1991.
2. Dowling, C.H., "Blast Vibration – Monitoring and Control", Prentice Hall Inc, Englewoods Cliffs, 1985.
3. Alan G. Daven Port, "Wind Effects on Buildings and Structures", Proceedings of the Jubileum Conference on Wind effects on Structures, Port Alegne, Brazil, pp 25-29, May 1998, Balkema A.A. Publishers, 1998.
4. "Concrete Structures Under Impact and Impulsive loading", Synthesis Report, CEB. Lousanne, Germany, 1988.

12CE321 DESIGN OF TALL BUILDINGS

Credits: 3:1:0

Course Objective
- To provide an insight to the modern techniques available for the analysis and design of tall buildings.

Course Outcome

- Student capacitated to performe analysis and design of tall buildings.

Unit I

DESIGN PRINCIPLES AND LOADING: Design philosophy – Materials: high performance, concrete, fibre reinforced Concrete, light weight concrete - Loading - Sequential loading – Gravity loading: dead and live load - Methods of live load reduction - Wind loading: Static and dynamic approach, analytical and wind tunnel experimental method - Earthquake loading – Equivalent lateral force – Combinations of loading.

Unit II

BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS: Factors affecting growth, height and structural form - High rise behavior: rigid frames, braced frames, infilled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, outrigger braced and hybrid mega systems.

Unit III

ANALYSIS AND DESIGN : Modeling for approximate analysis - Accurate analysis and reduction techniques - Analysis of buildings as total structural system considering overall integrity and major subsystem interaction - Analysis for member forces, drift and twist - Computerized general three dimensional analysis.

Unit IV

STRUCTURAL ELEMENTS: Sectional shapes - Properties and resisting capacity - Design - Deflection - Cracking – Pre-stressing - Shear flow - Design for differential movement - Creep and shrinkage effects -Temperature effects and fire resistance.

Unit V

STABILITY OF TALL BUILDINGS : Overall buckling analysis of frames - Wall-frames - Approximate methods - Second order effects of gravity of loading - P-Delta analysis - Simultaneous first-order and P-Delta analysis - Translational, torsional instability - Out of plumb effects - Stiffness of member in stability - Effect of foundation rotation.

Text Book

1. Bryan Stafford Smith and Alex Coull, "Tall Building Structures - Analysis and Design", John Wiley and Sons, Inc., 1991.

Reference Books

1. Taranath, B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill, 2011.
2. Coull, A. and Smith Staford, B. "Tall Buildings ", Pergamon Press, London, 1997.
3. Lynn, S.Beedle., "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi, 1996.

12CE322 DESIGN OF COMPOSITE STRUCTURES

Credits: 3:1:0

Course Objective

- To understand the behavior of steel concrete composite structures
- To design composite elements and structures
- To study the connections of composite structures

Course Outcome

- Student learnt to design steel concrete composite beams, columns, trusses with connection details

Unit I

INTRODUCTION : Introduction to steel - Concrete composite construction - Benefits of composite construction Introduction to IS, BS and Euro code provisions - Theory of composite structures - Elastic behaviour of composite beams - Ultimate load behaviour.

Unit II

DESIGN OF COMPOSITE BEAMS: Design of simply supported and continuous steel – Concrete composite beams with solid deck slabs and profiled deck slabs.

Unit III

DESIGN OF COMPOSITE TRUSSES AND COLUMNS: Behaviour and design of steel concrete composite trusses – Design of steel concrete columns.

Unit IV

DESIGN OF CONNECTIONS: Types of connections - Shear connections - Typical shear connectors and interaction with concrete – Tests for strength of shear connections - Design of connections in the composite structures.

Unit V

GENERAL: Seismic behaviour of composite structures – Case studies on steel-concrete composite construction in buildings and bridges.

Text Books

1. Johnson, R.P., "Composite Structures of Steel and Concrete", Blackwell Scientific Publications, UK, 2004.
2. Oehlers, D.J. and Bradford,M.A., "Composite Steel and Concrete Structural Members, Fundamental behaviour", Pergamon press, Oxford, 1995.

Reference Books

1. INSDAG., "Handbook on Composite Construction" – Multi-Storey Buildings, Institute for Steel Development and Growth Publishers, Calcutta, 1994.
2. INSDAG., "Design of Composite Truss for Building", Institute for Steel Development and Growth Publishers, Calcutta.
3. IS: 11384-1985., "Code of Practice for Composite Construction in Structural Steel and Concrete", Bureau of Indian Standards, New Delhi.
4. Appropriate IS, British and Euro Codes.

12CE323 DESIGN OF INDUSTRIAL STRUCTURES

Credits: 3:1:0

Course Objective

- To provide an insight to the modern techniques available for the analysis and design of industrial buildings

Course Outcome

- Student capacitated to perform the analysis and design of industrial buildings

Unit I

GENERAL: Classification of industries and industrial structures - Specific requirements for industries like engineering, textiles, chemicals, etc - Site layout and external facilities required.

Unit II

FUNCTIONAL REQUIREMENTS: Natural and artificial lighting: protection from the sun sky light – Services: electrical and wiring fixtures, cable and pipe bridge, electrical installations, substations, effluent disposal - Heating and ventilation: air conditioning, fire expanse and chutes, fire alarm, extinguishers and hydrants - Guidelines from factories act.

Unit III

INDUSTRIAL R.C. STRUCTURES: Design and detailing of R.C. gable frames, corbels, bunkers, silos and chimneys - North light shell roofs and folded plates - Cooling towers - Application of prefabrication techniques.

Unit IV

INDUSTRIAL STEEL STRUCTURES: Design of gantry girders, steel bunkers, silos and chimneys - High pressure boilers and piping design.

Unit V

MISCELLANEOUS: Design of nuclear containment structures - Design of power transmission structures: cables, transmission line towers - Substation structures - Tower foundations - Design of machine foundations.

Text Book

1. Proceedings of Advanced Course on Industrial Structures, Structural Engineering Research Centre, Madras, 1982.

Reference Books

1. Manohar, S.N., "Tall chimneys - Design and Construction", Tata Mc Graw Hill, 1985.
2. Santhakumar, A.R. and Murthy, S.S., "Transmission Line Structures", Tata Mc Graw Hill 1992.
3. Srinivasulu, P and Vaidyanathan, C., "Handbook of Machine Foundations", Tata

Mc Graw Hill 1976.
4. Jaikrishna and Jain, O.P., “Plain and Reinforced Concrete”, Vol-II, Nemchand and brothers, 1958.
5. Handbook on Fundamental Requirements of Industrial Buildings (Lighting and Ventilation), BIS.
6. Dayaratnam, P., "Design of Steel Structures", A.H. Wheeler & Co., Ltd., Allahabad, 1996.

12CE324 OPTIMIZATION OF STRUCTURES

Credits: 3:1:0

Course Objective

- To enable the student to understand the concept optimization
- To make them apply to different civil engineering problems

Course Outcome

- Student capacitated to apply optimization techniques and solve real time problems

Unit I

INTRODUCTION: Basic Concepts of minimum weight - Minimum cost design – Objective function, constraints.

Linear and Non-Linear Programming: Formulation of problems simplex method - Two phase method - Penalty method - Duality theory - Primal - Dual algorithm - Exhaustive and unrestricted search - Dichotomous search - Fibonacci method - Golden section method - Interpolation methods – Unconstrained optimization techniques.

Unit II

GEOMETRIC PROGRAMMING: Unconstrained and constrained problems with zero difficulty - Concept of solving problems with one degree of difficulty.

Dynamic Programming: Bellman’s principle of optimality - Representation of a multistage decision problem - Concept of sub-optimization problems using classical and tabular methods.

Unit III

GENETIC ALGORITHM: Genetic Algorithms – Operators – Reproduction – Mutation – Cross Over – Evolution Strategies – Methods for optimal design of structures, continuous beams and single storeyed frames – Minimum weight design for truss members.

Ant Colony Algorithm: Ant algorithm – Network – The ant – Initial population – Ant movement – Ant tours – Pheromone – Evaporation –Sample problem.

Unit IV

ARTIFICIAL NEURAL NETWORKS TO STRUCTURAL OPTIMIZATION: Basic concepts – Biological systems - Artificial neural network - Application characteristics - Overview of learning methods - Review of probability concepts.

Unit V

FUZZY LOGIC IN CIVIL ENGINEERING: Fuzzy set theory and logic – Fuzzy sets operation – Fuzzy relations - Membership function defuzzyfication - Fuzzy based rule systems – Applications.

Text Books

1. Rao, S.S., "Engineering Optimization, Theory and Practice", New Age International (p) Ltd., New Delhi, 2002.
2. Ross,T.J., "Fuzzy Logic with Engineering Applications", Mc.Graw Hill, 1995.
3. GoldBerg, D.E., "Genetic Algorithm in Search, Optimization and Machine Learning", Addison – Wesley, 1989.

Reference Books

1. Spunt, L., "Optimum Structural Design", Prentice Hall, New Jersey, 1971.
2. Gary Parker, R. and Ronald, L., "Discrete Optimization", Academic press 1988.
3. David Corns, Marco Dorigo and Fred Gloves, "New Ideas in Optimization", McGraw Hill Company, London, 1999.
4. Rajasekaran,S. and Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm", Prentice Hall of India Pvt. Ltd, Delhi, 2003.

12CE325 PREFABRICATED CONCRETE STRUCTURES

Credits: 4:0:0

Course Objective

- To know the prefabrication technique of various residential and industrial structures

Course Outcome

- Students learnt the prefabricated techniques of various components of residential building and industrial building

Unit I

INTRODUCTION: General principles of prefabrication - Types of prefabrication - Specific requirements for planning and layout of prefabrication plant - I.S.code specifications - Modular coordination - Transportation - Erection - Stages of loading and code provisions - Material properties - Deflection control - Lateral load resistance.

Unit II

FLOORS, STAIRS AND ROOFS: Types of floor slabs - Analysis and design of cored and panel types and two-way systems - Staircase slab system and design - Types of roof slabs and insulation requirements - Description of joints, their behaviour and reinforcement requirement - Short term and long term deflection control.

Unit III

WALLS: Types of wall panels - Blocks and large panels - Curtain, partition and load bearing walls - Load transfer from floor to wall panels - Vertical loads - Eccentricity and stability of wall panels - Design curves, types of wall joints, their behaviour and design - Leak prevention, joint sealant and sandwich wall panels.

Unit IV

MATERIALS AND ERECTION: Materials used in precast construction: types, properties, selection of materials - Erection and jointing - Joint design - Hoisting technology - Equipment for hoisting and erection - Techniques for erection of different types of members such as beams, slabs, wall panels and columns - Design for handling and erection stresses - Methods of minimizing erection stresses.

Unit V

PREFABRICATED ROOF FOR INDUSTRIAL SHEDS: Components of single storey industrial sheds with crane gantry systems – Behaviour of precast roof trusses, roof panels, crane-Gantry girders, corbels, columns and wind bracing - Joints between columns and foundations - Hand book based design of cylindrical and by par prefabricated shells - Folded plates.

Text Book

1. Lasslo Mokk, "Prefabricated concrete for Industrial and Public sectors", Akademiai Kiado, Budapest, 2004.

Reference Books

1. Kim Elliott, “Prefabricated concrete structures”, Butterworth-Heinemann, 2002.
2. Maurice Levitt, “Precast Concrete: Materials, Manufacture, Properties and Usage”, Taylor and Francis Group, 2007.

12CE326 DESIGN OF COASTAL AND OFFSHORE STRUCTURES

Credits: 4:0:0

Course Objective

- To learn the theories on wave motion
- To understand the behavior and design aspects of offshore structures

Course Outcome

- The student enabled to design offshore structures

Unit I

THEORIES OF PERIODIC WAVE MOTION: Small amplitude wave theory - Basic equations of hydrodynamics - Integration of equations of motion - Mathematical formulation of wave problem - Characteristics of small amplitude waves - Deep and shallow water waves - Wave energy - Group velocity of wave trains - Transformation of small amplitude waves - Reflection and deflection of waves breaking of wave and its importance.

Unit II

FORCES DUE TO OCEAN WAVES ON STRUCTURES: Finite amplitude wave theories - Wave forces on a circular cylinder - Coefficient of drag and inertia - Wave forces on breakwaters and sea walls due to non-breaking and broken waves - Wave forces on piles.

Unit III

SHORE PROTECTION WORKS: Sea walls and bulkheads - Groins - Offshore breakwaters - Artificial nourishment - Functional aspects of break waters - Design of breakwaters.

Unit IV

PIERS, WHARVES AND QUAYWALLS: General - Functional aspects - Design of wharves, piers and quay walls.

Unit V

OTHER STRUCTURES: Functional aspects and design of graving dry docks - Floating dry docks - Dolphins - Fenders - Offshore mooring buoys - Offshore marine platform.

Text Book

1. Keddy, D.V. and Arockiasamy, M., "Offshore Structures", Vol. I Krieger Publishing Company, Malabar, Florida, 1991.

Reference Books

1. Chakrabarti, S.K., "Hydrodynamics of Offshore Structures", Computational Mechanics Publications, 1987.
2. Thomas, H. Dawson., "Offshore Structural Engineering", Prentice Hall Inc., Englewood Cliffs, N.J.,1983.
3. API Recommended Practice, "Planning, Designing and Constructing Fixed Offshore Platforms", American Petroleum Institute Publication, RPZA, Dallas, 1999.
4. Wiegel, R.L., "Oceanographical Engineering", Prentice Hall Inc, Englewood Cliffs, N.J., 1964.
5. Brebia, C.A., and Walker, S., "Dynamic Analysis of Offshore structures", New-nest Butterworth, U.K.,1979.

12CE327 SPACE STRUCTURES

Credits: 4:0:0

Course Objective

- To understand the concept of space structures
- To understand the behaviour of space structures

Course Outcome

- The student enabled to design space structures

Unit I

INTRODUCTION: Space structures - Single and multi-layer grids - Barrel vaults – Domes - Towers - Tension structures - Pneumatic structures - Patterns - Notable structures in India and abroad – Material: steel, aluminum and plastics - Protection coats for the members.

Practical Construction Methods: Cladding - Cambering – Drainage - Transportation problem - Lifting technique corrosion protection - Maintenance and fire protection.

Unit II

BEHAVIOUR: Different forms of space structures - Tensegrity frame work - Tensile structures- Pneumatic structures

Prefabricated Space Structural Systems: Mero, Space deck, Nodus, Unistrut, Triodetic, Unibat and NS truss.

Unit III

NODE CONNECTORS: Mero - Octatube - Nodus system – Triodetic - Modular system - Tomo unit truss.

Unit IV

ANALYSIS: Finite element method - Linear – Nonlinear - Collapse - Dynamic and Stability analysis.

Design of Members: Joints - Support systems – Foundations.

Computer Aided Design: Expert system.

Unit V

CONFIGURATION PROCESSING: Formian Algebra - Case Studies - Failures.

Text Books

1. Makowski,Z.S., "Steel Space Structures", Michael Joseph Ltd., London, 1965.
2. Subramanian,N., "Principles of Space Structures", A.H.Wheeler co., 1983.

Reference Books

1. Nooshin,H., "Formex Configuration Processing in Structural Engineering", Elsevier Applied Science Publishers, London, 1984.
2. Proceedings of the First, Second, Third and Fourth International Conferences on Space Structures, University of Surrey, Guidford, England, 1975, 1985, 1993.
3. Davies,R.M., "Space Structures", Blackwell Scientific Publications, Oxford, 1967.

12CE328 CONSTRUCTION MANAGEMENT AND PROJECT MANAGEMENT

Credits: 4:0:0

Course Objective

- To understand the means of management of construction personnel
- To know the methods to adopt training as a tool for improvement
- To plan and complete the project within the stipulated time

Course Outcome

- Student enabled to apply the knowledge of management in construction

Unit I

PRINCIPLES OF MANAGEMENT: Definition - Importance - Functions of management - Relevance to Govt., Quasi Govt. departments - Private contractors - Contracting firms – Organization - Basic economic concepts - Economic decisions, fixed, variable costs - Break even analysis and chart pricing policies - Methods of evaluating capital expenditure - Probabilistic estimates.

Unit II

CIVIL ENGINEERING MANAGEMENT:

Construction Planning: Collection of field data - Preliminary estimates - Approval and sanction of estimates – Budget provision - Construction stages - Scheduling methods - progress reports and charts.

Resource Planning: Planning for materials, machines, men and organization - Resource allocation.

Labour And Labour Welfare: Relationship between management and labour - Labour problems - Labour legislation minimum wages act - Settlement of disputes - Industrial psychology.

Unit III

MANAGEMENT METHODS: Concepts of network - Network planning method - CPM/PERT - Management by network analysis and control - Principles of cost control - Control by graphical representation, by bill of quantities and by network analysis.

Unit IV

ORGANIZING PROJECT MANAGEMENT: Introduction - Trends in modern management - Strategic planning and project programming organization of project participants - Traditional Designer - Constructor sequence - Professional construction management: Owner-Builder Operation, turnkey operation - Leadership and motivation for the project team – Interpersonal behaviour in project organizations - Perception of owners and contractors - Innovation and technological feasibility - Innovation and economic feasibility - Construction Planning.

Unit V

LABOUR, MATERIAL, EQUIPMENT AND FINANCIAL MANAGEMENT: Factors affecting job-site productivity of labour – Labour relations in construction – Problems in collective bargaining – Materials procurement and delivery – Inventory control – Tradeoffs of costs in materials management – Construction equipment – Choice of equipment and standard production rates – Equipments for industrial construction and pre-fabrication - Type of construction cost estimates – Unit cost method of estimation – Application of cost indices to estimating – Estimate based on engineer's list of quantities allocation of construction costs over time – Estimation of operating costs – Computer aided cost estimation.

Text Books

1. Seetharaman, S., " Construction Engineering and Management", Umesh Publications, 2002.
2. Chitkara, K.K., "Construction Project Management", Tata McGraw Hill Co., New Delhi, 2003.

Reference Books

1. Chris Hendrickson and Tung Au., "Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000.
2. Chitkara, K.K., " Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 1998.
3. Frederick, E. Gould., "Construction Project Management", Wentworth Institute of Technology, 2000.
4. Choudhury, S., "Project Management", Tata McGraw-Hill Publishing Company, NewDelhi, 1988.
5. Ernest, E., Ludwig, "Applied Project Engineering and Management", Gulf Publishing Company, Houstan, Texas, 1988.
6. Harold Kerzner, "Project Management – A Systems Approach to Planning, Scheduling and Controlling", CBS Publishers & Distributors, Delhi, 1988.
7. Joy, P.K., "Total Project Management – The Indian Context", Macmillan India Ltd., New Delhi, 1992.

12CE329 HIGH PERFORMANCE CONCRETE

Credits: 4:0:0

Course Objective

- To understand the characteristics of high performance concrete
- To design high performance concrete mixes
- To understand the fire resistance of self-compacting concrete

Course Outcome

- Student enabled to understand the physical and mechanical properties of different types of concrete

Unit I

INTRODUCTION TO SELF COMPACTING CONCRETE: Self-compacting concrete – History – Definition - Applications of SCC - Advantages of SCC - Workability tests on fresh SCC - European guidelines on constituent materials, properties of SCC and mix design approach.

Unit II

CRACKS IN CONCRETE: Code provision on fire - Resistance of Concrete to fire - IS Code provisions - Cracks in concrete - types - Intrinsic cracking, structural cracking - Causes and remedies - Plastic cracks - Causes and remedies - Thermal contraction cracks

Unit III

TESTS ON HIGH PERFORMANCE CONCRETE: Permeability - Chemical attack - Sulphate attack - Durability - Thermal properties of concrete - Fire resistance - Compression test - Split tension test – Flexure Test - Stress strain characteristics of concrete - Determination of modulus of elasticity - Ultrasonic pulse velocity method, rebound hammer test.

Unit IV

MIX DESIGN: Basic considerations - Factors in the choice of mix proportions - Mix design methods – ACI method, IS method - Mix proportions for weigh batching and volume batching - Correction for moisture content and bulking - Design of high strength concrete mixes.

Unit V

CASE STUDIES ON FIRE RESISTANCE: Case studies on fire resistance of self-compacting concrete, Fire damaged concrete, Effect of fire on flexural and shear behavior of beams.

Text Books

1. Shetty, M.S., “Concrete Technology- Theory and Practice”, S. Chand and Company, New Delhi, 2009.

Reference Books

1. Neville, A.M., "Concrete Technology", Longman Scientific & Technical, 1990.
2. Gambhir, M.L.,“Concrete Technology”, Tata McGraw Hill, New Delhi, 2003.
3. Santha Kumar, A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2006.

4. IS: 10262, "Recommended Guidelines for Concrete Mix Design", 2009.
5. European Guidelines on Self Compacting Concrete.

12CE330 ADVANCED CONSTRUCTION TECHNIQUES

Credits: 4:0:0

Course Objective

- To know the construction technique of varies structures
- To understand the equipment used in major works

Course Outcome

- Student enabled to use exact equipment for specific purpose

Unit I

EQUIPMENT:

Equipment for Earthwork*:* Fundamentals of earth work operations - Earth moving operations - Types of earth work equipment: Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers.

Equipment for Production of Aggregate and Concreting: Crushers – Feeders - Screening equipment - Handling equipment - Batching and mixing equipment - Hauling, pouring and pumping equipment – Transporters

Other Construction Equipment: Equipment for dredging, trenching, tunneling, drilling, blasting - Equipment for compaction - Erection equipment - Types of pumps used in construction - Equipment for dewatering and grouting – Foundation and pile driving equipment

Unit II

SUB-STRUCTURE CONSTRUCTION: Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement – Tunneling techniques – Driving well and caisson – sinking cofferdam – cable anchoring and grouting – driving diaphragm walls, sheet piles – laying operations for built up offshore system – shoring for deep cutting large reservoir construction with membrane and earth system – well points – dewatering and stand by plant equipment for underground open excavation.

Unit III

SUPER STRUCTURE CONSTRUCTION: Vacuum dewatering of concrete floor - concrete paving technology - Erection techniques and in-situ pre-stressing of tall structures, high rise structures and sky scrapers - Launching techniques of large span structures - erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, RCC domes and pre-stress domes – Advanced construction techniques in offshore construction practice.

Unit IV

REPAIR CONSTRUCTION: Mud jacking grout through slab foundation – micro piling for strengthening floor and shallow profile – pipeline laying – protecting sheet piles, screw anchors – sub grade – water proofing – under pinning advanced techniques – Sequence in demolition and dismantling.

Unit V

MATERIALS HANDLING EQUIPMENT

Forklifts and related equipment - Portable Material Bins – Conveyors - Hauling Equipment

Construction Equipment Management: Identification - Planning - Equipment Management in Projects - Maintenance Management – Replacement – Unit Operating Cost - Cost Control of Equipment - Depreciation Analysis – Safety Management.

Text Book:

1. Jerry Irvine, "Advanced Construction Techniques", Rocker, 2001.

Reference Books:

1. Peurifoy,R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5thedn, McGraw-Hill, Singapore, 2001.
2. Sharma, S.C., "Construction Equipment and Management", Khanna Publishers, New Delhi, 2007.
3. Deodhar, S.V., "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2006.
4. Mahesh Varma, "Construction, Equipment it's planning and Application", Metropolitan Book Company, New Delhi. 1983.

12CE331 NONLINEAR ANALYSIS OF STRUCTURES

Credits: 3:1:0

Course Objective

- To study the basic principles of dynamic loads
- To study the basic types of dynamic loads and its behavior on structures

Course Outcome

- Students enabled to study the analysis of multi storied buildings subjected to Dynamic Loads.

Unit I

INTRODUCTION: Types of nonlinearity: Geometric nonlinearity, Material nonlinearity - Nonlinear governing Equation for beams: moment-Curvature nonlinearity, geometric nonlinearity due to stretching, material nonlinearity - geometrically nonlinear beam problems - Cantilever beam: Moment-curvature nonlinearity - Centrally loaded beam with two supports - Cantilever beam subjected to tip load.

Unit II

NONLINEAR STATIC ANALYSIS OF PLATES: Geometric and material nonlinearities - governing nonlinear equations of plates: stress function approach, displacement equations approach - Boundary conditions and method of solution - large deflection of rectangular plates.

Unit III

NONLINEAR ANALYSIS OF COLUMNS: Post buckling of cantilever column - Large deflection of column with both ends hinged.

Unit IV

NONLINEAR ANALYSIS OF TRUSSES AND FRAMES: Derivation of nonlinear stiffness matrix - Matrix displacement method for nonlinear analysis of structures - Nonlinear analysis of plane frames.

Unit V

ELASTIC-PLASTIC ANALYSIS: Displacement transformation matrix for a member with a hinge - Overall stiffness matrix - Elastic-plastic analysis of a propped cantilever - Elastic plastic analysis of frames.

Text Books

1. Sathyamoorthy, M., "Nonlinear Analysis of Structures", CRC Press, New York, 1998.
2. Majid, K.I., "Non Linear Structures", Butter worth Publishers, London, 1972.

Reference Book

1. Iyengar, N.G.R., "Elastic Stability of Structural elements", Macmillan and Co., 1989.

12CE332 RESEARCH METHODOLOGY

Credits: 4:0:0

Course Objective

- To get exposed to methods of research
- To know the data collection methods
- To have a knowledge about the preparation of thesis

Course Outcome

- Student enabled to do the research in a systematic way and write a thesis

Unit I

INTRODUCTION: Philosophy of research - Research theories - Types of research - Literary research and linguistic research – Topic and problem identification - Research method – Data collection classification and organization – Data analysis – Tools of analysis – Sources including electronic media – Forms and functions of documentation.

Unit II

EXPERIMENTAL DESIGNS: Laboratory and the field experiment - Internal and external validity - Factors affecting internal validity - Measurement of variables - Scales and measurements of variables - Developing scales: rating scale and attitudinal scales - Validity testing of scales developed - Reliability concept - Stability measures.

Unit III

QUESTIONNAIRE AND SAMPLING: Interviewing questionnaires etc. - Secondary sources of data collection - Guidelines for questionnaire design - Electronic questionnaire design and surveys - Special date sources: focus groups, static and dynamic panels - Data collection methods: advantages, disadvantages and uses - Sampling techniques - Probabilistic and non–probabilistic samples - Issues of precision and confidence in determining sample size - Hypothesis testing - Determination of optimal sample size - Data relevance to intellectual property rights (IPR) – Book keeping.

Unit IV

COMPONENTS OF RESEARCH REPORTS: Forms of discourse and the main intention - Exposition and its methods - Argument – Description – Narration - Effective writing (Diction-Sentence-Paragraph) - Sources of information - Primary source and secondary source - Review of earlier researches - Preparation of a working bibliography - Note Taking(on Cards).

Unit V

FORMAT AND PRESENTATION OF A REPORT: Text of a thesis - Introduction – Body of a thesis – Summation – Appendix(if any) – Works cited or consulted – Thesis Typing: paper, margin and spacing, pagination, title page, certificate, abstract, preface or acknowledgement, contents – Punctuation – Spelling – Grammar – Using quotations – Revising - Proof reading - Parenthetical documentation (MLA style sheet) - Other systems of documentation.

Text Books

1. Donald, R. Cooper and Remela, S. Schindler., "Business Research Methods", Tata McGraw Hill publishing company limited, New Delhi, 2000.
2. Uma Sekaran., "Research Methods for Business", John Wiley and Sons Inc., New York, 2000.
3. Kothari, C.R., "Research Methodology", Wishva Prakashan, New Delhi, 2001.

Reference Books

1. Donald, H. McBurney., "Research Methods", Thomson Asia Pvt. Ltd. Singapore, 2002.
2. Ticehurst, G.W., and Veal, A.J., "Business Research Methods", Longman, 1999.
3. Ranjit Kumar, "Research methodology", Sage Publications, New Delhi, 1999.

LIST OF SUBJECTS

Sub. Code	Name of the Subject	Credits
13CE101	Basic Civil Engineering	3:0:0
13CE301	Structural Dynamics	3:1:0
13CE302	Structural Engineering Laboratory	0:0:1
13CE303	Finite Element Methods in Engineering	3:1:0
13CE304	Computer Aided Structural Engineering Laboratory	0:0:1

13CE101 BASIC CIVIL ENGINEERING

Credit: 3:0:0

Objective:

- To introduce the student to the basics of civil engineering, which includes selection of building materials, sites, building components, water supply engineering and sanitary engineering, general layouts etc.

Outcome:

- The student will be enabled to gain knowledge on the basic principles in the various fields of Civil Engineering

Unit I

INTRODUCTION TO CIVIL ENGINEERING

Introduction: Engineering – Civil Engineering – History and development of Civil Engineering – Scope of Civil Engineering – Functions of Civil Engineers - Construction Materials: Characteristics of good building materials such as stones, bricks, timber, cement, concrete and steel sections - Surveying: Definition and purpose – classification – Basic principles – Measurement of length by chains and tapes – Field measurement - Area of a plot.

Unit II

STRUCTURAL AND GEOTECHNICAL ENGINEERING

General concepts relating to Buildings: Selection of site – Basic functions of buildings – Major components of buildings - Foundations: Purpose of a foundation – Bearing capacity of soils – types of foundations - Methods of construction: Brick masonry, Stone Masonry - Beams – Lintels – Columns – flooring – Roofing.

Introduction to Valuation:

Definition – Purpose of valuation – Factors which govern value of a building – Valuation of a building by plinth area method.

Unit III

ENVIRONMENTAL ENGINEERING

Water supply Engineering: Sources of water supply – Quantity of water requirements – Purification of water involving sedimentation, filtration and disinfection - Rainwater harvesting -Sanitary Engineering: Definition of terms – Sewerage systems – Working principle of Septic tanks and oxidation ponds – Collection and disposal of solid wastes.

Unit IV

TRANSPORTATION ENGINEERING

Transportation Engineering: Importance of roads – Classification of Highways – Cross sections of water bound macadam, bituminous and cement concrete roads - Railways: Importance of railways – Gauges –

Components of a permanent way - General layout of an airport and harbour- Bridges: Components of bridge, Types of bridges.

Unit V

WATER RESOURCES ENGINEERING

Dams: Purpose of Dams – Types of dams – Earth, masonry and concrete, arch and buttress dams – Selection of site for a dam – Types and functions of cross drainage works - Irrigation Engineering : Definition of irrigation – Types of irrigation.

Text Books:

1. Devadass. C.S.C., Jemimah Carmichael. M and Sheeba Ebenezer. J., "Basic Civil Engineering", Shristi Publishers, Coimbatore, 2004.

Reference Books:

1. Palanichamy, M. S.,"Basic Civil Engineering", Tata McGraw Hill Publishing Co. Limited, New Delhi, 2008.
2. Ramesh Babu V., 'Basic Civil Engineering', Anuradha Agencies, Kumbakonam, 2001.

13CE301 STRUCTURAL DYNAMICS

Credits: 3:1:0

Objective

- To impart knowledge on the basic principles of free and forced vibration (both undamped and damped) of single degree of freedom and multiple degree of freedom systems as well as distributed parameter systems
- To introduce the basic principles of structural dynamics and the solution techniques for free and forced vibration analysis of building frames subjected to dynamic loads

Outcome

- Students enabled to carry out vibration studies and their importance to structural engineering problems
- Students learnt to analyze multi storied buildings subjected to dynamic Loads

Unit I

INTRODUCTION TO PRINCIPLES OF DYNAMICS: Vibration studies and their importance to structural engineering problems - Elements of vibratory systems and simple harmonic motion - Vibration with and without damping - Constraints - Generalized mass - D'Alembert's principle - Hamilton's principle - Lagrange equations - Coupling.

SINGLE DEGREE OF FREEDOM: Degree of freedom - Equation of motion for S.D.O.F. - Damped and undamped free vibrations - Undamped forced vibration - Critical damping - Logarithmic decrement - Response to support motion - Response of one degree freedom system to harmonic excitation, damped or undamped - Evaluation of damping resonance - Band width method to evaluate damping - Force transmitted to foundation - Vibration isolation.

Unit II

RESPONSE TO GENERAL DYNAMIC LOADING: Fourier series expression for loading - Response to general dynamic loading (blast or earthquake) - Duhamel's integral - Numerical evaluation.

TWO DEGREES OF FREEDOM SYSTEMS

Equation of motion for free and forced vibration of 2 DOF system- normal modes of vibration - applications

Unit III

MULTI DEGREE FREEDOM SYSTEM: Mathematical model of MDOF system - Free vibration of undamped MDOF systems - Natural frequencies and mode shapes – Orthogonality conditions - Idealisation of multi-storied building frames for dynamic analysis - Shear buildings – Stiffness - flexibility and mass matrices - Free and forced vibration with and without damping- Solution of the Eigen Value Problem: Vector interaction methods - Stodala and Subspace iteration techniques - Transformation methods - Jacobi and Given's method - Frequency search methods - Holzer method, Transfer matrix methods and Dunkerlay's equation - Rayleigh-Ritz methods.

Unit IV

DISTRIBUTED PARAMETER SYSTEM: Expression for generalized system - Properties – Vibrational analysis with Rayleigh's variational method - Rayleigh-Ritz method - Differential equation of motion – Free and forced vibration of continuous systems – bars and beams - Effect of axial loads - Numerical evaluation of modes – Frequencies and response spectrum

Unit V

PRACTICAL APPLICATIONS:.

Solution for Equilibrium Equations**:** mode superposition method - Direct integration methods - Central Difference method - Houbolt method - Wilson-θ-method - Newmark method - Idealization and formulation of mathematical models for wind, wave, earthquake, blast and impact loading, aerodynamics, gust phenomenon, principles of analysis.

Textbooks:

1. Clough, R.,W., and Penzien, "Dynamics of Structures", McGraw Hill Book Co Ltd, 1986.
2. Paz Mario," Structural Dynamics - Theory and Computation", CBS publishers, US, 1999.

Reference Books

1. Craig, R.R., "Structural Dynamics - An Introduction to Computer Methods", John Wiley and Sons, UK, 1989.
2. Hurty, W.C and Rubinstein, M.F., "Dynamics of Structures", Prentice Hall, 1967.
3. Biggs, M., "Introduction to Structural Dynamics", McGraw-Hill, Co., New Delhi, 1964.
4. Thomson, W.T., "Theory of Vibration", Prentice Hall of India, 1975.
5. Manickaselvam, V.K., "Elementary Structural Dynamics", Dhanpat Rai and Sons, New Delhi, 1987.

13CE302 STRUCTURAL ENGINEERING LABORATORY

Credits: 0:0:1

Objective:

- To impart knowledge on concrete mix design for low strength and high strength concrete
- To study the behaviour of structural elements.
- To impart knowledge on non-destructive testing.

Outcome:

- The Students will be enabled to design a concrete mix and understand the behaviour of structural elements.

The faculty conducting the Laboratory will prepare a list of experiments [10/5 for 2/1 credit] and get the approval of HoD and notify it at the beginning of each semester.

13CE303 FINITE ELEMENT METHODS IN ENGINEERING

Credits: 3:1:0

Objective

- To understand the basic concept of finite element and derive the shape functions for one, two, and three dimensional finite elements including plate and shell elements.
- To study the various finite element procedures and solution techniques for linear and nonlinear structures.

Outcome

- Students enabled to analyze the problems using finite element method.

Unit I

CONCEPTS OF FINITE ELEMENT: Boundary value problem - Element types - Variational principles - Method of weighted residual - Principle of virtual work - Rayleigh-Ritz method - Galerkin's method of weighted residual – Weak formulation Energy Principles - Displacement, stress and hybrid model - Convergence and compatibility requirements -Pascal's triangle - Stiffness of an axial element - Melosh criteria - Storage schemes. Development of element stiffness matrix and nodal load vector for bar, beam and plane frame elements, Transformation matrices – application to relevant trusses, beams and plane frames

Unit II

STRESS AND STRAIN ANALYSIS (TWO DIMENSIONAL): Triangular Elements - Constant strain triangle - Element stiffness matrix - Various Methods of evaluating element stiffness-higher order triangular elements - comparison of different elements. Rectangular Elements - Serendipity family - Lagrangian family - Hermitian family - Sub-Iso-Super parametric elements - Shape function - Mapping - Linear iso-parametric quadrilateral.- Elements for fracture analysis

Unit III

STRESS ANALYSIS (THREE DIMENSIONAL ELEMENTS): Numerical Integration using Gaussian Quadrature - Weights and gauss points - Selective and reduced integration - Axisymmetric stress analysis - Tetrahedron element family - Parallelopiped element - Hexahedron Element family - ZIB 8 and ZIB 20 elements.

Unit IV

PLATE AND SHELL ELEMENTS: Triangular and rectangular elements - BFS Element – Mindlin plate elements- Faceted element for shells - Degenerated shell elements – bi-linear degenerated shell elements – degenerated axisymmetric shell elements - Finite strip method - Development of stiffness matrix and consistent load vector - Application to folded plates and bridge decks - Applications to Reinforced Concrete.

Unit V

SPECIAL TOPICS

NONLINEAR, VIBRATION AND THERMAL PROBLEMS

Material and geometric nonlinearities - methods of treatment – consistent system matrices – Dynamic condensation- thermal analysis.

MESHING AND SOLUTION PROBLEMS

Higher order elements - P and H methods of mesh refinement - Ill conditioned elements - Discretization errors – auto and adaptive mesh generation techniques - error evaluation.

APPLICATIONS

Modeling and analysis using recent softwares.

Text Book

1. Rajasekaran, S., "Finite Element Methods in Engineering Design", S.Chand & Co Ltd., New Delhi, 2003.
2. Tirupathi, R.Chandrupatla and Ashok, D. Belegundu., "Introduction to Finite Elements in Engineering", Prentice Hall of India Private Limited., New Delhi, 2004.

Reference Books

1. Chandrakant, S.Desai and John, F.Abel., "Introduction to the Finite Element method, A numerical Method for Engineering. Analysis", East West press Private Limited, Madras, 1972.
2. Krishnamoorthy, C.S., "Finite Element Method - Theory and Programming", Tata McGraw Hill Publishing Company", New Delhi, 1994.
3. Bathe, K.J., "Finite Element Procedure", Prentice Hall of India, New Delhi, 1997.
4. Zienkiewinz, O.C., "The Finite Element Method Vol. 1 & 2", McGraw Hill Book Company, New York, 1991.
5. Mukhopadhyay, M., "Matrix, Finite Element Computer and Structural Analysis", Oxford & IBH publishing Co., Pvt. Ltd. New Delhi, 1993.
6. Rajasekaran, S., "Numerical Methods in Science and Engineering - A practical approach", 2nd Edn., A.H. Wheeler & Co., 1999.
7. Robert D.Cook, e tal, " Concepts and Applications of Finite Element Analysis", John Wiley & Sons, Inc. Singapore

13CE304 COMPUTER AIDED STRUCTURAL ENGINEERING LABORATORY

Credits: 0:0:1

Objective
- To introduce the application of FEM in Software Packages
- To make the students to analyze and design various structural elements using STAAD Pro and ANSYS

Outcome
- Student capacitated to analyse and design RCC and steel structures by using STAAD Pro and ANSYS

The faculty conducting the Laboratory will prepare a list of experiments [10/5 for 2/1 credit] and get the approval of HoD and notify it at the beginning of each semester.